TITLE THE IMPACT OF UNIONS ON ECONOMIC PERFORMANCE : EMPIRICAL TESTS USING BRITISH MICRO-DATA.

AUTHOR S.J.MACHIN.

INSTITUTION and DATE University of Warwick. (1988)

THE IMPACT OF UNIONS ON ECONOMIC PERFORMANCE : EMPIRICAL TESTS USING BRITISH MICRO-DATA.

S.J.MACHIN.

SEPTEMBER 1988.

A Thesis Submitted for the Degree of Doctor of Philosophy at the University of Warwick.

CONTENTS.

List of Tables.

List of Figures.

ACKNOWLEDGEMENTS.

In conducting the research presented in this thesis numerous acknowledgements need to be made. First and foremost I would like to thank the Department of Economics at Warwick for allocating me an ESRC studentship to finance my three years study on the Doctoral Programme. Second, I would like to thank Ben Knight and Martyn Andrews whose M.A. course on the Economic Analysis of Trade Unions provided the starting point for the analysis presented here.

Several people have aided me in collecting and understanding the data used in this thesis. I would like to thank John Cable at Warwick and Nick Wilson at Bradford for allowing me to use their data on British engineering firms. The use of the Institute for Fiscal Studies Datastream data which was made available to me by Mike Devereux and Richard Blundell at the IFS is also gratefully acknowledged. Sushil Wadwhani of the London School of Economics is also to be thanked for letting me have some data from his survey of large British companies. I must also thank Paul Gregg and Pete Mitchell for their assistance in setting up the data from the Workplace Industrial Relations Surveys used in two Chapters of this thesis.

A large number of people have also provided comments and suggestions on certain parts of this work. I would like to thank seminar participants at Warwick, the Institute for Fiscal Studies, the Centre for Labour Economics at LSE and the 1988 EARIE conference in Rotterdam for a number of useful comments. Outside Warwick written comments on parts of various Chapters of this thesis have been kindly given by Martyn Andrews, Saul Estrin, Paul Geroski, Paul Gregg and Geoff Stewart. At Warwick the help of a considerable number of people needs to be acknowledged : these include John Cable, Martin Conyon, Keith Cowling, Peter Law, Paul Marginson, Robin Naylor, Wiji Narendranathan and Barry Reilly. Above all I would like to thank my supervisors Ben Knight and Mark Stewart for their encouragement and helpfulness in contributing to this work. Between them they have provided many incisive and insightful comments. Without their help and considerable knowledge in the area of this thesis the finished product would be considerably less complete.

SUMMARY.

To date, most applied econometric work analysing the effects of British trade unions has concentrated on their effect on relative wages. However, a considerable body of U.S. evidence suggests that unions significantly influence other economic variables. This thesis attempts to explore some of these issues using British data and uses econometric techniques to consider the effects of unions on productivity, profitability and the relationship between unionism and schemes which link workers' pay to performance. As the tendency in recent years has been for collective bargaining to take place at the level of the plant or firm in Britain the study prefers to use micro-economic data and several such data sources are accessed. The main finding is that trade unions certainly exert a significant influence on the behaviour of plants and firms in Britain in the early 1980's. Unions are found to reduce productivity in larger firms but have no impact in small firms in a sample of engineering firms. Using data on large British firms the union impact on profitability is observed to be negative but more marked in situations of market power so that unions effectively re-channel excess profits from capital to labour. The union impact on the financial performance of two large cross-sections of British establishments is also found to be negative and again more marked where these plants are able to exert some degree of product market power. Finally, union presence is positively related to the incidence of share ownership and profit sharing schemes unless strong unions are present when such schemes are no more likely to be present than in non-union workplaces. These results are of considerable interest and, despite the underlying macroeconomic and political climate, union activity is observed to have important economic effects in Britain in the early 1980's.

DECLARATION.

1. No part of this thesis has been presented to any University for any degree.

2. Chapters 5 and 6 of this thesis were undertaken as joint work with my supervisor Mark Stewart and Paul Gregg respectively. As such I contributed at least 50% to each venture. Chapter 6 is considerably revised in comparison to the joint work. I would like to thank my co-authors for their permission to use this joint work here. A statement from them confirming this is given below.

3. A considerably different version of Chapter 6 appeared in the *International Journal of Industrial Organisation* as Gregg and Machin(1988).

I confirm the above declaration referring to joint work I have carried out with S.J. Machin.

P.A. Gregg.

I confirm the above declaration referring to joint work I have carried out with S.J. Machin.

M.B. Stewart.

CHAPTER 1.

Introduction.

The question of how the presence of trade unions influences the economic performance of firms and industries is one that has generated interest among labour economists and industrial relations specialists for some time. It is however only recently that the impact of trade unions on economic variables has been rigorously examined using econometric methods. For instance, it is now fairly well established that unionised workers are on average paid more than their non-union counterparts. What is less clear is how this wage effect and other non-wage union effects feed through to affect economic performance. Given the considerable upheaval in British manufacturing industry in the early 1980's and that some commentators have pinpointed trade unions as one of the main causes of British industrial decline a study of the impact of British trade unions on economic performance is an important one to be undertaken. It is this broad issue which is to be addressed in this thesis.

The approach to be adopted is to empirically examine the influence that trade unions have on a number of indicators of performance. The reason for the empirical stance is effectively two-fold. Firstly, as will be discussed at greater length in Chapter 2, existing economic theory is very much couched in terms of the effects that unions have on wages and employment and, whilst some predictions regarding union effects on performance can be generated from formal models, the effects that unions may exert are likely to depend on the characteristics possessed by the firms and industries in which they are located. This can only be adequately considered using a detailed empirical approach. Secondly, a number of British data sources are available to address these issues, although to date they have yet to be accessed for this purpose.

A further methodological point that needs to be stressed is that all the work presented in this thesis is based on microeconomic data. That is, the data sets used are either at the level of the plant or firm. This is not a trivial point as it seems vital that to adequately consider the effects trade unions may have it is necessary to go to the level at which the union operates. The recent

trend, following industrial relations reform after the Donovan Commission(1968), has been towards plant and company level bargaining in Britain. As a consequence, the preferred level of disaggregation is either plant or firm level data. There are also econometric reasons for preferring micro-data : Geroski and Stewart(1986) identify a number of problems associated with the use of aggregate industry level data to analyse union wage mark-ups. In particular they find a great deal of variation in the mark-up conditional on various specification changes in their econometric model.

It is also worth remarking that almost all the data used in this thesis refers to the early 1980's. A number of characteristics of the overall economy at this time may also be an influence (directly or indirectly) on the impact that trade unions have on economic performance. The first is the high unemployment prevailing in Britain in the early 1980's. In times of high unemployment the priorities of trade unions in the collective bargaining process are likely to differ from those in times of full employment. Thus there may be some moderation in the wage bargain as unions are to some extent more concerned with employment levels. Alternatively there is the argument that as the individual quit threat becomes less credible in situations of high unemployment union non-union wage differentials can increase, thus giving a trade-off regarding the way in which unemployment impacts on the union influence on wages (see Holt(1970)). However, it is evident that, insofar as aggregate characteristics impinge on the microeconomic circumstances in which unions operate, high unemployment is likely to have an effect on factors such as the share of profits that unions are able to extract, the power unions hold in the control of the workplace and the credibility of the strike threat. A second characteristic of the economic environment of the 1980's has been the introduction of legislation aimed at curbing and restraining union power : recent legislation has been directed at, amongst other things, ballots regarding strike action, secondary picketing, political funds and the extent of the closed shop (see Batstone(1988)). Obvious economic consequences have emerged, most notably the reduction in industrial stoppages in the early 1980's in Britain. Thirdly, recent years have seen conscious efforts, both on the part of government and managers, to increase employee involvement in the operations of the firm. In this sense there is the emergence of a new style of industrial relations in which the likes of profit

sharing, quality circles, briefing groups and more consultation emphasise cooperation and compliance in production operations. Whether or not these are attempts at genuine 'power-sharing' or purely cosmetic methods to wrest power from unions in a situation where they are weakened by the economic and legislative climate is not clear. Thus, despite the fact that for econometric reasons and due to the problems of aggregation bias associated with macroeconomic data this thesis prefers to present work using micro-data, aggregate economy-wide factors need to be borne in mind as part of the broader setting in which the economic effects of trade unions are located.

Another point that has to made clear at the outset is what is meant by economic performance. In this context it refers to the performance of microeconomic production units, be they establishments or firms. The two indicators chosen for analysis are productivity and profitability, where productivity is taken to indicate the output produced by each input into production and profitability is the difference between unit revenue and unit cost. Both are important indicators of the way in which a firm in a given market is operating and are obviously interlinked. Indeed it is of some importance to empirically evaluate whether or not they are higher or lower in the presence of trade unions.

The econometric methodology to be adopted and how it defines a union effect on performance is also an issue. The use of statistical techniques to analyse trade union effects essentially involves the construction of a hypothetical experiment where economic variables are compared in firms which are the same except for their union status. The preferred indicator of union status which is used where possible in this thesis is whether or not trade unions are recognised for bargaining purposes. Hence, the experiment compares performance levels between firms which have recognised unions with those which do not and, as in practice firms are not identical except for their union status, the use of multivariate techniques controls for those factors which differentiate between firms. Hence, union effects can be thought of throughout this thesis as ceteris paribus union non-union effects so that the analysis attempts to best approximate what performance would be in a given firm if unions are present to what it would be in their absence.

Having clarified a number of general points it is now possible to turn to the various com-

ponents of this thesis. The next Chapter is a survey of relevant existing work. Initially it considers the traditional monopoly model of trade unions which depicts a union's only role as pushing up wages in excess of competitive levels. The effects that unions may exert on profitability and on productivity are then evaluated from this viewpoint. The effects generated when unions and firms bargain over wages and employment are considered next. However, as already alluded to, it is considered that formal models yield some insight but are not sufficient to adequately examine the influence unions may have on performance. Thus the relevance of institutional and economic characteristics of firms and their operating market are discussed in the next section. The next step is to survey the existing empirical work which focuses mainly on the few British studies but where considered appropriate addresses the U.S. results. Finally, a recently fashionable question to ask is whether linking the pay of workers to the performance of their firm can improve the workings of such firms. Thus the last section of Chapter 2 looks at the work on alternative compensation arrangements and asks what the relationship between them and union presence may be.

Chapter 3 considers the impact that trade unions have on productivity in a sample of British engineering firms over the period 1978-82. The study adopts the production function approach first introduced in the context of union effects by Brown and Medoff(1978) and attempts to evaluate whether some of the strong results found in the U.S. work cross over to the British situation. Most existing studies only present estimates of an average union effect on productivity and as a result this analysis argues that the extent of variation around the average is of vital importance and is what should be considered in more detail. The analysis then goes on to identify what are the characteristics of firms and unions for which statistically significant union productivity effects are observed.

The two following Chapters address the issue of how trade unions influence the financial performance of firms and plants in which they are located. Chapter 4 uses profitability data from the company accounts of a number of large British companies in 1984 and 1985 and augments it with union data from a postal survey conducted in the middle of 1987. This merging of data sources allows an exploration of the union impact on profit margins. As for the analysis of the

union impact on productivity, the variation in the union impact on profitability is deemed important and tests of whether unions affect profitability to a greater or lesser extent if their firms have some degree of product market power (and hence a greater potential ability to pay) are conducted. Chapter 5 uses plant level data from the Workplace Industrial Relations Surveys of 1980 and 1984 to see how unions affect the financial performance of these plants. Again tests are conducted to see how these effects vary with union strength and with characteristics of the establishments and their operating markets.

Chapter 6 presents some estimates of the relationship between trade union presence and the incidence of performance linked payment schemes in British workplaces. The data source used is the 1984 Workplace Industrial Relations Survey. The issues to be addressed in this Chapter are whether managers in unionised concerns are more likely to be attracted to these schemes and, if union opposition exists, whether stronger unions are more able to resist their implementation at their workplace. This is explored for three different types of sharing schemes operating in British establishments in 1984.

Although the work undertaken in this thesis focuses on a number of issues, they are interlinked in potentially important although often complex ways. Thus, having examined the effects of unions on productivity, profitability and on whether alternative pay systems are located in unionised situations the final Chapter attempts to draw together the results from the preceding analysis. Chapter 7 therefore offers some conclusions and highlights the main contributions of this thesis. Finally some remarks on a number of potentially fruitful routes that future research on the economics of trade unions could follow are offered.

CHAPTER 2.

Unions and Economic Performance : a Review of the Literature.

Trade union activity has been modelled by economists in a number of ways. Some have portrayed a trade union as an economic organisation attempting to maximise an objective function (for instance a number of objectives have been identified, some of the more popular ones being the wage bill, the average wage, utility of the membership and the rent accruing to its members). Others, often of an industrial relations or institutionalist persuasion, have been uncomfortable with the notions of a union maximising something and as such have shied away from defining a trade union maximand. These authors prefer to emphasise the institutional characteristics of unions and their role in the workplace. This Chapter is a review of the relevant literature, paying particular attention to the implications of these particular modelling strategies for the impact of unions on various indicators of economic performance. As such it is proposed to initially consider the traditional view of unionism where the union is depicted as a monopolistic supplier of labour pushing wages above competitive levels and to examine the predictions this generates for the union effect on productivity and profitability. More recently some economists have continued to use the notions of a union objective function but have recognised that bargaining may take place between unions and management and the next issue to be addressed is whether the predictions of these bargaining models differ from those generated by the monopoly model : these ideas are also considered in the section analysing formal economic models and how they relate to union effects on performance. After outlining the formal economic models consideration of the notion that unions have certain institutional features seems important and this is the subject to be considered next. The implications of this less restrictive stance for the union impact on economic performance are then evaluated and contrasted with those emanating from the monopoly and bargaining views. Having contemplated the theoretical predictions, a review of the empirical work, concentrating on the few existing British studies but also where considered relevant describing the U.S. evidence is offered. Finally, recent interest has focused on whether economic performance can be improved by introducing alternative more flexible compensation

methods at the workplace and thus the last section of this survey considers the nature of these payment schemes and whether or not they are likely to be introduced in the presence of unions in order to foster greater cooperation and as such improve performance.

2.1 Formal Economic Models of Union Behaviour.

In formal economic models unions have generally been described as an economic organisation analogous to the firm with some form of wage and employment considerations replacing profits as the variable of interest. For instance, the union monopoly model typifies a trade union as an organisation whose sole purpose is to obtain wage rates for its members which maximise the surplus above the competitive wage. This model[1] pictures the union as unilaterally setting wages and the firm then adjusts employment to find the profit maximising wage-employment combination. This is illustrated diagrammatically in Figure 2.1 where a firm's demand for labour schedule can be represented as L^d and W_N–L_N as the wage-employment combination prevailing in the absence of unions. However, if unions exist and aim to maximise utility (defined in some way over W and L and represented by the convex indifference curves $U_3>U_1>U_0$) subject to L^d then the union wage rate is raised to a higher wage like W_U and the corresponding employment level is then set by the firm as L_U. According to the Marshallian laws of derived demand, W_U will be higher relative to W_N the more inelastic is L^d since higher wage gains will have less of an employment reducing effect. In this context the rents accruing to the union are represented by the rectangle $W_U abW_N$ and this may be interpreted as a redistribution of income from capital to labour. What is also of interest from the neoclassical viewpoint is the dead-weight loss triangle abc which may be viewed as 'the social costs of unionism' and implies that unions induce allocative inefficiency by distorting price mechanisms.[2]

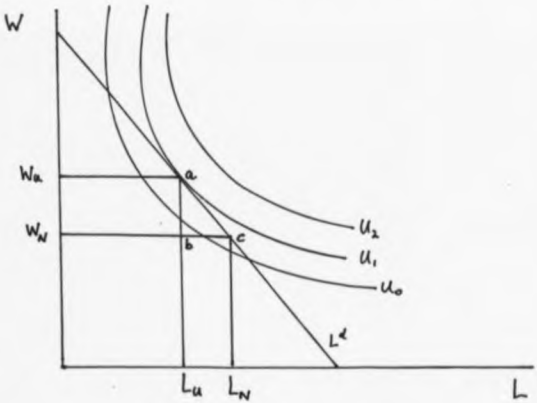
Whilst this model has usually been used to analyse union wage and employment effects it is able to generate some predictions regarding the effects of unions on economic performance.

---

[1] See, for example, Dunlop(1944) or Reynolds(1981)

[2] Although it should be noted that estimates of this social cost have generally been low : the usually cited example being Rees'(1963) calculation of about 0.5% of U.S. national income.

Figure 2.1 : Wage-Employment Outcomes in the Union Monopoly Model.



Under imperfect competition, consider a firm maximising the profit function defined simply in terms of the single labour input as $\Pi = R(L) - WL$, where Π is profits and R is sales revenue defined as price (P) times output ($Q(L)$). Since $\partial\Pi/\partial W = -L < 0$ it is evident that a union induced wage increase reduces profits. Accepting a positive union mark-up so that $W_U - W_N > 0$ then the profit reduction is

$$\Delta\Pi = -\int_{W_N}^{W_U} L \, dW \tag{2.1.1}$$

which is the area W_U or W_N in Figure 2.1.[3] Therefore, higher union wages come at the expense of higher firm profits.[4] Hence, profit margins defined as Π/R will fall as long as the proportionate reduction in sales revenue is less than the proportionate reduction in profits. Considering the pricing policies of firms makes it clear that, unless a firm is able to increase its prices to entirely offset the union wage effect, profit margins are likely to fall as a consequence of union activity. For the case of a profit-maximising oligopolist with a constant returns to scale production technology the profit rate can be shown to be equal to the price-cost margin (or degree of monopoly μ) so that, for the above profit function, $\Pi/R = \mu = (P - W)/P$ (see Cowling(1982) or Dixon(1987)). Evidently an increase in W will reduce μ unless prices rise by a sufficient amount. Hence, unless the wage increase is matched by the price increase, profit margins are likely to fall in the union monopoly model.

Still in the realms of the monopoly model, where the only union effect is to raise wages above competitive levels, union effects on productivity are likely to come about via a number of employer responses to higher wages. Firstly, the shift up the labour demand curve will generate a substitution away from labour to other inputs. For instance, if the production function is defined in terms of labour and capital union firms will be more capital-intensive. Second, the marginal

---

[3] This is what Kersart(1985) refers to as the union's share of the employer's surplus.

[4] It is obvious here that imperfect competition in the product market is assumed. The consequence of negative union profit effects in a perfectly competitive market would be (in the absence of any favourable productivity effect) to force unionised businesses to exit the market.

product of labour will be higher in unionised firms : the familiar first order condition from the profit function given above is

$$\frac{\partial R}{\partial L} = W \tag{2.1.2}$$

and since $W_U > W_N$ this implies that $(\partial R/\partial L)_U > (\partial R/\partial L)_N$. Thus unionised employers will hire workers of higher quality, namely those with higher marginal products. Hence, via these two routes unionised firms can have higher productivity than non-union firms (see Freeman and Medoff(1984) for further discussion). A third effect comes about due to the price increase that may follow an increase in wages : thus, because of higher union wages both output and employment will fall. The net effect on labour productivity, defined as output per employee, depends on a number of variables such as the nature of the firm's production technology, product and labour demand elasticities, the factor input mix and the ease with which the firm can substitute between factor inputs.[5] The net effect this implies must then be taken in conjunction with the other routes suggested by the monopoly model to ascertain the overall union impact on productivity.

In the traditional union monopoly model a negative union impact on profitability seems likely. It proves harder to gauge the direction of the union productivity effect which depends on a number of factors, even in the simple monopoly model. By adopting certain assumptions it is possible to generate firmer predictions (see Clark(1984)). The discussion here prefers to remain general to give an indicative idea of the possible effects. Of course the two effects are very much interlinked and the relationship between union wage, productivity and profit effects is a complex one, even in the confines of the monopoly model. However, from a neoclassical viewpoint, despite the fact that unions may raise productivity in individual firms, the efficiency implications of unionism are negative since unions distort the price mechanisms in the aggregate economy and induce allocative inefficiency.

[5] For example, Clark(1984) assumes a CES production technology with constant returns for a monopolist facing a demand curve which has a constant price elasticity d. A (positive) union wage mark-up of D % causes a fall in output of λdD % (where λ is labour's share) which, in the absence of any capital-labour substitution, will be exactly offset by a fall in employment (through the Hicksian formula relating labour and product demand elasticities) so that productivity is unchanged. This is a very specific example : more typically the effect could go either way depending on the assumptions made.

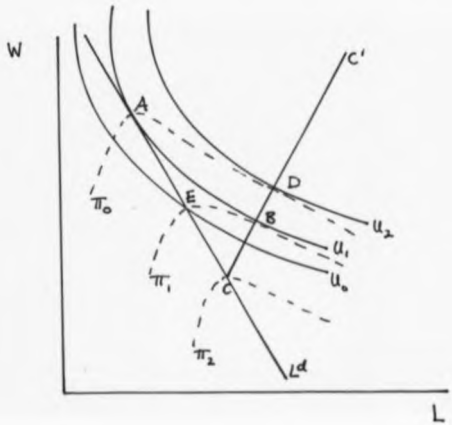
More recently the prediction that wage-employment combinations are 'on the labour demand curve' has been questioned by certain authors who feel that the union setting the wage and employers responding to choose employment is unrealistic. Whilst still in the realms of formal models these authors have suggested that bargaining between the firm and union over both wage and employment levels is more likely (see McDonald and Solow's(1981) efficient bargaining model) or that bargaining occurs over the wage and employment is then set by the employer (see the right to manage model of Nickell and Andrews(1982) or Dowrick(1985,1987) who claim this to be more representative of what actually happens in the collective bargaining process, especially in Britain). Compared to the union monopoly model these bargaining models suggest different outcomes for wages and employment and consequently different implications for the impact of unions on economic performance.

Bargaining over the wage and employment suggests that the outcome on the labour demand curve as described in the union monopoly model is Pareto inefficient. That is to say, there exists some achievable wage and employment combination which is preferable to both the firm and the union. The various possible scenarios derived from bargaining models are illustrated diagrammatically in Figure 2.2. The diagram indicates the firm's iso-profit curves as the dotted lines Π_i where $\Pi_0<\Pi_1<\Pi_2$ and union utility as U_i where $U_0<U_1<U_2$. The tangency between U_1, Π_0 and the labour demand curve yields the union monopoly outcome at point A. However, the firm is better off at point B for the same union utility and the union is better off at point D for the same firm profits. Thus one can isolate a number of points off the labour demand curve on a contract curve CC' which render the union monopoly outcome as sub-optimal.

The efficient bargaining model predicts an outcome somewhere on this contract curve, the slope of which depends on the relative importance of wages and employment in the union utility function. The right to manage model only allows the bargain to take place over wages and constrains the Nash bargaining solution to the labour demand curve (at a point like E in Figure 2.2).[6]

[6] Oswald(1987a) also derives a solution on the labour demand curve in the context of the efficient bargain by appealing to layoffs by seniority rules in a median voter model such that union indifference curves become flat after the median union member. In this case the labour demand curve model and the efficient bargain become observationally equivalent. Note also that if the union only cares about wages and $\psi = 1$ then the efficient bargain collapses to the monopoly model.

Figure 2.2 : Wage-Employment Outcomes in Bargaining Models.



What is of most relevance here is that the bargaining models predict an outcome involving higher employment than does the union monopoly model.

Formally, the efficient bargain can be viewed as an unconstrained asymmetric Nash bargain between firms and unions with the relevant objective function being

$$\Sigma = \max_{W,L} \; [(U(W,L))^{\psi}(R(L)-WL)]^{1-\psi} \qquad (0 \le \psi \le 1) \qquad (2.1.3)$$

In the Nash bargain ψ is taken as the union's strength in the bargain and the resultant wage-employment outcome is the best that could be achieved given the behaviour of the other party in the bargain. The relevant first order condition (after differentiating with respect to wages and employment) can be written

$$\frac{\partial R}{\partial L} = W - L\frac{\partial U/\partial L}{\partial U/\partial W} \qquad (2.1.4)$$

What needs to be noticed is that in the efficient bargaining case the marginal product of labour no longer equals the wage but is lower due to the extra term defined as the product of employment and the marginal rate of substitution between wages and employment in the union utility function (see Brown and Ashenfelter(1986)) : that is, the extent to which the marginal product of labour deviates from the wage depends on the importance of wages and employment in the union utility function and it is this which determines the slope of the contract curve.[7] Hence, the efficient contract predicts an employment level higher than that in the labour demand curve models, a result which holds as long as $L\frac{\partial U/\partial L}{\partial U/\partial W} > 0$, which is true if the union cares about employment as well as wages.

A variety of contract curves tracing out optimal wage-employment combinations are possible. Some examples are given in Figure 2.3. If the Nash settlement is on a vertical contract curve

[7] The right-to-manage model maximises equation (2.1.3) but subject to the labour demand curve (i.e. condition (2.1.2) is imposed). It generates a wage-employment combination on the labour demand curve with higher employment but lower wages than the monopoly model. Although note that the overall content of the bargain is of some importance here : Nickell and Wadhwani(1987) make the point that in the partial equilibrium framework in which these models are usually set (as above) employment will be higher in the efficient bargain. In a general equilibrium framework this need not necessarily be the case.

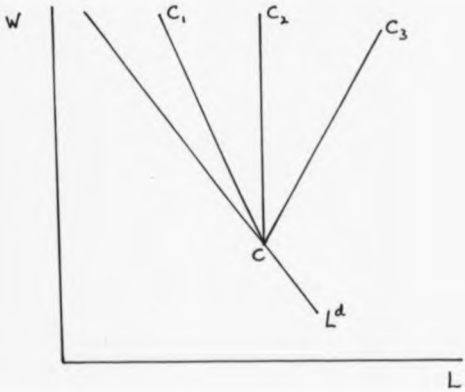
like C_2C then employment is unchanged from the non-union case. For the one factor production function considered here this suggests, subject to fairly stringent assumptions like identical production technologies and all workers being of the same productive quality for union and non-union firms, that $(Q(L)/L)_U = (Q(L)/L)_N$ so that productivity is unchanged. Considering wage-employment outcomes on non-vertical contract curves or on the labour demand curve complicates matters further. In this situation to gauge the direction of the union effect requires certain assumptions to be imposed on the parameters of the production function.[8] Obviously, considering a production function defined over several factor inputs makes things even more complicated. This discussion, taken in conjunction with the earlier points raised in the context of the monopoly model, indicates the difficulty in isolating a firm prediction regarding the union impact on productivity in formal models. It adequately illustrates that one needs to impose a number of a priori restrictions on a number of parameters to isolate an unambiguous union productivity effect.

Turning to profitability, the Nash bargaining framework generates the prediction that, ceteris paribus, the bargaining strength of unions enables them to gain pay premiums for their members : that is to say, unions are able to capture a share of the profits earned by the firm. Take the specific example of a vertical contract curve. Here price-cost margins (Π/R) will be reduced because profits fall and $R(L)$ is unchanged between union and non-union firms. In general, union presence is seen to bring about a reduction in profits and therefore, unless the firm's price response or a positive productivity effect offsets the union wage effect, a reduction in profitability. Hence, the prediction is qualitatively the same as for the monopoly model : this is made clear by looking at Figure 2.2 where a union non-union comparison indicates that unionised firms are situated on iso-profit contours corresponding to lower profits than otherwise comparable non-union firms.[9] Whether or not the union impact on profitability suggested by a bargaining framework is more or less marked than that suggested by the monopoly model depends on several

[8] To illustrate this, define the production function as $Q(L) = L^{\alpha}$ where α is the parameter indicating returns to scale. If $\alpha = 1$ so there are constant returns then $(Q(L)/L)_U = (Q(L)/L)_N$ and labour productivity is the same in union and non-union firms. If $\alpha \neq 1$ and $L_U \neq L_N$ this no longer holds.

[9] That is, non-union firms are at point C on iso-profit contour Π_2 whereas union-firm bargains (on or off the labour demand curve) are struck on iso-profit contours corresponding to lower profits like Π_1 and Π_0.

Figure 2.3 : Examples of Contract Curves in Efficient Bargaining Models.



factors. Numbered among them are the magnitude of the union wage premium, the employment level set in the bargain, the nature of the production technology and the price charged for goods sold by unionised firms relative to non-union firms in the same market : presumably these factors will depend on the strength and preferences of the union and on the characteristics of the firm and markets in which it is located. Only if trade unions do not care about employment and are free to choose a wage (when $\psi = 1$) does the efficient bargain collapse to the monopoly model so that the outcome is guaranteed to be the same.

Analysis of union-firm bargaining models has proved popular in the recent economic literature. As such numerous extensions to the models discussed here have been developed. For example, Manning(1987) has developed a more general model which nests the cases above in a framework where sequential bargains over wages and employment occur. The advantage this set-up gives is that ψ can differ in the wage and employment parts of the bargain. Another set of recent developments have tried to rationalise, in the confines of bargaining models, why unions exist and why, if they are present, membership in a given firm need not be 100% : a survey of this work is given in Booth and Chatterji(1988). Other extensions are discussed in the up-to-date surveys by Oswald(1985,1987b) and Ulph and Ulph(1988). Whilst these developments are of interest in their own right and their existence needs to be acknowledged the standard models discussed above are sufficient to illustrate what formal models have to say regarding the potential for unions to affect performance without going into any more detail.

Consideration of formal economic models yields some limited insight into the impact that unions have on economic performance. Things are a little better for predicting what the likely impact of unions on profitability will be and the general prediction (subject to certain caveats) is that price-cost margins are likely to fall as higher wages in the union sector are financed at least to a certain extent by unions capturing a share of profits. The union impact on productivity is however difficult to ascertain, even in very simplistic models. Brown(1986) notes this by stating 'models of wage bargaining behaviour can never be sufficient if they tacitly ignore that both employers and trade unions are, in their different ways, at least as concerned with the productivity implications of the bargain as with the wage implications' [Brown(1986) p.208]. This is

reflected in the fact that empirical tests of bargaining models are generally undertaken purely in terms of wages and employment and, as one might intuitively suspect, the outcomes they suggest are very mixed.[10] The difficulty to tie down a firm prediction regarding union effects on performance when using formal models may however be reasonable. Whilst consideration of union wage and employment effects is obviously necessary and tells part of the story it is unlikely to prove sufficient because the ability of trade unions to influence performance will vary from one situation to another and in particular will depend on the institutional and economic characteristics of the firms and industries in which they are located.

2.2 Institutional Considerations of the Union Impact on Performance.

As highlighted earlier, opposition to the notion of a union maximand has been considerable. A number of authors are unable to come to terms with a maximising trade union and as such prefer to discuss the possibility of union effects on performance in an economic context but appealing to alternative views in which union objectives are determined by a political process (Ross(1948)), its ability to provide a collective voice for its members (Freeman(1976), Freeman and Medoff(1984)) or by its nature as 'an organisational entity with security goals of its own' [Faith and Reid(1987) p.40)]. These analyses prefer to recognise the institutional characteristics of trade unions and note that simply considering a union in terms of the effects it has on wages and/or employment is not sufficient. In doing so they aim to stress both the desirable and undesirable features of unionism. This framework allows a more general evaluation of the effects that trade unions may have on economic performance since it permits a broader view of the situations in which unions operate which could not be incorporated into the highly specific formal models which have been studied to date. Obviously the cost of this approach is that it cannot be ade-

---

[10] Most, although not all, support an off the demand curve settlement but find it hard to determine whether the outcome is on a vertical contract curve : examples of such tests are Abowd(1987), Brown and Ashenfelter(1986), McCurdy and Pencavel(1986) and Svejnar(1986) using U.S. data and Carruth and Oswald(1985), Carruth, Oswald and Findlay(1986), Bean and Turnbull(1987) and Nickell and Wadhwani(1988) using British data. There is also some debate as to whether the mixing procedure which nests the labour demand curve models in the more general efficient bargain is appropriate : see Andrews and Harrison(1988) who argue such models are non-nested and that non-nested hypothesis tests should be used to discriminate between them.

quately adopted in a formal economic sense as those models which attempt to do so rapidly become intractable.

In an effort to recognise the institutional and economic aspects of unionism Freeman(1976) interpreted Hirschman's(1970) famous exit-voice model of the social system in terms of the labour market, paying particular attention to the distinction between the ability of union and non-union workers to air their grievances to management. He argues that individual workers are only able to express job dissatisfaction by quitting since once they have objected then they have been marked by employers as dissenting voices. This is what he refers to as the exit mechanism and is necessarily associated with a large cost (losing employment). On the other hand, in the presence of trade unions individuals who have similar grievances can air their views collectively through the union without fear of individual recrimination from employers. As such a trade union is able to provide a collective voice for its members which counters the need to quit as a means of making known discontent with the operations of the workplace. This view highlights a number of potentially desirable aspects of unionism which are relevant to the impact that unions may have on economic performance. Indeed the recognition that unions have 'two faces' (see Freeman and Medoff(1979)), the monopoly face and the collective voice face,[11] has important implications for untangling the sources of the union impact on productivity and profitability and it is these possibilities which are considered next.

Isolating the effect that trade unions have on productivity in the context of formal economic models is not straightforward. Consideration of institutional arrangements does not solve this but permits identification of a wide ranging number of possible routes through which positive and negative productivity effects may occur. For instance, the work of the collective voice school (see for example Brown and Medoff(1978) and Freeman and Medoff(1984)) isolates a number of possible sources of productivity improvements and reductions that might ensue from unionisation. It

[11] Although it should be noted that this is by no means an original distinction. For instance, as far back as 1902 Sidney and Beatrice Webb drew the distinction between what they termed the doctrine of a living wage and the doctrine of vested interests. Whilst the former refers purely to wage aspects of unions the latter focuses on the union's role in management decisions, watching over hiring methods, the use of new machinery and in identifying a role for unions in dismissal and disciplinary procedures.

should be noted that their analysis primarily has the U.S. in mind and as such one should be careful not to immediately translate their work to the British situation. However, most of the points they make are relevant to some degree and discussion in the British context supplemented by the relevant institutional context and by any additional observations relevant to Britain seems entirely plausible.

Neoclassical models of union behaviour axiomatically identify a number of employer responses to higher union wages. First, the shift up the labour demand schedule will cause a substitution from labour to capital such that unionised firms are more capital intensive. Secondly, unionised employers will hire higher quality workers, namely those who possess more human capital. A third response is that, conditional on market structure, product prices may rise due to a higher marginal cost of employing an additional worker. The collective voice school accepts these theoretical channels but feels that discussion of union effects on productivity should also recognise a number of other features. For instance, the exit-voice distinction suggests that quit rates will be lower in unionised circumstances. Reductions in labour turnover therefore mean that management may be more prepared to invest in firm specific training which raises the average skill ratio thereby enhancing productivity. The collective voice view also argues that interactions between workers are important such that improved morale and motivation among unionised employees can engender productivity improvements. One channel through which this may occur is the presence of union backed seniority rules for lay-offs or promotion which can reduce rivalry among workers. This may contribute to productivity gains : on the other hand, it might be argued that such rules (which it should be noted are more prevalent in the U.S. than in Britain) can prevent workers from gaining promotion as quick as they might wish or prevent unproductive workers from being laid off and as such hinder productivity.

Another non-wage route via which unions can have an impact on the workings of the production process is by ensuring that management recognise certain internal organisation procedures that they would not in the absence of unions. As Pencavel(1977) puts it 'the trade union may be interpreted as the employees' auditor of management checking that the employer is fulfilling his part in the labour contract' [Pencavel(1977) p.139]. The important point that this

makes is that unions are able to have a say in the organisational set-up of the firm and that any control they possess in this role may feed through into effects on performance. This monitoring role is also recognised by Faith and Reid's(1987) analysis which depicts a union as acting as an agent for its members : they highlight the organisational characteristics of unions and their role in the firm and by doing so recognise the scope for unions to affect performance. More specifically they argue that unions are able to help a firm to earn higher (pre-distribution) monopoly profits by restricting output (via work stoppages and restrictive work practices) such that there exists a real role for unions to monitor output. This effective cartelisation of output also ensures that unions may obtain a share of monopoly rents. Faith and Reid also argue that the presence of restrictive work practices can aid a union in taking some control in the operations of the workplace. More typically, the output reducing role of restrictive practices has been highlighted and put forward as one explanation of why productivity may be lower in unionised situations. The wide ranging definition of restrictive practices encompasses industrial action, overtime bans, bans on piecemeal rates, demarcation practices, the closed shop and a numerous other work related issues. In most situations these factors are likely to reduce levels of productivity.

The underlying economic, social and political climate is also pertinent to discussions of union power and the degree of control that unions have in the operations of the firm. Whether the industrial relations situation is more conducive to adversarial union management relations or whether, as recently in Britain, legislative measures force trade unions to behave in a more cooperative manner is of some relevance and will feed through into the union impact on productivity. The comparison between the 1970's when, following the Donovan(1968) report, unions were able to behave in a more independent fashion and the 1980's where unions have had to comply more and behave in a more cooperative style is important. The empirical work presented in Chapters 3 to 6 is based on data almost entirely from the 1980's, a time when the role of unions and the trade union movement is being questioned. Unfortunately, as the empirical analysis reported in the following Chapters is based on cross section data (or only covers a few years) the effects of a changing legislative environment cannot be ascertained. It does however lurk in the background and should be borne in mind when viewing the results.

This discussion adequately illustrates that a number of channels exist through which unions may influence productivity that the formal models fail to identify. Indeed this highlights the main contribution of the collective voice school : namely that recognition of the non-wage provisions made by trade unions is of some importance. For instance, they stress the role of unions in providing grievance and arbitration procedures, for recognising the channels of communication between workers and management, for negotiating workplace conditions and for providing fringe benefits such as pensions, holiday pay and accident insurance. The institutional and economic characteristics of the plants and firms in which unions are located are also important and should not be forgotten in studying the union impact on productivity. The indeterminancy of isolating a firm prediction concerning the union impact on productivity however suggests that ultimately the question is an empirical issue, although one which can be best considered by allowing both a role for the wage and non-wage aspects of unionism.

Institutional and organisational characteristics of unions and the firms and markets in which they operate are also of importance in analysing union effects on profitability. It is evident that higher union wages may be financed in a number of possible ways. Among these are higher product prices, through higher productivity, use of more efficient production technologies or via a reduction of profits. Whilst all are possible to some extent, a number of reasons exist to explain why unions should have a claim to a share of a firm's profits. In the formal models discussed above, unions are pictured as raising labour costs but also as making firms cut back on output and raise product prices. The net effect on profit margins then depends on the magnitude of the price rise relative to the union wage effect. Market structure is of some importance in dictating the extent to which firms may raise product prices. Kalecki(1971) suggests that coordination in price setting among firms in oligopolistic markets means that producers are unlikely to be able to increase prices sufficiently to outweigh the union induced wage increase ; hence price-cost margins will fall in unionised circumstances as unions appropriate a share of excess profits for themselves and their members. Whilst, again this needs to be resolved empirically it seems the idea that unions can capture a share of any rents thereby reducing profit margins has some intuitive appeal. As noted by the collective voice school the presence of negative union effects can also

provide a very plausible rationale as to why managerial opposition to unionism occurs since ultimately managerial performance is dictated by the profitability of the firm.

A further consideration is necessary. If a significant proportion of profits are distributed to labour this may deter investment (see Grout(1984)). Reducing investment can then hamper long term profitability. On the other hand, other arguments are possible : for instance higher union wages are often said to cause a switch from labour to capital thereby raising investment. Hence, investment is also another area in which ambiguous union effects are predicted (see the discussion in Metcalf(1988)). However, investment strategies are potentially important when considering the union impact on productivity and profitability and necessary allowance for differences in capital intensity between union and non-union situations is important in analysing both.

The relevance of outside factors like legislative measures and/or the underlying industrial relations climate is also likely to feed through into the union influence on profitability. The existence of a weaker trade union movement may shift the onus of control to management and away from unions and limit the ability of unions to extract a share of the organisational rent. The legislative measures curbing the power exerted by closed shop arrangements introduced in the early 1980's, together with the high unemployment prevailing in Britain make this a real possibility and one which should be recognised in interpreting the cross-section results reported in following Chapters.

The implication that follows from most of these considerations is that unions are likely to reduce profit margins : the channels through which this might occur are important and again one should be careful to identify the relevant characteristics of the union and firm or industry in which it is located. For example, Craypo(1981) notes that industrial structure is of some importance in dictating whether it is possible to pass on higher union wages as higher prices to the consumer. In industries where this is possible higher profits can be earned and this raises another issue, namely that unions may be more likely to attempt to organise the workforce in these industries since the premium for organising workers in highly profitable situations may be higher (see Abowd and Farber(1988)). This same observation can be made at the firm level by suggesting that those

firms which possess a greater degree of market power (presumably secured by a high market share) will be more prone to unionisation and thus more likely to be characterised by lower profit rates. This suggests the testable hypothesis that unions will be more likely to be a claimant of a share of profits in situations where there is a greater ability to earn economic rents. Again, the implication of this discussion is that the analysis of union effects on profitability is essentially an empirical issue and one in which organisational features of the firm, the institutional features of the union and the industrial characteristics of the firm's operating market should receive a primary role.

2.3 Unions and Productivity : Existing Empirical Evidence.

The majority of empirical work analysing the relationship between unions and productivity has been based on U.S. data. Some exceptions do exist, the British studies to date being Pencavel's(1977) historical study of British coal mining, Knight's(1988) analysis of the relationship between strikes and industry level value added per employee hour, Denny and Muellbauer's(1988) consideration of the union productivity effect between 1980 and 1984 and Edwards(1987) more institutional based approach. The main conclusions reached by the U.S. studies are more favourable to the collective voice unions raise productivity thesis than are the British studies although clearly direct comparison is complicated by the considerable institutional differences between the two countries.

The basic empirical methodology for analysing the union impact on productivity was initially introduced by Brown and Medoff(1978) and essentially involves estimation of a Cobb Douglas production function augmented by a vector of additional variables including a unionism variable. Their approach is best illustrated in the following way : a Cobb Douglas production function which is amended to allow one to draw the distinction between unionised labour (L_U) and non-unionised labour (L_N) can be defined as

$$Y = AK^{\beta_1}(L_N + cL_U)^{1-\beta_1} \qquad (0 \leq \beta_1 \leq 1). \qquad (2.3.1)$$

where Y is output, A is a constant, K is capital, β_1 is the elasticity of output with respect to capital and the production function is defined to have constant returns to scale.

If $c>1$ (<1) this implies unionised workers are more (less) productive than their non-union counterparts. Rearranging equation (2.3.1) gives

$$Y = AK^{\beta_1}L^{1-\beta_1}\{1+(c-1)U\}^{1-\beta_1} \tag{2.3.2}$$

where $L = L_N + L_U$ and U is the unionised proportion L_U/L.

Dividing throughout by L and taking natural logarithms yields

$$\ln(Y/L) = \ln A + \beta_1 \ln(K/L) + (1-\beta_1)(c-1)U \tag{2.3.3}$$

The productivity differential of unionised establishments is the coefficient on union density ($(1-\beta_1)(c-1)$). If the differential is positive (negative) then the production frontier of union firms lies outside (inside) that of the non-union firms. By the same token, $(c-1)$ is the productivity differential between unionised and non-unionised workers.

The assumption of constant returns can be relaxed by replacing $(1-\beta_1)$ by β_2 and rearranging to give[12]

$$\ln(Y/L) = \ln A + \beta_1 \ln(K/L) + (\beta_2+\beta_1-1)\ln L + \beta_2(c-1)U \tag{2.3.4}$$

Therefore, estimating equation (2.3.4) allows one to determine the impact of unionism on worker productivity for a given level of worker quality and capital per worker. To control for the higher capital to labour ratio suggested by the standard price theoretic union monopoly model $\ln(K/L)$ is included as an independent variable. To control for the notion that an outward movement in the labour demand curve occurs due to hiring higher quality workers is usually achieved by estimating an auxiliary earnings function and adjusting the labour input such that those workers with more human capital represent more units of labour. A labour quality index based on the

[12] Obviously a test of whether the production function displays constant returns amounts to a test of H_0 : $\beta_2+\beta_1-1=0$. A significant positive (negative) coefficient on ln$L$ implies increasing (decreasing) returns to scale.

fitted values of an earnings equation is generally constructed and then included as an argument in the production function. Finally, perhaps the most troubling aspect is that the dependent variable usually used in these studies is value added and as such contains the price effects resulting from union induced wage increases. There seem to be two ways to circumvent this problem. The first and most desirable route is to define output in physical units so that there is no contamination by price effects : however such measures of output are only appropriate for certain sectors of the economy.[13] In general such information neither exists nor is appropriate. The second alternative is to deflate value added by a relevant price deflator so as to isolate and remove the price effect. Clearly problems occur if the price index is not perfectly matched. Despite this, deflation of the dependent variable (even if by an imperfect index) is of some importance in the empirical analysis of union productivity effects.

The Brown-Medoff approach is adopted by most studies as their starting point and the results from the U.S. are, as one might expect, fairly mixed but point if anything to a productivity enhancing role for trade unions. Examples of studies finding positive productivity effects are Brown and Medoff's(1978) analysis of U.S. manufacturing industry and Allen's(1984) analysis of U.S. construction. Examples of neutral productivity effects are reported in Clark's(1984) firm level study and Allen's(1986a) study of elementary and secondary school construction projects.[14] The few existing British results are less optimistic. Pencavel's(1977) study of British coal mining utilises a CES production function in evaluating whether a unionised firm's production frontier lies inside or outside that of a non-union firm. His main conclusion[15] is that ceteris paribus a totally unionised coalfield is 22% less productive than a completely non-unionised coalfield. However, as stated by Pencavel 'it would be absurd to generalise from a study of a single industry some seventy years ago to the situation that obtains in Britain today'.[Pencavel(1977) p.145]. A contemporary study by Denny and Muellbauer(1988) utilises industry level productivity data

[13] See for example Clark's(1980a,1980b) analysis of the U.S. cement industry or Ichniowski's(1984) analysis of U.S. paper mills where output can be defined in physical units.

[14] For more extensive showing the variety of U.S. results obtained see the surveys in Freeman and Medoff(1984) and Hirsch and Addison(1986).

[15] He also finds an insignificant union relative wage effect which he claims reduces problems of contamination by price effects.

supplemented by industrial relations data from the Workplace Industrial Relations Surveys of 1980 and 1984. For the most part they find neutral union effects although the use of some union variables produces a negative effect. Edwards(1987) uses data from the 1978 Warwick Survey of manufacturing establishments (see Brown(1981) for more details) and a survey carried out by the Industrial Relations Research Unit at Warwick in 1984 to analyse the effects of plant level unionisation on company level sales per employee.[16] He finds that the effect of unions is insignificant using data from both studies. Similarly Knight's(1988) study fails to isolate any discernible influence of strike activity on labour productivity for British manufacturing industry in 1968. He interprets this as evidence to dispel the myth that unions always exert a depressant effect on performance.

It might come as no real surprise that the results from the British studies differ from the U.S. results on unions and productivity. For instance, Pratten(1976) compares labour productivity (defined as value added per employee) between Britain and other countries using data on plants owned by international companies. He isolates a productivity differential which suggests that British plants are 50% less productive than their U.S. counterparts. Of this 50% he attributes 15% to behavioural factors such as strikes, overmanning and restrictive work practices. Another international productivity study worthy of note is Caves'(1980) comparison of factor productivity in 71 British and U.S. manufacturing industries. He argues that labour relations play an important role in determining productivity and pays particular attention to strikes, restrictive practices and overtime clauses in labour contracts. In a productivity regression (with dependent variable the ratio of British productivity to U.S. productivity) measures of strikes and work days lost have a statistically significant negative influence. Hence he argues that disruptions in the workplace do influence productivity and that a conflictual industrial relations climate has acted as a hinderance to productivity in Britain. Davies and Caves(1987) also come to a similar conclusion in finding the extent of unionism to be negatively correlated with productivity growth in their study using

[16] Unfortunately the dependent variable was not deflated nor, due to data unavailability, were material costs netted out. Clearly these problems are also compounded by the fact that the dependent variable is at company level whilst the union data is not.

industrial data from the late 1960's and 1970's in Britain.[17] The evidence presented by these studies suggests that talk of a union potential to raise productivity may be less applicable in the British situation.[18]

The studies cited to date generally derive some kind of average union effect on productivity within their sample. However, more recently some (mostly American) work has attempted to open up the 'black box' containing the sources of union effects on productivity. For instance, Freeman(1980a,1980b) provides empirical evidence to back up the exit-voice idea that unionised workers have lower quit rates and that labour turnover is lower in unionised circumstances. Stewart(1987b) provides similar evidence for Britain. Additional evidence for the collective voice notion that unionised workers are more likely to air grievances is provided by Leigh(1986) who reports evidence that unionised workers are more likely to express job dissatisfaction. With reference to the notion that unions have some kind of 'shock effect' on managerial practices, Clark(1980b) considers six U.S. cement plants that changed union status over the period 1953-76. Through interviews with management and unions he was able to obtain information regarding worker and management responses to unionisation. His main conclusion was that significant differences occurred following unionisation especially with respect to managerial behaviour. This he views as evidence for a union shock effect on management. Another conjecture offered in the discussion of routes through which unions may affect productivity levels was their impact on the morale and motivation of their members. Pencavel's(1974) analysis of British coal mining constructs an index of industrial morale (based on quit rates, absenteeism rates, accident rates and the incidence of strike activity) and finds lower morale to be associated with lower output. This, he states, suggests that the morale and motivation of the workforce is an important determinant of the workings of the production process.

On the negative side, the presence of restrictive work rules (such as overmanning, seniority

---

[17] Although note that a number of U.S. studies have reported negative union effects on productivity growth : an example is Hirsch and Link(1984). This suggests that static and dynamic productivity effects may be very different.

[18] See Addison(1984) who also points to the existence of the closed shop and the greater incidence of restrictive practices in Britain to make this point.

rules and 'make work' strategies) may provide sources of dampening productivity effects. Empirical work on this has been carried out by Ichniowski(1984) and Allen(1986b), again using U.S. data. Ichniowski(1984) proxies the number and complexity of work rules by the number of pages of the labour contract and (whilst one can question the use of such a proxy on the grounds that a shorter contract does not necessarily mean fewer work rules) finds a significant inverse relationship between plant productivity and number of contract pages. He claims this as supportive evidence for the view that restrictive work practices restrict productivity. Allen(1986b) follows Freeman and Medoff's(1982) assertion that the existence of restrictive work practices generates lower price elasticities of demand and elasticities of substitution between factor inputs in the union sector.[19] The sample used by Allen, based on data on commercial office buildings and elementary and secondary school construction projects, has the advantage of referring to identical products and technology for union and non-union constructors and hence he claims to be able to accurately test the hypothesis. He finds lower elasticities of substitution between skilled, supervisory and unskilled workers in the union sector (but no difference in elasticities of substitution between labour and non-labour inputs) and claims this as some evidence to reflect the idea that work rules do have an adverse influence on performance. However, simulations based on his estimated model suggest the magnitude of the effect is not particularly large. It can also be argued that unions impede productivity in unionised firms by disrupting production via industrial sanctions. However, Neumann and Reder(1984) find that in U.S. manufacturing strikes have little influence on firms' overall output. These results are mirrored for the British situation by Knight(1988).

A large (and growing) research programme has undertaken an empirical evaluation of the impact that trade unions have on productivity and the routes through which these effects may occur. However, most of these studies have used U.S. data and making any firm predictions regarding the productivity effects of British trade unions is difficult since little work has been

[19] Freeman and Medoff found lower demand elasticities in the union sector although, due to use of a highly aggregated data set, were unable to discover whether this was due to the presence of union work rules or due to the notion that unions tend to organise labour in sectors with lower demand elasticities.

conducted in this area. It seems clear from viewing existing evidence that the effect will vary from one situation to another and what needs to be examined is the variation of union productivity effects in different contexts. Clearly the discussion in this section suggests a considerable need for the empirical analysis of the effects of contemporary British trade unions on the production process.

2.4 Unions and Profitability : Existing Empirical Evidence.

A long history of Industrial Organisation studies analysing the determinants of profitability at the level of the firm and industry now exists.[20] Typically these studies identify a large number of determinants of the ability to earn above-normal profits including the number and size distribution of sellers and buyers in the market, the share of the market possessed by individual firms, the nature and degree of product differentiation, the conditions of entry for new sellers, the degree of foreign competition, the characteristics of demand and whether the firm produces consumer or producer goods. However, it seems plausible that labour activity may be able to play a role in the ability of firms or industries to raise profit margins. Whilst this observation has been noted on theoretical grounds for a considerable time[21] it is only recently that empirical structure-performance studies have viewed unions as a claimant to residual profits.

In a general sense a model using firm level data to empirically evaluate the impact of unions on profitability can be depicted as

$$\pi_{ij} = \pi(X_j, Z_{ij}, U_{ij}) \qquad (2.4.1)$$

where π is the profit rate for the ith firm operating in the jth industry, X is a vector of structural characteristics of the operating industry (e.g. market concentration, the extent of entry barriers, import competition), Z is a vector of firm specific variables (e.g. market share, capital intensity) and U is a (scalar) measure of union presence in the firm.[22]

[20] Surveys of these studies are given by Scherer(1980), Schmalensee(1986) and Geroski(1988).

[21] See for example, Segal(1964) or Levinson(1967) for two differing views on this subject.

[22] Due to data difficulties some studies have been forced to use industry level union measures which as-

Equation (2.4.1) or an industry level equivalent has generally been estimated using a variety of U.S. data sources. Of considerable interest is that regardless of data source, measure of profits, or time period under consideration unions are found to reduce the profit rate. Industry level studies which show that unions erode price-cost margins are Freeman(1983), Karier(1985,1988), Domowitz et al.(1986) and Voos and Mishel(1986). Firm level studies showing a lower rate of return on sales or capital or a fall in market value based profitability measures are Clark(1984), Salinger(1984), Connolly, Hirsch and Hirschey(1986) and Hirsch and Connolly(1987).[23] No contemporary British studies exist at the time of writing although Cowling and Waterson(1976) do include a lagged union density measure in a first differenced industry level price-cost margin equation based on 1960's data but find no significant relationship. However, what does exist is the British studies of unionism and wage share from which can be inferred a union profitability effect. As the share of wages in value added is negatively related to the price-cost margin the positive estimates of union presence on wage share found in the British industry level studies of Cowling and Molho(1982), Henley(1984) and Conyon(1988) can be viewed as suggestive evidence of a negative union influence on price-cost margins.[24] Thus the existing evidence from both Britain and the U.S. seems to support the notion that the profit rate will fall as a consequence of unionism.

As highlighted in the discussion of existing theoretical explanations of union effects on performance union profit effects are likely to be a function of the characteristics of firms and markets in which they are located. In this light, it seems reasonable that product market imperfections may be interactive with the union ability to extract a share of profits. As Rapping(1967) puts it 'unions are more effective when bargaining in industries in which product market competition is absent and ability to pay is high' [Rapping(1967) p.32]. To test this assertion, a number of the U.S. studies have tested whether this interactive relationship occurs and thus whether union profit effects are more marked in positions of product market power. Most of the industry level

---

sums that union activity in the firm is the industry average : this is obviously a strong assumption.

[23] See also the analysis of Ruback and Zimmerman(1984) showing a negative relation between successful union representation elections and the equity valuation of firms.

[24] For some evidence using U.S. data see Henley(1987a).

studies (Freeman(1983), Karier(1985,1988), Voos and Mishel(1986)) find that unions reduce profit margins by more in highly concentrated industries.[25] This is corroborated by the firm level study of Salinger(1984). Recent developments in the empirical Industrial Organisation literature based on firm level data have however questioned the use of concentration as the key determinant of the ability to earn monopoly profits. These studies (see Gale and Branch(1982), Ravenscraft(1983) and Kwoka and Ravenscraft(1986)) emphasise the role of firm specific market share as the main determinant of profitability. Firm level studies analysing the interaction between union presence and market share have produced mixed results. Hirsch and Connolly(1987) find some evidence of more marked union effects in firms with higher market share. But they prefer to emphasise the role of other determinants of profitability such as R&D expenditure and cost advantages that firms possess due to technological innovations in providing rents that unions can capture.[26] As such they prefer to conclude that union effects are negative but it is not necessarily market power but firm specific factors like R&D expenditure and the ability to innovate which determine the size of the union profit effect. Another U.S. firm level study is that of Clark(1984) who finds the somewhat surprising result that those firms with lower market share are more likely to be characterised by negative union effects. This data set does however seem to be something of an outlier (based on large firms, most of which have market power) and these results seem to be very specific to this data source.

Certain studies have tried to get a handle on what proportion of profits is redistributed to workers in the form of higher wage gains. Salinger(1984) finds that unions benefit most from the existence of monopoly power and some 77% of monopoly profits made by a sample of U.S. firms go to unions. Voos and Mishel(1986) suggest that at least 80% of the entire union wage effect is financed from a redistribution of profits. This is therefore construed as evidence that unions have positive distributional effects (which may offset their detrimental allocative effect) since the majority of the union wage effect does not come either at the expense of non-union members or

[25] Domowitz et al.(1986) however find no relationship.

[26] See also Connolly et al.(1986) and Hirsch and Link(1987) who forward arguments along the same lines.

via higher prices but via a reduction in profits.

The empirical literature analysing the union impact on profitability is still relatively new although a number of interesting results have already emerged. The notion that unions have wide ranging effects and may influence performance, one indicator of which is profitability, is of some importance. As with most economic hypotheses, the result that unions reduce the profit rate is open to interpretation in a number of ways. It is clear that the results finding negative union profit effects can be appealed to as a rationale for management opposition to unionism as ultimately this implies that trade unions damage the bottom line of company accounts. What is less clear is whether negative union profit effects are undesirable from a welfare stance. Whether union rent seeking is more or less marked in situations of market power is of some importance in attempting to answer this question. Since these ideas have yet to be confronted with British data it therefore seems that there is a need to attempt to examine union effects (and the channels through which they occur) on financial performance in Britain.

2.5 Unions and Alternative Compensation Arrangements.

Traditionally trade unions have fought hard to maintain wage premiums for their members based on the standard wage system giving a fixed rate per hour, week or month. However, recently there has been a renewed interest in flexible payment methods, partly due to the work of Weitzman(1984,1985,1987) and partly due to a worry regarding high labour costs damaging the performance of the economy.[27] These involve paying workers a base wage plus some bonus which depends on the performance of their establishment or firm. The performance measures generally considered are profits, share prices or value added, giving rise to profit sharing, share ownership or value added schemes respectively. It is hence of some interest to see whether the recent uptake of these schemes in British workplaces creates a conflict with traditional union attitudes towards methods of pay.

[27] See Estrin, Grout and Wadhwani(1987) and Standing(1988) for extensive reviews of the relevant literature.

Weitzman(1984) postulates three main reasons as to why a sharing system is superior to the traditional wage system. Firstly, holding shares or being paid some share of value added or profits generates a greater allegiance to employer goals on the part of employees. Increased company loyalty and a greater feeling of involvement in the actions of the firm is considered to increase employee morale and motivation and thus increase productivity. Sharing arrangements are likely to do so where worker effort is imperfectly observed such that sharing can mean that a firm and its workers can have similar objectives which then reduces a need for monitoring (see Hart(1983)). The second reason is that performance linked pay adds a dimension of increased wage flexibility thereby reducing labour turnover costs. The idea here is based on the neoclassical premise that a firm will hire workers until the wage equals the marginal revenue product of labour. If one specifies wages in terms of a base wage plus a bonus linked to performance then setting the base wage equal to the marginal product implies that, for a given overall wage, the firm will want to hire more workers. Any shocks then mean that wages will adjust (via the performance linked component) so that employment stability is maintained. Hence, wages will be more flexible and employment higher than in a firm operating a conventional wage system. Finally, by extending this argument to the macroeconomic context profit linked pay will result in lower unemployment since macroeconomic shocks will be absorbed by the economy as wages adjust over the business cycle. Clearly it is mainly the first two propositions which are of interest here since it is the relationship between sharing arrangements and unionism at the level of the plant or firm in which we are interested. What is of considerable interest is that both the claim that sharing generates increased productivity through improved morale and motivation and the claim that sharing schemes may reduce turnover costs and increase wage flexibility are two of the claims made in favour of unionisation by the collective voice school. This might be construed as suggesting that by introducing performance linked payment methods employers feel they can achieve productivity gains without unionisation and without the other productivity reducing features of union presence. Thus it seems to be of considerable interest to ascertain whether or not these schemes are introduced in the presence of unions.

Mitchell(1987) outlines three fundamental reasons why unions are likely to be sceptical about the introduction of performance linked payment schemes. Firstly, these schemes shift a portion of the risk associated with variable wages from employers to employees. Secondly, the link with performance undermines the principle of equal pay for equal work, a long held union goal. Thirdly, because of the lower base wage management has an incentive to take on more workers and if they do so this would dilute the bonus payment going to each employee. Reasons therefore exist as to why unions are likely to oppose the introduction of these schemes.

Given that unions are generally sceptical about changes in payment methods it is of considerable interest to see whether these schemes have been introduced in unionised circumstances and to ascertain the motives behind their introduction. For instance, it is evident that the introduction of schemes can alter the nature of the collective bargaining process. Take the case of profit sharing. In the absence of profit sharing, profits may be defined as $\Pi = R(L) - WL$ where the notation is as in Section 2.1. Wages and employment can then be set as the solution to the Nash bargaining problem (either unconstrained or constrained to the labour demand curve)

$$\Sigma = [(U(W,L))^{\psi}(R(L)-WL)]^{1-\psi} \qquad (0 \le \psi \le 1). \qquad (2.5.1)$$

Clearly, the bargain here occurs over wages and employment (or if constrained to the labour demand curve, just over wages). In a profit sharing firm things become more complicated. In this situation workers are paid a base wage $\overline{W}$ plus a share, say s, of firm profits such that

$$W = \overline{W} + s\left[\frac{R(L)-\overline{W}L}{L}\right] \qquad (2.5.2)$$

and firm profits now become

$$\Pi^{s} = (1-s)(R(L)-\overline{W}L) \qquad (2.5.3)$$

The difficulty now is how to define the bargain. Do unions bargain over the base wage alone ? Is the bargaining only over shares ? Do they bargain over the base wage and the share seperately ? Or, is the bargain the same as it would be in the standard wage system ? In a general sense the

Nash bargain under sharing becomes

$$\Sigma^S = [(U(\overline{W}, L)]^{\theta}[(1-s)(R(L)-\overline{W}L)]^{1-\theta} \tag{2.5.4}$$

where the superscript S is an indicator that the objective function refers to a firm with sharing arrangements.

What is clear is that the nature of the bargain can alter in the presence of sharing arrangements. It seems likely (although not necessary) that the relative strengths in the bargain and indeed the trade-off between W and L in the union utility function will alter in the presence of sharing schemes. This may impinge on the decision of whether or not to introduce schemes when unions are present and is addressed in more detail in Chapter 6.

Wadhwani(1988) assumes a particular functional form for the objective function as $\Sigma = W^{\theta}\Pi$ where θ is the relative bargaining strength parameter $\frac{W}{(1-W)}$, to show that in unionised situations a wage system will generate a higher value of Σ than will a sharing system.[28] The argument here is that for a given overall wage employment will be higher in sharing firms : this is because employment is set in sharing firms according to the first order condition $\partial R/\partial L = \overline{W}$ compared to $\partial R/\partial L = W$ in traditional wage firms. Thus for a given overall wage profits are lower under sharing and consequently so is Σ. Because of this, unless tax relief is offered on sharing schemes so that Σ under sharing can exceed its value in the traditional wage system, neither unions nor firms in which they are located will be attracted to schemes. As recent legislation in Britain (mainly the 1978, 1980 and 1984 Finance Acts) has been geared towards offering tax incentives on share ownership and profit sharing (although not for schemes linking pay to value added) then it is possible that in some firms the potential value of Σ under sharing can rise above its non-sharing level. The presence of tax incentives therefore provides a rationale for why some companies have recently introduced sharing schemes.[29]

[28] Wadhwani's analysis effectively augments that of Weitzman(1985) by the inclusion of a wage bargain. Weitzman's analysis is based on monopolistic competition in the product market and profit sharing in the labour market. An informal analysis is given in Weitzman(1984) ; a more rigorous analysis in Weitzman(1985) ; and the issues of union-firm bargaining is also addressed in Weitzman(1987).

[29] The theoretical papers by Jackman(1988)and Pohjola(1987) are also relevant here. The arguments underlying their analyses are that higher employment under profit sharing may be viewed as a way of forcing

When tax relief is available there is also an incentive for firms and unions to get together and collude in wage setting so as to each obtain a share of the additional rent that a government subsidy makes available. For instance, suppose the availability of tax relief makes the wage in a sharing firm $\overline{W} + \tau s\,(R(L)-\overline{W}L)/L$ where τ is a tax parameter indicating the proportion of profit related pay not to be taxed. Given this overall wage and the higher resultant profits (because of τ) the value of Σ^s can exceed that of Σ. Wadwhani(1987a,1988) however argues that there is a real possibility that the presence of tax relief can be exploited. If the union and firm collude to pick a total wage, say $\hat{W} + \tau s\,(R(L)-\overline{W}L)/L$, then, as long as $\hat{W} > \overline{W}$, an even higher value of Σ^s can be achieved. In this situation schemes will be purely cosmetic as they are only introduced because firms and unions can take advantage of the subsidy. Despite the fact that the wage actually paid out by the firm falls it is augmented by the subsidised profit share payment so that the overall wage may be unchanged or could even rise. The advantage to the firm is that it can earn higher profits because it is paying out lower wages. As a consequence of this collusive behaviour the potential economic effects, in particular the higher employment levels Weitzman(1984,1985,1987) claims profit sharing will generate, may be negligible. Thus, whilst the availability of tax relief for sharing arrangements can provide an incentive for the introduction of such schemes, the existence of cosmetic sharing means that their economic effects may be nullified.

Poole(1988) acknowledges the importance of tax incentives for the introduction of schemes but also argues that additional factors are of some importance. The managerial style within a given company is highlighted, as is the state of industrial relations. He describes data on 303 companies to show that where there exists more consultative management-worker relations and where information is more freely given to workers and their representative trade unions schemes are more likely to be present : on top of this his data suggests that firms with formal collective bargaining agreements are more likely to operate schemes. This is certainly of some interest and is explored more fully using micro-data in Chapter 6, in particular linking the extent of union

labour contracts towards an efficient bargaining outcome rather than the 'on the labour demand curve' arrangements characterising contracts in traditional wage firms.

presence to the probability of operating a scheme.

Other empirical evidence on sharing schemes is mostly very recent and generally considers their impact on economic variables. Much of this work has been aimed at testing the Weitzman propositions. Wadhwani and Wall(1988) present evidence to show that profit sharing actually increases overall remuneration such that it is simply a bonus on top of the 'normal' wage. This is not in line with Weitzman's claim that increased wage flexibility ensues from profit sharing and even suggests that schemes may be inflationary. In an employment equation they find that it is not the base wage, but the overall wage, which the firm considers to be the marginal cost of labour. In this situation the employment consequences of sharing profits are insignificant, hence casting doubt on the unemployment reducing facility of sharing as promoted by Weitzman.[30] In the same study it is also of interest that Wadhwani and Wall find some evidence of higher productivity levels in firms with profit sharing. This seems to imply that, in their sample, profit sharing is essentially an incentive type payment purely aimed at generating higher productivity.

Other empirical evidence on the economic impact of sharing arrangements is fairly mixed. For instance, Estrin and Wilson(1986) find that profit sharing significantly reduces remuneration and increases employment in a small sample of engineering firms. Cable and Wilson (1988) find that profit sharing boosts productivity in the same sample : interestingly they cite the industrial relations climate in the engineering sector as a source of such effects. Bradley and Estrin(1987) find higher employment in the John Lewis Partnership (a firm that has engaged in profit sharing for some time) but no remuneration effect relative to its four main retail trade competitors. Richardson and Nejad(1986) present evidence to show share prices in the multiple stores sector are higher in firms with employee share ownership schemes. However, most of these are studies of particular sectors of British industry : Blanchflower and Oswald(1987a,1987b) use the nationally representative Workplace Industrial Relations Surveys of 1980 and 1984 to show that share ownership/profit sharing has no significant influence on levels of employment or on managerial perceptions of capital investment or financial performance. Therefore, the economic effects of

[30] Similar conclusions are reached by Wadhwani(1987b) in an empirical study using aggregate data from Japan.

performance linked pay are still far from clear. However, given the increased number of schemes linking pay to performance and the present Government's advocacy of such schemes it seems of interest to analyse whether schemes are being introduced in the hope of raising performance levels in unionised workplaces, or to shift control from labour to management or merely to obtain the tax advantages that recent laws make available to employers and employees participating in such schemes.

2.6 Summary.

This survey of existing work analysing the relationship between unions and economic performance highlights the fact that, to date, very little British work has studied these issues. It also emphasises that pure consideration of formal economic models is not sufficiently general to adequately consider the link between unionism and the two indicators of performance chosen, namely productivity and profitability. Taking the predictions of economic theory in conjunction with those derived from a more institutional viewpoint makes it clear that the determination of the union effect on productivity and profitability is a complex subject. The approach to be adopted in the remaining Chapters is to empirically examine the relationship between unions and economic performance using microeconomic data on British firms and establishments. Finally, it was noted that the implications flexible payment schemes have for unions is of some interest and thus, after determining the possible effects unions may have on performance in Chapters 3-5, the relationship between trade unions and the presence of sharing arrangements will be analysed in some depth in Chapter 6, after which some insight is hoped to have been gained into some of the economic features of British trade unions.

CHAPTER 3.

The Productivity Effects of Unionisation and Firm Size in British Engineering Firms.

The discussion in Chapter 2 highlighted that, until very recently, little work has been undertaken to analyse the influence that British unions have on productivity. Whilst the U.S. evidence is well documented and a number of data sets exist to permit examination of the union impact on productivity data deficiencies have largely prevented study of this issue in Britain. Indeed data demands to carry out such work are quite heavy. Adequate measures of productivity are not easily found and data sets which do include satisfactory productivity measures more often than not do not possess industrial relations data. On the other hand, industrial relations data sources rarely contain economic data of any note. However, a data set describing a small sample of British engineering firms over the period 1978-82, derived from a survey undertaken by J.Cable and N.Wilson does have the relevant information to empirically evaluate the effects that unions have on productivity. This is therefore the subject of this Chapter.

The data on engineering firms to be used in this Chapter is particularly useful in that it yields a considerable amount of information on a variety of union related issues. Rather than simply looking at a single indicator of union presence this permits consideration of several dimensions of the union impact on productivity.[1] In particular this lets recognition of certain institutional characteristics of the firms in the sector under study enter the analysis. The richness of the data also allows an evaluation of the importance of issues like firm size and the nature of the production process in isolating the influence of unions on productivity. Additionally, the fact that the sample consists of a group of relatively homogeneous firms operating in the engineering industry means that, unlike studies which focus on the whole of manufacturing, omission of certain industry specific factors is not a problem. On the other hand, the relative disadvantage of

[1] See Wilson(1987) who utilises this data to examine union wage and productivity effects using a single indicator of union presence. Estrin and Wilson(1986) also use this data set to examine the impact of profit sharing on wages and employment. Cable and Wilson(1988) look at the impact on profit sharing on productivity : this Chapter also has something to say about this latter area.

using data from a single sector of the economy is that it prevents generalisation of the results to other industries.

The layout of this Chapter is as follows. The next section attempts to translate the relevance of collective voice arguments (which have mainly been forwarded by U.S. labour economists) to the British situation. Section 3.2 considers the methodology to be employed in the empirical work and describes the construction of a union presence index. Section 3.3 describes the data and the institutional background underlying the sector under study. Section 3.4 presents empirical estimates of the union impact on productivity and examines in detail the source of such effects and how they vary across the firms in the sample. Parallel results analysing the influence of the closed shop on productivity are also presented for comparison with those derived from the index. The differences between union effects on productivity in small and large firms are also considered in more detail. Section 3.5 analyses the robustness of the main results and finally Section 3.6 highlights the main results emerging from this Chapter.

3.1. Unions, Collective Voice and Productivity in Britain.

The need for economists to analyse the non-wage influence of trade unions is made forcefully by Freeman and Medoff's U.S. work.[2] They state that researchers should recognise the institutional features of unionism and not simply treat trade unions as monopolistic suppliers of labour whose sole purpose is to push wages above competitive levels thereby inducing allocative inefficiency. Indeed some of the empirical research undertaken by the collective voice school suggests that the non-wage effects of unions may offset the efficiency losses highlighted by the traditional monopoly view of unionisation. One such route through which this may occur is for unions to raise productivity. Empirical evidence for positive union productivity effects is provided by, among others, Allen(1984) and Brown and Medoff(1978). However, whilst other studies report statistically insignificant effects very few U.S. studies report a negative union impact on productivity.[3] This suggests that there may be some credence in the idea of U.S. unions

[2] See Freeman and Medoff(1984) and the numerous references cited therein.

[3] See Chapter 2 and the surveys in Hirsch and Addison(1986) and Freeman and Medoff(1984) for more details).

having some beneficial impact on productivity which goes some way to offset their positive influence on wages.[4] The existing British evidence tends to reflect less of a productivity enhancing role for unions as the results of Pencavel's(1977) historical study and the research by Denny and Muellbauer(1988), Knight(1988) and Wilson(1987) point to a neutral or negative impact. It therefore is of importance to consider the influence of unions on productivity in the British context, especially given the considerable institutional differences relative to unions operating in the United States.

Trade union influences on productivity can be expected to manifest themselves in a number of ways. A veritable black box of potential sources of union productivity effects has been identified by U.S. labour economists, some of which are clearly more appropriate than others to the British situation. One popular idea is that a trade union is able to monitor the behaviour of management thereby inducing an improvement in managerial efficiency. Brown and Medoff(1978) and Clark(1980a,1980b) allude to a union "shock effect" which prompts managers into recognising certain internal organisation procedures that they would not in the absence of unions. Improved managerial efficiency monitored by the union is then hypothesised to raise productivity. This idea is certainly feasible in situations where 'industrial relations are good, with management and unions working together to produce a bigger "pie"' [Freeman and Medoff(1984) p.165]. On the other hand, an adversarial industrial relations climate is likely to generate union opposition to managerial attempts to re-define production operations. In Britain, this is evident in union opposition to the likes of overtime working or payment by piece rates. Clearly if this non-cooperative situation exists then talk of unions having a depressant effect on productivity may be more appropriate. As more conflictual industrial relations have traditionally characterised British collective bargaining arrangements[5] compared to the U.S. then this latter situation is probably more indicative of the British situation. The international studies of Pratten(1976) and Caves(1980) referred to in Chapter 2 report lower labour productivity in British plants compared

[4] Although the evidence on unions and profitability is unambiguous in that all studies to date find that unions reduce profits : for some U.S. examples see Freeman(1983) or Karier(1985) and the discussions in Hirsch and Addison(1986) and Freeman and Medoff(1984), for some British evidence see Chapters 4 and 5.

[5] Although exceptions, most notably the electrician's union, do exist.

to their U.S. counterparts. This adds weight to the idea that control of the production process and more conflictual industrial relations may be more relevant as a source of dampening union effects on productivity in the British context relative to that presiding in the United States.

The state of industrial relations also impinges on the issue of workplace control and the way in which the extent of worker control of production operations can affect productivity. It is evident that if unions are able to exert some control over the relevant production technology then they may enhance or restrict performance as a show of bargaining power through the control of manning levels or via sanctions like go-slows, overtime bans or strikes (on this power interpretation see Cable(1987)). If control is viewed as a zero-sum game then in a conflictual industrial relations climate characterised by each side trying to further its control of production at the cost of the other side the likely outcome will be reduced productivity. If, on the other hand, cooperative union-management relations exist, perhaps through extensive employee involvement in the running of the firm and genuine (as a pose to cosmetic) 'power-sharing', then control need not be zero-sum and joint control of the workplace can raise productivity.

Obviously if managerial functions are operating efficiently in the absence of unions then there exists no monitoring role for the union. This begs the question of whether X-inefficiency (or sub-optimal production activity) is more or less likely to be present in union or non-union firms. Without going into great detail firms may not behave optimally (be X-inefficient) due to a number of internal firm specific factors : these include the effort exerted by workers, the fluency of information channels between managerial hierarchies within the organisation, the existence of managerial perks, the motivation of management, the nature of the production process and so on.[6] These factors are necessarily tangled up with the size of the firm. In particular, larger firms are often pinpointed as those with problems of X-inefficiency : for instance, larger firms are generally those which tend to suffer from poor information channels and find it harder to monitor workers' effort. Returning to the union issue, the existence of sub-optimal firm behaviour means that there exists a role for unions to monitor managerial behaviour (see Faith and Reid(1987)) and this is

[6] These ideas are discussed in more detail in the seminal article by Leibenstein(1966) and in the book by Frazer(1988).

one very plausible explanation of the empirical observation that unions are more likely to organise workers in large firms. This suggests that a potentially important area of examination is to explore whether union productivity effects differ with firm size and indeed whether this monitoring role implies that unions may be able to possess greater control in such situations.

Whilst the nature of the production process is obviously a relevant factor in determining the union impact on productivity an importance can also be attached to the nature of labour force adjustment in union and non-union firms. For example, it has been argued that lower labour turnover and quit rates among unionised workers reduces costs and may lead to productivity gains in unionised firms (see Chapter 2 and the references cited therein). On the other hand, it may be that union "equality of opportunity" policies (such as seniority rules) prevent more ambitious workers from climbing the promotion ladder thus resulting in a potential reduction in productivity.

Neoclassical models of union behaviour also have something to say about the possible direction of the union productivity effect. The monopoly union model predicts that the managerial response to the union wage effect causes a substitution from labour to capital, from unskilled to skilled labour (since unionised employers are more likely to invest in firm specific human capital) and a rise in product prices. The social consequences of this are that unions induce allocative inefficiencies through price distortions and that, even if productivity effects in a given firm may be positive, from a welfare viewpoint unions are undesirable as they harm economic efficiency. The presence of restrictive work practices merely worsens this by inducing more inefficiencies.

As the discussion has already made clear the numerous routes through which unions may affect productivity suggest that the direction of the effect is not obvious. Indeed the diversified nature of these possible sources also makes it evident that some are more likely to be applicable than others to certain firms and certain industries. Thus to give an indication of whether unions raise, lower or have a neutral influence on productivity it is necessary to confront these issues with data and this is the purpose of this Chapter, namely to analyse the influence of trade union activity on productivity in a sample of firms operating in a sector of British manufacturing indus-

try.

3.2. Modelling and Estimation of Union Productivity Effects.

The basic methodology used in the union-productivity literature (see for example the seminal work of Brown and Medoff(1978)) and in the closely linked empirical work on participation (see for example Cable and Fitzroy(1980)) is to estimate a Cobb-Douglas production function augmented by variables indicating characteristics of the production unit under consideration. Chapter 2 showed that the Brown-Medoff approach based on a Cobb-Douglas production technology generates an equation of the form

$$\ln(Y/L) = \beta_0 + \beta_1 \ln(K/L) + (\beta_2+\beta_1-1)\ln L + \beta_2(c-1)U \tag{3.2.1}$$

where the notation is the same as in Chapter 2.

This is simply a re-arranged production function allowing for non-constant returns (when $\beta_1 + \beta_2 \neq 1$) and includes a union variable as a determinant of labour productivity. Therefore the basic method of discriminating between productivity levels in unionised and non-unionised situations is to estimate equation (3.2.1) supplemented by a number of control variables. The latter are included since the objective of the productivity studies is to determine the impact of unionisation on worker productivity in an otherwise comparable firm. In convenient notation this can be expressed for the ith firm as,

$$y_i = \alpha + X_i'\beta + Z_i'\gamma + U_i'\delta + \varepsilon_i \tag{3.2.2}$$

where y is the logarithm of value added per employee, X is a vector of logarithms of factor inputs (i.e. $\ln(K/L)$ and $\ln L$), Z is a vector of additional control variables, U is a (scalar) measure of union presence, α is a constant term and ε a random error.

Measurement of the indicator of union presence U is of some importance. In existing empirical work analysing the effects of unions on economic variables several possibilities have been considered :

(i) U can be defined as a dichotomous variable indicating union or non-union status. The union non-union split is usually defined as whether or not unions are recognised by employers for collective bargaining purposes.

(ii) The definition of U emerging as L_u/L in the Brown-Medoff formulation is union density, namely the number of union members divided by the number of employees in the firm.

(iii) A third possibility is the proportion covered by collective bargaining agreements : this gives an indication of the extent of union presence in terms of those being paid union wage rates.

Generally the measure of U that is used is dictated by data availability. If a single measure were to be used the preferred measure would be an indicator of whether unions are recognised by management for collective bargaining purposes : this gives a useful dichotomisation of union or non-union status. Unfortunately, despite the richness of the data source to be utilised in this Chapter, data on recognition is unavailable. Several other firm-specific indicators of union activity are however available for use. Given the lack of recognition data, it is probable that simple use of a single indicator of union presence in this framework may not tell the whole story. For instance, use of union density alone does not really give an indication of union strength. Hence, unions with similar density may have different impacts on the workings of the production process.[7] The other possibility is to consider using the information contained in a number of indicators. This generates problems of its own. Firstly, whilst several of these indicators could be entered into the production function as individual arguments they are likely to be correlated with one another (some more heavily than others) such that entering them simultaneously may induce problems of multicollinearity that may cause misleading inferences to be drawn from the results. Second, it is also true that, in studies such as this where the sample size is fairly small, degrees of freedom limitations prevent inclusion of several indicators. This is especially true when interactions between determinants of value added and indicators of unionisation are to be considered.

[7] Metcalf's(1988) review points to Edwards and Scullion's(1982) work which states that unions with strong roots in the shop floor organisation of the 1950's and 1960's can possess a great deal more strength than other unions of similar density without such a tradition.

Thus, the lack of information on trade union recognition prevents any meaningful union non-union distinction based on a single indicator of U to be drawn and this makes a greater need for some appropriate measure of union presence to be derived. Therefore it is proposed to include an index V which is a linear combination of the various components and may be defined as $V = \sum_{i=1}^{s} \phi_k v_k$ where v_k is the kth component, ϕ_k is the weight attached to v_k and there are s components in all. In some respects this is similar to the labour attitude index calculated by Norsworthy and Zabala(1985a,1985b) and in ideas to Katz, Kochan and Gobeille's(1983) study of Quality of Working Life programmes in the U.S. The difference in the Norsworthy and Zabala approach is their use of a translog index which includes second order interactions between the v_k. However in the present study it is preferred to stick with the first order specification since it is considered that use of a full translog index asks a lot of the data. The main practical problem in constructing V is to ascertain the appropriate weights ϕ_k attached to each indicator of union presence. As Cable(1985) has noted one obvious point is that choice of weighting structure is somewhat arbitrary and that this may enable researchers to effectively 'get the results they want'. Hence, rather than simply assigning some arbitrary values to ϕ_k, the index is to be constructed as a linear combination of the v_k using the weights implied by the first principal component of the variance covariance matrix of the various constituents of the index.[8]

As a further econometric point, several studies considering the effects of unions on relative wages have stressed the importance of examining interactions between the union variable and the explanatory variables (examples are Mellow(1983) or Stewart(1983b)). Thus it may also be interesting to examine whether interactions between the determinants of productivity and the index V prove important in the empirical analysis of trade union productivity effects. That is to

[8] More details on the construction of the index are given in the Data Appendix. See Pencavel(1974) for a similar approach used to calculate an index of industrial morale from information on quits, strikes, absenteeism and accident rates in British coal mining. It should however be noted that use of principal components is not without difficulties. For instance it is necessary that the variables to be transformed have variances of similar size and that scaling of the data may influence the weighing values. However, given that the four indicators to be used are all bounded by 0 and 1 this is not a problem in this study. It should also be noted that use of the first component weightings alone ignores the other $(s-1)$ components. If the first component explains a significant amount of the variance in V then this is reasonable. If however it only explains a small proportion then use of only the first component may be questionable. See Jolliffe(1986) for futher details.

say, the equation specified to date only allows the union effect to operate through the intercept term in the production function. It is however perfectly feasible (and probably likely) for the union impact to make itself felt in an interactive manner with various characteristics of the firm. For instance, it may be that in large firms the union impact is different to that in small firms and simply allowing an intercept shift does not permit consideration of this. A fully interactive model can be written, replacing U from equation (3.2.2) with the index V, as

$$y_i = \alpha + W_i'\lambda + V_i'\Theta + (V_i * W_i)'\theta + e_i \tag{3.2.3}$$

where $W = [X, Z]$.

Obviously it is important to see whether or not the results from the interactive model differ to those from the case where the union effect manifests itself as a shift in the intercept term. This involves seeing whether the effects of the variables contained in the W-vector differ in union and non-union firms. In terms of equation (3.2.3) this amounts to a classical hypothesis test of $H_0 : \theta = 0$ which, if W is of length m is a $\chi^2(m)$ test. One can ascertain whether the impact of individual components of the W-vector differ with V by considering the partial derivatives

$$\text{If } V > 0 \quad \frac{\partial y}{\partial W} = \hat{\lambda} + V'\hat{\theta} \tag{3.2.4}$$

$$\text{If } V = 0 \quad \frac{\partial y}{\partial W} = \hat{\lambda}$$

and their associated standard errors. In terms of the example cited above if the first component of the W-vector, say W_{1i}, is a dummy variable indicating whether the variable is a large firm then any productivity advantages/disadvantages from scale economies in non-union firms can be denoted by the estimate of λ_1. In fully unionised firms (where $V = 1$) this becomes the estimate of $\lambda_1 + \theta_1$. If these differ significantly from one another it is important to allow for this in the empirical work.

In terms of equation (3.2.3) the estimated union non-union effect on labour productivity in firm i is $\hat{D}_i = \hat{\Theta} + W_i'\hat{\theta}$. An average union effect across the sample is $\bar{\hat{D}} = \hat{\Theta} + \bar{W}'\hat{\theta}$ where a bar

denotes a mean value. By partitioning the covariance matrix to obtain $f = Var(\xi)$ where $\xi = [\Theta, \theta]$ an asymptotic standard error for the union effect can be calculated as $ase(\bar{D}) = (\bar{M}' f \bar{M})^{1/2}$ where $M = [1, W]$.[9] Obviously standard errors can be calculated for each firm in an analogous way, simply replacing the mean values with those actually observed for each firm.

3.3. Institutional Background and Data Description.

The production function is to be estimated from a sample of fifty two British engineering firms over the period 1978-82. The source of the data is an ESRC financed survey conducted by J.Cable and N.Wilson. The nature of the data is that time-varying information is available on economic characteristics of the firm although structural characteristics (such as the unionisation variables) are available only in 1982. This precludes consideration of the intertemporal relationship between unions and productivity (for example in a fixed effects model taking deviations from time means or differencing the data would eliminate the union variables from the estimating equation) and thus the analysis is to be performed on the basic pooled cross section assuming no change in structural characteristics over the five years.[10]

Information on some indicators of the extent of union activity in the firms in the sample is reported in Table 3.1. Several important characteristics of the sample can be noted. Firstly, the mean of union density (UNION) shows that the sample under study is comprised of highly unionised firms and the mean exceeds the national average for this period (about 30%-55% : see Price and Bain(1983)). Secondly, the engineering industry is also characterised by multi-unionism : for instance in 1978 23 manual and staff unions were affiliated to the Confederation of Shipbuilding

---

[9] Note that the index V is scaled such that it lies in the [0,1] interval so that a non-union situation can be compared with one which has maximum union presence, or alternatively collective voice, where V equals unity.

[10] The instrumental variables methodology of Hausman and Taylor(1981) does allow one to obtain the effects of a time invariant variable whilst allowing for the panel nature of the data. However, in the present analysis, the large number of time invariant variables in the data set make things somewhat difficult. When Hausman-Taylor estimates were obtained the use of alternative instruments (the time-means of various time-varying variables in the data) showed the results to be sensitive to the choice of instrumental variables. As the focus of this analysis is on union effects and not purely on the determinants of productivity attempts to allow for the panel nature of the data were not pursued any further.

and Engineering Unions which had an affiliated membership of some 2.5 million workers.[11] As Marsh et al.(1981) report the majority of manual union members in 1978 were in one of the following large unions : the Amalgamated Union of Engineering Workers (then the AEUW), the Transport and General Workers Union (TGWU) and the General and Municipal Workers Union (GMWU). Most non-manual employees were in the Association of Professional, Executive, Clerical and Computer Staff (APEX), the Association of Scientific, Technical and Managerial Staffs (ASTMS) and the Technical and Supervisory Section (TASS) of the AEUW. This trend of multiple unionism is borne out in the current sample where a number of firms have more than one shopfloor and staff union, as depicted by the variables NSHOP and NSTAFF. A third point of note is that closed shop arrangements are common among the firms in the sample : 25 out of 52 firms have these arrangements. This is obviously an important institutional characteristic of the sample and needs to be considered in the analysis of union productivity effects.

Four components are therefore to be used to form the union presence index : the union density variable, the two multiple unionism variables and a dummy variable indicating whether a closed shop is present (CLOSED). The correlation matrix of the four components is reported in Table 3.2 and Table 3.3 reports the weights derived as the scaled first principal component of the appropriate covariance matrix.[12] The first principal component accounts for 47.8% of the variation in the four variables and it is interesting to note that all four weights have the same sign. Thus the strongest measure of union presence occurs for a firm with 100% union membership, a closed shop and multiple staff and shopfloor unions. This clearly conforms with the institutional background discussed above. For comparative purposes results are also reported in this Chapter using the closed shop dummy alone : this gives a weak union/strong union split in this highly unionised sample of firms.

One point that needs to be clarified here is the issue of the potential endogeneity of union status. A number of authors have claimed that in analysing union effects on economic variables

---

[11] It should however be noted that these unions are not solely confined to engineering and are predominantly amalgamated unions.

[12] To obtain the unscaled weights it is simply necessary to multiply each weight by 1.227.

TABLE 3.1.

Industrial Relations Characteristics of Engineering Firms.		
UNION	Proportion of union members	0.784
CLOSED	Proportion of firms with any closed shop arrangements	0.481
NSHOP	Proportion of firms with multiple shopfloor unions	0.481
NSTAFF	Proportion of firms with multiple staff unions	0.404

TABLE 3.2

Correlation Matrix of Union Presence Indicators.				
	UNION	CLOSED	NSHOP	NSTAFF
UNION	1.000			
CLOSED	0.652	1.000		
NSHOP	0.180	0.230	1.000	
NSTAFF	0.397	0.071	0.385	1.000

TABLE 3.3

Estimated Weights Used in Union Presence Index.	
Indicator	Estimated Weight
UNION	0.156
CLOSED	0.258
NSHOP	0.310
NSTAFF	0.277

Notes.

(1) Calculated weights are those suggested by the first principal component of the covariance matrix of the four indicators and re-scaled such that the index based on the weights lies in the 0-1 interval. More details are given in the Data Appendix.

one should address the issue that not only is union status a determinant of the economic variable in question but that the economic variable is also a determinant of union status.[13] Take the issue considered in this Chapter. The endogeneity issue arises because union activity affects productivity but it may also be the case that unions organise in more (or less) productive firms. Failure to account for this can induce simultaneity bias. However, the main measures of union presence used in this thesis are union recognition and the presence of closed shop arrangements. These are historically determined variables which, as such, can be viewed as exogenous to the current period : in effect they can be treated as lagged endogenous variables. In terms of the example used, it may be true that unions are more likely to organise in more (or less) productive firms : this however occurred in the past and is exogenous to the current period. This is the approach to be followed throughout this thesis. There are also statistical problems underlying this endogeneity question. To allow for endogenous union status one needs to estimate a union status equation along with the equation analysing the union impact on a certain issue. Therefore, certain identification problems emerge : what is left out of the union status equation that is included in the other equation (and vice-versa) proves paramount and results are often sensitive to these ad-hoc identifying restrictions. In this Chapter of the 4 indicators used to construct the index the accusations of endogeneity problems can only really be levelled at one component, namely union density. However, as with all structural characteristics in the data set it is fixed over the five years and, as instrumenting one characteristic incorporated in the index is not very desirable, this is acknowledged but by-passed in the empirical work.

The dependent variable to be used in the empirical analysis is value added per employee where value added is deflated by an appropriate industry level price index (Source : Monthly Digest of Statistics). The point stressed in Chapter 2 was that this deflation is necessary to prevent confounding a union productivity effect with a union induced price effect. Obviously to the extent that the price index is mismatched then the estimated union effect on productivity will be contaminated by price effects. This possible contamination is obviously not a trivial one although

[13] See, inter alia, Schmidt and Strauss(1976) or Duncan And Leigh(1985).

the only way to circumvent it is to have some kind of physical output measure which does not contain any price effects : for instance, Clark's(1980a) analysis of the U.S. cement industry uses tons of cement as an output measure. However, such physical measures are for the most part not appropriate to firms operating in the engineering sector of British industry and even in those cases where they are relevant are not readily available for use. Therefore, the possibility of price effects entering the analysis is one which must be acknowledged and dealt with in the best way possible given the available data, namely the deflation of value added referred to above.

Some raw data relating value added per employee to the union presence index and to the incidence of the closed shop among the firms in the sample is reported in Table 3.4. Value added per employee is converted to 1980 prices by the deflation procedure and is observed to be slightly higher than the average for engineering of £8493 per employee reported in the 1980 Census of Production. The first row shows that labour productivity between firms with high or low values of the index is much the same. In the closed shop firms however value added per employee is lower. Breaking down labour productivity by union presence and firm size simultaneously points to one particularly strong looking result. In large firms (over 1000 employees) with greater union presence value added per employee is on average lower than for other firms in the sample. This points to a potentially important interaction between firm size and union presence in attempting to identify the union productivity effect in this sample of British engineering firms.

More detail on the means and definitions of the variables to be used as explanatory variables and how they differ with the union presence index and the closed shop dummy are reported in Table A3.1 of the Data Appendix. Since a Cobb-Douglas specification is to be used, the log of the capital to labour ratio $\ln(K/L)$ is included to control for capital-labour substitution occurring as a response to union wage effects.[14] To allow for non-constant returns to scale it was found that a dummy variable indicating whether a firm has more than 1000 employees ($L \geq 1000$) worked best.[15]

[14] As often proves the case in the estimation of production functions the Cobb-Douglas specification performed satisfactorily. The issue of alternative specifications of the production function is addressed in more detail below in Section 3.5.

[15] The usual practice is to simply include $\ln L$ as an explanatory variable. Inclusion of $\ln L$ did produce qualitatively similar results (although not as strong statistically as the dummy) although, as the empirical

TABLE 3.4

Labour Productivity, Union Presence and Firm Size in Engineering Firms.					
	All firms	INDEX≥0.5	INDEX<0.5	Closed shop	No closed shop
Value added per employee	8759	8896	8650	8365	9123***
N	260	115	145	125	135
Value added per employee in large firms	8650	8362	9566	7322	10689*
N	71	54	17	43	28
Value added per employee in small firms	8799	9369	8528***	8911	8714*
N	189	61	128	82	107

Notes.

(i) Value added per employee (deflated) is in units to the nearest £ per employee.

(ii) Large firms are those with 1000 or more employees.

(iii) Significant differences between sub-groups of union presence are denoted by *, ** and *** for 1%, 5% and 10% significance levels respectively.

Variables indicating worker participation and involvement in decision making are often recognised as being important for productivity (see Cable and Fitzroy(1980) and Jones and Svejnar(1985)). Data is available on a number of firm characteristics such as those indicating whether the firm has any quality circles, a works council, a cash based profit sharing or value added scheme or a share option scheme. Unfortunately, however, these variables are only available as a single observation and as such exhibit no time series variation. Therefore, when modelled as dummy variables they give no indication as to relative importance of these functions in each firm. Thus it is not possible to judge whether a positive coefficient on such variables indicates whether progressive already productive firms are introducing these functions or whether they have been introduced and are instrumental in raising productivity. Similarly it is not clear whether a negative coefficient means a need has been identified or whether they are actually damaging productivity. Instead of including all four of these 0-1 variables it is preferred to use a variable (BONUS) which does indicate the relative importance of one of these functions across firms, namely the percentage of wages that is paid, on average, in the form of a profit sharing or value added bonus.[16] This is for the most part a small percentage although does reach as high as 10% in some of the firms in the sample. Whilst this still suffers from some of the problems discussed in the context of the other four variables it does exhibit cross firm variation and may be viewed as a proxy either for progressive management or perhaps for the productivity gains that might accrue from the incentive effects of having workers' pay linked to the performance of the firm. Finally variables indicating the production technology used by the firm are included : these are dummy variables indicating whether the dominant mode of production is by job (JOB) or using flow lines (FLOW) compared to a base of batch production methods. The proportion of skilled workers in the manual workforce (SKILL) is also included so as to ascertain the productive quality of the workforce.

---

work to follow shows, it is attractive to model some kind of small firm or large firm decomposition especially in the light of the theoretical discussion undertaken in Section 3.1 and in terms of the cross-tabulations in Table 3.4.

[16] It should be noted that results were not fundamentally different when 4 dummy variables reflecting whether the firm operates the functions listed above were included : the only problems revolved around their interpretation.

3.4 Estimates of the Union Impact on Productivity.

The discussion in Section 3.1 highlighted that determination of the sign and magnitude of the trade union impact on productivity is largely an empirical issue. To explore this notion in the context of British engineering firms estimates of augmented production functions are presented in Table 3.5. In the first two columns the parameters of the production function are allowed to differ with the degree of unionisation, as measured by the union presence index in equation (1) and the closed shop dummy in equation (2). The interaction terms are on the whole very significant and their inclusion is statistically supported against the null hypothesis of a model which simply allows for an additive union effect, the relevant $\chi^2(6)$ statistics being 18.80 and 23.79 respectively, compared to a 5% critical value of 12.60. Columns (3) and (4) allow the parameters to differ between large and small firms and again the interactive model is preferred to a specification including a large firm dummy alone, the appropriate $\chi^2(4)$ statistics being 14.70 and 21.45 as compared to a critical value of 9.49.

Some diagnostic checks of the estimated models are also reported. The models perform reasonably well with respect to the tests of functional form and suggest no need for further nonlinearities in the equations.[17] As often proves the case with cross-section data the null hypothesis of homoskedastic error terms cannot be accepted. This problem is countered by presenting White(1980) standard errors which correct the estimated covariance matrix for unknown heteroskedasticity of an arbitrary functional form. Tests for departures from normality were also calculated (using the Lagrange Multiplier tests as described in Kiefer and Salmon(1983)) and produced large values which decisively rejected the null hypothesis in all cases. It should however be noted that in the linear model these Lagrange Multiplier tests form part of White's(1982) Information Matrix (IM) test : see Hall(1987) who shows that the IM test is composed of three components, namely White's(1980) heteroskedasticity test, a skewness test and a kurtosis test. The sum of the last two is the normality test considered here. Both Chesher and Spady(1988) and Davidson and MacKinnon(1988) have provided Monte Carlo evidence to show that for moderate

[17] Wald tests based on the appropriate covariance matrix are reported because of the use of heteroskedastic consistent standard errors.

TABLE 3.5

Estimates of the Impact of Unionisation and Firm Size on Labour Productivity.					
Equation No.	(1)	(2)		(3)	(4)
	U=INDEX	U=CLOSED		U=INDEX	U=CLOSED
Constant	8.309(0.457)	8.056(0.407)	Constant	8.902(0.362)	8.977(0.323)
ln(K/L)	0.054(0.058)	0.075(0.053)	ln(K/L)	-0.021(0.048)	-0.027(0.046)
$L \geq 1000$	0.364(0.174)	0.095(0.071)	$L \geq 1000$	-1.603(0.910)	-1.838(0.854)
BONUS	-0.026(0.016)	0.032(0.012)	BONUS	0.008(0.007)	0.010(0.006)
JOB	0.202(0.121)	0.091(0.074)	JOB	-0.058(0.076)	-0.078(0.074)
FLOW	0.735(0.228)	0.231(0.081)	FLOW	0.031(0.137)	0.106(0.097)
SKILL	0.400(0.160)	0.502(0.134)	SKILL	0.469(0.114)	0.471(0.113)
U	0.651(0.838)	1.304(0.532)	U	0.053(0.075)	-0.002(0.054)
U*ln(K/L)	-0.078(0.096)	-0.148(0.068)	$L \geq 1000$*ln(K/L)	0.211(0.106)	0.231(0.101)
U*$L \geq 1000$	-0.620(0.240)	-0.324(0.105)	$L \geq 1000$*U	-0.444(0.193)	-0.369(0.095)
U*BONUS	0.079(0.026)	0.002(0.014)	$L \geq 1000$*BONUS	0.058(0.021)	0.062(0.021)
U*JOB	-0.813(0.297)	-0.730(0.117)	$L \geq 1000$*JOB	a	a
U*FLOW	-1.297(0.391)	-0.218(0.147)	$L \geq 1000$*FLOW	b	b
U*SKILL	0.031(0.305)	-0.126(0.172)	$L \geq 1000$*SKILL	-0.002(0.265)	-0.086(0.243)
R^2	0.161	0.191		0.147	0.183
N	260	260		260	260
Functional form	0.18(3.84)	0.59(3.84)		0.02(3.84)	1.58(3.84)
Heteroskedasticity	57.95(23.70)	85.62(23.70)		56.88(23.70)	76.19(23.70)

Notes.

(i) The dependent variable is the log of (deflated) value added per employee : its mean is 9.005.

(ii) Heteroskedastic consistent standard errors are in parentheses.

(iii) a denotes that in the case of JOB only two observations were characterised by a firm having 1000 or more employees which meant that the remaining three observations for that firm corresponded to less than 1000 : thus the interaction was omitted.

(iv) b denotes that all firms with FLOW equal to one have 1000 or more employees : thus the interaction term $L \geq 1000$*$FLOW$ would, if entered, be perfectly collinear with FLOW and was thus omitted.

(v) The test for functional form is Ramsey's(1969) RESET test : it is a $\chi^2(1)$ Wald test of the significance of adding to the squares of the fitted values of the estimated models. Collinearity problems precluded consideration of higher order fitted values.

(vi) The test for heteroskedasticity is Breusch and Pagan's(1979) test and is distributed as $\chi^2(p-1)$ where p is the number of estimated parameters. It is calculated as 1/2 the explained sum of squares from the auxiliary regression of $d^2/\hat{\sigma}^2$ on the independent variables, where d is the residuals from the models and $\hat{\sigma}^2$ the estimated (Maximum Likelihood) error variance from the equations in the Table.

sample sizes the White Information Matrix test has a tendency to reject the null far too often. Indeed, very large χ^2 statistics are often obtained. Davidson and MacKinnon highlight the problems with the kurtosis component which is where the problems lie here. Thus it should be noted that the null of normally distributed errors is not upheld but that the test statistics used to ascertain this should not be viewed with a great deal of confidence. Indeed Davidson and MacKinnon go as far as saying 'it (*the IM test*) should probably never be used unless the sample size is truly enormous' [Davidson and MacKinnon(1988) p.11].[18]

The specifications in Table 3.5 identify a number of determinants of productivity, most of which have differing impacts conditional on the degree of unionisation and firm size. Considering initially equations (1) and (2) the determinants of productivity in non-union firms can be ascertained by ignoring the interaction terms (i.e. setting $U = 0$). Non-union firms are more likely to have higher productivity if they have in excess of 1000 employees, more sophisticated production technologies (as measured by the flow lines variable) and a higher proportion of skilled workers. Examining the effects in unionised firms requires consideration of the coefficients on both the non-interactive and interactive variables, as described in equation (3.2.4). As the degree of unionisation increases with higher values of INDEX in column (1) the positive effect of the skill variable remains but the flow lines variable actually exerts a negative effect as does the other technology variable JOB. This suggests that if unions are able to exert some control over production technologies then they may reduce productivity through the likes of overmanning and restrictive work practices. Also, if employees are paid a higher profit sharing bonus unionised firms may be more productive, compared to the non-union situation where no such effect is observed.[19] This supports the arguments aired in Gregg and Machin(1988) who suggest that profit sharing is

[18] Hence the normality test statistics are not reported in the Table. As a matter of interest the large numbers they produced for columns (1) to (4) respectively were 801.04, 927.32, 654.21 and 755.82. Compared to a 5% critical value of 5.99 these imply a decisive rejection of the null. It is, for the most part, due to very large kurtosis test statistics that the tests fail. This rejection is clearly a combination of several factors : the poor quality of the test ; fat tails in the distribution ; and because in the case of the normal distribution the fourth moment equals three times the square of the second, and the null of homoskedastic errors (i.e. constant second moment) is not upheld, the large kurtosis numbers may be partially reflecting heteroskedasticity.

[19] Rather than or firms with a more progressive management strategy, as proxied by the flexible payment scheme variable, in conjunction with unions presence are more productive. This may conceivably be viewed as a proxy for the idea that cooperative industrial relations practices may raise productivity.

likely to have differing impacts in unionised and non-unionised situations.[20] Finally large union firms are not likely to have the productivity advantages that scale economies give large non-union companies relative to their smaller counterparts. These effects are similar for the closed shop measure used in column (2) with the exception of the flow lines and profit sharing effects. Again of considerable interest is the strength of the negative coefficient for large firms with a closed shop.

In the equations reported in the third and fourth columns of Table 3.5 the interaction between union presence and firm size is again observed to be important as larger unionised firms are at a productivity disadvantage compared to both smaller firms and non-unionised large firms. The specifications conditioning the coefficients of the production function on firm size also offer some other interesting results. Performance linked pay only exerts a positive influence among the larger firms in the sample. There is also some weak evidence of the capital to labour ratio exerting a positive effect (as would be expected), but only among larger firms. In small firms the effect is somewhat inexplicably negative although insignificant. Finally the skill ratio is positively related to productivity but no additional advantages accrue to larger firms.

The major result emerging from Table 3.5 is that the union impact on productivity interacts in an important way with firm size, at least in the context of this data set. Consequently average union non-union and large firm small firm effects on productivity deduced from the models in Table 3.5 are reported in Table 3.6. Also reported is the average union non-union effect among larger and smaller firms derived from equations (1) and (2) and an analogous measure, the average large firm small firm effect with maximum or zero union presence (i.e. INDEX or CLOSED set to 1 or 0) from equations (3) and (4). The effects deduced from both models point to the same conclusion : the average union non-union effect among larger firms is always negative and statistically different from zero. In smaller firms effects are neutral. Productivity levels therefore do not differ with the degree of unionisation among smaller firms and scale effects are unimportant unless a firm is unionised. To summarise, negative union productivity effects only occur in larger

[20] This is also to be explored more fully in Chapter 6.

firms and in firms with less than 1000 employees the effect of trade unions is largely innocuous.[21]

The results to date are strong evidence to suggest that trade union effects on productivity in this sample of engineering firms are significantly negative among large firms but insignificant among the rest. However, they yield little information about the distribution of these effects over the firms in the sample. Thus it is also of interest to calculate union productivity effects for each firm. Table 3.7 presents a summary of such a procedure and illustrates that the effects, which are averaged over the five years for each firm, vary quite considerably about the average differential.

In terms of the overall sample the productivity effects deduced from the unionisation index, reported in the upper part of Table 3.7, suggest that nine out of fifty two firms are characterised by statistically significant positive union effects and thirteen by statistically significant negative effects. Thus, despite an overall insignificant union effect, in a considerable percentage (42.3%) of firms in the sample trade unions significantly influence productivity levels. This wide ranging dispersion of union productivity effects supports the idea that no one fixed rule holds for gauging union effects on performance : even in this sample of relatively homogeneous firms the deviations from the average are substantial. Given this considerable variation it seems particularly important to attempt to isolate the source of these effects and Table 3.7 also breaks down these union effects by a number of variables and examines the distribution of the significance of the effects in each sub-sample. The results are quite striking. None of the positive effects are located in firms with more than 1000 employees. Paying employees a profit sharing bonus features strongly among the firms with significantly positive union effects as all nine have some kind of cash based sharing scheme. This is in line Weitzman's(1984,1985,1987) advocacy of the potential for performance linked pay to raise productivity, at least in unionised circumstances.[22] A definitive statement on this cannot however be offered for the reason already given above, namely that it is not clear whether it is progressive managements in highly unionised already productive

[21] These results remain essentially unaltered and are not sensitive to the inclusion of either a set of industry dummies or time dummies or both to the specifications in Table 3.5 : see the robustness checks reported in the next Section.

[22] See also Wadhwani and Wall(1988) who provide evidence to show that profit sharing raises productivity in a sample of large highly unionised British companies.

TABLE 3.6

The Relationship Between Union Productivity Effects and Firm Size.				
Based on Equation No.	Average Union Non-Union Effect	Average Large Firm Small Firm Effect	Average Union Non-Union Effect in Small Firms	Average Union Non-Union Effect in Large Firms
(1)	-0.105(0.066)	0.050(0.073)	0.064(0.077)	-0.555(0.204)
(2)	-0.159(0.048)	-0.069(0.052)	-0.070(0.050)	-0.394(0.098)
(3)	-0.068(0.076)	0.029(0.078)	0.053(0.075)	-0.391(0.182)
(4)	-0.103(0.046)	-0.033(0.055)	-0.002(0.054)	-0.372(0.080)

Notes.

(i) These effects are calculated by setting INDEX/CLOSED and the large firm dummy equal to 1, 0 or mean values where appropriate and all the other variables are set to mean values. Variable means are reported in the Data Appendix.

(ii) Asymptotic standard errors, calculated using the methods of Stewart(1987b) and described in Section 3.2, are in parentheses.

firms who want such schemes or whether they are actually raising productivity. The relation between the presence of performance linked payment schemes and unionism is explored in more detail in Chapter 6 using data from the 1984 Workplace Industrial Relations Survey.

Turning to the thirteen significantly negative effects they are mostly located among large firms and, of the two firms with flow lines as their dominant production mode, both are among them. Similarly half of those firms in the sample whose production method is mainly by job are in the significantly negative region. No discernible pattern emerges with respect to the three union dummies CLOSED, NSTAFF and NSHOP although it can be seen that positive productivity effects are possible even in firms with closed shop arrangements. It is therefore not being unionised alone which reduces productivity nor is it being in a large firm : what implies a negative union influence on productivity is being both large and highly unionised.

Individual firm union productivity effects based on the regression including the closed shop dummy are reported in the lower panel of Table 3.7. For the most part they tend to confirm the picture emerging from the effects on productivity deduced from the index, although fewer firms have statistically significant positive effects and more have significant negative effects. As with the index none of the larger firms are characterised by positive union effects. The negative union effects associated with the JOB and FLOW variables again emerge, as does the location of performance related bonus payments in the positive part of the distribution. No clear-cut relationship follows from the consideration of the three discrete indicators of union presence considered in this Chapter. These results very much highlight that firm size is an important determinant (along with other characteristics of the firm like the nature of the production technology and the presence of performance-linked pay) of the union productivity effect in this data.

The main result emerging from this analysis is that trade unions exert no damaging effect on productivity unless they are located in firms with more than 1000 employees. No claims to generalise this result outside of this sample are made here, especially noting the traditional strength of union activity in this sector of British manufacturing. The importance of unionisation and firm size taken hand-in-hand suggests that the explanation underlying this result could be

TABLE 3.7a

Estimated Union Productivity Differentials for each firm - based on INDEX.					
Sample	Number of firms	significantly negative	insignificantly negative	insignificantly positive	significantly positive
All firms	52	13	9	21	9
500>L	27	3	4	15	5
500≤L <1000	11	1	1	5	4
L≥1000	14	9	4	1	0
BONUS>0	21	2	5	5	9
JOB=1	6	4	1	1	0
FLOW=1	2	2	0	0	0
CLOSED=1	25	6	2	12	5
NSTAFF=1	21	8	4	4	5
NSHOP=1	25	10	4	6	5

TABLE 3.7b

Estimated Union Productivity Differentials for each firm - based on CLOSED.					
Sample	Number of firms	significantly negative	insignificantly negative	insignificantly positive	significantly positive
All firms	52	18	18	13	3
500>L	27	6	10	9	2
500≤L <1000	11	1	5	4	1
1000≤L	14	11	3	0	0
BONUS>0	21	7	7	4	3
JOB=1	6	6	0	0	0
FLOW=1	2	2	0	0	0
CLOSED=1	25	8	9	7	1
NSTAFF=1	21	9	4	5	3
NSHOP=1	25	12	8	3	2

Notes.

(i) The upper panel is calculated from equation (1) and the lower panel from equation (2) in Table 3.5.

(ii) Since the number of employees in the firm varies over time a firm is denoted as small, medium or large according to which category it is located in most over the five years.

(iii) Significance levels are based on two tail tests at the 5% level of significance.

greater X-inefficiency in unionised large firms. On the other hand, it might be that in the presence of managerial hierarchies where there exist greater communication problems (i.e. in large firms) unions are able to push the 'frontiers of control' outwards thereby placing more formal structures on work practices, manning levels and so on. Hence, the productivity disadvantage faced by larger unionised firms may be attributed to the increased control over the functioning of the production process held by unions relative to the situation in smaller firms where management structures are more closely knit and less subject to informational difficulties.

3.5 Robustness of Main Findings.

The analysis to date has considered the union impact on productivity in an effective but fairly simple econometric model. One therefore needs to see how robust the reported results are with respect to specification changes and certain generalisations of the model. Table 3.8 reports estimates of the union impact on productivity in small and large firms derived from generalising equations (1) and (2) reported in Table 3.5.

The first sensitivity check concerns whether the inclusion of a set of industry specific dummies (at the 2-digit level) alters the results. Comparing row (ii) of Table 3.8 with row (i), which reproduces the earlier results to allow easy comparison, the effects are seen to smaller when industry dummies are included but maintain the overall pattern. Including year specific dummies (row (iii)) hardly influences the estimates and the inclusion of both industry and time controls (row (iv)) shows that the results stand up to these checks.

A further issue is that to date the analysis has been based on a Cobb-Douglas production function, a highly restrictive functional form, which, as is well documented, imposes a number of restrictions on technology, namely homogeneity, homotheticity and a unitary elasticity of substitution between factor inputs. It could be argued that the reported results are conditional on this choice of functional form. It seems therefore of interest to consider other functional forms. One possibility is to extend the analysis to a Constant Elasticity of Substitution (CES) production function which relaxes the assumption of a unitary substitution elasticity. The approximation pro-

vided by Kmenta(1967) means that it can be written as

$$\ln Y = a_0 + a_1 \ln K + a_2 \ln L + a_3 [\ln K - \ln L]^2 + \sum_{j=1}^{m} a_j M_j \qquad (3.5.1)$$

where Y is output, K and L are capital and labour inputs and M denotes other control variables.

Relative to the Cobb-Douglas function estimating a CES specification simply adds the term $[\ln K - \ln L]^2$, which allows a departure from a unit elasticity. Estimating equation (3.5.1), still allowing the parameters to differ with union presence, produces the results in row (v). The effects are less well determined with higher estimated standard errors but still tell the same story : in large firms the union impact is negative but in small firms it is neutral.[23]

The models reported in Table 3.5 allowed parameter estimates to differ with union presence or firm size. Whilst in small samples such as this estimation of models with large numbers of parameters can be problematic it may however be worth generalising the model to allow interactions with unionisation and firm size simultaneously. A final sensitivity check therefore estimates this model for both the index and for the closed shop dummy. Estimates of the union impact are reported in column (vi) of Table 3.8. They are remarkably similar to those deduced from the more specific model in Table 3.5.

Hence, none of the checks of robustness seem to warrant any amendment of the conclusions reached earlier. These results therefore emphasise the diversity of the union effect between small and large firms in this sample. They also illustrate that whilst the union impact in larger firms is fairly well determined as negative and statistically significant among smaller firms the union effect is less precisely determined.

[23] Generalising even further to a translog function which adds squares and cross-products of $\ln K$ and $\ln L$ to the basic Cobb-Douglas model produces similar qualitative results but with an even greater loss of precision.

TABLE 3.8

Checks of Robustness of the Estimated Union Effect.				
Model	Average Impact of INDEX in Small Firms	Average Impact of INDEX in Large Firms	Average Impact of CLOSED in Small Firms	Average Impact of CLOSED in Large Firms
(i) Models in Table 3.5	0.064(0.077)	-0.555(0.204)	-0.070(0.050)	-0.394(0.098)
(ii) + Industry dummies	0.048(0.082)	-0.425(0.221)	-0.029(0.056)	-0.355(0.099)
(iii) + Year dummies	0.059(0.077)	-0.557(0.220)	-0.070(0.050)	-0.394(0.096)
(iv) + Industry and Year dummies	0.043(0.082)	-0.430(0.222)	-0.029(0.056)	-0.356(0.097)
(v) CES production function	0.176(0.111)	-0.611(0.271)	-0.088(0.069)	-0.387(0.151)
(vi) General model	-0.043(0.080)	-0.534(0.177)	-0.053(0.049)	-0.418(0.083)

Notes.

(i) The general model allows parameters to differ with both union presence and firm size.

3.6 Conclusions.

This Chapter presents evidence on the impact of union presence on the average productivity levels of workers in a sample of British engineering firms. A lack of information on union recognition necessitates the use of an index of union presence which is formed as a combined measure of a number of indicators of unionisation. Using this index, the analysis finds that union effects on labour productivity in the average firm are insignificantly different from zero. However, effects in firms with over 1000 employees are found to be significant and negative when using either the index or a dummy variable indicating whether the firm has a closed shop to model union presence.

Union non-union effects on productivity are also estimated for each firm (averaged over the five years) and are seen to exhibit a considerable variation around the average neutral effect. This is similar to Stewart's(1983a) finding that the union non-union wage differential varies considerably although the present analysis is based on a far smaller database. Whilst in terms of generalising the results the small and specific nature of the sample is a disadvantage its main advantage is to show that union effects may vary considerably across a relatively homogeneous group of firms. This is especially interesting given that a great deal of the now accepted industrial relations orthodoxy was based on case studies of various plants and firms operating in this particular sector of British industry. The analysis also attempts to isolate this variation and it is found that scale economies, the nature of the production technology and paying employees some kind of performance related bonus are important in explaining the influence of unions on labour productivity.

The particularly strong result emerging from the analysis reported in the Chapter is that, at least in this sample, negative union productivity effects only occur among relatively large firms. Whether this is due to increased X-inefficiency in large unionised firms or due to the increased control over the workings of the production process held by unions in large firms unfortunately cannot be untangled from the empirical results. Future research may be able to link information on the organisational form of companies and this may allow some discrimination between control and X-inefficiency arguments. This is however beyond the scope of this study. As a final point, it

is not entirely surprising that some of the U.S. results indicating that unions raise productivity are not mirrored using British data. This is especially true given the traditional adversarial relationship between British unions and management compared to the U.S. situation where cooperative industrial relations and business unionism are more the order of the day.

CHAPTER 4.

The Impact of Unions on the Profit Margins of British Companies.

Most empirical work analysing the economic effects of British trade unions has concentrated on their influence on relative wages.[1] However, as the U.S. work on unions, summarised in Freeman and Medoff(1984), has made patently obvious the influence of unions stretches far wider than their effects on wages and unions can and indeed do influence other economic variables. Given their evidence it seems that a disproportionate amount of British work has focused on union wage effects and barely considered the other economic effects of trade unions.

At the date of writing there is a comparative dearth of British work on unions and performance. A few studies have considered the relation between unions and productivity and there is even less work on unions and profitability.[2] Whilst the reason for this lack of work is partially data difficulties this is by no means an adequate explanation since there is considerable scope to analyse these issues at various levels of disaggregation. As stated earlier this thesis prefers to use micro-data for a number of reasons. Two microeconomic data sources are potentially available for use in the study of the union impact on financial performance.[3] Unfortunately there are difficulties associated with both. The first is to utilise existing survey data which often has good information on union related issues but is poor on economic data. The Workplace Industrial Relations Surveys of 1980 and 1984[4] are particularly guilty of this although the data is of sufficient quality to analyse union effects on financial performance : this is the issue to be addressed in Chapter 5. The second source is company accounts data which generally gives relatively good

---

[1] See, inter alia, Blanchflower(1986a) or Stewart(1981a,1987a,1987c,1988)).

[2] Chapter 3 presents some productivity results and other contemporary work (using 1980's data) on productivity has been carried out by Denny and Machin(1988), Edwards(1987) and Wilson(1987). Only Cowling and Waterson(1976) have included a union variable in a British profitability equation and their study refers to aggregate industry level data from the 1960's.

[3] Use of aggregate industry level data from the Census of Production and comparable union coverage information from the New Earnings Survey (in 1973, 1978 and 1983) could permit a fairly highly aggregated study of the effects of unions on price-cost margins in British manufacturing. However, given the problems associated with industry level data (see Geroski and Sawers(1986)) this strategy is not to be pursued in this Chapter where it is preferred to make use of more disaggregated data.

[4] For comprehensive descriptions of the Workplace Industrial Relations Surveys see Daniel and Millward(1983) and Millward and Stevens(1986).

economic information but has no data on unions. It is these latter sources of data which are to be accessed in this Chapter. To circumvent the problem of having no information on unionisation this study uses profitability data from company accounts and links it to data obtained from two surveys asking questions on union matters in a number of companies operating in British manufacturing.

The layout of the Chapter is as follows. Section 4.1 considers the theoretical underpinning of the union impact on profitability, discusses existing empirical work on unions and profitability and on the determinants of profitability and also acknowledges the much discussed problems involved with the use of firm level profitability data. Section 4.2 describes briefly the nature of the data and presents some basic descriptive statistics on the companies in the sample. Section 4.3 presents estimates of a standard Industrial Organisation equation and attempts to ascertain the importance of labour's claim to a share of profits. The next section examines the relationship between the ability of unions to influence profitability and various firm and industry level characteristics. Section 4.5 considers the robustness of the results to certain issues not addressed in the previous sections, namely whether there is a role for absolute firm size, whether the results are sensitive to the choice of profitability measure used and whether the key results are sensitive to the inclusion of industry specific effects. Finally, Section 4.6 summarises the main results and offers some conclusions.

4.1. Unions and Profitability : Theoretical Background and Existing Evidence.

The natural background to the work presented in this Chapter is the U.S. work on unions and economic performance, together with the fact that most of the issues addressed in the U.S. work have yet to be confronted with British data. Given the considerable institutional differences between Britain and the U.S. it seems to be of particular interest to analyse whether some of the strong results found in the U.S. work also hold in the British context. A general consensus reached in the studies using U.S. data is that unions significantly reduce profitability regardless of data set, profitability measure or measure of union presence used in the analysis.[5] This is often

[5] See, among others, Clark(1984), Freeman(1983), Kaufman(1985,1988), Salinger(1984), Voos and

appealed to as a rationale for explaining managerial opposition to unionisation. It is also in line with the predictions of economic theory. For example, both the union monopoly model or a bargaining model of union behaviour depict a unionised firm as being on an iso-profit contour corresponding to lower profits than an otherwise comparable non-union firm.

More formally, a simple bargaining model between firms and unions can be used to illustrate that ceteris paribus profit margins are likely to be lower in unionised firms. Unlike in Chapter 2 where union objectives were considered in general terms this Chapter assumes a specific functional form for union preferences so as to generate some illustrative results regarding the potential union impact on profitability. Managerial objectives can be viewed as maximising the profit function $\Pi = R(L) - WL$ where Π is profits, R is revenue, W is the wage rate and L is employment. Trade union objectives can be represented by a utility function defined over wages and employment $U = U(W, L)$: a useful characterisation depicts the union as attempting to maximise rents, namely the excess of union wages (W) over non-union wages (W_N) times employment, as $U(W, L) = (W - W_N)L$. The following asymmetric Nash bargain between firms and unions is sufficient to illustrate that the wage effects of trade unions are likely to be financed to some extent by a share of profits

$$\max_{W,L} \; [(W - W_N)L]^{\psi}[R(L) - WL]^{1-\psi} \qquad (0 \le \psi \le 1). \qquad (4.1.1)$$

In the Nash bargain ψ is taken as the union's strength in the bargain and the resultant wage-employment outcome is the best that could be achieved given the behaviour of the other party in the bargain. The first-order condition with respect to W is

$$\frac{\psi L}{(W - W_N)L} = \frac{(1-\psi)L}{R(L) - WL} \qquad (4.1.2)$$

Defining the potential surplus available to the firm in the absence of unions as $\Omega = \frac{R(L) - W_N L}{R(L)}$, re-arranging and substituting into (4.1.2) gives the wage W^* at the Nash solution

Michell (1986) and Hensley (1987b). The existing literature is more fully surveyed in Chapter 2.

$$W^* = \psi \frac{R(L)}{L} + (1-\psi)(1-\Omega)\frac{R(L)}{L} \tag{4.1.3}$$

Substituting (4.1.3) into the profit function and dividing by R to give a measure of the rate of return on sales revenue gives

$$\frac{\Pi^*}{R(L)} = (1-\psi)\Omega \tag{4.1.4}$$

Equation (4.1.4) suggests the profit rate in unionised firms will be lower (as long as unions possess some power such that $\psi>0$) than in otherwise comparable non-union firms. Equation (4.1.4) also illustrates that stronger unions (higher ψ) extract a greater share of potential profits. Thus, by appropriating a share of profits trade unions will reduce profitability relative to the case in which they are absent. The extent of this reduction is likely to depend on the product market conditions faced by the firm and on the union wage differential which determine the size of the potential surplus and dictate how the resultant union induced rise in wages 'eats' into price-cost margins. Therefore, in this simple model trade unions are, all other things being equal, likely to capture a share of economic rents and as such exert a negative impact on profitability.[6]

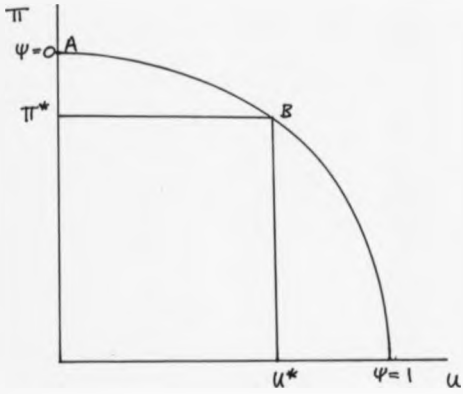
The functions in the bargain above were chosen for their analytical tractability and hence it is a specific example. It is an efficient bargaining model which generates an outcome on a vertical contract curve (see Chapter 2 for more discussion). As such it is the relative bargaining strength parameter ψ which determines the outcome : profits are maximised in the absence of unions where $\psi = 0$ and unions are all-powerful where $\psi = 1$.[7] However, it seems reasonable to expect that the main thrust of the results carries over to other models. Take the general Nash bargain $\Sigma = argmax\,[U-\bar{U}]^{\psi}\,[\Pi-\bar{\Pi}]^{1-\psi}$, where $\bar{U}$ and $\bar{\Pi}$ denote union and firm "threat points" or baseline utility and profits respectively. The Nash bargain can be illustrated diagrammatically as in Figure 4.1.[8] Here a bargaining frontier sketches out the possible (Pareto-efficient) values of Σ that can be

[6] The model above only allow unions to affect wages and defines profits as a function of W and L alone. As such union effects on other factor inputs and prices, and indeed output prices, are not considered.

[7] This model is also used by Svejnar(1986) : he points out that $\psi = 1$ can be viewed as representing a labour managed firm which distributes all profits to its owner-workers.

[8] Figure 4.1 is drawn so that $\bar{U} = \bar{\Pi} = 0$ is the no-bargain outcome : this is not necessary but allowing them to have non-zero values does not add any extra insights to the discussion here (see McDonald and Solow(1981)).

Figure 4.1 : The Union Impact on Profits in the Generalized Nash Bargain.



generated in the bargain. The Nash solution depends on the relative strengths of the two parties in the bargain. For example, if $\psi = 0$ such that unions are not present (or if they are they have no power in the bargain) then the Nash bargain simply maximises profits at point A. More generally the wage-employment outcome from the bargain, say $[W^*, L^*]$, generates an outcome $[\Pi^*, U^*]$ such as point B in Figure 4.1. The exact location of the bargaining outcome, which gives the division of the surplus or organisational rent (see Aoki(1984)), along the frontier depends on the relative strengths in the bargain. Therefore the efficient bargaining framework predicts that profits are higher the lower is ψ : a union non-union comparison indicates lower profits in the presence of unions. Hence, unless employers can raise prices to entirely offset the wage increase that the bargain generates, or in the absence of any offsetting productivity effect (as in the specific model above), price-cost margins will fall in the presence of unions.

The predictions of economic theory are therefore that unions are likely to reduce profitability (see the discussion in Chapter 2 for more details). In addition to this, strong arguments can also be made for the idea that the union effect will vary with product market power. In perfectly competitive markets it seems unlikely that trade unions will reduce profits since, unless they are able to organise the whole market, a profit reduction will drive unionised firms out of business. The unlikely occurrence of completely unionised markets[9] tends to suggest that the union wage effect is more likely to be financed by unions appropriating a share of profits from firms which possess some degree of product market power (those firms with a higher Ω in the model above). One mechanism through which unions may reduce profitability in such situations is where the interdependence in price setting behaviour among firms operating in oligopolistic markets prevents the passing on of higher wages in the form of higher product prices. Also, in relatively larger firms unions may find it productive to pursue more aggressive wage policies which can become more credible as the revenue losses associated with the threat of strike action become greater. Thus, unless firms use their profits arising from market power to build up

[9] Observe for example the 1985 industry level coverage data from the New Earnings Survey where no 3-digit manufacturing industry has all employees covered by collective bargaining agreements. Although some that 3-digit industries are only approximances to economic markets so that, in some albeit uncommon cases (e.g. newspaper printing), whole markets may be near enough completely unionised.

inventories, price-cost margins will be lower in relatively large unionised firms.

Consequently a number of arguments[10] can be proposed for the idea that union strength in the bargain shifts excess profits from capital to labour if the firms in which they operate can exercise some degree of power in the product market : this seems especially likely if the interaction between firms in a given industry prevents the passing on of higher wages through higher product prices. Indeed, results showing higher union wage gains in less competitive circumstances are reported by Stewart(1988) who uses data from the 1984 Workplace Industrial Relations Survey. He estimates a significant union non-union wage differential of 8% in plants facing few competitors (≤5) and no mark-up whatsoever (0%) in more competitive situations.[11]

A number of U.S. studies have addressed the issue of whether product market power provides a source of rents that trade unions can capture. However, less of a consensus has been reached here. Whilst most of the U.S. empirical work relates significant union profit effects to elements of market structure (usually industry concentration)[12] a sizable number of dissenting papers do exist : for example, Connolly, Hirsch and Hirschey(1986) and Hirsch and Link(1987) argue and provide empirical evidence to show that the main source of union profit effects is not market power but firm specific factors like R&D expenditure or innovative activity. Hence, they argue that unions capture a significant share of the rents but they come not from market power but from intangible capital within the firm. In the light of this discussion it is therefore of some importance to empirically test whether the extent of product market power exercised by firms impinges on the ability of trade unions to influence profitability.

Before considering the data and empirical results, other points are worthy of discussion. Since the present analysis intends to use an accounting rate of return as a measure of firm profitability some acknowledgement of the debate questioning whether such a practice is valid or

---

[10] For additional discussion see Chapter 2 and Stewart(1988).

[11] Much has been made of the insignificant or negative effect of the interaction between unionism and concentration often found in wage equations : see for example Weiss(1966), Kwoka(1983) or Blanchflower(1986b). The problem here, as recognised by Stewart(1988), is that concentration is not the appropriate indicator of market power when using microeconomic data. As such the issue of whether union wage gains come from market power remains far from resolved.

[12] See Chapter 2.

not should be made. In the empirical work to follow the measure of profitability to be used is the ratio of trading profits (that is income including depreciation, interest charges and taxation) to sales (hereafter denoted Π/S). The concern expressed by some authors is that accounting rates of return such as this are misleading measures of economic profitability and as such should not be used to measure the ability to earn monopoly profits.[13] Of particular relevance here is Fisher's(1987) claim that the profit-sales ratio is an invalid indicator of the ability to earn high economic profits. These arguments are based on the idea that whilst accounting rates of return reflect current profitability they do not reflect the "true" economic profit rate which is the economic rate of return defined as the discount rate which maximises the expected net revenue stream of an initial outlay. Essentially this is because current profit figures yield no insight into the future profit flows accruing to an investment. As such economic rates of return and accounting rates of return are likely to differ. However, it seems reasonable, as Geroski(1988) points out, that economic and accounting profits are likely to be correlated and indeed as stated in the response to Benston by Scherer et al.(1987) that these criticisms are unduly negative. This analysis therefore acknowledges that from a theoretical viewpoint accounting and economic rates of return are likely to differ although from a practical stance that measures of accounting profitability are a worthwhile indicator of the ability to make higher or lower profits.[14]

Traditional Industrial Organisation studies generally identify structural characteristics of the industry such as market concentration or barriers to entry as key determinants of industry profitability. These factors are presumed to encourage collusion, raise industry prices and thus enable higher profits to be made. For an industry level study an empirically implementable characterisation of this can be represented for industry j as

$$(\Pi/S)_j = \alpha + X_j\beta + \epsilon_j \qquad (4.1.5)$$

[13] See in particular Fisher and McGowan(1983), Benston(1985) and Fisher(1987).

[14] The obvious alternative is to use some market value based measure such as Tobin's q (see Salinger(1984) or Smirlock et al.(1984) who follow such an approach) although this generates problems of its own, not least of which is its method of calculation (see Shepherd(1986)).

where X is the vector of structural variables, α and β are parameter vectors and ε a random error term.

In the early empirical literature the conventional wisdom was that the coefficient on the concentration ratio contained in the X vector is positive. Inference based on this then claimed that concentration acts as the major determinant of high profit rates. However, it should be noted that industrial concentration is only one element of product market power. This is an especially pertinent observation at the level of the firm. Indeed certain authors have recently used disaggregated firm level data and postulated that firm market share matters more than market concentration in determining the ability to make above-normal profits. These studies, such as those carried out by Gale and Branch(1982), Kwoka and Ravenscraft(1986), Martin(1983) and Ravenscraft(1983), typically estimate an equation for the ith firm operating in industry j which can be characterised as follows

$$(\Pi/S)_{ij} = \alpha + X_j'\beta + Z_{ij}'\delta + \varepsilon_{ij} \qquad (4.1.6)$$

where Z is a vector of firm specific variables.

Of particular interest is the finding that when Z contains some kind of market share measure (as theory suggests it should) industry concentration is no longer positively related to profitability and sometimes the estimated relationship is observed to be significantly negative. This is usually rationalised by stating that inclusion of the market share measure means that an increase in concentration will, for a given market share for the ith firm, mean that rival firms are stronger and as such will reduce the profit rate of firm i. The main point this suggests is that one needs to be careful in defining product market power and, at the micro-level, market share and not industry concentration is the main indicator of the ability to make above-normal profits.

Whilst the early empirical work did not contain a union variable more recent empirical work in industrial economics has begun to recognise a role for labour activity.[15] Thus a final addition to equation (4.1.6) is an indicator of union presence U. Consequently, the basic equation

[15] A typical example is Domowitz et al.(1986).

to be estimated becomes

$$(\Pi/S)_{ij} = \alpha + X_i'\beta + Z_{ij}'\delta + U_{ij}'\theta + \varepsilon_{ij} \tag{4.1.7}$$

The union effect in equation (4.1.7) simply works as a shift in the intercept. It therefore sheds no light on whether product market influences are related to the ability of unions to restrict profitability. However, the discussion above and the formal model suggests that product market strength is likely to affect the union's ability to capture a share of rents. The interactive nature of equation (4.1.4) (the rate of return at the Nash solution) suggests that $\frac{\partial^2(\Pi^*/R(L))}{\partial\psi\partial U} < 0$ so that unions erode profit margins by more in firms who possess a greater potential to earn higher returns (those with higher Ω). If the bargaining strength parameter ψ is treated as a function of U then the idea that product market power matters can be tested by including interactions between the union variable and various components of the firm and industry vectors. In particular this permits a test of the idea that union profit effects are related to firm specific indicators of market power like market share and industry level variables like industry unionisation, concentration and the extent of foreign competition.

4.2 Data Description.

The data to be used in this study is company accounts information from the Datastream and Extel databanks supplemented by industry level data from the Census of Production and by information on union activity from two surveys of companies present in the two databanks. The first survey, carried out by the author in the summer of 1987, is discussed in more detail in the Data Appendix and the second was conducted by Sushil Wadhwani, also in the summer of 1987. The empirical work uses data on 145 firms. This number was arrived at after deleting observations with missing or inappropriate firm or industry information and, so as to ensure that any firms with misleading profit figures (for example, due to new setting up costs) do not enter the sample, only considering firms with complete information available from 1983 to 1985. In order to increase degrees of freedom the data was pooled over two years (1984 and 1985) to give a

sample size of 290. Data on union activity is only available as a single observation and no retrospective information was obtained. It is therefore treated as a fixed effect in the empirical analysis. Because of this it was viewed as undesirable (despite the availability of accounts data) to stretch the sample further back due to the changes in unionisation following government legislation and the decline of manufacturing industry that occurred in the early 1980's. This concern seems reasonable given the changes in union density, union recognition and the extent of closed shop arrangements in manufacturing observed between 1980 and 1984 in the Workplace Industrial Relations Surveys (see Millward and Stevens(1986)).[16]

Basic descriptive statistics on the profitability, extent of union recognition and market shares possessed by the firms in the sample are reported in Table 4.1. The mean of the profitability measure, the ratio of trading profits to sales, is observed to be 9.4% over the whole sample. This is however an average over 1984 and 1985 and one worry with the use of cross-sectional accounts data is that profit measures derived from them may fluctuate considerably from year-to-year. For this reason some authors prefer to take a number of years data and use averages to smooth this out. The data was however checked to see whether this is the case and Table 4.1 shows a crude indicator of this by reporting sample averages for 1984 and 1985 : a t-test of the difference in sample means is insignificant at conventional levels ($|t| = 0.46$). When the trading profit margin is broken down by union recognition it is some 1.7 percentage points lower among unionised firms. This is what would be expected given the discussion in Section 4.1 and is in line with the raw U.S. data presented by some authors (see for example Clark(1984). It is also clear that firms with higher shares of their market are able to earn higher returns on sales. Firms with market shares in excess of 5% have profit margins that are 1.8 percentage points higher than those with shares below 5%. This suggests that market share may imply an ability to raise margins and thus generate rents that unions can capture : it is however beyond simple breakdowns such as those in the Table to test this and a more detailed econometric approach is needed. After discus-

[16] Whilst de-recognition has been a fairly rare occurrence and most of the 1980-1984 fall was due to firms going out of business and plants being shut down the most recent annual report by ACAS(1987) does identify some cases of de-unionisation and de-recognition occurring recently in Britain.

TABLE 4.1

Profit Margins of 145 British Companies, 1984-85.		
Sample	Sample Size	Average Profit margin
All Firms	290	0.094
All firms in 1984	145	0.096
All firms in 1985	145	0.092
Unions recognised	234	0.091*
No unions recognised	56	0.108*
Market share≥5%	78	0.107**
Market share<5%	212	0.089**

Notes.

(i) See the text and the Data Appendix for variable definitions and sources.

(ii) A significant difference between sub-sample splits is denoted by ***, ** and * for 1%, 5% and 10% significance levels respectively.

sion of the data this is the subject of the next two Sections in this Chapter.

Turning to the description of the explanatory variables that are to be used in the empirical analysis, use of the return on sales as dependent variable necessitates the inclusion of a control for differences in capital intensity across firms : a lack of current cost information for all the firms in the sample prevents the construction of the capital stock measure used by Nickell and Wadhwani(1988) and thus capital intensity is simply proxied by the ratio of the book value of net fixed assets to sales (K/S). More details on the construction of all the variables used here and their sample means are reported in Table A4.1 in the Data Appendix.

A second component in the vector of firm specific variables described in Section 4.1 is market share (MS) which is weighted across different industries to allow for the diversified nature of those firms which have activities in multiple industries.[17] Construction of a reasonable indicator of market share is somewhat difficult as the sales figures in company accounts usually include, where relevant, sales income from overseas activity. Thus defining market share by dividing firm sales by industry sales from the Census of Production may tend to overstate 'true' market share. However, it does give some indication of relative market shares and the results reported below should be interpreted in this light. The market share variable constructed in this way is seen to be higher among unionised firms : the mean of MS in unionised firms is 9.3%, whilst the mean in non-union firms is 1.2% : this reflects the well known phenomenon that unions are more likely to be located in larger firms (which in this case it is still true even if industry size is taken account of). On this point it should be noted that MS is a measure of size relative to firms in the same industry. Absolute size is also of potential relevance : the size of union firms in the sample is much higher than non-union firms (in 1984 prices the average of total sales (SIZE) is £439 million in union firms compared to £18 million in non-union firms). Absolute and relative size are however fairly highly correlated for this data set : a correlation coefficient between MS and ln(SIZE) is 0.70. Hence, whilst MS is used to indicate the returns to firm specific market power, the role of absolute size is also addressed below in the section concerning robustness checks.

[17] The weights used are the proportion of sales in each of the firm's product groups.

Another firm level variable that we would like to control for is the age of the company since one argument that can be advanced is that newer firms can earn higher profits, at least in the short run. To allow for this possibility a variable indicating the number of years that a firm has been present in the Exstat databank was considered : presumably more recent entry to the data source reflects being, in relative terms, a newly set-up or newly quoted company.[18] This is the variable YEARS which, as one would expect, indicates that non-union concerns have, on average, been in the databank for fewer years.

Turning to the vector of industry level variables to be used in the analysis the five firm concentration ratio (CONC) has a mean of 36%, which is slightly lower than the average over all 3-digit production industries.[19] A second industry variable, included as an attempt to get a handle on the extent of scale economies or entry barriers in a firm's operating industries is a cost disadvantage ratio (CX), defined as the ratio of sales per employee in small plants in an industry to sales per employee in larger plants.[20] This is included to see if any profitability advantages accrue to larger firms when there are cost disadvantages for smaller production units in a given industry. In the empirical work to follow a dichotomous variable (CDR) is defined equal to one if CX<0.87 and 0 otherwise.[21] To control for disequilibrium factors industry sales growth (GROWTH) over the previous five years is also included. As discussed in the context of the market share measure the fact that a number of the companies in the sample operate in world markets also seems pertinent to this study. Unfortunately complete information on exports and overseas activity is not available for all firms : thus an industry level export to sales ratio (EXPS) and an import share variable (IMPS) are included in the vector of industry level control variables. As Table A4.1 in the Data Appendix shows EXPS is more likely to be higher if the firm does not recognise trade unions for bargaining purposes. Similarly trade unions are more likely to be

[18] Care was taken to ensure that relatively recent additions included in the sample were not due takeover/merger activity.

[19] The mean over all production industries (SIC 200-499) from the Census of Production is more of the order of 50%.

[20] Small plants are those with less than 100 employees and large plants those with 100 or more.

[21] The cut-off point of 0.87 was found by grid search methods, searching at intervals of 0.01, which maximise the appropriate log-likelihood.

active in firms which are less exposed to import competition. Finally, the theoretical discussion in Section 4.1 indicated that the extent of unionisation in the firm's operating market may impinge on the union impact on profit margins. Additionally, it could be argued that unions are more likely to gain a greater wage premium and hence reduce profits by more in highly unionised markets. To allow for this an industry level union coverage variable (COVER) is also considered and, not surprisingly, union firms are more likely to be located in highly covered industries.

The basic variable used to model union or non-union status is a dummy variable equal to one if unions are recognised for bargaining purposes among manual or non-manual employees and, within this sample, its mean is 0.81. Also a feature of the firms participating in the survey is that a considerable proportion which recognise unions for manual workers do not have union recognition among non-manual employees.[22] Indeed, non-manual unions are only recognised in just over half of the firms in the sample. This suggests a further method of modelling union presence, namely to define two dummy variables indicating whether employers recognise trade unions for both manual and non-manual employees (ALLREC) or merely for manual or non-manual workers alone (SOMEREC). This (admittedly naive) split permits a somewhat crude test of whether workplace representation for both manual and non-manual employees means that trade unions have more power and as such are able to extract a greater share of any excess profits. The other possibility here is to use an interaction between RECOG and the industry coverage measure COVER to model union strength as one would expect unions in highly unionised situations to be stronger (i.e. be able to achieve a higher mark-up) and hence to have some claim to an additional share of the available rents. This notion is also tested in the interactive specifications reported in Section 4.4.

4.3. Estimates of the Union Impact on Profitability.

The key hypotheses to be tested in this Chapter are first whether unions affect profitability and second if so, do they do so by more or less in situations where firms possess product market

[22] One firm also recognises non-manual unions but not manual unions.

power. This Section addresses itself to the first issue whilst the second is explored in the following Section. The upper panel of Table 4.2 presents some simple illustrative regressions to show the influence of market share and union recognition on profitability whilst controlling for capital intensity but, for the moment, excluding other controls. In column (1) market share is positively and significantly related to the return on sales. This is in line with a number of U.S. studies (see, for instance, Shepherd(1972), Gale and Branch(1982) and Ravenscraft(1983)). The basic impact of union recognition in column (2) indicates that unionised firms have significantly lower rates of returns than non-union firms in this sample. This conforms to the discussion of Section 4.1. When market share and recognition are considered simultaneously in column (3) both remain significant and impact on profitability in opposite directions.

Columns (1)-(3) simply give the basic correlations between the two main variables of interest and profitability. The lower part of Table 4.2 adds the other controls and presents estimates of profitability equations both including and excluding measures of unionisation. Column (4) is a standard Industrial Organisation equation without a union variable, column (5) supplements this specification by the basic union recognition dummy and the industry level coverage variable and column (6) considers the union effect on profitability conditional on whether unions are recognised for all employees or just for one of the two broadly defined occupational categories. Diagnostic checks indicated that heteroskedasticity is a problem : to counter this White's(1980) standard errors are presented. Again, as in Chapter 3, the null hypothesis of normally distributed errors cannot be accepted : the reservations expressed by Chesher and Spady(1988) and Davidson and MacKinnon(1988) regarding the validity of these kinds of Lagrange Multiplier based tests for the normal linear regression are therefore re-iterated here.[23]

The specifications in Table 4.2 for the most part reflect the usual results found in the Industrial Organisation literature. The control for capital intensity raises profitability as would be expected, and the market share effect remains robust to the inclusion of the controls.[24] The age

[23] As a consequence of these doubts regarding the quality and power of the non the normality statistics are not reported in the Table. For the three equations in Table 4.2 the values obtained for the Kiefer-Salmon(1983) test were 288.18, 334.35 and 327.71, compared to a 5% critical value of 5.99.

[24] The potential endogeneity of market share is a pertinent issue : when instrumented by lagged market share similar results were obtained. For example, calculating a Hausman(1978) test statistic based on this

TABLE 4.2

Determinants of Profitability Among a Sample of British Firms 1984-85.

	(1)	(2)	(3)
Constant	0.061(0.006)	0.082(0.013)	0.082(0.013)
K/S	0.105(0.019)	0.113(0.019)	0.109(0.019)
MS	0.042(0.018)	-	0.058(0.019)
RECOG	-	-0.025(0.012)	-0.029(0.012)
R^2	0.132	0.144	0.159
N	290	290	290
Mean of dep. var.	0.094	0.094	0.094

	(4)	(5)	(6)
Constant	0.067(0.023)	0.070(0.027)	0.070(0.027)
K/S	0.107(0.019)	0.109(0.018)	0.109(0.018)
MS	0.044(0.022)	0.054(0.023)	0.052(0.023)
YEARS	-0.0030(0.0014)	-0.0018(0.0014)	-0.0019(0.0014)
CONC	0.066(0.031)	0.068(0.031)	0.067(0.031)
CONC>0.56	-0.080(0.017)	-0.082(0.017)	-0.083(0.017)
CDR	0.021(0.007)	0.022(0.007)	0.022(0.007)
GROWTH	0.012(0.014)	0.010(0.014)	0.010(0.014)
IMPS	-0.020(0.035)	-0.025(0.033)	-0.026(0.033)
EXPS	0.018(0.034)	0.023(0.033)	0.022(0.034)
COVER	-	0.009(0.029)	0.008(0.030)
RECOG	-	-0.026(0.012)	-
ALLREC	-	-	-0.025(0.012)
SOMERREC	-	-	-0.027(0.012)
R^2	0.256	0.273	0.273
N	290	290	290
Mean of dep. var.	0.094	0.094	0.094
Functional form	17.10(5.99)	14.90(5.99)	15.14(5.99)
Heteroskedasticity	115.78(18.30)	132.33(21.00)	132.28(22.40)

Notes.

(i) The dependent variable is the ratio of trading profits to sales.

(ii) $CDR=1$ if $CX<0.87$ and 0 otherwise.

(iii) All equations include a time dummy equal to one for 1985.

(iv) Heteroskedastic consistent standard errors are in parentheses.

(v) The test for functional form is Ramsey's(1969) RESET test : it is a $\chi^2(2)$ Wald test of the significance of adding in the squares and cubes of the fitted values from each model.

(vi) The test for heteroskedasticity is Breusch and Pagan's(1979) test which is distributed as $\chi^2(p-1)$ where p is the number of estimated parameters in the model.

(vii) The numbers in parentheses adjacent to the diagnostics are the relevant 5% critical values.

proxy YEARS is negatively related to profitability and illustrates that firms newer to the databank earn higher rates of return. This confirms the view that higher short-run profits can be made by more recently quoted firms.

When entered by itself the continuous concentration variable was found to be negatively related to the return on sales. However, further examination revealed a non-linear relationship where moderate concentration (below 56%) raises profitability, after which the effect of concentration becomes negative.[25] These concentration variables point to a complex non-linear relationship between profitability and market concentration (on this see also Geroski(1981)). The estimated effects are however in line with the existing U.S. firm level studies as discussed earlier and confirm that, after including a market share variable, high concentration reduces the return on sales, albeit in a more complicated manner than usually considered. As would be expected in a study of large firms, if there is some cost disadvantage associated with small plants in an industry, firm profitability is higher. However, being in a faster growing industry, a highly covered industry or in one with high import or export activity does not yield any statistically significant differences in profit rates, at least in the specifications in Table 4.2. Thus, of the variables other than unionisation, the ability to make above normal profits is determined by both firm specific factors like market share and capital intensity and by external industry level variables like the degree of seller concentration and cost advantages that larger firms might have over their smaller competitors.

The basic union recognition dummy is negative and statistically significant in column (5) and suggests that, after controlling for both firm and industry specific factors, unions reduce the rate of return on sales by some 2.6 percentage points. This corresponds to a decline of 27.6% relative to the sample mean or 24.1% relative to the non-union mean. This amounts to a substantial union impact on profitability : this result proved robust across a number of alternative specifications and sample definitions.[26] Note however that the $\chi^2(2)$ Wald tests of functional form

---

produced a $\chi^2(1)$ value of 0.88 in the specification of column (5) in Table 4.2 which is well below the 5% critical value of 3.84.

[25] The cut-off point of 56% which dictates the "critical concentration ratio" (see Wham(1976)) was found by grid searches with a stepsize of 1% to maximise the log of the likelihood function.

[26] The results are also robust to the addition of a set of industry dummies : if 19 2-digit industry dummies

all produce statistics that lie above the 5% critical value suggesting some missing non-linearities in the model : this provides a statistical rationale for the consideration of interaction terms, which is undertaken in the following Section. Comparison of column (5) with column (4) also shows that omission of the union variable causes little bias : the YEARS variable loses significance although this apart very few changes emerge. Notwithstanding this, union effects are certainly important and the union status of the firm acts as an important determinant of profit margins in this data.

The equation in column (6) indicates that recognition for all employees generates a fall in the return on sales of 2.5 percentage points whilst the corresponding reduction if unions are recognised for only manuals or non-manuals is 2.7 percentage points. The specification in column (6) can be tested using a formal hypothesis test against that in column (5) : as heteroskedastic consistent standard errors are reported this necessitates the use of a Wald test based on the appropriate adjusted covariance matrix. The resultant $\chi^2(1)$ statistic is 0.074 which, compared to the 5% critical value of 3.84, suggests that no difference emerges if unions are recognised for all workers compared to the case where unions are only recognised for a sub-set of employees.[27] This implies that strength of the union is less of an issue than its mere presence in this sample of firms. However the data is hardly strong enough to validate this assertion as the variables ALLREC and SOMEREC are very imperfect measures of differential union strength ; moreover the interaction with the industry coverage measure considered in the next section shows that stronger unions (i.e. unions in highly covered industries) may influence the profit rate more heavily, a result which is in line with the bargaining model set out in Section 4.1. Nonetheless, as they stand these results tend to support the view that managerial opposition to unionisation occurs because ultimately, regardless of any potential productivity enhancing role of trade unions, unionised firms are more susceptible to having their price-cost margins eroded by labour activity

are included in the equation in column (5) the union effect is estimated to be -0.027(0.012).

[27] Other splits possible in the smaller sample (N=174) from the smaller survey (excluding Wadhwani's firms) were whether a firm has a closed shop or a joint consultative committee in any of its plants. Decomposing the union recognition dummy into categories based on these variables yielded no statistically significant differences for profitability equations based on the smaller sample.

and correspondingly less profitable than otherwise comparable non-union firms.

4.4. The Union Impact on Profitability and Product Market Strength.

Whilst the specifications in Table 4.2 served their purpose in showing that profit equations should include some indicator of labour's claim to a share of residual profits, it seems likely that the influence of unions is interactive with the characteristics of the firms in which they are located. An exploration of the variation in the union profit effect is undertaken in Table 4.3 which presents profitability equations including interactions between union recognition and firm market share, industrial concentration, union coverage, import penetration and export intensity. Inclusion of these interactions permits an explicit test of the ideas outlined in Section 4.1, in particular allowing a test of the hypothesis that product market power matters in isolating the union impact on profitability.[28]

In the first column of Table 4.3 the interaction with market share is strongly significant and negatively related to the rate of return on sales. The Wald statistic W shows that the union effect differs significantly with market share and, as the coefficient on RECOG loses statistical significance, this suggests that product market power is a pre-requisite for capturing a share of available rents and reducing profitability. Also of interest is that in this specification high market share only raises the profit margins of firms in the non-union sector. Thus product market strength, as measured by firm market share, interacts in an important way with the ability of unions to capture economic rents among the firms in the sample. This is strong evidence for the product market power matters hypothesis set out in Section 4.1.

A great deal of the U.S. evidence postulates that market concentration can be used to proxy the existence of monopoly rents and as such union profit differentials are more likely to be greater

[28] Table 4.3 only presents interactions with certain variables as prescribed by the theoretical discussion in Section 4.1. The other alternative is to estimate a fully interactive model allowing all the explanatory variables to have different effects in the union and non-union sectors. However there are only 56 non-union observations and more precise parameter estimates were obtained by considering the parsimonious interactive specifications whilst telling the overall same story. For sake of completeness when interactions with CDR, GROWTH and YEARS were added to the specifications in Table 4.2 all had positive signs but each interaction terms had an insignificant (heteroskedastic consistent) t-statistic (t=0.05, 1.45 and 0.27 respectively).

TABLE 4.3

Profitability Equations - Interactions With Firm and Industry Characteristics.			
	(1)	(2)	(3)
Constant	0.063(0.029)	0.070(0.033)	-0.018(0.048)
K/S	0.103(0.017)	0.107(0.018)	0.113(0.017)
MS	0.633(0.276)	0.046(0.022)	0.057(0.023)
YEARS	-0.0018(0.0014)	-0.0016(0.0014)	-0.0020(0.0014)
CONC	0.067(0.032)	0.057(0.065)	0.056(0.031)
CONC>0.56	-0.081(0.017)	-0.115(0.043)	-0.079(0.017)
CDR	0.023(0.007)	0.022(0.007)	0.021(0.007)
GROWTH	0.014(0.014)	0.017(0.013)	0.016(0.013)
IMPS	-0.034(0.032)	-0.015(0.033)	-0.020(0.032)
EXPS	0.024(0.033)	0.024(0.034)	0.032(0.032)
COVER	0.011(0.029)	0.013(0.029)	0.159(0.072)
RECOG	-0.019(0.012)	-0.041(0.019)	0.083(0.046)
RECOG*MS	-0.583(0.276)	-	-
RECOG*CONC	-	0.041(0.047)	-
RECOG*CONC>0.56	-	0.018(0.068)	-
RECOG*COVER	-	-	-0.184(0.074)
R^2	0.282	0.285	0.294
N	290	290	290
Mean of dep. var.	0.094	0.094	0.094
W	4.47(3.84)	2.48(5.99)	6.14(3.84)
Functional form	9.63(5.99)	17.25(5.99)	8.12(5.99)
Heteroskedasticity	141.10(22.40)	129.54(23.70)	130.45(22.40)

TABLE 4.3 (CONTINUED).

Profitability Equations - Interactions with Firm and Industry Characteristics.			
	(4)	(5)	(6)
Constant	0.096(0.029)	0.101(0.028)	-0.026(0.049)
K/S	0.115(0.017)	0.113(0.016)	0.108(0.017)
MS	0.049(0.022)	0.052(0.022)	0.654(0.237)
YEARS	-0.0015(0.0014)	-0.0019(0.0013)	-0.0020(0.0014)
CONC	0.064(0.031)	0.057(0.030)	0.055(0.031)
CONC>0.56	-0.074(0.016)	-0.073(0.016)	-0.077(0.017)
CDR	0.021(0.007)	0.020(0.007)	0.022(0.007)
GROWTH	0.022(0.014)	0.026(0.014)	0.020(0.012)
IMPS	-0.108(0.066)	-0.016(0.030)	-0.029(0.031)
EXPS	0.032(0.033)	-0.068(0.059)	0.034(0.032)
COVER	0.001(0.028)	-0.006(0.028)	0.163(0.072)
RECOG	-0.067(0.024)	-0.065(0.021)	0.092(0.047)
RECOG*MS	-	-	-0.601(0.236)
RECOG*COVER	-	-	-0.186(0.074)
RECOG*IMPS	0.110(0.065)	-	-
RECOG*EXPS	-	0.127(0.061)	-
R^2	0.292	0.303	0.303
N	290	290	290
Mean of dep. var.	0.094	0.094	0.094
W	2.83(3.84)	4.35(3.84)	9.50(5.99)
Functional form	13.22(5.99)	9.30(5.99)	2.12(5.99)
Heteroskedasticity	129.51(22.40)	119.07(22.40)	142.49(23.70)

Notes.

(i) As for Table 4.2.

(ii) W is a Wald test of the significance of the interaction terms. The number in parentheses is the appropriate 5% significance level.

in highly concentrated industries or in firms operating in such industries. However, when RECOG is interacted with CONC and HCONC a positive but statistically insignificant effect is observed.[29] Thus being in a highly concentrated industry does not imply a greater ability of unions to erode profit margins. It should be noted that this does not rule out the existence of such a relationship at the industry level where market concentration is a more appropriate measure of market power. However, irrespective of this possibility, the dominant source of excess profits and consequently union rent seeking in this sample is individual firm market share and not industry concentration.

A third interaction considered in Table 4.3 is whether the extent of industry unionisation impinges on the union non-union profit differential. The coefficient on the interaction term RECOG*COVER is estimated to be negative and strongly significant and union rent seeking is seen to be more marked when competitors in the firm's operating industry are also unionised. If being in a highly unionised market adds to union power in the wage bargain (as one would intuitively feel it does) then stronger unions are more able to capture a share of profits. This is interesting as it coincides with the work on relative wage effects which finds that individual, plant or firm specific unionisation measures need to be augmented by industry level unionisation measures in wage equations to ascertain more accurately the union wage premium (see Lewis(1983)). Since part of the profit effect is likely to finance the union wage differential then it is reassuring that the industry level coverage measure is of importance in addition to the firm specific recognition measure used in this study.

A fourth interaction reported in Table 4.3 is with import competition. This is included to test the idea that protection from international competition implies that unions can pursue more aggressive wage policies and hence obtain a significant share of the organisational rent. This is confirmed empirically (although the interaction term is only significant at the 10% level) as the profit margins of firms which have more exposure to import pressures are less affected by union activity. The interaction with the other foreign activity variable EXPS is also positive and

[29] The same pattern of statistical insignificance is observed if interactions with the continuous measure or with the dummy indicating high concentration are considered individually.

indicates that being in an environment where diversification into foreign markets is easier enables firms to dampen down the union effect on profit margins. These two interactions taken hand-in-hand are mild evidence for the idea that being active only in domestic markets where barriers to international competition exist and where firms are less able to shift sales abroad facilitates a greater ability of unions to reduce profitability.

If all the interactions with RECOG considered in columns (1)-(5) are included in a single specification a Wald test suggests they are jointly significant ($\chi^2(6)=15.20$). However, the general model incorporating all these interactions can be simplified to the model only including interactions with MS and COVER, the appropriate $\chi^2(4)$ statistic being 9.29, compared to a 5% critical value of 9.49. This gives the parsimonious specification in column (6) which illustrates that the key characteristics which determine the union profit effect are market share and the extent of unionisation in the firm's operating market. Additionally, in column (6) the RESET test passes comfortably thereby rejecting the possibility of model misspecification through a need for any further non-linearities in the model. This is evidence for the importance of these two interaction terms, relative to both the non-interactive models in Table 4.2 and the other specifications of Table 4.3, and highlights that the key determinants of the union effect in this data are market share and industry unionisation.

The simple one-way interactions in Table 4.3 make interesting reading and stress that certain characteristics of firms and their market provide sources of potential rents that unions are able to capture. In particular the interactions with market share and union coverage warrant further investigation : given that union effects are seen to be more negative in firms with high market share or in firms in highly unionised industries it is interesting to consider the effect for firms characterised by both. A set of more detailed interactions examining this are chronicled in Table 4.4.

The estimates in column (1) of Table 4.4 re-define the union variable in terms of two mutually exclusive dummies which break down the basic recognition dummy by high and low union coverage.[30] A Wald test supports this decomposition on statistical grounds ($\chi^2(1)=5.72$) and the

[30] The critical value of 0.67 was found by simple grid searches to maximise the log-likelihood of the es-

TABLE 4.4

Profitability Equations - Multiple Interactions.			
	(1)	(2)	(3)
MS	0.051(0.022)	0.597(0.240)	0.682(0.217)
COVER	0.066(0.039)	0.066(0.039)	0.069(0.039)
RECOG*COVER≥0.67	-0.043(0.014)	-0.035(0.014)	-0.029(0.011)
RECOG*COVER<0.67	-0.016(0.012)	-0.010(0.013)	-
RECOG*COVER≥0.67*MS	-	-0.551(0.238)	-
RECOG*COVER<0.67*MS	-	-0.547(0.245)	-
RECOG*MS	-	-	-0.637(0.215)
R^2	0.289	0.296	0.295
Functional form	5.95(5.99)	2.06(5.99)	1.52(5.99)
Heteroskedasticity	125.81(22.40)	139.56(25.00)	124.05(22.40)

Notes.

(i) As for Table 4.2.

(ii) All equations include the explanatory variables from column (1) Table 4.2.

impact of unions on profitability is more marked in firms in highly covered industries, the effect only being statistically significant for the high coverage group. Introducing interactions between the two union variables and MS shows that higher market share provides a source of rents which unions are able to capture regardless of the extent of unionisation in their market. However, effects unrelated to market share are only significant for firms in high coverage industries : therefore the general model in column (2) can be simplified to the form in column (3), the relevant $\chi^2(2)$ statistic being 0.58. The upshot of this is that unions located in firms in highly unionised industries may erode price-cost margins but the union induced reduction will be greater if the firm has some market power. In less unionised industries unions can only extract a significant share from high market share firms. These results reinforce the view that in firms with product market power there is more scope for unions to reduce profit margins : in addition they show that higher unionisation in the firm's operating environment can also generate reduced profit margins.

The results presented in this section provide strong evidence to show that union activity in a number of large companies is negatively related to the ability to earn a higher return on sales. They also suggest that the negative effect is more marked in situations where firms possess some degree of market power. The implication of these results is that because the erosion of price-cost margins is greater in firms who can exercise some degree of power in their operating market then trade unions are appropriating a share of rents from oligopoly power. Overall consideration of the results lends more weight to the notion that unions reduce and re-allocate excess profits than to the idea that union profit effects are merely damaging corporate performance.

4.5. Further Considerations and Robustness Checks.

Other extensions to the basic model presented here are possible. This section considers some of these possibilities as a means of checking the robustness of the results reported to date.

timated equation.

TABLE 4.5

Robustness Checks.				
	MS	RECOG*COVER*0.67	RECOG*MS	Size control
(i) Basic model	0.683(0.217)	-0.029(0.010)	-0.641(0.215)	-
Size Controls				
(ii) ln(SIZE)	0.609(0.221)	-0.031(0.011)	-0.598(0.216)	0.432(0.300)[a]
(iii) SIZE	0.682(0.217)	-0.029(0.011)	-0.639(0.215)	0.046(0.186)[b]
Profitability Measures.				
(iv) Pre-tax return on sales	0.716(0.164)	-0.033(0.011)	-0.658(0.164)	-
(v) Post-tax return on sales	0.398(0.128)	-0.024(0.008)	-0.365(0.129)	-
(vi) Pre-tax return on total assets	0.819(0.241)	-0.035(0.015)	-0.764(0.240)	-
Industry Dummies.				
(vii) 19 2-digit industry dummies	0.397(0.151)	-0.033(0.011)	-0.337(0.151)	-

Notes.

(i) ln(SIZE) and SIZE are instrumented by their lagged values.

(ii) [a] denotes that the coefficient and its standard error have been scaled up by 10^3 for presentational purposes.

(iii) [b] denotes that the coefficient and its standard error have been scaled up by 10^6 for presentational purposes.

(i) Absolute Size.

Despite the strong intercorrelation between market share and absolute size in this data it seems important to check whether, in addition to the relative size measure, there is a role for absolute size in determining profit margins. This is especially true as some British studies of large firms have isolated a negative impact of firm size on profitability (an example is Whittington(1980)). Rows (ii) and (iii) of Table 4.5 add the natural log of sales and the linear sales variable to the preferred specification from earlier. Both are instrumented by their lagged values due to the endogenous nature of the variable.[31] As Table 4.5 shows no such negative effect emerges from this data when either variable is included. The results reached earlier are not qualitatively altered and remain very robust.[32] Controlling for absolute size, in addition to relative size, does not affect the basic thrust of the results. Including interactions between the size controls and the union variable also proved unfruitful as the key firm level determinant of the trade union effect remains to be relative and not absolute size.

(ii) Profitability Measures.

If results can be reproduced using alternative profitability measures this adds weight to the conclusions generated. Consequently, rows (iv)-(vi) of Table 4.5 re-estimate the basic interactive model for three alternative profitability measures : the pre-tax return on sales, the post-tax return on sales and the pre-tax return on total assets. All are again derived from company accounts and remain subject to the criticisms made by Fisher and McGowan(1983) and others as discussed above. However, they provide a useful sensitivity check of the results given earlier. Estimated coefficients are of a different scale due to the use of alternative dependent variables although the same pattern of results emerges. Hence, the main results prove robust to alternative definitions of the profit rate.

[31] A Hausman(1978) exogeneity test confirmed the need for this.

[32] Considering the total number of employees or total assets did not alter these conclusions.

(iii) Industry dummies.

As reported earlier (footnote no. 26) the basic union effect remained unaffected by the inclusion of a set of 19 2-digit industry dummies. Row (vii) adds this vector of dummies to the parsimonious model. Whilst the same pattern of significance emerges the estimated coefficients are reduced somewhat. The coefficients on MS and RECOG*MS only remain significant due to the use of White standard errors suggesting some underlying problems of potential misspecification, which become noticeable once one adds in the industry controls. It should however be noted that the inclusion of an extra 19 parameters is asking a lot of the data and as such it is reassuring that the results remain qualitatively similar. Nevertheless they do suggest that part of the market share effect is wiped out by certain unobservable industry level factors. This suggests a further avenue for future research, considering in more detail interactions between firm level and industry level determinants of profitability.

4.6. Conclusions.

This Chapter provides some estimates of the impact of trade unions on profitability in a sample of large companies. The study is very much considering a snapshot of a number of manufacturing firms in 1984 and 1985. As such the longer term aspects of unionisation are not considered : this means that there is no allowance for dynamic or individual firm specific effects. A lack of longitudinal data on trade union presence at firm level precludes study of this although results from this initial study are clearly illuminating. The general finding of U.S. studies, namely that unions reduce profitability, is mirrored for this data source. This union induced reduction is found to be more marked where firms in which unions are located possess some product market power although, unlike most of the U.S. work, the ability of unions to capture a share of profits is not related to concentration but is intrinsically linked to firm specific market share and to the degree of union activity in the firm's operating industry. The implication of these results is therefore that unions seem to re-channel excess profits made by firms with market power from capital to labour. These issues are further explored using a different data set in the next Chapter.

CHAPTER 5.

The Impact of Unions on the Financial Performance of British Private Sector Establishments.

As earlier Chapters have pointed out there is now a long history of Industrial Organisation studies analysing the determinants of firm performance, which pays particular attention to the impact of market structure on the ability of firms to make above-normal profits.[1] This literature provides extensive evidence of links between structure and performance, although there is disagreement about the appropriate measurement of the variables, the interpretation of the observed correlations and the policy implications to be drawn.

Also long debated has been the ability of trade unions to affect profit levels in certain situations by extracting a share of any rents. This interface between the labour and product markets has however been far less fully investigated and it is only recently that much effort has gone into the empirical estimation of the union impact on financial performance. Chapter 4 provided some evidence to show that labour's claim to a share in profits is a strong one and one that is intrinsically linked to the market power that a firm possesses. The analysis presented in this Chapter uses establishment-level data from the 1980 and 1984 Workplace Industrial Relations Surveys to examine the determinants of financial performance at the micro level.[2] In particular the data set allows an examination of the impact of unions on financial performance in a broad cross section of British private sector establishments.[3]

The layout of the Chapter is as follows. Section 5.1 discusses the measure of financial performance used in this Chapter and why use of alternative measures of the ability to earn higher returns is desirable. Section 5.2 sets out the appropriate modelling strategy. The data is discussed in more detail in the following section and Section 5.4 presents some basic estimates of the union impact on financial performance. Section 5.5 considers the variation in the union effect with

[1] For surveys of this work see, inter alia, Scherer(1980), Schmalensee(1986) and Geroski(1988).

[2] Blanchflower and Oswald(1987b) also utilize the 1984 data to examine the extent to which performance-linked payment schemes exert an influence on financial performance.

[3] This Chapter draws heavily on joint work with Mark Stewart : see the paper by Machin and Stewart(1988) for more details.

respect to the relative market power of the production units in the sample. Section 5.6 considers the robustness of the results to certain respecifications. Included here is modelling the performance measure by transforming the data to allow for industry specific fixed effects. This is treated as a sensitivity check of the results presented earlier. Finally Section 5.7 compares and contrasts the results with those using the company accounts measures of profitability reported in Chapter 4.

5.1. On Measuring Financial Performance.

There has been considerable disagreement about the appropriate measurement of the performance variable in Industrial Organisation studies of the determinants of financial performance. Results may be biased as a consequence of differences between the accounting measures often used in empirical work and real economic rates of return. These differences arise from, amongst other things, the depreciation methods used in accounting conventions. Fisher and McGowan (1983), for example, go so far as to assert that as a result of this 'there is no way in which one can look at accounting rates of return and infer anything about relative economic profitability or, a fortiori, about the presence or absence of monopoly profits' [Fisher and McGowan(1983) p.90]. This position has been strongly contested by a number of respondents to the Fisher-McGowan article in the American Economic Review in 1984 [pp.492-517], Kay and Mayer (1986) and others. Geroski (1988) notes in his survey that 'it appears to be easy to construct examples in which accounting and economic rates of return diverge spectacularly' [Geroski(1988) p.111], but is reassured by the fact that, although the most important systematic determinant of the difference seems to be firm size, 'correlations between this type of measurement error and market concentration do not appear to be very strong'. However since current evidence suggests that market share rather than concentration is the appropriate indicator of market power at the micro-level[4] and since market share is of course highly correlated with size this may be misplaced. Price-cost margins, now usually preferred to rates of return in empirical work, also seem to suffer from similar

[4] See Chapter 4 and the U.S. studies of Gale and Branch(1982), Ravenscraft(1983) and Kwoka and Ravenscraft(1986).

anomalies (see Leibowitz(1982)). A number of recent studies have examined Tobin's q as a measure of monopoly rents.[5] However this also has a number of shortcomings.[6] As Chapter 4 modelled the union impact on accounting rates of return it also seems desirable to utilise some other indicators of financial performance to ensure that it is not simply use of accounting data which generates the reported results. Given the potential deficiencies of the various measures, strength is obviously added to the weight of evidence on the hypothesis if evidence can be produced on the basis of a range of performance measures. It is in this spirit that the evidence on the measure used in this Chapter is presented.

A point made in the previous Chapter was that there is no natural source of data to investigate the impact of unions on financial performance at the micro-level in Britain. Such a study requires a combination of both financial and industrial relations data. Since there is no existing survey sample with extensive information covering both these dimensions, one of two approaches can be adopted, using either a financial data source or an industrial relations data set as the starting point. Chapter 4 begins with financial data and augments it, using a small postal survey, with some basic union information. This Chapter follows the opposite route : an industrial relations survey is used and, since the plants and firms involved cannot be identified (ruling out augmentation), use is made of the limited financial information provided by the survey.

The measure of financial performance used in this Chapter is qualitative and based on survey questioning of managers. The question asked in the surveys was

"How would you assess the financial performance of this establishment, compared with other establishments and firms in the same industry ?

(i) Better than average

(ii) About average

(iii) Below average."

---

[5] See, inter alia, Salinger(1984) and Smirlock et al.(1984).

[6] See Geroski(1988, second footnote, p.111) for discussion of the virtues and defects of this measure.

In 1984 additional information is provided with the 'above' and 'below' categories being divided into "a lot" and "a little" above or below, thus yielding five rather than three categories. Despite the reduced information provided by a categorical variable such as this relative to a continuous profit measure, and the subjective nature of the question, it still possesses useful information pertinent to an empirical analysis of the determinants of financial performance. Given the anomalies associated with accounting measures of profitability and Census based price-cost margins this type of information has advantages as well as disadvantages and provides a useful counterpoint to the more conventional measures. In particular, it reflects what managers actually consider to be financial performance and, even if this is a mixture of various indicators like accounting profits, productivity and cash flow, this is of considerable interest in itself. It obviously provides a rather noisy signal of financial performance, but if meaningful results can be extracted despite the noise this provides useful evidence on the likely effects.

Survey respondents may be prone to overstate (or understate) their own establishment's financial performance. However, as long as such reporting errors are non-systematic and in particular uncorrelated with establishment performance and the explanatory variables to be used in the analysis, these managerial responses provide an unbiased estimator of the relative financial performance of establishments that can be used in the analysis without measurement-error biases. Some raw data on the proportion of plants in each response category is reported in Table 5.1. More detail and comparison with data from the whole sample population of the two Workplace Industrial Relations Surveys is given in the Data Appendix. Table 5.1 does indeed show that respondents may be more likely to say their performance is above rather than below average. This should not however detract from the information contained in this variable. The data also shows that the probability of reporting above average financial performance is lower for plants with recognised unions across both years. By the same token it is also observed that the probability that non-union plants report below average performance is very low (6% in 1980 and 5% in 1984). Given the evidence reported using accounting profit rates in the previous Chapter and in the U.S studies referred to in earlier Chapters this is what would be expected. Whilst one could say that perhaps managers in union plants have some in-built reasoning as to why they should

TABLE 5.1

Relative Financial Performance and Union Recognition in British Private Sector Establishments.

	1980			1984		
	All	Union Sector	Non-Union Sector	All	Union Sector	Non-Union Sector
Above Average	0.480	0.451	0.595	0.464	0.438	0.555
About Average	0.443	0.467	0.349	0.436	0.446	0.400
Below Average	0.077	0.082	0.056	0.100	0.115	0.045
N	623	497	126	511	401	110

Notes.

(i) The (unweighted) data refers to private sector establishments in manufacturing and is derived from the 1980 and 1984 Workplace Industrial Relations Surveys.

(ii) N is the number of cases : this sample is the one used for most of the empirical work in this Chapter. For details on all plants in the Workplace Industrial Surveys, see the Data Appendix.

state that they have lower performance or that the variable essentially reflects 'managerial optimism' it is reassuring that this variable corroborates, at least in its raw form, data from other sources.

5.2. Econometric Modelling of the Financial Performance Measure.

The econometric model used to analyse financial performance in this Chapter is conditioned by the nature of the data. Since the available measure of performance in the Workplace Industrial Relations Surveys is categorical standard econometric techniques for a continuous dependent variable are not appropriate. The ordinal nature of the question indicates that financial performance is appropriately modelled here as an ordered response model. More specifically it can be viewed as an ordered response model where the (unobserved) thresholds between performance categories vary with an industry average measure of financial performance.[7]

More formally, let y_i^* denote the level of financial performance in the ith establishment. Since the dependent variable measures financial performance relative to competitors then some kind of industry financial performance measure is needed as a normalisation measure to ensure that it is relative rather than absolute performance that is being modelled. Thus if $\bar{y}_i^*$ is the industry average measure of financial performance for the industry in which the ith establishment operates, then (for the 1980 survey) the unobservable variable y_i^* can be related to the observable qualitative variable y_i as follows :

$$y_i = \begin{cases} 3 & \text{if } y_i^* - \bar{y}_i^* > \delta_2 \\ 2 & \text{if } \delta_2 > y_i^* - \bar{y}_i^* > \delta_1 \\ 1 & \text{if } \delta_1 > y_i^* - \bar{y}_i^* \end{cases} \qquad (5.2.1)$$

where δ_1 and δ_2 are the unobserved thresholds defining the boundaries of below and above average financial performance respectively.

[7] For a survey of ordered response models see Amemiya(1981,1985).

Financial performance can be viewed as a function of a vector of explanatory variables, x_i, which may include both establishment and industry level factors such that

$$y_i^* = x_i'\gamma + \varepsilon_i \qquad \varepsilon_i \sim N(0,\sigma^2) \tag{5.2.2}$$

In this framework the probability that an establishment has above average financial performance is

$$\begin{aligned} Pr[y_i=3] &= Pr[y_i^*-\bar{y}_i^* > \delta_2] \\ &= Pr[x_i'\gamma+\varepsilon_i-\bar{y}_i^* > \delta_2] \\ &= 1-\Phi(\theta_2-x_i'\beta) \end{aligned} \tag{5.2.3}$$

where Φ is the standard normal distribution function, $x_i' = (x_i', \bar{y}_i^*)$, $\beta = (\gamma/\sigma\ ,\ -1/\sigma)$ and $\theta_2 = \delta_2/\sigma$.[8]

Similarly the probabilities of about average and below average financial performance are

$$Pr[y_i=2] = \Phi(\theta_2-x_i'\beta)-\Phi(\theta_1-x_i'\beta) \tag{5.2.4}$$

$$Pr[y_i=1] = \Phi(\theta_1-x_i'\beta) \tag{5.2.5}$$

where $\theta_1=\delta_1/\sigma$.

Given these probabilities the appropriate likelihood function may be written for the standard ordered probit model in the following way

$$\begin{aligned} L &= \prod_{j,k} Pr[y_i=1]\prod_{j,k} Pr[y_i=2]\prod_{j,k} Pr[y_i=3] \\ &= \prod_{j,k}\Phi(\theta_1-x_i'\beta)\prod_{j,k}(\Phi(\theta_2-x_i'\beta)-\Phi(\theta_1-x_i'\beta))\prod_{j,k}(1-\Phi(\theta_2-x_i'\beta)) \end{aligned} \tag{5.2.6}$$

or

[8] Note that σ is not identified unless one is prepared to adopt the strong assumption that $\bar{y}_i^*$ is not one of the industry level variables included in x_i.

$$\log L = \sum_{j=1}^{J} \sum_{i \in I_j} \log [\, \Phi(\theta_j - x_i'\beta) - \Phi(\theta_{j-1} - x_i'\beta) \,]$$

Since the x-vector contains a constant, the full set of θ's is not identified. To put it another way the origin on the scale of measurement for y^* is not identified in such a model. Only differences in the θ's can be estimated and thus a normalisation is required to fix the origin of the y-scale. The conventional one adopted is $\theta_1 = 0$. As a consequence, the estimated θ's are effectively measured relative to θ_1, the lowest threshold. Maximisation of the likelihood function therefore gives Maximum Likelihood estimates of β and the thresholds differences $\theta_j - \theta_1$ ($j = 2$ in 1980 and $j = 2,3,4$ in 1984).[9] The likelihood is globally concave (Pratt(1981)) and thus convergence to the global maximum is guaranteed. The framework is obviously easily extended to the 1984 case where there are five distinct categories and correspondingly four unobserved thresholds between performance categories, three of which are estimated as free parameters.

Until recently very few studies analysing discrete data have presented diagnostic checks of their models. The reason for this is essentially because most specification tests have been developed with the classical linear regression in mind and do not translate to the case where the dependent variable is not continuous. Recently however some authors have proposed diagnostic tests for limited dependent variable models. Chesher and Irish(1987) and Gourieroux et al.(1987) have suggested defining an analogue to least squares residuals from discrete data models and to derive Lagrange Multiplier tests based on these generalised residuals. More specifically, Chesher and Irish offer tests for the probit, tobit and grouped dependent variable cases.

The Ordered Probit model is similar to but has notable differences from the grouped dependent variable (GDV) model (see Stewart(1983c) for a discussion of the properties of the GDV model). In particular the GDV model has known values for thresholds between groups : in the case of the Ordered Probit the thresholds have to be estimated. However, the diagnostic tests developed for the GDV model by Chesher and Irish can be extended to the Ordered Probit case in

[9] The estimates reported in this Chapter were all carried out using LIMDEP (see Greene(1985)). The algorithm used is that of Davidson, Fletcher and Powell and standard errors are calculated from the Berndt, Hall, Hall and Hausman(1974) variance matrix based on the inner product of the first derivatives of the log-likelihood.

quite a straightforward manner.[10] This is outlined in the Appendix to this Chapter. Hence, to ascertain the statistical adequacy of the estimated models these diagnostic checks of functional form, heteroskedasticity, normality and heterogeneity in the estimated thresholds are reported in this Chapter.

5.3. Data Description.

The 1980 and 1984 Workplace Industrial Relations Surveys contain respectively 2040 and 2019 British establishments with twenty five or more employees and give detailed information on trade union matters and certain, fairly limited, information on the economic characteristics of the establishment.[11] More detail on the sample used here and the derivation of data from the Workplace Industrial Surveys is presented in the Data Appendix. Some brief discussion is given in this Section. The initial analysis presented here focuses on private sector manufacturing establishments (SIC(1980) Divisions 2-4). Each establishment is allocated to a 3 digit SIC industry and this permits consideration of industry level factors. After allowing for missing values and for deletion of observations with unsuitable industry information the number of establishments under consideration is 623 in 1980 and 511 in 1984. This fall in numbers over the two years obviously reflects the decline of the manufacturing sector since 1981 (see Oulton(1987)). The decline in unionisation over this time period is also illustrated by the data : see the definitions and weighted means of the variables to be used in the analysis which are reported in the Table A4.3 of the Data Appendix.

The vector of determinants of financial performance (x_i) contains the following establishment level variables :

(i) To get a handle on the market shares possessed by establishments in the data set the variable MS was defined as total employment divided by industry level employment.[12] Market power is

[10] This extension was developed by Mark Stewart as part of joint work.

[11] See Daniel and Millward(1983) and Millward and Stevens(1986) for more details.

[12] Since it can be argued that use of employment shares can understate the relative size of large plants in a given industry, a re definition of the variable as a sales based proxy utilising data from the Census of Production was undertaken. Use of this measure altered the results little.

measured in relative terms : a dummy variable (HMS) equal to one for the 30% of establishments with the highest values of MS is used.[13] This dichotomous representation permits a comparison to be drawn between union effects in high and low market power establishments. Diagnostic checks of the adequacy of this binary measure relative to the continuous one are conducted. It should also be noted that HMS measures relative size : the issue of whether absolute size impinges on financial performance is considered in more detail below.

(ii) The analysis also allows for different dimensions of unionisation to influence financial performance. The most basic measure is a dummy variable indicating whether or not any manual unions are recognised for collective bargaining purposes in the establishment (RECOG). Given the evidence in Stewart(1987a,1987c) that larger union wage premiums occurred in plants with pre-entry closed shop arrangements (denoted here by the variable PRE) it is of interest to investigate whether stronger unions (i.e. RECOG*PRE) are able to redistribute income at the expense of higher profits by more than weaker unions (RECOG*(1-PRE)) and this issue is also addressed.

(iii) A dummy variable indicating whether the demand for an establishment's products has been rising (DRISE) over the previous twelve months. The relevant base group is the stable or falling demand category.

(iv) Establishment level capital intensity in 1980 is also measured by a dummy variable indicating whether capital investment has been increasing (IRISE) over the previous two or three years relative to a base group of stable or falling investment. Unfortunately the 1984 survey did not have a question in the basic management questionnaire concerning investment but instead asked whether the plant is operating at or below full capacity. Thus a dummy variable indicating whether the establishment is at full capacity (FULLCAP) is included in the 1984 specification.

The following industry level variables (measured at the 3-digit SIC level) are used in the analysis :

(i) An industry level price-cost margin (PCM) to proxy average industry profitability y_i^* : this is

[13] 30% was chosen so as to ensure that some non-union plants entered the HMS=1 group ; sensitivity checks showed the results not to be dependent on the exact position of this cut-off point.

derived from the Census of Production and defined as (Net output-Wage bill of operatives-Net capital expenditure)/Gross output.[14]

(ii) The five firm concentration ratio in the appropriate 3-digit industry (CONC).

(iii) The extent of coverage by collective bargaining for male manual employees in the plant's 3-digit industry (COVER).

5.4. Estimates of the Union Impact on Financial Performance.

The set of basic results are reported in Table 5.2. Column (1) reports results using the 1980 data and column (2) corresponding results for 1984. Only differences between the unobserved thresholds are identified and estimates of these differences are also reported as $\theta_j - \theta_1$, $j = 2$ for 1980 and $j = 2,3,4$ for 1984. The measure of union presence in columns (1) and (4) is the basic union recognition dummy variable.

Firstly, considering briefly the variables other than unionisation, the estimated coefficient on DRISE implies that those establishments which have increasing demand are likely to be in a more favourable financial position than those which do not. The notion that financial advantages may accrue from more recent capital is also supported by the capital investment variable in 1980. Similarly, plants operating at full capacity in 1984 have an improved financial standing. A higher relative share of employment in the establishment's operating industry does not have any discernible impact on financial performance either in 1980 or in 1984, at least in the formulations in Table 5.2. The three industry variables fail to reach statistical significance in both years. Score tests for a set of 2-digit industry dummies produce significant statistics for 1980, although not for 1984. As a result the importance of industry specific fixed effects is addressed in more detail below in the Section analysing the robustness of the results.

The union variable provides interesting results. In the basic equations reported in Table 5.2 the coefficient on the union recognition dummy variables is negative and statistically significant in both years (although only at the 10% level in 1980). This result is robust to specification

[14] See Cowling(1982) for a justification of using this definition of a price-cost margin.

TABLE 5.2

Ordered Probit Estimates of the Union Impact on Financial Performance.		
	1980	1984
	(1)	(2)
Constant	1.699(0.375)	2.262(0.358)
Establishment Variables		
DRISE	0.391(0.114)	0.411(0.101)
IRISE	0.496(0.103)	-
FULLCAP	-	0.202(0.108)
HMS	0.017(0.113)	0.102(0.119)
RECOG	-0.222(0.125)	-0.336(0.127)
Industry Variables		
PCM	-0.209(0.587)	-0.463(0.599)
CONC	-0.150(0.279)	0.006(0.291)
COVER	-0.046(0.043)	-0.053(0.042)
$\theta_1^{min}-\theta_2^{min}$	1.553(0.079)	-
$\theta_2^{min}-\theta_3^{min}$	-	0.524(0.091)
$\theta_3^{min}-\theta_4^{min}$	-	1.962(0.117)
$\theta_4^{min}-\theta_5^{min}$	-	2.751(0.126)
logL	-542.13	-659.48
N	623	511
Heteroskedasticity	7.77(14.07)	13.16(14.07)
Non-normality	4.70(5.99)	0.32(5.99)
Heterogeneity in thresholds	12.24(14.07)	28.41(32.67)
Omitted variables		
(i) Continuous MS	2.64(3.84)	1.95(3.84)
(ii) 2-digit industry effects	34.29(31.41)	17.04(31.41)
Functional form	4.88(7.81)	3.57(7.81)

Notes

(i) Asymptotic standard errors are in parentheses.

(ii) Details of the construction of the diagnostic tests are given in the text.

(iii) The figures in parentheses adjacent to the diagnostic test statistics are the relevant 5% critical values.

changes or changes in sample definition. Score tests based on generalised residuals from the limited dependent variable models also engender considerable confidence in the results. The null hypothesis of homoskedasticity cannot be rejected for the specifications in Table 5.2. Non-normality is not found to be a problem for either year.[15] A score test for heterogeneity in the thresholds, allowing them to differ with all elements of the x-vector, cannot reject the null of no such threshold heterogeneity in either year. An adapted form of a functional form test (see Ramsey(1969) or Ramsey and Schmidt(1976)) suggests that higher order terms in these variables are not required. The fact that the estimated models survive this barrage of diagnostic tests bodes well for inferences based on the reported models.

The estimated specifications suggest that unions, regardless of any potential positive productivity effects they may have, limit financial performance to a significant degree. This helps to explain management opposition to unionisation. It is also in line with evidence based on accounting profit measures reported in Chapter 4 and with the mass of U.S. evidence. Additional information can be provided by considering the probability that a unionised establishment has, relative to an otherwise comparable non-union establishment, of having below average, about average or above average financial performance. Such probabilities are reported in Table 5.3 for the three categories in 1980 and the five categories in 1984. Clearly unionised establishments are less likely to have above average financial performance and are more likely to have about average or below average levels of performance. As an example, a unionised establishment is some 3% and 5% more likely to have below average financial performance in 1980 and 1984 respectively, while on the other hand, the probabilities that a unionised establishment has above average performance are 9% and 13% lower.[16] There does seem to be a shift in this effect over time, the

[15] This is an interesting side issue : the use of qualitative data is, due to the bounded nature of the dependent variable, more likely to generate reasonable test statistics and limit departures from normality and the problems that Chesher and Spady(1988) cite for the linear model seem less relevant here. Hence the reasonable normality tests here compared to those based on continuous data in Chapters 3 and 4.

[16] One possible objection to these results is the basis of financial performance used by managers to form their answer to the survey question. For instance it might be that in establishments belonging to large organisations managers use organisation profits as the basis for their response and as such the inference for their establishment may be inaccurate. To ascertain the importance of this tests of whether the thresholds vary with a variable indicating whether an establishment is a single independent producer or whether it is part of a larger organisation were conducted. The score test $\chi^2(1)$ statistics of 1.18 and 1.57 for 1980 and 1984 suggest that this does not appear to be a problem. Additionally, the tests reported earlier find no evidence that the thresholds vary with any of the variables in the x-vector for the basic models in either year.

TABLE 5.3

The Impact of Unions on Financial Performance - Probability Effects.		
	1980	1984
$Pr[y_t=1 \mid RECOG=1]-Pr[y_t=1 \mid RECOG=0]$	0.026	0.020
$Pr[y_t=2 \mid RECOG=1]-Pr[y_t=2 \mid RECOG=0]$		0.028
$Pr[y_t=3 \mid RECOG=1]-Pr[y_t=3 \mid RECOG=0]$	0.063	0.085
$Pr[y_t=4 \mid RECOG=1]-Pr[y_t=4 \mid RECOG=0]$	-0.088	-0.036
$Pr[y_t=5 \mid RECOG=1]-Pr[y_t=5 \mid RECOG=0]$		-0.097

Notes.

(i) For ease of comparison, in 1984 y_t=1, 2, 3, 4 and 5 correspond to well below average, below average, about average, above average and well above average financial performance respectively. For the 1980 data 1 and 2 are grouped together for below average financial performance, 3 refers to about average and 4 and 5 are grouped together for below average performance. Summing together the 1 and 2 and 4 and 5 categories enables comparison between 1980 and 1984. The about average (y_t = 3) groups are directly comparable.

(ii) These effects are calculated from the specifications in Table 5.2 and are evaluated at weighted means, reported in Table A5.3 of the Data Appendix.

comparative probabilities in Table 5.3 indicating a stronger downward effect in 1984 than in 1980.

5.5. Union Performance Effects and Relative Market Power.

The next question to be addressed is that of identifying the economic environments in which union effects are most prominent. In the context of the present analysis interaction terms between the union variables and the relative market share dummy are included to see if union effects are any more pronounced in establishments with a high or low relative market share. Therefore, Table 5.4 reports results in which the recognition dummy is decomposed into two mutually exclusive categories conditional on whether the plant is in the top 30% of the market share distribution. The impacts on financial performance in both 1980 and 1984 are seen to be more pronounced in establishments with 'high' market share. This is further illustrated by the probability effects derived from the specifications in Table 5.4 which are presented in Table 5.5. They show the extent to which these performance effects are broken down between high and low market share. For instance, in plants with high market share unions are 29% and 40% less likely to have above average performance in 1980 and 1984 respectively. In low market share situations these effects are dampened down as the probabilities fall to 5% and 11% respectively. Hence, like the results in Chapter 4, these results confirm that in the union sector, unions are likely to restrict financial performance where market share is relatively high and that union effects are less marked if market share is low. The score tests are again reasonably favourable to the models and generate confidence in the results.[17] However, it should be noted that the reported effects are not that precisely determined and in 1980 are not significantly different from one another, with column (1) of Table 5.2 being acceptable against column (1) of Table 5.4 in terms of a Likelihood Ratio test.

[17] Although it should also be noted that, relative to the non-interactive models, some differences do emerge : for example, the functional form test for 1980 now exceeds the 5% critical value, suggesting some missing non-linearities in the model. However, given the non-rejection of the functional form test in column (1) of Table 5.2 then this failure implies that the omitted variable must be a complex interaction between explanatory variables not included in the basic model. Such an interaction is not one with an obvious interpretation. Also, the statistic testing for unconserved heterogeneity in the thresholds exceeds the 5% critical value in 1980, hence suggesting that the thresholds may vary with some components of the x-vector in this more general model not in the basic model, i.e. the interactions between RECOG and HMS.

TABLE 5.4

The Union Impact on Financial Performance and Relative Market Share.				
	1980		1984	
	(1)	(2)	(3)	(4)
Constant	1.644(0.379)	1.602(0.379)	2.246(0.359)	2.159(0.359)
Establishment Variables				
DRISE	0.376(0.116)	0.395(0.115)	0.412(0.102)	0.413(0.100)
IRISE	0.491(0.104)	0.491(0.104)	-	-
FULLCAP	-	-	0.194(0.108)	0.215(0.108)
HMS	0.582(0.297)	-	1.093(0.510)	-
RECOG*HMS	-0.768(0.290)	-	-1.319(0.510)	-
RECOG*(1-HMS)	-0.135(0.138)	-	-0.261(0.133)	-
(1-RECOG)*HMS	-	0.699(0.279)	-	1.279(0.505)
Industry Variables				
PCM	-0.326(0.597)	-0.358(0.593)	-0.554(0.610)	-0.634(0.610)
CONC	-0.137(0.282)	-0.189(0.261)	0.011(0.290)	0.013(0.267)
COVER	-0.043(0.044)	-0.051(0.042)	-0.057(0.042)	-0.074(0.041)
$\theta_j^{1984}-\theta_j^{1980}$	1.555(0.080)	1.552(0.080)	-	-
$\theta_j^{1984}-\theta_j^{1984}$	-	-	0.523(0.091)	0.520(0.090)
$\theta_j^{1984}-\theta_j^{1984}$	-	-	1.964(0.117)	1.954(0.117)
$\theta_j^{1984}-\theta_j^{1984}$	-	-	2.758(0.126)	2.745(0.124)
logL	-540.56	-541.32	-657.17	-659.26
N	623	623	511	511
Heteroskedasticity	10.37(15.51)	9.68(12.59)	14.67(15.51)	13.20(12.59)
Non-normality	5.82(5.99)	5.44(5.99)	0.34(5.99)	0.11(5.99)
Heterogeneity in thresholds	17.29(14.07)	17.21(12.59)	33.86(36.42)	29.04(28.87)
Omitted variables				
(i) Continuous MS	3.32(3.84)	1.41(3.84)	2.02(3.84)	0.72(3.84)
(ii) 2-digit industry effects	34.21(31.41)	34.74(31.41)	17.86(31.41)	17.49(31.41)
Functional form	11.99(7.81)	10.52(7.81)	1.56(7.81)	1.73(7.81)

Notes

(i) As for Table 5.2.

TABLE 5.5

The Impact of Unions on Financial Performance - Probability Effects.		
	1980	1984
$Pr[y_i=1 \mid RECOG*HMS=1]-Pr[y_i=1 \mid RECOG*HMS=0]$		0.291
	0.155	
$Pr[y_i=2 \mid RECOG*HMS=1]-Pr[y_i=2 \mid RECOG*HMS=0]$		0.090
$Pr[y_i=3 \mid RECOG*HMS=1]-Pr[y_i=3 \mid RECOG*HMS=0]$	0.134	0.023
$Pr[y_i=4 \mid RECOG*HMS=1]-Pr[y_i=4 \mid RECOG*HMS=0]$		-0.133
	-0.289	
$Pr[y_i=5 \mid RECOG*HMS=1]-Pr[y_i=5 \mid RECOG*HMS=0]$		-0.271
$Pr[y_i=1 \mid RECOG*(1-HMS)=1]-Pr[y_i=1 \mid RECOG*(1-HMS)=0]$		0.039
	0.018	
$Pr[y_i=2 \mid RECOG*(1-HMS)=1]-Pr[y_i=2 \mid RECOG*(1-HMS)=0]$		0.024
$Pr[y_i=3 \mid RECOG*(1-HMS)=1]-Pr[y_i=3 \mid RECOG*(1-HMS)=0]$	0.036	0.045
$Pr[y_i=4 \mid RECOG*(1-HMS)=1]-Pr[y_i=4 \mid RECOG*(1-HMS)=0]$		-0.018
	-0.054	
$Pr[y_i=5 \mid RECOG*(1-HMS)=1]-Pr[y_i=5 \mid RECOG*(1-HMS)=0]$		-0.090
$Pr[y_i=1 \mid (1-RECOG)*HMS=1]-Pr[y_i=1 \mid (1-RECOG)*HMS=0]$		-0.031
	-0.053	
$Pr[y_i=2 \mid (1-RECOG)*HMS=1]-Pr[y_i=2 \mid (1-RECOG)*HMS=0]$		-0.055
$Pr[y_i=3 \mid (1-RECOG)*HMS=1]-Pr[y_i=3 \mid (1-RECOG)*HMS=0]$	-0.209	-0.334
$Pr[y_i=4 \mid (1-RECOG)*HMS=1]-Pr[y_i=4 \mid (1-RECOG)*HMS=0]$		-0.045
	0.261	
$Pr[y_i=5 \mid (1-RECOG)*HMS=1]-Pr[y_i=5 \mid (1-RECOG)*HMS=0]$		0.465

Notes.

(i) For ease of comparison, in 1984 y_i=1, 2, 3, 4 and 5 correspond to well below average, below average, about average, above average and well above average financial performance respectively. For the 1980 data 1 and 2 are grouped together for below average financial performance, 3 refers to about average and 4 and 5 are grouped together for below average performance. Summing together the 1 and 2 and 4 and 5 categories enables comparison between 1980 and 1984. The about average (y_i = 3) groups are directly comparable.

(ii) These effects are calculated from the specifications in Table 4.4 and are evaluated at weighted means.

The estimates of the general model also indicate that higher relative market share raises financial performance only in the non-union sector. If the part of the model concerning union recognition and market share is written separately as

$$y^* = \beta_1 HMS + \beta_2 RECOG*HMS + \beta_3 RECOG*(1-HMS) + x^{*\prime}\beta + \varepsilon \qquad (5.5.1)$$

where x^* is the components of the x-vector not including RECOG and HMS, then the effect of high market share is given by

$$\frac{\partial y^*}{\partial HMS} = \beta_1 + (\beta_2 - \beta_3)RECOG \qquad (5.5.2)$$

In non-union establishments the market share effect (β_1) is positive in both years, while the effect in union establishments ($\beta_1 + \beta_2 - \beta_3$) is numerically small in both years (-0.051 and 0.035 respectively) and insignificantly different from zero in both cases (the appropriate asymptotic standard errors are 0.122 and 0.123 for 1980 and 1984). The strong hypothesis that unions capture the whole of the returns to higher performance generated from high market share is not rejected by the data. Whilst it seems likely that this rather overstates the effect, it does highlight the importance of considering union interactions when examining the impact of market share on financial performance.

An even stronger version of the hypothesis states that these returns from high market share provide the entire source of union gains : that is, $\beta_3 = 0$ in addition to $\beta_1+\beta_2-\beta_3 = 0$. Under the imposition of both restrictions the model becomes

$$y^* = \beta_1(1-RECOG)*HMS + x^{*\prime}\beta + \varepsilon \qquad (5.5.3)$$

Estimates of this model are given in columns (2) and (4) of Table 5.4. Although β_3 is significantly different from zero in the general model in 1984, Likelihood Ratio tests of imposing these two restrictions yield $\chi^2(2)$ statistics of 1.52 and 4.18 for 1980 and 1984 respectively (compared to a 5% critical value of 5.99) implying that imposition of the two restrictions cannot be rejected by the data. The estimated coefficient on (1-RECOG)*HMS is also positive and strongly

significant in both years. Non-union plants with some degree of market power hence are more likely to have above average performance levels. In probability terms, these plants are 26% and 42% more likely than otherwise comparable union plants to have above average performance levels (see Table 5.5). Additionally, it should not be forgotten that for the 1980 data the non-interactive model in column (1) of Table 5.2 is acceptable against the general model in column (1) of Table 5.4. However, for both years the restricted models of columns (2) and (4) of Table 5.4 dominate the other models in terms of the Akaike Information Criterion.[18] Thus the dominant model among the specifications reported to date in Tables 5.2 and 5.4 is one in which unions are able to capture the whole of the returns from high market share.[19]

5.6. Investigations of the Robustness of the Main Findings.

The results reported to date provide evidence to support the idea that product market power provides a major source of rents which unions are able to capture. This is in line with the results reported in the previous Chapter. A number of additional issues concerned with the robustness of the results and possible refinements of the hypothesis are considered in this section.

(i) Union Bargaining Strength.

The first additional issue to be addressed is whether the increased bargaining strength resulting from a pre-entry closed shop arrangement increases the ability of a union to extract a share of any rents. Table 5.6 presents some estimates which allow a role for the pre-entry closed shop (PRE) in affecting financial performance both independent of and in conjunction with relative market power. In columns (1) and (3) the relative magnitude of the coefficients implies that unions reduce financial performance by more where there is a pre-entry closed shop. However, the estimates lack precision and the coefficients on the two mutually exclusive dummies are not significantly different from one another in either year. When interactions with HMS are

[18] The Akaike Information Criterion is the minimum of $(-2\log L/N)+(2K/N)$, K being the number of estimated parameters and N the sample size (see Maddala(1988) p.429 for a discussion).

[19] One reservation here is that columns (3) and (6) show a deterioration in the diagnostic tests relative to columns (1) and (4).

TABLE 5.6

Pre-entry Closed Shop Effects.				
	1980		1984	
	(1)	(2)	(3)	(4)
HMS	0.020(0.115)	0.584(0.296)	0.101(0.119)	1.085(0.510)
RECOG*PRE	-0.343(0.180)	-	-0.560(0.179)	-
RECOG*(1-PRE)	-0.202(0.126)	-	-0.301(0.128)	-
RECOG*HMS*PRE	-	-1.103(0.336)	-	-1.429(0.541)
RECOG*HMS*(1-PRE)	-	-0.701(0.295)	-	-1.295(0.512)
RECOG*(1-HMS)*PRE	-	-0.128(0.229)	-	-0.541(0.207)
RECOG*(1-HMS)*(1-PRE)	-	-0.136(0.139)	-	-0.218(0.135)
logL	-541.67	-539.25	-657.95	-655.49
N	623	623	511	511
Heteroskedasticity	8.62(15.51)	16.51(18.31)	12.98(15.51)	16.05(18.31)
Non-normality	4.39(5.99)	3.50(5.99)	0.74(5.99)	0.66(5.99)
Heterogeneity in thresholds	12.24(15.51)	23.39(18.31)	34.85(36.42)	39.43(43.77)
Functional form	3.70(7.81)	9.83(7.81)	2.77(7.81)	3.09(7.81)

Notes

(i) Asymptotic standard errors are in parentheses.

(ii) Details of the construction of the diagnostic tests are given in the text.

(iii) The figures in parentheses adjacent to the diagnostic test statistics are the relevant 5% critical values.

(iv) All equations include the same controls as in Table 5.2.

considered in columns (2) and (4) the observed effects are strongest for pre-entry closed shops in plants with market power. However, in high market share unionised plants without a pre-entry closed shop effects remain significantly negative and the coefficients are not precisely determined enough to reject a null of equality. Finally, note that columns (2) and (4) of Table 5.4 are acceptable against columns (2) and (4) of Table 5.6. Thus while there is some evidence that unions extract a bigger share of the rents when there is a pre-entry closed shop, the results in Table 5.6 do not suggest a modification of the conclusions reached in the previous section.

(ii) Number of Competitors and the Measurement of Market Power.

The 1984 data also has qualitative information on the number of competitors that an establishment perceives it faces. This permits some investigation of the appropriate measure of market power. Given that Stewart(1988) finds that union wage differentials from WIRS are greater in plants facing relatively few competitors (≤5) than in those which face many this is obviously worthy of investigation here. A consequence of the use of this variable here is that missing values on the 'number of competitors' variable generate a reduction in sample size from 511 to 423 establishments. A dummy variable indicating few competitors (FEW) is introduced to the analysis and, as column (1) of Table 5.7, shows, it is not significant and the other results remain largely unchanged.[20] In column (2) the union effect is broken down by this new variable. Significant negative union effects are only observed for those plants operating in less competitive markets. This is in line with the wage results of Stewart(1988). Based on the smaller sample the strong effects of HMS are again observed as reported in column (3).[21] The fourth column includes multiple interactions between RECOG, HMS and FEW. Whilst there is some evidence that the union effect in an establishment with a high market share is greater if there are also relatively few competitors, the coefficients on the FEW and (1-FEW) interactions are not significantly different from one another. Restriction of the specification in column (4) to that in

[20] The dummy variable FEW covers just over half (unweighted mean = 0.511) of these establishments (weighted mean = 0.493).

[21] To ensure comparability between results on the larger sample HMS is defined using the same cut-off as for the larger sample. It therefore refers to the top 30.5% of plants in the market share distribution.

TABLE 5.7

Few Competitors Effects.				
	1984			
	(1)	(2)	(3)	(4)
HMS	0.152(0.127)	0.150(0.127)	1.292(0.579)	1.268(0.562)
FEW	0.155(0.109)	0.365(0.238)	0.148(0.109)	0.344(0.243)
RECOG	-0.325(0.141)	-	-	-
RECOG*FEW	-	-0.458(0.213)	-	-
RECOG*(1-FEW)	-	-0.191(0.178)	-	-
RECOG*HMS	-	-	-1.457(0.577)	-
RECOG*(1-HMS)	-	-	-0.258(0.147)	-
RECOG*HMS*FEW	-	-	-	-1.653(0.562)
RECOG*HMS*(1-FEW)	-	-	-	-1.227(0.593)
RECOG*(1-HMS)*FEW	-	-	-	-0.331(0.224)
RECOG*(1-HMS)*(1-FEW)	-	-	-	-0.193(0.193)
logL	-543.35	-542.81	-541.37	-540.23
N	423	423	423	423
Heteroskedasticity	9.30(15.51)	15.43(16.92)	13.02(16.92)	20.68(19.68)
Non-normality	0.33(5.99)	0.57(5.99)	0.24(5.99)	0.43(5.99)
Heterogeneity in thresholds	29.35(36.42)	32.67(40.11)	33.64(40.11)	68.79(47.11)
Functional form	1.95(7.81)	0.83(7.81)	4.73(7.81)	3.87(7.81)

Notes

(i) Asymptotic standard errors are in parentheses.

(ii) Details of the construction of the diagnostic tests are given in the text.

(iii) The figures in parentheses adjacent to the diagnostic test statistics are the relevant 5% critical values.

(iv) All equations include the same controls as in Table 5.2.

column (3) is acceptable, giving a $\chi^2(2)$ Likelihood Ratio statistic of 2.28. The further stratification by FEW is not required. Restriction to the equivalent of column (4) in Table 5.4 is again acceptable to the data, giving a $\chi^2(5)$ Likelihood Ratio statistic of 7.40. Thus the main conclusions of Section 5.5 remain intact.

(iii) Absolute and Relative Size Effects.

The measure of market power used to date is a variable indicating the relative size of establishments in a given industry. It may however be that absolute size also has a role to play either in addition to or instead of HMS. This possibility is considered in Table 5.8 where a dummy variable (BIG) representing those plants with 500 or more employees is added to the specifications presented in Table 5.2.[22] Columns (1) and (5) add the BIG dummy to the basic 1980 and 1984 specifications respectively. It is almost significant at the 10% level in 1980 but has no influence in 1984. Breaking down the recognition dummy by the size variable in columns (2) and (6) produces more negative coefficients for large union plants but, compared to columns (1) and (5), the union effect does not differ with absolute size ($\chi^2(1)$ = 0.72 and 0.92 respectively). In columns (3) and (7) the interactions with HMS and (1-HMS) are reproduced for the equations including the size dummy and these dominate columns (2) and (6) in likelihood terms. Finally columns (4) and (8) present the most general models breaking down the union effect by both absolute and relative size. Evidently the relative size split dominates as the coefficients on the BIG and (1-BIG) interactions are very close to one another for both years : the models can easily be simplified to the equations in columns (3) and (7) with $\chi^2(2)$ Likelihood Ratio statistics of 0.44 and 0.10 for 1980 and 1984. Simplification to the restricted model of columns (2) and (4) of Table 5.4 is also easily upheld with $\chi^2(5)$ statistics of 5.20 and 4.34 respectively. Hence the relative size measure and not the absolute size variable is what matters for isolating the union impact on financial performance.

[22] Results are unaffected by the choice of 500 as the cut-off point : results using 300, 400 or 600 employees produced very similar results to those in the Table. The mean of BIG is 0.360 for 1980 and 0.370 for 1984 : corresponding weighted means are 0.083 and 0.047 respectively.

TABLE 5.8

	1980			
	(1)	(2)	(3)	(4)
HMS	-0.108(0.136)	-0.105(0.136)	0.502(0.300)	0.505(0.309)
BIG	0.206(0.128)	0.520(0.393)	0.233(0.130)	0.226(0.432)
RECOG	-0.261(0.129)	-	-	-
RECOG*BIG	-	-0.565(0.393)	-	-
RECOG*(1-BIG)	-	-0.226(0.135)	-	-
RECOG*HMS	-	-	-0.870(0.304)	-
RECOG*(1-HMS)	-	-	-0.170(0.140)	-
RECOG*HMS*BIG	-	-	-	-0.886(0.450)
RECOG*HMS*(1-BIG)	-	-	-	-0.761(0.386)
RECOG*(1-HMS)*BIG	-	-	-	-0.115(0.459)
RECOG*(1-HMS)*(1-BIG)	-	-	-	-0.182(0.142)
logL	-540.83	-540.47	-538.94	-538.72
N	625	625	625	625
Heteroskedasticity	8.05(15.51)	8.34(16.92)	10.79(16.92)	12.08(19.68)
Non-normality	5.36(5.99)	6.22(5.99)	6.12(5.99)	6.53(5.99)
Heterogeneity in thresholds	13.68(15.51)	14.21(16.92)	18.80(16.92)	19.55(19.68)
Functional form	3.46(7.81)	4.43(7.81)	7.49(7.81)	7.26(7.81)
	1984			
	(5)	(6)	(7)	(8)
HMS	0.090(0.150)	0.097(0.150)	1.080(0.516)	1.051(0.603
BIG	0.021(0.142)	0.430(0.491)	0.034(0.142)	0.109(0.565)
RECOG	-0.342(0.130)	-	-	-
RECOG*BIG	-	-0.743(0.485)	-	-
RECOG*(1-BIG)	-	-0.304(0.135)	-	-
RECOG*HMS	-	-	-1.332(0.510)	-
RECOG*(1-HMS)	-	-	-0.269(0.135)	-
RECOG*HMS*BIG	-	-	-	-1.384(0.553)
RECOG*HMS*(1-BIG)	-	-	-	-1.251(0.653)
RECOG*(1-HMS)*BIG	-	-	-	-0.327(0.583)
RECOG*(1-HMS)*(1-BIG)	-	-	-	-0.271(0.138)
logL	-659.47	-659.01	-657.14	-657.09
N	511	511	511	511
Heteroskedasticity	15.97(15.51)	16.41(16.92)	17.00(16.92)	18.57(19.68)
Non-normality	0.32(5.99)	0.31(5.99)	0.33(5.99)	0.33(5.99)
Heterogeneity in thresholds	27.96(36.42)	40.31(40.11)	35.25(40.11)	41.90(47.11)
Functional form	3.43(7.81)	3.07(7.81)	1.81(7.81)	2.98(7.81)

Notes

(i) As for Table 5.6.

(iv) Industry Effects.

The 3-digit industry variables included in the earlier results did not add significantly to the explanatory power of the models but score tests revealed some role for 2-digit industry effects in the 1980 model. This is of some concern since it might be that some unobservable industry variables are of importance in determining financial performance. Inclusion of 3-digit industry dummies would seem to be the best way to get round this problem : but, incorporating a large number of 3-digit dummies is likely to prove computationally burdensome. Recalling that the ordinal information on the dependent variable refers to financial performance relative to competitors in the establishment's operating industry then, in terms of the notation adopted in Section 2, this is $y_i^* - \bar{y}_i^*$. Thus it is financial performance relative to the industry mean. This suggests another way of modelling financial performance which can control for industry specific unobservable effects. Write the model for the latent performance variable as

$$y_i^* = x_i'\beta + d_i + u_i \tag{5.6.1}$$

where d_i is an industry specific fixed effect for the industry in which the ith establishment operates. Subtracting industry means gives

$$y_i^* - \bar{y}_i^* = (x_i - \bar{x}_i)'\beta + v_i \tag{5.6.2}$$

where $\bar{x}_i$ is the industry average x-vector for the industry in which the ith establishment operates. Thus the Ordered Probit with $(x_i - \bar{x}_i)$ as explanatory variables becomes the appropriate model. Note of course that this transformation eliminates any industry level variable in x. Also, the transformation may induce heteroskedasticity : appropriate tests are conducted for this and in all cases the null hypothesis of homoskedastic error terms cannot be rejected.

This is obviously analogous to a fixed effects model in panel data except that industry means are subtracted out rather than time means. Estimates of this 'fixed effects' model are reported in Table 5.9. One advantage of this model is that the sample no longer has to be confined to manufacturing alone and thus estimates are reported for manufacturing and across all indus-

TABLE 5.9

'Fixed Effects' Estimates (Subtracting Out 3-digit Industry Means).				
	1980		1984	
	(1)	(2)	(3)	(4)
	Manufac-turing	All	Manufac-turing	All
Constant	1.485(0.075)	1.533(0.061)	1.836(0.106)	1.860(0.081)
Establishment Variables				
DRISE	0.340(0.121)	0.409(0.092)	0.370(0.114)	0.352(0.087)
IRISE	0.521(0.113)	0.498(0.088)	-	-
FULLCAP	-	-	0.165(0.115)	0.214(0.088)
HMS	0.118(0.139)	0.122(0.130)	0.108(0.135)	0.164(0.125)
RECOG	-0.237(0.145)	-0.162(0.104)	-0.351(0.139)	-0.307(0.093)
$\theta_j^{sm}-\theta_j^{ssm}$	1.538(0.079)	1.588(0.065)	-	-
$\theta_j^{lm}-\theta_j^{ssm}$	-	-	0.514(0.087)	0.458(0.064)
$\theta_j^{sm}-\theta_j^{ssm}$	-	-	1.931(0.111)	1.906(0.084)
$\theta_j^{lm}-\theta_j^{ssm}$	-	-	2.704(0.119)	2.621(0.090)
logL	-548.73	-852.5	-668.29	-1184.90
N	624	984	512	916
Heteroskedasticity	2.26(9.49)	2.98(9.49)	3.76(9.49)	8.15(9.49)
Non-normality	1.70(5.99)	1.51(5.99)	0.77(5.99)	2.11(5.99)
Heterogeneity in thresholds	2.36(9.49)	2.98(9.49)	7.76(21.03)	12.71(21.03)
Functional form	2.76(7.81)	5.28(7.81)	1.45(7.81)	2.08(7.81)

Notes

(1) As for Table 5.2.

TABLE 5.10

'Fixed Effects' Estimates with Market Share Interactions.				
	1980		1984	
	(1)	(2)	(3)	(4)
	Manufac-turing	All	Manufac-turing	All
Constant	1.486(0.075)	1.536(0.061)	1.837(0.106)	1.863(0.081)
Establishment Variables				
DRISE	0.331(0.121)	0.400(0.092)	0.366(0.114)	0.347(0.087)
IRISE	0.516(0.113)	0.497(0.088)	-	-
FULLCAP	-	-	0.165(0.116)	0.207(0.088)
HMS	0.526(0.434)	0.593(0.359)	0.625(0.620)	0.915(0.415)
RECOG*HMS	-0.634(0.422)	-0.652(0.352)	-0.872(0.618)	-1.122(0.431)
RECOG*(1-HMS)	-0.179(0.155)	-0.115(0.109)	-0.319(0.144)	-0.273(0.094)
$\theta_j^{1980}-\theta_j^{1980}$	1.538(0.080)	1.588(0.065)	-	-
$\theta_j^{1984}-\theta_j^{1984}$	-	-	0.514(0.087)	0.458(0.064)
$\theta_j^{1984}-\theta_j^{1984}$	-	-	1.931(0.111)	1.907(0.084)
$\theta_j^{1984}-\theta_j^{1984}$	-	-	2.706(0.119)	2.625(0.090)
logL	-548.11	-851.35	-667.83	-1182.70
N	624	984	512	916
Heteroskedasticity	5.48(11.07)	7.04(11.07)	3.84(11.07)	7.49(11.07)
Non-normality	2.48(5.99)	2.65(5.99)	0.63(5.99)	3.13(5.99)
Heterogeneity in thresholds	5.08(11.07)	7.06(11.07)	9.27(25.00)	16.16(25.00)
Functional form	1.05(7.81)	2.19(7.81)	3.76(7.81)	0.80(7.81)

Notes

(i) As for Table 5.2.

TABLE 5.11

Tests of Whether Unions Capture All the Returns from HMS.		
	1980	1984
Basic Model (Table 5.4)	1.52	4.18
Industry Effects Model - Manufacturing (Table 5.10)	1.44	5.16
Industry Effects Model - All Industries (Table 5.10)	1.66	8.00

Notes.

(i) All tests are $\chi^2(2)$ Likelihood Ratio tests. The appropriate 5% and 1% critical values are 5.99 and 9.21 respectively.

tries. As one would expect (implicit) inclusion of a large number of industry dummies results in a rise in the estimated standard errors. Of course the demands made by this transformation ask rather a lot of the data to expect any precision in the estimates. However, despite this, the coefficient estimates remain remarkably robust to the data transformation. In all columns the basic union effects are negative, both for manufacturing and across all industries.[23] Again, the models perform well and satisfy the diagnostic checks in all cases. Greater precision is obtained for the larger samples in both years.

Table 5.10 reports estimates of this fixed effects model which stratify the union effect by the relative market share dummy variable.[24] For the manufacturing equations in columns (1) and (3) it seems that this is really asking too much of the data, although for the larger sample (columns (2) and (4)) the estimates are still fairly well determined. As for the earlier results negative union effects are seen to be more pronounced in establishments with relatively high market power. In this specification it is still possible to test the hypothesis of whether unions are able to capture all the returns available from HMS. Test statistics are reported in Table 5.11. The first row reproduces the results from the manufacturing sample used earlier. The second and third rows report Likelihood Ratio test statistics derived from the models in Table 5.10, for manufacturing and across all industries. It is evident that the hypothesis cannot be rejected with one exception : in 1984 for all industries the hypothesis cannot be accepted at a 5% level of significance, although is not rejected at a 1% level, which comes about as a consequence of the significant coefficient on RECOG*(1-HMS). Hence, earlier results are not altered fundamentally by the cross reported here as the sensitivity checks reported in this Section illustrate the robustness of the main results of this Chapter.

---

[23] Observe the slightly larger sample sizes for the manufacturing equations since there is no need to include industry level variables on which there were missing values in the earlier analysis.

[24] Again, to ensure comparability, HMS is defined in terms of the cut-off point used earlier. The smaller number of relatively large non-manufacturing plants means that HMS equals unity for 20.5% of plants in 1980 and 18.5% of the sample in 1984. Changing this to the top 30% over all plants alters results little.

5.7. Conclusions.

The evidence presented in this Chapter using the Workplace Industrial Relations Surveys of 1980 and 1984 suggests that trade unions significantly restrict financial performance in a sample of British establishments. This is in line with U.S. evidence on this issue and, taken in conjunction with the evidence of Chapter 4 and Stewart(1987a,1987c,1988), backs up the view of Hill(1981) that 'collective rather than individual bargaining may indeed produce some change in the way in which surpluses would otherwise be distributed, away from profits and into wages' [Hill(1981) p.130]. It is also found that these effects are more pronounced in establishments which, in terms of employment, have a larger share of their market which implies that unions are able to obtain a significant share of the returns to market power. In fact the data do not reject the very strong hypothesis that unions capture the whole of these returns from high market share and that these rents provide the entire source of union gains.

Union effects are also found to be more negative in 1984 than in 1980. This is consistent with Stewart's(1987c) finding that compositional changes, particularly the shift in the size distribution of establishments and the decline of manufacturing, have caused a rise in the union wage differential from 7% in 1980 to 8.5% in 1984. Hence, the early 1980's may not necessarily have seen a weakening of union power but a concentration of union activity in those areas where they have traditionally been strong. In these areas the economic effects of trade unions remain important.

It is very reassuring that the results presented in this Chapter are very similar to those from Chapter 4, where the use of more traditional accounting profitability measures produced results to suggest that the main source of union gains is high market share. After all, the two Chapters use very different data sources and very different measures of the ability to earn higher returns. This corroboration of results from both plant and firm level data evidently adds weight to inference based on the results from both Chapters.

Appendix : Diagnostic Tests for the Ordered Probit Model.

The log-likelihood for the Ordered Probit model is

$$\log L = \sum_{j=1}^{J} \sum_{y_i = j} \log \{ \Phi(\theta_j - x_i'\beta) - \Phi(\theta_{j-1} - x_i'\beta) \} \tag{A5.1}$$

For the Grouped Dependent Variable (GDV) model, the generalised residuals of Gourieroux et al.(1987) or first moment residuals of Chesher and Irish(1987) are given by

$$g_i^{(1)} = \frac{\hat{\phi}_{U-1i} - \hat{\phi}_{Li}}{\hat{\Phi}_{Li} - \hat{\Phi}_{U-1i}} \tag{A5.2}$$

where $\phi_{Li} = \phi(w_{Li})$, ϕ denoting the standard normal density function, $\Phi_{Li} = \Phi(w_{Li})$ and $w_{Li} = \theta_j - x_i'\beta$. A hat denotes that unknown parameters are replaced by their Maximum Likelihood estimates. These are the estimated intercept (β_0) score contributions. The score contributions for the remaining elements of β (i.e. $\partial \log L / \partial \beta$) are simply the products of these with the corresponding element of x_i.

The extension to the GDV model is that in the Ordered Probit model it proves necessary to take account of the threshold score contributions which are given by

$$\frac{\partial \log L}{\partial \theta_j} = \eta_{Li} = \begin{cases} \dfrac{\phi_{Li}}{\Phi_{Li} - \Phi_{U-1i}} & \text{if } y_i = j \\ \dfrac{-\phi_{Li}}{\Phi_{U+1i} - \Phi_{Li}} & \text{if } y_i = j+1 \\ 0 & \text{otherwise} \end{cases} \tag{A5.3}$$

for $j = 2, \ldots, J-1$.

Tests of first order adequacy of the estimated models can be based on seeing whether any omitted regressors are correlated with the $g_i^{(1)}$. To test for higher order adequacy of the model, higher order moment residuals are required. Higher order conditional moments of the latent variable can be specified in terms of the functions defined in Stewart(1983c) :

$$M_{ij} = \frac{w\hat{\sigma}_{j-1|i}\,\phi_{j-1|i} - w_j^2\,\phi_j}{\hat{\sigma}_{j|i} - \hat{\sigma}_{j-1|i}} \tag{A5.4}$$

The first four moment residuals (Chesher and Irish(1987)) are then defined as

$$d_i^{(1)} = M_{1i} \tag{A5.5}$$

$$d_i^{(2)} = M_{2i}$$

$$d_i^{(3)} = 2d_i^{(1)} + M_{3i}$$

$$d_i^{(4)} = 3d_i^{(2)} + M_{4i}$$

The score test statistics reported in this Chapter all take the form[25]

$$\xi = l'F(F'F)^{-1}F'l \tag{A5.6}$$

where l is an N-dimensional vector of ones and F is a matrix with row order N (the sample size), each row of which contains the score contributions for all parameters of the model, both those estimated and those set to zero under the null. (The elements of $F'l$ corresponding to the β's and θ's are all zero). Hence ξ is simply N times the non-centred R^2 from a regression of l on the columns of F. The test statistics used in this Chapter are now discussed in turn

(i) Omitted Explanatory Variables.

The general model is assumed to be given by

$$y_i^* = x_i'\beta + q_i'\alpha + \varepsilon_i \tag{A5.7}$$

where q is a vector of length k (not including a constant) then for $y_i^* = x_i'\beta + \varepsilon_i$ to be the model prevailing under the null hypothesis a score test for model misspecification amounts to a test of $\alpha = 0$, the test statistic being of the form ξ given above with rows of F given as

[25] The general form for a score test is, in terms of the log likelihood function, $[\partial \log L/\partial\beta]\,[I(\beta)]^{-1}\,[\partial \log L/\partial\beta]'$, $I(.)$ being the estimated information matrix under the null.

$$F_i = (d_i^{(1)}z_i, \hat{\eta}_{2i}, \ldots, \hat{\eta}_{(J-1)i}, d_i^{(1)}q_i). \tag{A5.8}$$

Under the null hypothesis ξ is distributed as $\chi^2(k)$.

The test statistic for functional form presented here is an adapted form of a RESET test (see Ramsey(1969), Ramsey and Schmidt(1976)) and is a test of the significance of powers of $y_i^* = x_i'\hat{\beta}$. Three powers are added (squared, cubed and quadrupled) so that the test reported is a $\chi^2(3)$ test.

(ii) Heteroskedasticity.

The variance of ε can be assumed to be given by

$$\sigma_i^2 = 1 + q_i'\alpha \tag{A5.9}$$

The rows of F for the score test of $\alpha = 0$ become

$$F_i = (d_i^{(1)}z_i, \hat{\eta}_{2i}, \ldots, \hat{\eta}_{(J-1)i}, d_i^{(2)}q_i). \tag{A5.10}$$

Under the null hypothesis ξ is distributed as $\chi^2(k)$. In this Chapter q_i is taken as all components of the x-vector.

(iii) Non-Normality.

The rows of F in the usual $\chi^2(2)$ test for skewness and/or kurtosis are given by

$$F_i = (d_i^{(1)}z_i, \hat{\eta}_{2i}, \ldots, \hat{\eta}_{(J-1)i}, d_i^{(3)}, d_i^{(4)}). \tag{A5.11}$$

(iv) Heterogeneity in the Thresholds.

Under the alternative the thresholds are allowed to vary systematically over the observations

$$\theta_{ji} = \bar{\theta}_j + q_i'\alpha_j \tag{A5.12}$$

so that a score test can be constructed for the null of $\alpha_j = 0$, $j = 2, \ldots, J-1$. The rows of F in this case will be given by

$$F_i = (d_i^{(1)} x_i, \hat{\eta}_{2i}, \ldots, \hat{\eta}_{J-1i}, \hat{\eta}_{2i} q_i, \ldots, \hat{\eta}_{J-1i} q_i). \tag{A5.13}$$

Under the null hypothesis ξ_i is distributed as $\chi^2(k(J-2))$.

CHAPTER 6.

Unions and the Incidence of Performance Linked Pay Schemes.

The recent economic literature has seen an increased interest in discussion of the merits of performance linked remuneration schemes. Much of this interest has developed from worries regarding the inflationary nature of traditional payment methods and from the work of Martin Weitzman(1984,1985 and elsewhere) who claims that profit sharing can relieve the major unemployment problems currently faced by most Western economies.[1] Instrumental to these ideas is the way in which employers, employees and their representative trade unions view these schemes. If, as Weitzman has argued, sharing schemes can improve performance and induce greater wage flexibility then it can be argued that these schemes may be more attractive to unionised employers. This is especially true given the evidence that unions reduce financial performance reported in the previous two Chapters. On the other side of the coin, trade unions are often sceptical about proposed changes in methods of payment. Observe the view of John Edmonds of the General and Municipal Boilermakers who has stated that management 'were keen on share ownership when it induces people to comply with their objectives, but not when it eroded their own power' [Edmonds(1987) p.8]. The focus of this Chapter is on the relationship between trade union presence and the existence of sharing arrangements in British workplaces. The analysis explores this relationship using data from the 1984 Workplace Industrial Relations Survey by estimating incidence equations for three kinds of sharing schemes and relating the degree of union strength to the probability of operating a scheme.[2]

The layout of the Chapter is as follows. Section 6.1 considers the theoretical background concerning union attitudes to the introduction of performance linked payment methods. Section 6.2 sets out the appropriate modelling strategy and Section 6.3 discusses the data to be used in the

[1] Reviews of the relevant literature can be found in Harris, Gross and Wadhwani(1987), Standing(1988). Section 2.5 of Chapter 2 discusses the work pertinent to this study.

[2] This Chapter is a revised, re-estimated version of Gregg and Machin(1988) focusing very much on the relationship between union strength and the incidence of sharing schemes.

analysis. The following three sections estimate Probit equations for the incidence of share ownership, profit sharing and value added schemes in just over 1000 British private sector establishments. Section 6.7 compares and contrasts the relationship between union status, union strength and the presence of these three schemes in British workplaces. Finally, some concluding remarks regarding the relationship between unions and sharing schemes and on the reasons why employers may be more (or less) able to introduce such schemes if unions are present are offered.

6.1 Trade Unions and Performance Linked Payment Schemes : Theoretical Background.

As discussed in Chapter 2, most British empirical work analysing performance linked pay tests the effects of profit sharing or share ownership on various economic variables like wage costs and employment (Estrin and Wilson(1986), Bradley and Estrin(1987), Wadhwani and Wall(1988)), share prices (Richardson and Nejad(1986)), investment, employment and financial performance (Blanchflower and Oswald(1987a,1987b)) and productivity (Cable and Wilson(1988), Wadhwani and Wall(1988)). The evidence is fairly mixed regarding the potential productivity gains and increased wage flexibility that operating schemes may yield (see Section 2.5 in Chapter 2 for a fuller discussion).

The point made strongly in earlier Chapters is that the presence of a trade union impinges on a number of economic characteristics of the workplace. Whether the beneficial economic effects that advocates of performance linked pay promote are able to come about is therefore likely to depend on the extent of trade union activity. As such, the correlation between union activity and the incidence of sharing schemes can give an indication of whether or not unionised managements are attracted more or less to these schemes as a means of improving the workings of their firm. The impact of unions on the incidence of sharing arrangements is likely to manifest itself in a number of ways and may be best considered in terms of the objectives of management, union leaders and the rank and file membership, all of whom will be attracted to these schemes if the perceived net gains from their introduction are positive. What is however clear is that different objectives apply to different groups and that in many cases a potential benefit to one group of agents is a potential cost to another.

Poole(1988) makes the point that the decision on whether to introduce these schemes is intrinsically linked to the managerial style within a given firm. Hence, from a managerial viewpoint, the potential gains associated with schemes are likely to be generated from improved economic performance, a less adversarial industrial relations climate and through greater motivation, loyalty to the company and increased effort on the part of workers. These potential benefits to management will be perceived to be greater in unionised firms if unions reduce profitability and financial performance (as in Chapters 4 and 5) or productivity (as found for larger engineering firms in Chapter 3) or if they promote non-cooperative relations between workers and management. Indeed, Poole(1988) observes a positive correlation between union activity and the presence of profit sharing or share ownership schemes in a sample of 303 firms in Britain in 1986.

From a worker's viewpoint dissatisfaction with his or her current pay package could prompt a desire to participate in these schemes in the hope of improving their individual remuneration. However, this may create a conflict of interests with those union leaders who view schemes suspiciously in that they herald a new industrial relations climate in which the union's role could be reduced to bargaining over shares.[3] If unions view flexible payment methods unfavourably and as shifting control from them to management then it seems reasonable that they will oppose their introduction through their ability to influence managerial objectives ; this will be especially true if the rank and file are satisfied with their current pay and also wary of any proposed change in the payment system.[4] Following this line of argument the influence of unions will be on the management based decision on whether to introduce a scheme : the union effect will therefore work through threats of what they could do to economic performance or worker-management relations if a scheme were to be introduced against their wishes. This threat effect will be more credible if it comes from a stronger union and, in the empirical work to follow, stronger unions

[3] See the TUC's official guidelines on profit related pay for an example of trade union suspicion of profit sharing unless, as Wadhwani and Wall(1988) note, it is treated simply as a bonus payment on top of the bargained wage .

[4] As sharing increases the risk associated with an employee's level of pay it then induces some degree of uncertainty. Clearly employees will be less attracted to sharing if they are risk averse and/or satisfied with their pay under a wage system. This will be the case if the certainty equivalent level of pay under a sharing arrangement is less than the level of pay based on a standard fixed wage.

are divided from weaker unions by the presence of a closed shop. This practice is further justified by the second element dictating union ability to resist which is whether union members are content with their current earnings.[5] This is more likely to be the case where union wage premiums are higher which, as Stewart(1987a,1987c) has shown, is more likely to be the case if a closed shop is present. Indeed Weitzman(1987) himself also recognises this when saying 'the greatest resistance to profit sharing is likely to come from those sectors or firms where powerful unions are able to extort above-competitive wages' [Weitzman(1987) p.103].

The introduction of sharing arrangements may also alter the relative bargaining strengths of unions and firms. Take the usual Nash bargain $\Sigma = argmax\ (U-\bar{U})^{\psi}(\Pi-\bar{\Pi})^{1-\psi}$ where U is union utility, Π is firm profits, ψ the strength of the union in the bargain and a bar denotes union and firm 'threat' points or baseline levels of utility and profits respectively. If ψ is reduced under sharing then managers may want to introduce schemes as the distribution of the organisational rent Σ shifts in their favour. The likelihood of a change in bargaining power emerges if collective bargaining arrangements are altered under profit sharing. If the switch to profit sharing simply means that unions and firms bargain only over the base wage or shares then ψ is likely to fall under sharing ; if bargaining still occurs over the overall wage, in the form of a bargain over the base wage and the share, then ψ is more likely to remain unchanged.[6] If the move to profit sharing reduces ψ sufficiently then management may want to introduce schemes when facing union opposition, even in the absence of any incentives such as the tax relief available on share ownership and profit sharing schemes in Britain.

This discussion therefore generates several empirically testable propositions. First it is argued that the incidence of schemes is likely to differ with union status. Where union performance effects are negative schemes are more likely to be attractive to managers of unionised firms. Similarly if the schemes are viewed as a means of fostering 'cooperative' industrial relations and switching employee loyalty from the union to the firm then unionised managers will be

[5] This is not to say that all unions actively oppose these schemes : for example, the electricians' union has openly encouraged their uptake and introduction.

[6] Note that Estrin, Grout and Wadhwani(1987) cite that over 90% of share ownership schemes in Britain do not involve a bargaining role for the union.

attracted to them. Also, when the presence of tax incentives can facilitate mutual benefits to both parties in the bargain (as in Wadhwani's(1988) discussion of the possibility of 'cosmetic' sharing schemes - see Chapter 2) their introduction may be attractive. The second proposition is that the incidence of schemes will differ with union strength such that, in situations where managers would like schemes but union opposition exists, the threat effects of stronger unions makes them more able to resist the implementation of flexible payment methods at their workplace. A third possibility is that where unions feel they can take control of such schemes (as they did with payments by results systems in the 1960's) then their introduction may be encouraged by union leaders. Some raw data on the incidence of sharing schemes from the 1984 Workplace Industrial Relations Survey is reported in Table 6.1.[7] Share ownership and profit sharing schemes are more likely to be present in workplaces which have recognised trade unions but no closed shop. This conforms to the discussion set out above : in these situations schemes offer potential benefits to managers and, even if unions disapprove, the threat of strike action may not be strong enough to deter their introduction. However, in plants with closed shop arrangements both schemes are less likely to be present and, in the case of profit sharing, less prevalent than in non-union plants. For value added schemes the pattern is different as schemes are least likely to be present in establishments with a closed shop but the incidence is highest in non-union plants.

The data in Table 6.1 implies different correlations between union status and, on the one hand, share ownership and profit sharing schemes and, on the other, value added schemes. It is therefore also of some importance to see whether the determinants of different flexible pay schemes vary and indeed whether unions are more likely to welcome or oppose one type of scheme more than another. It is possible to shed some light on this by examining whether different explanatory variables are statistically important in incidence equations for different schemes. There are a number of reasons for expecting this to be the case. For example, Estrin, Grout and Wadhwani(1987) point out that share ownership schemes are likely to weaken work-

[7] The actual question asked in the survey is reproduced in the Data Appendix along with more details on the data. Only data on one kind of scheme, namely share ownership schemes, is available from the 1980 survey. Therefore the analysis only considers data from 1984.

TABLE 6.1

Proportions of British Establishments with Performance Linked Pay Schemes in 1984.				
	All establishments	No unions recognised	No closed shop, unions recognised	Closed shop
Share ownership	0.293	0.176	0.377	0.315
Profit sharing	0.216	0.205	0.251	0.173
Value added	0.116	0.147	0.106	0.091
Sample size	1001	341	406	254

Notes.

(i) The (unweighted) data refers to private sector establishments and is derived from the Workplace Industrial Relations Survey of 1984.

ers' monopoly power in the long run. They argue that this results in a reduced role for unions in the wage setting process and as such shifts power from unions to management. This is the very point made above in terms of the potential for a change in the relative bargaining strengths of firms and unions that could be generated by a switch to sharing arrangements. This might provide a greater incentive for managers to introduce share ownership schemes in the union sector. However, cash based profit sharing or value added schemes are more likely to be treated in conjunction with and not independent of wage negotiations. This suggests there may be different reasons underlying the introduction of cash based or share based pay schemes.

A second reason for expecting differential determinants is that recent legislation has offered tax incentives to employers and employees who participate in share ownership or profit sharing schemes. No such tax benefits are available for value added schemes.

Thirdly, the performance measure used to gauge the bonus payment is different for each scheme : whilst share ownership and profit sharing link pay to financial measures value added schemes are based on output measures. This suggests that the question of whether to introduce the latter schemes may be more appropriate within individual establishments whilst, as the former require some corporate measure of performance like share prices or profits, the decision on whether to introduce share ownership or profit sharing may be more company based. However, given that profit centres do exist in most large companies discussion of whether to introduce profit sharing may be feasible at a lower level than that of the organisation. Therefore it is considered that the three schemes are likely to have different determinants : in particular it seems likely that establishment variables will be of most importance in explaining the incidence of value added schemes, of some importance to profit sharing and less important than organisation variables to the explanation of the incidence of share ownership schemes.

6.2. Modelling the Incidence of Sharing Schemes.

The discussion in Section 6.1 implied that an employer will wish to introduce a scheme if the perceived benefits from its introduction outweigh any perceived costs (such as threats from a

hostile union regarding what it may do to production in the event of a scheme being introduced against its wishes). This can be characterised by the following latent variable model

$$S_i^* = X_i'\beta + \varepsilon_i \tag{6.2.1}$$

where S_i^* is the perceived net benefits from introducing a scheme in the ith establishment, β is a parameter vector and ε_i a random error term.

S_i^* is not however directly observable but instead information is available on whether or not an establishment operates a share ownership, profit sharing or value added scheme. This can be represented by a dichotomous variable S_i where $S_i=1$ if an establishment operates a scheme and $S_i=0$ otherwise. The unobservable variable S_i^* can be related to the observable variable S_i as follows

$$S_i = \begin{cases} 1 & \text{if } S_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \tag{6.2.2}$$

As S_i is to be used as dependent variable the classical linear regression model is no longer the appropriate estimating method.The reasons for this are well documented : use of least squares can generate predictions outside the [0,1] interval ; errors in the least squares model will not be homoskedastic ; the distribution of errors given X will not be normal and OLS standard errors and thus t-statistics will be biased (see Maddala(1983)or Amemiya(1985) for more details). An estimator which allows for the discrete nature of S_i is therefore required and a Probit estimator is to be used. Probit models effectively transform the real line [—∞, ∞] into the unit interval [0,1] by reformulating the dependent variable in terms of probabilities. Specifying the probability of an establishment operating a scheme as $Pr[S_i = 1] = \Phi(X_i'\beta)$ where $\Phi(.)$ is the standard normal distribution function then the probability of not operating a scheme is of course $Pr[S_i = 0] = 1 - \Phi(X_i'\beta)$. Probit models can be estimated consistently using Maximum Likelihood methods. Hence, the log-likelihood function for the Probit model can be written as

$$\log L = \sum_{i=1}^{N} S_i \log \Phi(X_i'\beta) + (1-S_i) \log (1-\Phi(X_i'\beta)) \tag{6.2.3}$$

Maximisation of this function gives Maximum Likelihood estimates of β which are not subject to the problems that applying least squares to a discrete dependent variable generate. This is therefore the estimation method applied in this Chapter.[8]

As remarked in Chapter 5 regarding the Ordered Probit model, very few studies analysing categorical data have reported diagnostic checks of their models. Recently, this deficiency has been remedied somewhat as some authors have developed testing procedures for limited dependent variable models. Chesher and Irish(1987) and Gourieroux et al.(1987) have recognised that test procedures based on the classical linear regression model are often based on residuals and have defined analogous residuals for models based on grouped or censored data. Tests developed by Chesher and Irish for functional form, heteroskedasticity and non-normality for the Probit model are reported in this Chapter. Their method of construction is given in the Appendix at the end of the Chapter.

Section 6.1 isolated a number of reasons as to why the incidence of sharing schemes will differ with (a) union status and (b) union strength. To test these ideas the model is to be estimated (if upheld statistically) over three sub-samples namely, non-union establishments, those establishments which have recognised unions but no closed shop and those which have a closed shop. This generates three sets of estimates of β which can be denoted β^{NU}, β^{U} and β^{CL} respectively where *NU* denotes non-union plants, *U* denotes the non-closed shop weak union group and *CL* denotes plants with a closed shop (the strong union group). An average weak union effect on the incidence of sharing arrangements can be calculated as $\bar{\hat{D}} = \bar{X}'(\hat{\beta}^{U} - \hat{\beta}^{NU})$ where a bar denotes a mean value and a hat an estimate. An asymptotic standard error is $ase(\bar{\hat{D}}) = \sqrt{\bar{X}'H\bar{X}}$ where H is the sum of the covariance matrices from the U and NU sub-samples. To calculate strong union non-union effects and their standard errors it is simply necessary to replace β^{U} with β^{CL} and to use the appropriate covariance matrices in setting up H.

[8] All estimation in this Chapter was undertaken using LIMDEP (see Greene(1985)). The algorithm used for the Probit model is the Newton-Raphson method and the reported standard errors are based on the variance matrix derived from the second derivatives of the log-likelihood function.

These average union non-union effects analyse the influence of unions on S^*. It is also of interest to calculate probability figures which allow comparison of magnitude of weak and strong union effects for different schemes. These are calculated in the following way

$$\text{Weak Union} \qquad \bar{P} = \Phi(\bar{X}'\beta^{U}) - \Phi(\bar{X}'\beta^{NU}) \tag{6.2.4}$$

$$\text{Strong Union} \qquad \bar{P} = \Phi(\bar{X}'\beta^{U2}) - \Phi(\bar{X}'\beta^{NU})$$

6.3. Data Description.

The data to be accessed in this Chapter is the Workplace Industrial Relations Survey of 1984. As remarked in Chapter 5 and expanded on in the Data Appendix this is a survey of 2019 British establishments which gives detailed industrial relations information. It also gives information on sharing arrangements and this is the data to be focused on in this Chapter.

The vector of independent variables to be used in the analysis is split into the following three groups as dictated by the theoretical discussion undertaken in Section 6.1.[9] More details on the data and their construction plus weighted means are given in the Data Appendix.

(i) Organisation variables.

The Workplace Industrial Relations Survey is an establishment based survey but it does give information on various characteristics of the organisation to which the establishment belongs. Those to be considered in the empirical work are

(a) Organisation Size : the number of employees in the organisation is available as a grouped variable and thus organisation size (OSIZE) is modelled using three dummy variables indicating whether the organisation has between 500 and 9999 employees, between 10000 and 49999 employees or in excess of 50000 employees. If tax incentives are more appropriate to large firms, if large firms are more informed of their existence or if enforcement of effort to prevent shirking

[9] The variables chosen are those found by Gregg and Machin(1988) to be the major determinants of sharing schemes in British establishments.

is more necessary in larger firms then one would expect a positive correlation between organisation size and the probability of operating a scheme.

(b) Information given regarding company performance : this is modelled using a dummy variable (FINORGA) indicating whether management gives a lot of information about the financial position of the organisation. Presumably if they do so then schemes are more likely to be present as workers will feel less likely to be tricked by entering into a scheme and will be more prepared to bear a risky income. If employers are risk averse then they will be more prepared to yield information and enter into a risk sharing agreement. There is also the idea advanced in the implicit contracts literature (see Hart(1983)) that workers rate managers more highly if information is given : thus sharing arrangements may be more easily introduced in a cooperative worker-management environment. Hence FINORGA may proxy managerial competence or 'good management' and, in the union sector, the extent of cooperative industrial relations.

(c) Ownership : modelled as a dummy variable indicating whether the organisation of which the establishment is part is partially or wholly foreign owned. It seems evident that share ownership schemes would prove harder to run if a company is foreign owned as communication of a foreign share price to employees would prove difficult. Similarly, if profit-centres are abroad the appeal of profit sharing schemes as generating employee identification with the company may prove less attractive.

(ii) Industry variables.

The environment in which the establishment operates may also be of some importance in explaining whether or not sharing arrangements are likely to be functioning in a given workplace. Therefore to allow for the effect of recent demand conditions in the establishment's operating industry the following industry variable is included :

(a) Industry growth : proportionate growth in employment in the establishment's operating industry from 1980 to 1984 (GROWTH).[10]

[10] It might be argued that some kind of industry risk measure (e.g. the standard error of employment growth over a number of years) might be more appropriate. However data limitations prevented calculation

(iii) Establishment variables.

The data set yields a considerable amount of information on the characteristics of the establishments taking part in the survey, a number of which are relevant in modelling the probability of operating a scheme.

(a) Establishment Size : modelled as the number of employees in the establishment (EMPLOY). If introduction of a scheme is more an establishment based issue then one might expect this to dominate organisation size.

(b) Workforce characteristics : this is modelled by simply using the proportion of manual employees in the workforce (MPROP). This is included to see whether schemes are more likely to be introduced in plants with higher proportions of blue or white collar employees. A positive association would be expected if employers feel they can generate higher productivity from the manual workforce via these schemes. A negative coefficient might be expected if schemes are viewed in some sense as managerial perks for white collar workers.[11]

(c) Consultative committees : the existence of consultative machinery may also act as a determinant of the probability of operating a scheme and this is modelled by a dummy variable (JCC) which indicates whether the plant has a Joint Consultative Committee or not. Like the financial information variable JCC may also pick up managerial efficiency effects : on top of this JCC can be viewed as a collective voice function in the presence of unions and therefore one may expect a different correlation between JCC and the incidence of sharing schemes among union and non-union plants.

(d) Union variables : as described above two mutually exclusive union variables indicating weak and strong unions are used. A strong union variable is defined equal to unity if unions are recognised in the workplace and there is a closed shop for at least some workers (CLOSED). The weak

---

of such a measure. Other industry variables that might be of interest are market concentration or import penetration : these variables are however only available for manufacturing industry and their inclusion would involve a considerable fall in sample size ; as their interest is only tangential they are not considered here.

[11] Gregg and Machin(1988) have considered this issue in more detail and for the most part this simple split is sufficient on statistical grounds as inclusion of more detailed workforce features does not add any additional explanatory power to the models.

counterpart equals one if unions are recognised and there are no closed shop arrangements at the establishment (UNION). The reason for modelling the union variables as recognition across any occupational group of workers is because the introduction of these schemes is an issue for both manuals and non-manuals : this differs from the union measures from the same data source used in the previous Chapter as there it was viewed that manual workers are of more importance in talking about extracting a share of economic rents. In that context the pay of white collar workers is much more an overhead cost and less relevant in the collective bargaining process (see Cowling(1982)).

6.4 Determinants of the Incidence of Share Ownership Schemes.

Probit estimates of the incidence of share ownership schemes in 1001 British private sector establishments are reported in Table 6.2. The results are stratified into sub-samples for workplaces with strong unions, weak unions and no union recognition. This split is supported statistically, the relevant Likelihood Ratio statistic being $\chi^2(20) = 34.31$ as compared to a 5% critical value of 31.40. In order to compare the magnitude of the impact of different variables across samples and with the profit sharing and value added equations in the next two sections the estimated coefficients are also converted to probability equivalents and these are also reported in Table 6.2.[12] Diagnostic tests of the Probit equations are also set out in the Table : they indicate that the equations perform fairly well, especially the incidence equations for non-union plants.

In general the organisation variables are very important in explaining the incidence of share ownership schemes. This is observed across all three specifications in Table 6.2. The monotonically increasing coefficients on the organisation size dummies show across all three samples that larger organisations are more likely to have schemes. This points to the idea that there exist

[12] For continuous variables the probability effects are the probability of operating a scheme for an establishment with mean characteristics compared to one with the variable of interest set to zero. For the jth element in the X_i vector these are calculated as $\partial Pr[S_i=1]/\partial X_{ij} = \beta_j\ \phi(X_i'\hat{\beta})$ where ϕ is the standard normal density and are evaluated at the (weighted) means of $\phi(X_i'\hat{\beta})$. For dichotomous variables the effects are the change in the probability of operating a scheme resulting from a unit change in the explanatory variable. For a dichotomous variable A_i in the $X_i=[Y_i, A_i]$ vector with coefficient λ these are calculated as $Pr[S_i=1|A_i=1]-Pr[S_i=1|A_i=0] = \Phi(Y_i'\Lambda+\lambda) - \Phi(Y_i'\Lambda)$. All other variables are set to (weighted) mean values in calculating these effects.

TABLE 6.2

Unions and the Incidence of Share Ownership Schemes.						
	No unions recognised		No closed shop, unions recognised		Closed shop	
	Probit Estimates	Probability Effects	Probit Estimates	Probability Effects	Probit Estimates	Probability Effects
Constant	-1.775(0.252)	-	-1.046(0.237)	-	-2.147(0.541)	-
Organisation Variables						
500≤OSIZE<10000	0.718(0.273)	0.142	0.896(0.230)	0.324	1.428(0.478)	0.437
10000≤OSIZE<50000	1.444(0.332)	0.420	1.240(0.262)	0.464	1.507(0.498)	0.527
OSIZE≥50000	1.551(0.368)	0.445	1.518(0.290)	0.549	1.639(0.521)	0.580
FINORGA	0.727(0.225)	0.154	0.425(0.156)	0.157	0.269(0.192)	0.083
FOREIGN	-0.768(0.321)	-0.086	-1.059(0.267)	-0.295	-1.704(0.335)	-0.351
Industry Variables						
GROWTH	-0.798(0.793)	-0.119 *	1.055(0.588)	0.300 *	0.286(0.745)	0.081 *
Establishment Variables						
MPROP	-0.856(0.350)	-0.128 *	-0.571(0.269)	-0.162 *	0.461(0.453)	0.130 *
JCC	0.690(0.221)	0.138	0.162(0.151)	0.058	0.146(0.201)	0.045
EMPLOY/100	0.039(0.035)	0.004 *	0.015(0.012)	0.004 *	0.006(0.009)	0.002 *
logL	-91.67		-201.97		-125.61	
N	341		406		254	
Mean of dep. variable	0.176		0.378		0.315	
Functional form	3.45(7.81)		10.04(7.81)		5.55(7.81)	
Heteroskedasticity	19.34(18.30)		20.50(18.30)		35.87(18.30)	
Non-normality	2.84(5.99)		9.96(5.99)		5.47(5.99)	

NOTES.

(i) The dependent variable is a 0-1 dummy indicating the existence of a share ownership scheme.

(ii) Asymptotic standard errors are in parentheses.

(iii) * denotes that a probability effect is a mean effect for a continuous variable. All other reported probabilities are 0-1 effects for dummy variables.

(iv) The tests for functional form, heteroskedasticity and normality are based on the pseudo residuals formed for limited dependent variable models as set out in Chesher and Irish(1987) : see the text for more details.

(v) Numbers in parentheses adjacent to the diagnostic test statistics are the appropriate 5% critical values.

economies of scale in operating share schemes : that is, the costs per worker of setting up and monitoring a share ownership scheme are likely to be greater among small firms and this deters management from introducing them. Not least is the presence of legal obstacles which may give small firms difficulties in getting Inland Revenue approval to operate schemes under the conditions of the Finance Acts relating to performance linked pay. The extent to which the organisation is prepared to yield financial information to its employees is positively related to the incidence of share ownership schemes. It is however only significant in the weak union and non-union samples. This could be construed as reflecting some kind of mutual trust between strong unions and employers such that if a scheme is in operation this information is not necessary : in the situation where FINORGA is significant the effect can be seen either as proxying 'progressive management' or may reflect the notion that additional information is required to ensure that workers are more prepared to shoulder some of the risk associated with more variable wages. Belonging to a foreign owned organisation means that schemes are less likely to be present : in the closed shop sample establishments are 35% less likely to have a scheme if they belong to a foreign owned interest. This falls to -30% and -9% for the weaker union and non-union plants.

The introduction of share ownership schemes is therefore very much linked to the characteristics of an establishment's parent organisation. Having said that, characteristics of the establishment and its operating industry may also be of some importance. The industry employment growth variable does not really display any pattern although becomes significantly positive at the 10% level in the weak union sample. Establishment variables are however of some relevance : for instance, establishments with a large non-manual component of their workforce are more likely to have share ownership schemes. This reflects the idea that non-manual wages are in general less flexible (due to a lack of overtime or bonus payments) and thus schemes may be introduced as a means of gaining wage flexibility through a kind of 'manualisation' of the wages of non-manual labour. Also, if these schemes form a kind of managerial perk (because of the tax incentives they offer) then they may be more prevalent among white collar workers. The coefficient on the Consultative Committee variable JCC is insignificant in unionised establishments but is strongly positive among non-union plants : non-union establishments with a JCC are 14% more likely

than non-union plants without such a function to have a share ownership scheme. In the non-union sector JCC may be viewed as a proxy for progressive management which wants to obtain any desirable effects from consultation and cooperation but without union presence. This kind of management also appears to want share ownership schemes as part of their machinery. However, where unions and JCC's co-exist collective voice effects may be strong so that, relative to the non-union case, plants with JCC's are less likely to have share ownership schemes (since the estimated coefficients are significantly lower in the union sector). Finally, plant size is of little importance and is clearly dominated by the size of the parent organisation as a determinant of the existence or otherwise of share ownership schemes.

6.5. Determinants of the Incidence of Profit Sharing Schemes.

Parallel results to Table 6.2 with profit sharing replacing share ownership as the variable of interest are reported in Table 6.3. Again the decomposition into three sub-samples is supported on statistical grounds with a $\chi^2(20)$ Likelihood Ratio statistic of 33.28. Comparison with Table 6.2 lends some support to the differential determinants story set out in the theoretical discussion.

For profit sharing the very strong organisation size effects found for share ownership are not observed. Only among non-union plants is being part of a large organisation positively and significantly related to operating a scheme. In the absence of collective voice functions and communication channels provided by unions this could reflect that managers in large non-union firms are attracted to profit sharing schemes in the hope that they may offset problems of X-inefficiency and improve internal organisation procedures (via greater effort, more company loyalty and so on). Releasing a lot of information about the company's financial standing for the most part is positively related to the probability of operating a profit sharing scheme. Again, as for share ownership, the very strong foreign ownership effects are present, the probabilities (in absolute terms) again increasing with union strength.

Industry employment growth has no effect on the likelihood of operating a profit sharing scheme. Of the establishment variables having more non-manual workers is positively related to

TABLE 6.3

Unions and the Incidence of Profit Sharing Schemes.						
	No unions recognised		No closed shop, unions recognised		Closed shop	
	Probit Estimates	Probability Effects	Probit Estimates	Probability Effects	Probit Estimates	Probability Effects
Constant	-0.662(0.182)	-	-0.270(0.208)	-	-1.543(0.467)	-
Organisation Variables						
500≤OSIZE<10000	0.277(0.217)	0.072	-0.085(0.203)	-0.025	0.575(0.388)	0.140
10000≤OSIZE<50000	0.130(0.327)	0.036	-0.018(0.240)	-0.005	0.158(0.433)	0.039
OSIZE≥50000	1.731(0.350)	0.599	0.387(0.262)	0.127	0.451(0.454)	0.123
FINORGA	0.122(0.216)	0.031	0.394(0.163)	0.122	0.385(0.208)	0.091
FOREIGN	-0.493(0.280)	-0.101	-0.896(0.297)	-0.198	-0.596(0.261)	-0.112
Industry Variables						
GROWTH	0.869(0.636)	0.186 *	0.832(0.604)	0.234 *	0.185(0.773)	0.044 *
Establishment Variables						
MPROP	-1.356(0.318)	-0.291 *	-0.744(0.280)	-0.209 *	-0.373(0.466)	-0.009 *
JCC	0.116(0.210)	0.029	-0.166(0.152)	-0.050	0.201(0.216)	0.047
EMPLOY/100	0.010(0.030)	0.002 *	0.006(0.010)	0.002 *	0.002(0.009)	0.001 *
logL	-132.46		-201.18		-108.72	
N	341		406		254	
Mean of dep. variable	0.205		0.251		0.173	
Functional form	5.98(7.81)		19.08(7.81)		25.45(7.81)	
Heteroskedasticity	17.10(18.30)		25.43(18.30)		41.02(18.30)	
Non-normality	3.89(5.99)		19.06(5.99)		8.88(5.99)	

NOTES.

(i) The dependent variable is a 0-1 dummy indicating the existence of a profit sharing scheme.

(ii) See notes (ii)-(iv) in Table 6.2.

the probability of having a profit sharing scheme. This trend is a function of union strength as it disappears among plants with a closed shop. Unlike the share ownership equations the existence of a Consultative Committee does not impinge on the probability of operating a scheme, regardless of the extent of union activity. Finally, as with share ownership, no discernible role emerges for plant size.

6.6. Determinants of the Incidence of Value Added Schemes.

Whilst one could argue that there are certain similarities between some of the results for profit sharing and share ownership the value added equations reported in Table 6.4 bear no relation to the other two incidence equations. Firstly, a sub-sample split into strong, weak and non-union plants could not be supported on statistical grounds ($\chi^2(20) = 25.20$). Therefore a simple additive shift in the union variables (rather than the fully interactive models for the other two schemes) is reported in column (1) and in column (2) only those statistically significant interactions with the union variables are included.[13] Secondly, it proved difficult to identify significant determinants of value added schemes. Having said that, none of the diagnostics exceeds the 5% critical value for either equation and this just might reflect that these schemes are so heterogeneous in nature that to isolate their determinants in a precise way using regression techniques is not possible. On the heterogeneity issue it is evident that the definition of a value added scheme is going to differ in production plants compared to plants in the service sector. For instance, how does one define value added in banking ? An industrial breakdown reported in Table A6.3 of the Data Appendix does however show that value added schemes feature across manufacturing and non-manufacturing alike. It might therefore be that respondents to the question treat value added schemes as a kind of catch-all. After all, share ownership and profit sharing schemes are more

---

[13] All the work is done by the 4 interactions in column (2) : a $\chi^2(4)$ statistic of 15.70 testing column (2) against the null of column (1) is strongly significant. A test of the significance of the other 16 possible interactions yields a statistic of 9.50 which is insignificant at any reasonable level of significance.

[13] No significant role was found for industry dummies in the specifications in Table 6.4 : inclusion of eight 1-digit SIC dummies produced a Likelihood Ratio test statistic of 13.98, compared to a 5% critical value of 15.50 (see also footnote 16).

TABLE 6.4

Unions and the Incidence of Value Added Schemes.				
	All establishments		All establishments	
	Probit Estimates	Probability Effects	Probit Estimates	Probability Effects
Constant	-1.235(0.142)	-	-1.260(0.160)	-
Organisation Variables				
500≤OSIZE<10000	-0.045(0.144)	-0.009	-0.018(0.149)	-0.003
10000≤OSIZE<50000	0.049(0.178)	0.009	0.105(0.184)	0.020
OSIZE≥50000	-0.175(0.210)	-0.031	-0.193(0.217)	-0.032
FINORGA	0.224(0.123)	0.044	0.660(0.209)	0.136
FOREIGN	-0.157(0.158)	-0.028	-0.129(0.163)	-0.022
Industry Variables				
GROWTH	-0.324(0.396)	-0.062 *	-0.317(0.403)	-0.059 *
Establishment Variables				
MPROF	0.331(0.201)	0.063 *	0.384(0.206)	0.072 *
JCC	0.008(0.119)	0.001	0.022(0.121)	0.004
EMPLOY/100	0.006(0.006)	0.001 *	-0.091(0.051)	-0.017 *
UNION	-0.308(0.131)	-0.056	-0.382(0.173)	-0.050
CLOSED	-0.464(0.163)	-0.076	-0.345(0.215)	-0.060
INTERACTIONS				
UNION*FINORGA	-	-	-0.438(0.266)	-0.066
CLOSED*FINORGA	-	-	-0.928(0.309)	-0.110
UNION*EMPLOY/100	-	-	0.084(0.053)	0.016 *
CLOSED*EMPLOY/100	-	-	0.108(0.052)	0.020 *
logL	-350.22		-342.37	
N	1001		1001	
Mean of dep. variable	0.116		0.116	
Functional form	3.48(7.81)		2.58(7.81)	
Heteroskedasticity	20.09(21.00)		15.31(26.30)	
Non-normality	2.22(5.99)		2.59(5.99)	

NOTES.

(i) The dependent variable is a 0-1 dummy indicating the existence of a value added scheme.

(ii) See notes (ii)-(iv) in Table 6.2.

easily defined, both from the measure on which they are based (share prices or accounting profits) and from official guidelines relating to the Finance Acts which address the issue of performance linked pay.[14]

Some limited insight is however given in the specifications in Table 6.4. Organisation and industry variables are mostly of no importance in explaining the incidence of schemes linking pay to value added. The exception to this rule is the financial information variable which is significant and positive in the non-union sector. Its insignificance among unionised plants can be viewed as evidence for the idea that giving a lot of information to unions may, relative to the non-union case, generate exploitation of the scheme. Some of the establishment specific variables are of more importance as, unlike for the other two schemes, plants with more manual employees are more likely to operate schemes. The overall effect of plant size is insignificant but the interactions show that larger unionised plants are more likely to have value added schemes than are non-union plants. Hence the plant size effect is neutral in the union sector but in non-union situations there is some weak evidence that it is smaller plants which operate these schemes. This tends to compound the idea that introduction of these schemes is far more of an establishment based issue.

6.7. Unions and the Incidence of Sharing Schemes.

The specifications in Tables 6.2, 6.3 and 6.4 lend some weight to the idea that the three schemes under consideration have different determinants. The main purpose of this analysis is however to consider the relationship between the incidence of sharing schemes and unionisation to see if any systematic pattern emerges.[15] The theoretical discussion put forward the hypothesis that whilst these schemes may be more attractive to unionised employers if they feel they can be used to offset negative union effects on performance there are reasons for expecting this to differ with union power. More specifically if strong unions do not want these schemes in their

[14] Although note here that these schemes are also very different across different companies : the formula used to calculate the shares often differ, as does the measure of profits used (a hazy issue in itself) and the number of shares issued and so on.

[15] Gregg and Machin(1988) discuss the different determinants section in more detail.

workplace they can use the strike threat to discourage management from introducing such schemes. Weak unions will obviously be less able to do so.

Average union non-union effects and associated probability effects calculated using the methods set out in Section 6.2 are reported in Table 6.5. The results for share ownership and profit sharing are broadly in line with one another : if unions are weak a scheme is more likely to be present. The weak union effects for these two schemes are positive and statistically significant, whilst the strong union effects are insignificantly different from zero. In probability terms, a unionised establishment which does not have a closed shop is, ceteris paribus, 13% or 10% more likely to have a share ownership or profit sharing scheme than an otherwise comparable (i.e. with mean characteristics) non-union establishment. The corresponding figures for a strong union are 2% and -4% respectively.[16] For value added schemes however both weak and strong union effects are negative and statistically significant. Their respective probabilities suggest that unionised establishments with and without workers in a closed shop are 9% and 6% less likely to have a scheme. Thus management in unionised plants appear to favour share ownership or profit sharing schemes.

One possible explanation for this is that unionised establishments often belong to large organisations who are simply trying to obtain the tax advantages associated with share ownership and profit sharing which are not available for value added schemes. Since tax relief is only available for profit sharing and share ownership schemes this can be appealed to as a rationale for the results reported here. This view seems to tell part of the story. However, the results reported both in this and earlier Chapters suggest that additional factors are important. Firstly, despite the emergence of some similar results in explaining the incidence of the tax incentive schemes, some noticeable differences are also present. The size of the union probability effects for share ownership and profit sharing in Table 6.5 are also quite different. Secondly, if unions are able to exploit

[16] Adding in a set of industry dummies did not fundamentally alter the results although resulted in severe overparameterisation problems which led to extremely imprecisely determined parameter estimates. As a matter of interest specifications including nine 1-digit industry dummies generated weak union probabilities of 0.151, 0.116 and -0.065 for share ownership, profit sharing and value added respectively. The corresponding strong union probabilities became 0.021, 0.005 and -0.086 respectively.

TABLE 6.5

Weak and Strong Union Effects on the Incidence of Flexible Pay Schemes.						
	SHARE OWNERSHIP		PROFIT SHARING		VALUE ADDED	
	$\bar{\delta}$	$\bar{\gamma}$	$\bar{\delta}$	$\bar{\gamma}$	$\bar{\delta}$	$\bar{\gamma}$
Weak Union	0.576 (0.179)	0.126	0.359 (0.142)	0.097	-0.306 (0.140)	-0.062
Strong Union	0.105 (0.292)	0.017	-0.214 (0.238)	-0.044	-0.480 (0.177)	-0.089

NOTES.

(i) These effects are calculated from the estimated models in Tables 6.2-6.4.

(ii) Evaluated at weighted means, reported in the Data Appendix.

(iii) Asymptotic standard errors are in parentheses.

the presence of tax incentives then one would not expect to observe a significant difference between plants with closed shops and those without : surely if these schemes were beneficial to both parties in the bargain then one would expect strong unions to also get in on the act.

A third point follows from the arguments that sharing arrangements can bring about improvements in the economic performance of the firm. The evidence in Chapters 4 and 5 pointed to lower profitability and financial performance in unionised situations. Hence, if management view unions as mainly reducing profits and share schemes as a way of reducing union strength by providing workers with an alternative interest in the firm they will be more motivated to introduce them. The positive correlation between union recognition (without a closed shop) and the presence of the two schemes linked to financial measures is supportive of the idea that lower performance levels in the union sector are part of the reason why these schemes are introduced. In this context, the difference in estimated effects between strong and weak unions can be rationalised in terms of the more credible threat possessed by stronger unions regarding what they could do to performance or union-management relations if a scheme were to be proposed for introduction against their wishes. This threat effect may be strong enough to offset the advantages managers perceive a scheme can offer and therefore deter management who may be attracted to schemes from being able to introduce them. Outside the confines of the closed shop this threat is likely to be less powerful and if the perceived benefits that managers attach to schemes still outweigh the costs, including the latent threat of the union, schemes can be introduced anyway. It should also be noted that although Blanchflower and Oswald(1987b) are unable to detect a relationship between the existence of a share ownership or profit sharing scheme and higher financial performance this does not conflict with the findings reported here. Managers may introduce schemes in the hope of raising performance but that does not guarantee that this will work. Introduction is very much an ex-ante decision in which perceived net benefits are positive which may not give, for various reasons, the ex-post desired results. Also, as most of these schemes have only been introduced recently then enough time for them to desirably influence performance levels may not have yet elapsed.

Fourthly, subject to the caveats regarding the quality of the data on value added schemes, the incentive for unionised managements to introduce schemes linked to value added seems to be less pressing. Related to this is the idea that management may be far less tempted to introduce value added schemes in the presence of unions following the experience of the 1950's and 1960's when unions were able to exploit similar schemes, such as payment by results systems, through their ability to regulate effort and to hold on to some degree of control in the workplace due to their power in the collective bargaining process. Thus it appears to be the case that management are reluctant to introduce value added schemes for a fear of (at least partial) loss of control but that they are more confident of obtaining any desirable effects from the other two schemes whilst simultaneously retaining, or even strengthening, workplace control.

6.8. Concluding Remarks.

Recent economic debate has concerned itself with the idea of whether alternative employee compensation systems can have an impact on employment stability, wage flexibility and economic performance. Despite the recent revival of interest the study of these schemes and their implications for trade unions is by no means new. For instance, Dobb(1928) states that 'Some employers, in addition to, or instead of, ordinary systems of payment by results, favour a system known as profit-sharing with the aim of stimulating a collective spirit among the workpeople favourable to greater output, and of giving to the employees a financial interest in the success of the firm' [Dobb(1928) p.62]. He goes on to discuss the incentive for managers to introduce profit sharing schemes in the presence of unions by stating that 'Not infrequently a further advantage is hoped for from the scheme in detaching the workers from a trade union and freeing the management from the constriction of collective bargaining and possible strikes' [Dobb(1928) p.63]. These ideas are not dissimilar to some of those discussed in the modern literature on sharing arrangements and in this Chapter. So as to empirically test these notions, this Chapter uses data from the nationally representative Workplace Industrial Relations Survey of 1984 to examine the relationship between union presence and the incidence of flexible payment schemes operating in British establishments. It attempts to determine whether unionised plants are more or less likely

to have these schemes. Several interesting findings emerge from the analysis. Unionised plants are more likely to have schemes which link pay to financial measures but are less likely to have schemes which link pay to value added. Given that Chapter 3 found union effects on productivity to be neutral and that Chapters 4 and 5 found negative union effects on accounting profits and financial performance one possible explanation of these results is that managers in plants with unions present are more attracted to schemes linking pay to financial measures in the hope of offsetting these negative union effects. Data difficulties certainly prevent a definitive test of this hypothesis. Indeed, as with most economic hypotheses several interpretations may be offered for the reported results. However, some evidence for the ideas discussed in Section 6.2 is found as the presence of schemes differs with union strength. In particular, amongst unionised plants these schemes are less likely to be present where a closed shop operates. What is also evident (and explored in more detail in Gregg and Machin(1988)) is that these schemes are not homogeneous substitutes and that different explanatory variables have different effects on the incidence of share ownership, profit sharing and value added schemes.

Appendix : Diagnostic Tests for the Probit Model.

The log-likelihood for the Probit model is given by

$$\log L = \sum_{i=1}^{N} S_i \log \Phi(X_i'\beta) + (1-S_i) \log (1-\Phi(X_i'\beta)) \tag{A6.1}$$

For the Probit model above the Chesher and Irish(1987) definition of residuals is the derivative of (A6.1) with respect to the constant in the β vector and is given by

$$d_i^{(1)} = -(1-S_i)\, h(X_i'\beta) + S_i\, h(-X_i'\beta) \tag{A6.2}$$

where $h(.) = \phi(.)/1-\Phi(.)$, the hazard function for the standard normal distribution (ϕ is the standard normal density). Higher order moments are defined by Chesher and Irish as

$$d_i^{(2)} = -(X_i'\beta)\, d^{(1)} \tag{A6.3}$$

$$d_i^{(3)} = (2 + (X_i'\beta)^2)\, d^{(1)}$$

$$d_i^{(4)} = -(3X_i'\beta + (X_i'\beta)^3)\, d^{(1)}$$

Definition of these first four conditional moments means that various score tests can be carried out. As with the tests for the Ordered Probit model reported in Chapter 5 they are all calculated as[17]

$$\xi = i'F(F'F)^{-1}F'i \tag{A6.4}$$

where i is an N-dimensional vector of ones and F is a matrix with row order N, N being the sample size. Calculation of the tests simply involves ascertaining the score contributions made by each parameter and those set to zero under the null hypothesis and these form the columns of F. Three tests are reported in this Chapter :

[17] See the Appendix to Chapter 5 or Chesher and Irish(1987) for more details.

(i) Functional form.

As in the previous Chapter this can be constructed in the form of ξ with the rows of F given as

$$F_i = (d_i^{(1)}X_i, d_i^{(1)}q_i). \tag{A6.5}$$

where q_i is a vector containing the squared, cubed and quadrupled values of $\hat{\xi}_i^*$ so that the tests reported are $\chi^2(3)$ tests.

(ii) Heteroskedasticity.

For a test of the null of homoskedastic errors the rows of F are

$$F_i = (d_i^{(1)}X_i, d_i^{(2)}q_i). \tag{A6.6}$$

q_i is treated as all the components of the X-vector and thus the test is in all cases a $\chi^2(10)$ test.

(iii) Non-Normality.

The rows of F in the usual $\chi^2(2)$ test for skewness and/or kurtosis are given by

$$F_i = (d_i^{(1)}X_i, d_i^{(3)}, d_i^{(4)}). \tag{A6.7}$$

CHAPTER 7.

Summary of Main Results and Concluding Remarks.

Quantifying the impact that trade unions have on the economic performance of plants and firms in which they operate is by no means a straightforward exercise. The effects of unions will be likely to vary from one situation to another and are a function of a great many economic, social and political variables. Naturally an econometric study cannot analyse all these and only a sub-set of these variables can be controlled for in any one piece of empirical work. This thesis has used econometric techniques to ascertain the impact of union presence on productivity, profitability and related it to the incidence of performance linked pay schemes operating in British workplaces in the early 1980's. The main finding is that trade unions certainly exert a significant influence on the production operations, methods of worker payment and financial performance of plants and companies in Britain.

The main conclusion reached in Chapter 3 was that the union impact on productivity varies considerably with the characteristics of the firms where unions are present. Using an index of union presence based on several indicators of union strength, the average union non-union effect on labour productivity in a sample of 52 engineering firms between 1978 and 1982 was estimated to be statistically insignificant. However, in just over 40% of firms in the sample individual union effects were observed to be statistically important. In particular, negative effects were found in relatively large firms whilst in small firms the union impact was largely innocuous. This confirms that different firms have different experiences regarding the way that unions affect the production process.

Chapters 4 and 5 provided complementary evidence from two independent data sources to show that trade unions reduce financial performance to a significant degree : in both cases the ability of unions to extract a share of economic rents thereby reducing profitability was observed to be more marked in situations where there exists a greater ability to earn monopoly profits. Hence, trade unions can be seen as a moderating influence which limits the ability of oligopolistic

producers to earn excessive profits. Chapter 4 used accounting data at the level of the firm to reach this conclusion whilst Chapter 5 used qualitative information on financial performance from plant level data to obtain similar results. Given the debate regarding the appropriate way to measure profitability it is reassuring that the same qualitative conclusions emerge from two very different performance measures derived from two very different samples.

Having considered the union impact on profitability and productivity Chapter 6 addressed the relationship between the incidence of performance linked payment methods and union presence. The empirical work using plant level data from 1984 showed that unionised plants are on the whole more likely to operate share ownership and profit sharing schemes but that stronger unions are able to oppose re-definitions of payment methods so that in plants with closed shops these schemes are no more likely to be present than in non-union plants.

The empirical analysis reported here therefore finds that the presence of trade unions is intrinsically linked to the way in which production is conducted and can significantly alter the performance of plants and firms relative to the case in which they are not present. It is of considerable interest that even in the 1980's, where legislative measures and recession are often said to have weakened union power, significant effects have been observed. Evidence on wage differentials also suggests that, where unions exist, the pay premiums they can achieve compared to non-union situations have changed little through the early 1980's (see Stewart's(1987c) comparison of estimates between 1980 and 1984). Rather than weakened union presence it might therefore be that the 1980's has seen a concentration of union power in those areas where unions have traditionally been strong so that in these areas their economic effects remain important. Witness the growth in union merger activity that has occurred in the 1980's, a union response often observed in times of recession and an unfavourable legislative climate as a means of 're-grouping' so as to maintain strength (see Waddington(1987)). In the service industries however newly set-up firms are predominantly non-union and it has proved difficult for unions to make inroads into these industries. This highlights one potential shortcoming of the data used in this thesis as it mostly refers to manufacturing which has traditionally been a stronghold for union activity. It would be of considerable interest to see how unions affect the performance of non-manufacturing firms

although this is clearly beyond the scope of the work presented here.

It should also be noted that as most of the work in this thesis is based on cross-section data it is static in nature and as such more dynamic issues, such as the impact of unions on productivity growth or the dynamics of profitability, are not considered. Indeed, on this point, certain U.S. studies have found very different results regarding productivity growth compared with the impact on productivity levels derived from cross-section data (for an example see Hirsch and Link(1984)). Consideration of dynamic issues should be placed on the agenda for future research although at present the lack of longitudinal data on trade union activity at the micro-level provides a major constraint.[1]

Also worthy of future consideration are several issues which lurk in the background of the analysis reported here. One such issue is how trade unions influence the investment strategies of firms : this clearly may play a part in explaining the union profit effects reported in Chapters 4 and 5 of this thesis. It may also shed some light on the longer term consequences of union activity. Related here, and also to the union impact on productivity, is the adoption of new technology, a subject which has generated controversy among industrial relations experts and economists alike as trade unions have often been pinpointed as acting as a barrier to the introduction of new technology at workplaces. Daniel(1987) provides descriptive evidence to counter this view although very little economic work has addressed this issue in any detail.[2] The economic effects that profit sharing has in union and non-union situations also needs to be addressed more fully. Some of the work in Chapters 3 and 6 sheds some light on this although, given the large number of British workplaces now operating sharing schemes, further work needs to be undertaken.

The increased appeal of encouraging employee involvement in the operations of the firm

---

[1] Although Denny and Muellbauer(1988) have attempted to conduct such an exercise between 1980 and 1984 using aggregate industry level value added data supplemented by data from the Workplace Industrial Relations Surveys of those two years. Also, industry level work analysing this could be possible using Census of Production productivity data in conjunction with union coverage data from the 1973, 1978 and 1985 New Earnings Surveys.

[2] Although a great body of industrial relations research on the subject exists. For a theoretical economic model analysing the uptake of new technology and unions see Taubman and Weiss(1987).

running through Britain in the early 1980's also underlies a number of the results presented here. Whether this manifests itself in a cosmetic or genuine manner is an issue and one that is not resolved in the context of this thesis, which only considers one mild form of involvement, namely sharing arrangements for pay. Other forms such as quality circles and briefing groups are worthy of consideration, especially in the presence of the more compliant industrial relations system characterising British collective bargaining in the 1980's (see Metcalf(1988)).

A general theme running through the Chapters of this thesis is that recognition of the institutional features of unions and the organisational features of firms is of some importance in isolating the union impact on performance. Hence, industrial relations and industrial organisation notions are considered complementary to the labour economics base from which the analysis sets out. Much has been made of the link between industrial relations and economics recently often emphasising the lack of communication between the two fields (see Oswald(1987b), Stewart(1986) and Turnbull(1988) for differing views on the subject). Nevertheless, again despite data difficulties in this regard, the analysis reported here recognises this potentially important link.

Finally, in conclusion, it is worth re-iterating the contributions made by the work in this thesis. In an area where data difficulties are severe and where a firm theoretical underpinning is hard to form, this thesis has taken the issue of how union activity is related to performance and fitted econometric models using micro-economic data to analyse the way in which unions affect productivity, profitability and the incidence of performance linked pay schemes in Britain. A number of interesting conclusions have emerged and, as very little work has to date analysed these issues in Britain, it is hoped that the work contained herein has contributed to a better understanding of the economic consequences of trade unionism in Britain in the early 1980's.

APPENDIX 1.

Description of Data Sources.

Chapter 3 : Data Description.

The data used in Chapter 3 is kindly provided by John Cable and Nick Wilson from ESRC project F0023021 on Work Organisation, Participation and Economic Performance in British firms. This is a detailed survey of firms operating in British engineering over the period 1978-82. The survey initially covered 87 firms located mainly in the West Midlands and West Yorkshire and reduces to 52 which have complete data over the five years. The nature of the data is such that information on performance related variables is available for all five years but that information on the structural characteristics of the firm is only available as a single observation.

The measure of productivity used is value added per employee where value added is defined as sales less material costs and is deflated by a 2-digit industry level price index which varies annually (Source : Monthly Digest of Statistics). The number of employees is the total number of employees (i.e. manual and non-manual employees) in the firm.

The data set is essentially self-contained so that the source for the variables is the same. The sample selection is simply to use the data on all 52 firms. The means of the independent variables used in the analysis are reported in Table A3.1. Descriptions are now given :

(a) Capital to labour ratio (K/L) : K is defined as fixed assets as reported in the company accounts. It is deflated by an annual price index (1980=1) for fixed assets (provided by Nick Wilson). L is the total number of employees in the firm.

(b) Profit sharing bonus (BONUS) : the average percentage of gross pay which is paid as a profit sharing or value added bonus.

(c) Dominant mode of production : denoted by two dummy variables indicating whether the main method of production is by job (JOB) or using flow lines (FLOW). The base group is production by batch.

TABLE A3.1.

Means of Variables Used in Chapter 3.					
Variable	All firms	INDEX≥0.5	INDEX<0.5	Closed shop	No closed shop
ln(K/L)	8.189	8.135	8.233	8.228	8.154
L≥1000	0.273	0.470	0.117***	0.344	0.207***
BONUS	2.199	2.630	1.857*	2.960	1.494***
JOB	0.115	0.044	0.172***	0.040	0.185***
FLOW	0.038	0.044	0.035	0.040	0.037
SKILL	0.559	0.565	0.554	0.564	0.555
UNION	0.784	0.935	0.664***	0.981	0.601***
CLOSED	0.481	0.739	0.276***	1.000	0.000
NSHOP	0.481	0.913	0.138***	0.600	0.370***
NSTAFF	0.404	0.739	0.000***	0.440	0.370***
INDEX	0.507	0.824	0.255***	0.718	0.311***

Notes.

(i) Variable descriptions are given in the text of the Data Appendix.

(ii) Significant differences between sub-groups of union presence are denoted by *, ** and *** for 1%, 5% and 10% significance levels respectively.

(d) Skill ratio (SKILL) : the proportion of the manual workforce classified as skilled.

(e) Union density (UNION) : the number of union members divided by total employment.

(f) Closed shop (CLOSED) : a dummy variable indicating whether the firm has any closed shop arrangements.

(g) Multiple unionism : denoted by two dummy variables indicating whether the firm has more than one union for manual workers (NSHOP) or non-manual workers (NSTAFF).

As remarked in Chapter 3 the sample comprises of a number of highly unionised firms and does not contain any information on union recognition. Therefore a union presence index was constructed using the four indicators UNION, CLOSED, NSHOP and NSTAFF. This Appendix gives more detail on its construction than does Chapter 3.

Let the four indicators be denoted v_k (k = 1 to 4). An index can be defined $V = \sum_{k=1}^{4} \phi_k v_k$ where the weights are denoted ϕ_k. Construction of these weights is the difficulty and is done by using the weights of the first principal component of the variance covariance matrix of the indicators $\Psi = v_k' v_k$. The data is not standardised as is sometimes the case and hence the covariance matrix is used in preference to the correlation matrix. This is because use of the correlation matrix imposes equal weights on each of the components (i.e. all have unit variance) which, in this case, effectively defeats the purpose of the exercise (see Chatfield and Collins(1980)). The first principal component of Ψ is $V = \sum_{k=1}^{4} \phi_k v_k$ and ϕ_k is calculated as the (4x1) eigenvector of Ψ corresponding to its largest eigenvalue λ_1. V is therefore the linear function of the 4 indicators which has maximum variance. The variation accounted for by the first principal component can be defined $\lambda_1 / \sum_{k=1}^{4} \lambda_k$, λ_k being the kth eigenvalue of Ψ. To ensure that the index V is bounded by 0 and 1 it is scaled such that $\sum_{k=1}^{4} \phi_k = 1$. This measure of unionisation is therefore used in Chapter 3 to compare and contrast with the results using the closed shop dummy alone.

Chapter 4 : Data Description.

The data used in Chapter 4 is derived from the Datastream and Exstat databanks of company accounts and linked to data obtained from independent surveys by myself and Sushil Wadhwani conducted in the summer of 1987. Thus the data description given here is split into two sections, each outlining the nature of the data and their sources and, where relevant, their method of construction.

1. Company accounts data.

(i) Firm level variables.

(a) Profitability (π/S) : defined as the ratio of trading profits to sales. Trading profits is defined as income including depreciation, interest expenses and taxation. The source of the trading profit margin is Datastream item 711.

(b) Capital intensity (K/S) : defined as the ratio of net fixed assets to sales. Net fixed assets is item 339 from Datastream. Sales is total sales/turnover and is item C31 from Exstat.

(c) Age proxy (YEARS) : number of years since first account appeared on the Exstat databank. Derived from item B2 on Exstat which gives the date of the first account.

(d) Absolute size (SIZE) : total sales in £million in 1984 prices.

(ii) Industry level variables.

To introduce industry variables it was first necessary to allocate each firm to an operating industry. Hence the fact that a number of firms operate in several markets/industries complicates matters. Datastream gives a breakdown of sales by main product groups and this information was used to construct a set of weights to allow for diversification.[1]

For example, if a firm operates in 2 markets and makes 80% of its sales in market 1 and 20% in market 2 then the weights $w_1 = 0.8$ and $w_2 = 0.2$ can be defined. Thus an industry variable

[1] Each product group is generally allocated by Datastream to a 2 or 3 digit SIC industry. The Datastream allocations were generally adhered to although in some cases some inaccuracies seemed present and firms were re-allocated to more appropriate industries where considered relevant.

X which takes values X_1 in market 1 and X_2 in market 2 can be allocated to this firm as $0.8\,X_1 + 0.2\,X_2$. More generally a firm operating in N industries would be allocated a value of X equal to $\sum_{i=1}^{N} w_i X_i$.[2]

The following industry level variables (with respective sources) were allocated to firms in this way :

(a) Industry sales : Source - Census of Production Summary Tables, 1984 and 1985.

This was used to construct the market share variable (MS) defined as firm sales/industry sales.

(b) Industry concentration (CONC) = proportion of industry sales accounted for by largest 5 firms in a given industry : Source - Census of Production Summary Tables, 1984 and 1985.

(c) Industry cost disadvantage ratio (CX) = ratio of sales per employee in small plants (<100 employees) to sales per employee in larger plants (≥ 100 employees) in a given industry. Source : Census of Production Summary Tables, 1984 and 1985. In the empirical work this is modelled as a dummy variable (CDR) defined equal to one if CX<0.87 (see Chapter 4).

(d) Industry growth (GROWTH) = (Industry sales in 1984/1985 - Industry sales in 1979/1980) divided by Industry sales in 1979/1980. Source : Census of Production Summary Tables, 1980, 1984 and 1985.

(e) Import penetration (IMPS) = Industry imports divided by Domestic sales where Domestic sales is (Industry sales+Industry imports-Industry exports). Source : Business Monitor Publication 'Import penetration and export sales ratios for manufacturing industry'.

(f) Export intensity (EXPS) = Industry exports divided by industry sales. Source : Business Monitor Publication 'Import penetration and export sales ratios for manufacturing industry'.

(g) Industry union coverage (COVER) - proportion of male manual workers covered by collective bargaining agreements in 1985. Source : New Earnings Survey 1985.

---

[2] Slight practical problems emerged because some firms' sales figures included inter-company sales and what were termed 'other' sales by Datastream. These were excluded in the construction of weights although total sales figures including these components were used elsewhere.

TABLE A4.1

Means of Variables Used in Chapter 4.			
Variable	All Firms	Unions Recognised	Unions not Recognised
IT/S	0.094	0.091	0.108*
K/S	0.285	0.297	0.235**
MS	0.077	0.093	0.012***
YEARS	10.797	11.603	7.429***
SIZE	357.3	438.6	17.5***
CONC	0.362	0.353	0.398
CDR	0.572	0.556	0.643*
GROWTH	0.397	0.356	0.571***
IMPS	0.334	0.312	0.426***
EXPS	0.308	0.291	0.377***
COVER	0.642	0.662	0.558***
RECOG	0.807	1.000	0.000
ALLREC	0.538	0.667	0.000
SOMEREC	0.269	0.333	0.000
N	290	234	56

Notes.

(i) Variable descriptions are given in the text of the Data Appendix.

(ii) For the variables other than the union variables a significant difference between firms with and without union recognition is denoted by ***, ** and * for 1%, 5% and 10% significance levels respectively.

2. *Survey data.*

In the summer of 1987 questionnaires asking about union related issues were sent to 499 firms identified as being in the Datastream databank in 1985 and whose activities were in manufacturing industry.[3] The actual questionnaire is in Appendix 2. The first wave of questionnaires generated 71 responses and the second, sent out some three months after the first, elicited a further 34. This gave some 105 usable questionnaires, most of which contained complete information. More or less at the same time Sushil Wadhwani carried out a similar survey asking Datastream companies questions about union status and pay bargaining. Certain questions coincide from the two surveys.

The information obtained from my survey was asked for two years (1985 and 1987) and yielded details for manual and non-manual workers on trade union recognition, the extent of the closed shop, union membership and coverage by collective bargaining. Information was also asked regarding the number of shop stewards and on the incidence of combine committees. Finally some subjective material on any changes in the way the company deals with union related issues that occurred between 1985 and 1987 was also obtained.

The survey by Wadhwani also asked questions for manual and non-manual employees and on union recognition and coverage, although as the focus was on pay bargaining, did not ask questions on the closed shop or other institutional arrangements. To gain in sample size some sacrifices therefore have to be made regarding the detail of union information available. Thus when the two surveys are pooled together the measure of union presence adopted is whether unions are recognised for collective bargaining purposes (RECOG). Additionally two mutually exclusive variables were defined : ALLREC = 1 if unions are recognised for manual and non-manual employees ; SOMEREC = 1 if unions are recognised only for one of these two groups.

[3] This includes a number of oil companies so strictly speaking the definition should cover the whole of the production industries.

Sample Selection Criterion.

The following conditions were specified to generate the sample used in Chapter 4 :

(i) Firms' accounts must have been recorded on the Exstat or Datastream databanks for 1983-1985 inclusive.

(ii) Firms must have no missing industry variables.

(iii) Recent additions to the sample were carefully scrutinised to be not as a result of takeover or merger activity (checked using information in the Stock Exchange Quarterly report).

Chapter 5 : Data Description.

Two Workplace Industrial Relations Surveys have been carried out in the early 1980's under the supervision of the Economic and Social Research Council, the Department of Employment, the Policy Studies Institute and, in the case of the second survey, the Advisory Conciliation and Arbitration Service. The first survey was conducted in 1980 and the second in 1984. The two surveys are respectively surveys of 2040 and 2019 British establishments with 25 or more employees. The 1980 survey was based on the sampling frame of the 1977 Census of Employment and the 1984 survey on the 1981 Census of Employment. Large establishments were deliberately oversampled to guarantee their presence in the sample and a weighting system exists to allow for this. In each survey, interviews were undertaken with a senior manager, worker representatives and, where appropriate, with a production works manager. The results presented in this thesis use data from interviews with the manager responsible for industrial relations. More details on the nature of the surveys not covered in this brief description can be found in Daniel and Millward(1983) for the 1980 survey and in Millward and Stevens(1986) for the 1984 survey and for comparisons between 1980 and 1984.

In Chapter 5 the dependent variable used is the response to the question

How would you assess the financial performance of this works compared with other establishments in the same industry ? Would you say it was

better than average

below average

or about average ?

In 1984 an additional question asked

Is that a lot better (below) or a little better (below) ?

This generates three ordered categories for 1980 and five for 1984. The question was asked

only for private sector establishments. The number of plants answering each category were :

TABLE A5.1.

Number of Plants in Each Financial Performance Category 1980 and 1984.				
	1980		1984	
	All	Sample used in Chapter 5	All	Sample used in Chapter 5
Better than average	549(534)	299(206)	519(541)	237(180)
About average	540(535)	276(194)	485(534)	223(160)
Below average	83(66)	48(33)	88(77)	51(36)
Missing	292(297)	-	293(222)	-
No. of plants	1464(1432)	623(432)	1385(1373)	511(376)

Notes.
(i) Numbers in parentheses are weighted frequencies.

In the 1984 survey the 607 plants in the overall sample and the 288 plants in the sample used in Chapter 5 who answered above or below were then asked the follow up question. This gave the following frequencies

TABLE A5.2.

Responses to Additional Financial Performance Question 1984.		
	1984	
	All	Sample used in Chapter 5.
Lot better/below	278(309)	121(146)
Little better/below	314(298)	159(143)
Missing	15(10)	8(3)
No. of plants	607(618)	288(216)

Notes.
(i) Numbers in parentheses are weighted frequencies.

The explanatory variables used in Chapter 5 are mostly drawn from the two surveys although as each establishment is also allocated to a 3-digit SIC industry this permits augmentation by certain industry level variables. As most industry level variables are only available for manufacturing the initial analysis confined itself to manufacturing. Brief descriptions of the variables used are now given. Their weighted means are reported in Table A5.3, for the two samples used in each year.

(i) Establishment level variables.

(a) Demand for the establishment's product. This is a response to the question

Over the past twelve months, would you say that demand for the main products or services of this establishment has been

Rising

Falling

Neither ?

The variable used to model favourable demand conditions (DRISE) is a dummy variable equal to one if the respondent said demand was rising. The base category was the other two categories.

(b) Capital investment. In 1980 the following question was asked

In the recent past, say the last 2-3 years, has capital investment in the establishment been

Increasing

Falling

Stable ?

A variable (IRISE) was defined equal to one if respondents answered increasing and zero otherwise. This question was not asked on the basic management questionnaire in 1984.

(c) Capacity utilisation - In 1984 managers were asked

In relation to current plant and equipment, would you say that this establishment is working

At full capacity

Somewhat below full capacity

Or considerably below full capacity ?

A variable (FULLCAP) was defined equal to one if respondents answered that their plant was operating at full capacity and zero otherwise.

(d) Market share : defined as MS=number of employees/industry employment. A relative market share variable (HMS) was defined equal to one for the top 30% of the MS distribution in manufacturing.

(e) Unionisation variables : the basic measure is a dummy variable (RECOG) equal to unity if unions are recognised for bargaining purposes for manual employees. The sequence used to ask the question on recognition in the 1980 and 1984 surveys involves asking the following two questions :

You say that there are ---- manual employees here. Are any of them members of a union ?

Yes

No

No information available - company policy

Don't know ?

If the answer is Yes.

Are any unions recognised by management for negotiating pay and conditions for any sector or sections of the manual workforce in this establishment ?

Yes

No ?

TABLE A5.3

Weighted Means of Explanatory Variables used in Chapter 5.				
	Weighted Means			
	Manufacturing		All industries	
Variable	1980	1984	1980	1984
DRISE	0.317	0.554	0.413	0.599
IRISE	0.618	-	0.578	-
FULLCAP	-	0.414	-	0.495
HMS	0.082	0.070	0.039	0.031
RECOG	0.637	0.544	0.473	0.422
PRE	0.081	0.096	0.046	0.053
PCM	0.264	0.293	-	-
CONC	0.327	0.299	-	-
COVER	0.740	0.640	-	-
N	623	511	984	916

Notes.

(i) Variable descriptions are given in the text of the Data Appendix.

By design then any plants without manual workers are omitted from the questioning and are treated as missing values. As such they are left out of the empirical work in Chapter 5.

Information is given on the extent of closed shop arrangements and thus a second union variable to be considered is a dummy variable (PRE) equal to one if any manual workers are in a pre-entry closed shop. This is indicated by an affirmative answer to both the questions

Do the manual workers at this establishment normally have to be members of a union to have or to keep their jobs

Yes, all

Yes, some

No ?

If the answer is Yes, all or Yes, some

Do recruits for any of the jobs covered by this closed shop arrangement, have to be union members before starting work ?

Yes, all

Yes, some

No ?

(ii) Industry level variables.

Each plant is allocated to a 3-digit operating industry. It can therefore be allocated industry average values of certain variables. The ones considered here are

(a) Price-cost margins (PCM) - defined as (Net output-Operative wage bill-Net capital expenditure) divided by Gross output. The source of each industry level variable is the 1980 or 1984 Census of Production.

(b) Industrial concentration (CONC) - defined as the proportion of sales accounted for by the 5 largest firms in a given industry. Source - 1980/1984 Census of Production.

(c) Industry unionisation (COVER) - proportion of male manual employees in the 3-digit industry who are covered by collective bargaining arrangements. The source is the 1978 New Earnings Survey for 1980 and the 1985 New Earnings Survey for 1984.

Sample Selection Criterion.

The following conditions were specified to generate the sample used in Chapter 5 :

(i) Plants with missing values on the dependent or independent variables were deleted.

(ii) Analysis was confined to private sector establishments.

(iii) Most (although not all) of the analysis was confined to plants operating in manufacturing (i.e. SIC codes 200-499).

Chapter 6 : Data Description.

The Workplace Industrial Relations Survey of 1984 is accessed for the empirical evaluation of the incidence of sharing schemes in Chapter 6. In Chapter 6 the dependent variable used is the response to the question

Does (the company/organisation that owns) this establishment operate any of the following schemes for any of the employees here ?

A share ownership or share option scheme ?

A profit sharing scheme ?

A value added bonus scheme ?

The question was asked for all establishments. The distribution of schemes across the sample is indicated as follows :

TABLE A6.1

Number of Plants with Sharing Arrangements in 1984		
	All	Sample used
Share ownership	344(263)	293(212)
Profit sharing	254(248)	216(197)
Value added	150(192)	116(144)
Missing	52(33)	-
No. of plants	2019(2000)	1001(1094)

Notes.
(i) Numbers in parentheses are weighted frequencies.
(ii) Share ownership schemes do not include those that are available for management levels only.

Three dummy variable indicating the existence or otherwise of a share ownership, profit sharing or value added scheme were then used as dependent variables in Chapter 6.

The 1984 Survey gives details on a number of characteristics of both the plant and the organisation which owns the plant. It also allocates each plant to a 3-digit industry. Thus the explanatory variables used were organisation, industry and establishment characteristics.

Weighted means of the variables are reported in Table A6.2. Descriptions of the variables and their sources are now given.

(i) Organisation variables.

(a) Organisation size (*OSIZE*) is available as a banded variable of the form $\alpha^L < OSIZE \leq \alpha^U$ where α^L and α^U are respectively lower and upper cut-off points. A number of cut-off points are available : 100, 200, 500, 1000, 2000, 5000, 10000, 50000, 100000 employees. The lower limit is 25 as the smallest establishment in the survey has 25 employees and the upper limit is open-ended. For reasons of parsimony three dummies are defined, the cut-offs being 500, 10000 and 50000 respectively. The base group is thus establishments in organisations with less than 500 employees.

(b) Release of financial information : a dummy variable (FINORGA) is created if management gives a lot of information to employees regarding the financial position of the organisation. The exact question asked was

Does management consult with employees or their representatives about the financial position of your organisation as a whole ?

Yes, a lot

Yes, a little

No.

FINORGA was defined equal to one for the 'Yes, a lot' respondents and the relevant base is the other categories.

(c) Ownership : managers were asked the question

Is the (parent) company UK owned or is ownership outside the UK ?

UK owned/controlled

50/50 UK and foreign ownership

Owned/controlled outside UK

TABLE A6.2

Weighted Means of Variables Used in Chapter 6.				
	All establishments	No unions recognised	No closed shop, unions recognised	Closed shop
500≤OSIZE<10000	0.274	0.205	0.347	0.354
10000≤OSIZE<50000	0.108	0.066	0.142	0.167
OSIZE≥50000	0.085	0.045	0.128	0.124
FINORGA	0.233	0.158	0.313	0.314
FOREIGN	0.090	0.078	0.087	0.149
GROWTH	-0.039	-0.021	-0.053	-0.077
MPROP	0.506	0.460	0.511	0.669
JCC	0.246	0.175	0.288	0.409
EMPLOY	93.95	62.87	108.6	175.9

Notes.

(1) Variable descriptions are given in the text of the Data Appendix.

TABLE A6.3

Industrial Distribution of Sharing Schemes				
	No. of Plants	Share Ownership	Profit Sharing	Value Added
All Industries	1001(1004)	0.293(0.212)	0.216(0.197)	0.116(0.144)
Energy	8(9)	0.250(0.386)	0.125(0.007)	0.000(0.000)
Mineral Extraction, Metal Manufacture & Chemicals	105(74)	0.276(0.103)	0.295(0.341)	0.133(0.156)
Metal Goods, Engineering & Vehicles	230(128)	0.357(0.152)	0.143(0.118)	0.122(0.106)
Other Manufacturing	228(185)	0.234(0.109)	0.132(0.137)	0.079(0.150)
Construction	44(65)	0.182(0.147)	0.205(0.205)	0.250(0.249)
Distribution, Hotels & Catering	225(338)	0.351(0.256)	0.253(0.176)	0.138(0.193)
Transport & Communication	39(59)	0.282(0.143)	0.179(0.112)	0.103(0.091)
Banking & Finance	136(211)	0.397(0.423)	0.434(0.396)	0.088(0.086)
Other Services	80(106)	0.150(0.117)	0.100(0.061)	0.075(0.061)

Notes.

(i) The sample is that used in the empirical work in Chapter 6.

(ii) Weighted frequencies and proportions are in parentheses.

A dummy variable (FOREIGN) was defined equal to one if the response is yes to either 50% or 100% foreign ownership.

(ii) Industry variables.

(a) Industry growth : each firm was allocated its 3-digit industry employment level and a variable (GROWTH) was defined as the growth in industry level employment - (Industry employment in 1984 - Industry employment in 1980) divided by Industry level employment in 1980.

(iii) Establishment level variables.

(a) Occupational composition of workforce : a variable (MPROP) was defined as the proportion of manual workers in the establishment. The definition of manual or non-manual is as follows. Non-manual occupations are defined as managerial, professional or clerical jobs. These include jobs involving selling but exclude security service occupations. Those occupations not falling into the non-manual category are therefore treated as manual (Source of definition - ESRC Data Archive Documentation).

(b) Consultative committees : a variable (JCC) was defined equal to one for those plants which answered positively to the question

Apart from Health and Safety Committees, do you have any joint committees of managers and employees, primarily concerned with consultation rather than negotiation ?

Yes

No.

(c) Establishment size : simply defined as the total number of employees in the establishment (EMPLOY).

(d) Unionisation variables : in this Chapter the basic union recognition variable refers to recognition among manual or non-manual employees. It is thus directly comparable to the measure used in Chapter 5 except that it is taken from both manual and non-manual parts of the questionnaire. If plants have recognition for any workers and no closed shop arrangements a dummy variable

(UNION) is set equal to one. If plants have closed shop arrangements for manuals or non-manuals a dummy variable (CLOSED) is set to unity. Thus the relevant base group for comparison is plants which do not recognise either manual or non-manual unions.

Sample Selection Criterion.

The following conditions were specified to generate the sample used in Chapter 6 :

(i) Plants with missing values on the dependent or independent variables were deleted.

(ii) Analysis was confined to private sector establishments.

APPENDIX 2.

Survey Questionnaire.

ENTERPRISE LEVEL INDUSTRIAL RELATIONS SURVEY

SECTION 1

BACKGROUND

1. How many establishments with 25 or more employees does this enterprise have in the U.K. ?

Number in 1985 _____ Number in 1987 _____

2. Have there been any changes in the major business activities of the enterprise since 1980?

Yes _____

No _____

If yes give details and state when changes occurred _____

_____

SECTION 2

UNION RECOGNITION : MANUAL WORKERS

3. How many manual workers are there in total (full and part-time) within this enterprise?

Number in 1985 _____ Number in 1987 _____

4. What percentage (to the nearest 5%) of manual workers employed in the enterprise are members of a union?

_____ percent of the manual workforce were union members in 1985.

_____ percent of the manual workforce are union members in 1987.

5. What percentage of the manual workforce are paid wage rates which are set by collective bargaining between unions and management ?

_____ percent in 1985. _____ percent in 1987.

6. Are any unions recognised for negotiating the pay and conditions of any of the manual workers at the establishments in the enterprise ?

In 1985 Yes _____ In 1987 Yes _____

No _____ No _____

If the answer is yes in question 6.

7. Are manual unions recognised for negotiation in ALL establishments in which there are manual workers or only in some ?

In 1985 All _____ In 1987 All _____

Some _____ Some _____

8. Is there a closed shop for any manual workers in any of the establishments of the enterprise?

In 1985 Yes _____ In 1987 Yes _____

No _____ No _____

If the answer to 8 is Yes

9. Is there a closed shop in for the majority of manual workers in ALL the establishments of the enterprise ?

In 1985 Yes _____ In 1987 Yes _____

No _____ No _____

SECTION 3

UNION RECOGNITION : NON-MANUAL WORKERS

10. How many non-manual workers are there in total (full and part-time) within this enterprise?

Number in 1985 _____ Number in 1987 _____

11. What percentage of non-manual workers (to the nearest 5%) employed in the enterprise are members of a union ?

_____ percent of the non-manual workforce were union members in 1985.

_____ percent of the non-manual workforce are union members in 1987.

12. What percentage of the non-manual workforce are paid wage rates which are set by collective bargaining between unions and management ?

_____ percent in 1985. _____ percent in 1987.

13. Are any unions recognised for negotiating the pay and conditions of any of the non-manual workers at the establishments in the enterprise ?

In 1985 Yes _____ In 1987 Yes _____

No _____ No _____

If the answer to question 13 is yes.

14. Are non-manual unions recognised for negotiation in ALL establishments in which there are non-manual workers or only in some ?

In 1985 All _____ In 1987 All _____

Some _____ Some _____

15. Is there a closed shop for any non-manual workers in any of the establishments of the enterprise ?

In 1985 Yes _____ In 1987 Yes _____

No _____ No _____

If the answer to 15 is Yes

16. Is there a closed shop for the majority of non-manual workers in ALL the establishments of the enterprise ?

In 1985 Yes _____ In 1987 Yes _____

No _____ No _____

SECTION 4

ENTERPRISE UNIONISM

17. How many full time shop stewards are there in the establishments in this enterprise ?

Number in 1985 _____ Number in 1987 _____

18. Has there been any change since 1980 in the way in which the enterprise deals with unions for manual and/or non-manual workers ?

Yes _____

No _____

If Yes

19. In what areas have these changes occurred ?

(a)Union recognition Year of change _____

(b)Shop steward facilities Year of change _____

(c)Number of shop stewards Year of change _____

(d)Others areas (describe and state year of change)_____

_____

20. Do meetings occur between stewards/union representatives from different establishments within this enterprise ?

In 1985 Yes _____ In 1987 Yes _____

No _____ No _____

Thank you for your cooperation.

ENTERPRISE LEVEL INDUSTRIAL RELATIONS SURVEY

CONFIDENTIALITY STATEMENT

(i) The anonymity of the information provided by respondents will be preserved at all times.

(ii) Each questionnaire has a code number for administrative purposes although this number will be kept separate from the data and will remain confidential to the survey coordinators.

(iii) Questionnaires and data placed on the computer will not at any time include the names and addresses of respondents or their companies.

(iv) No individuals or companies will be identified or identifiable in any subsequent research conducted on the data.

(v) Any published work utilising the survey information will not make any reference to cooperating companies.

BIBLIOGRAPHY.

ACAS(1987) Advisory Conciliation and Arbitration Service Annual Report.

Abowd,J.M.(1987) Collective bargaining and the division of the value of the enterprise, Princeton University Industrial Relations Section Working Paper No. 218.

Abowd,J.M. and Farber,H.S.(1988) Product market competition and union organising activity : preliminary results, Princeton University mimeo.

Addison,J.T.(1984) Trade unions and restrictive practices, in J.J.Rosa(ed.) 'The economics of trade unions : new directions', Kluwer-Nijhoff publishing, pp.83-114.

Allen,S.G.(1984) Unionised constructors are more productive, Quarterly Journal of Economics, 99, pp.251-74.

Allen,S.G(1986a) Unionisation and productivity in office building and school construction, Industrial and Labor Relations Review, 39, pp.187-202.

Allen,S.G.(1986b) Union work rules and efficiency in the building trades, Journal of Labor Economics, 4, pp.212-42.

Amemiya,T.(1981) Qualitative response models : a survey, Journal of Economic Literature, 19, pp.1483-1536.

Amemiya,T.(1985) Advanced econometrics, Basil Blackwells, Oxford.

Andrews,M. and Harrison,A.(1988) Testing for efficient contracts in unionised labour markets, University of Manchester mimeo.

Aoki,M.(1984) The cooperative game theory of the firm, Oxford University Press.

Batstone,E.(1988) The reform of workplace industrial relations : theory, myth and evidence, Oxford University Press.

Bean,C. and Turnbull,P.(1987) Employment in the British coal industry : a test of the labour demand model, Centre for Labour Economics Discussion Paper No. 274.

Benston,G.(1985) The validity of profits-structure studies with particular reference to the FTC's line of business data, American Economic Review, 75, pp.37-67.

Berndt,E.R., Hall,B.H., Hall,R.E. and Hausman,J.A.(1974) Estimation and inference in nonlinear structural models, Annals of Economic and Social Measurement ,3, pp.653-66.

Blanchflower,D.(1986a) What effects do unions have on relative wages, British Journal of Industrial Relations, 24, pp.195-204.

Blanchflower,D.(1986b) Wages and concentration in British manufacturing, Applied Economics, 18, pp.1025-38.

Blanchflower,D. and Oswald,A.J.(1987a) Shares for employees : a test of their effects, Centre for Labour Economics Discussion Paper No.273.

Blanchflower,D. and Oswald,A.J.(1987b) Profit-related pay : prose discovered, Centre for Labour Economics Discussion Paper No.287.

Booth,A. and Chatterji,M.(1988) A survey of trade union models with endogenous membership, Paper presented to EMRU Labour Economics Workshop, Swansea, March 28-30.

Bradley,K. and Estrin,S.(1987) Profit sharing in the retail trade sector : the relative performance of the John Lewis Partnership, Centre for Labour Economics Discussion Paper No. 279.

Breusch,T.S. and Pagan,A.R.(1979) A simple test for heteroscedasticity and random coefficient variation, Econometrica, 47, pp.1287-94.

Brown,C. and Medoff,J.L.(1978) Trade unions in the production process, Journal of Political Economy, 86, pp.355-78

Brown,J.N. and Ashenfelter,O.(1986) Testing the efficiency of employment contracts, Journal of Political Economy, 94, Supplement, pp.40-87.

Brown,W.(1981) The changing contours of British Industrial Relations, Blackwells.

Brown,W.(1986) Comments, British Journal of Industrial Relations, 24, pp.208-9.

Cable,J.R.(1985) Some tests of employee participation indices, Warwick Economic Research Papers No.258.

Cable,J.R.(1987) Control, technology and the social efficiency of traditional production, Warwick Economic Research Papers No.279.

Cable,J.R. and Pitzroy,F.K.(1980) Productive efficiency, incentives and employee participation : a study of West German firms, Kyklos, 33, pp.100-22.

Cable,J.R. and Wilson,N.(1988) Profit-sharing, productivity and public policy, University of Warwick mimeo.

Carruth,A.A. and Oswald,A.J.(1985) Miners' wages in post war Britain : an application of models of trade union behaviour, Economic Journal, 95, pp.1003-1020.

Carruth,A.A., Oswald,A.J. and Findlay,L.(1986) A test of a model of trade union behaviour : the coal and steel industries in Britain, Oxford Bulletin of Economics and Statistics, 48, pp.1-18.

Caves,R.(1980) Productivity differences among industries, in Caves,R.E and Krause,L.B.(eds.) 'Britain's economic performance', Brooking's Institution, pp.135-92.

Chatfield,C. and Collins,A.J.(1980) Introduction to multivariate analysis, Chapman and Hall.

Chesher,A. and Irish,M.(1987) Residual analysis in the grouped and censored normal linear model, Journal of Econometrics, 34, pp.33-62.

Chesher,A. and Spady,R.(1988) Asymptotic expansions of the information matrix test statistic, University of Bristol Discussion Paper No.88/206.

Clark,K.B.(1980a) Unionisation and productivity : micro-econometric evidence, Quarterly Journal of Economics, 95, pp.613-39.

Clark,K.B.(1980b) The impact of unionisation on productivity : a case study, Industrial and Labor Relations Review, 33, pp. 451-469.

Clark,K.B.(1984) Unionisation and firm performance : the impact on profits, growth and productivity, American Economic Review, 74, pp.893-919.

Connolly,R.A., Hirsch,B.T. and Hirschey,M.(1986) Union rent seeking, intangible capital and market value of the firm, Review of Economnic and Statistics, 68, pp.567-77.

Conyon,M.(1988) An empirical investigation into income distribution, market structure and unionisation in U.K. manufacturing 1980-1984, University of Warwick mimeo.

Cowling,K.(1982) Monopoly capitalism, MacMillan Press.

Cowling,K. and Molho,I.(1982) Wage share, concentration and unionism, Manchester School, 50, pp.99-115.

Cowling,K. and Waterson,M.(1976) Price-cost margins and market structure, Economica, 43, pp.267-74.

Craypo,C.(1981) The decline of union bargaining power, in Carter,M.J. and Leahy,W.H. 'New directions in labor economics and industrial relations' ,University of Notre Dame Press, pp.107-66.

Daniel,W.W.(1987) Workplace industrial relations and technical change, Frapces Pinter and Policy Studies Institute.

Daniel,W.W. and Millward,N.(1983) Workplace industrial relations in Britain : the DE/PSI/ESRC survey, Heinemann Educational Books.

Davidson,R. and MacKinnon,J.G.(1988) A new form of the information matrix test for regression models, Queen's University mimeo.

Davies,S. and Caves,R.(1987) Britain's productivity gap, Cambridge University Press.

Denny,K. and Muellbauer,J.(1988) Economic and industrial relations explanations of productivity change : some evidence for the British manufacturing sector 1980-1984, University of Oxford mimeo.

Dixon,H.(1987) Unions, oligopoly and macroeconomic policy : a simple two-sector model, Birkbeck Discussion Paper No.87/5.

Dobb,M.(1928) Wages, Cambridge Economic Handbooks.

Domowitz,I., Hubbard,R.G. and Petersen,B.C.(1986) The intertemporal stability of the concentration-margins relationship, Journal of Industrial Economics, 35, pp.13-34.

Donovan Commission(1968) Royal Commission on trade unions and employers' associations, Report, Cmnd. 3623, London : HMSO.

Dowrick,S.(1985) Why employers prefer not to bargain over jobs, Warwick Economic Research Papers No.264.

Dowrick,S.(1987) Union-oligopoly bargaining : micro and macroeconomic implications, Australian National University Working Paper No.145.

Duncan,G.M. and Leigh,D.E.(1985) The endogeneity of union status : an empirical test, Journal of Labor Economics, 3, pp.385-403.

Dunlop,J.T.(1944) Wage determination under trade unions, MacMillan.

Edmonds,J.(1987) Maybe we will have a better society, Industrial Participation, No.595, pp.7-8.

Edwards,P.K.(1987) Managing the factory, Blackwells.

Edwards,P.K. and Scullion,H.(1982) The social organisation of industrial conflict : control and resistance in the workplace, Blackwells.

Estrin,S., Grout,P. and Wadhwani,S.(1987) Profit sharing and employee share ownership, Economic Policy, 4, pp.13-62.

Estrin,S. and Wilson,N.(1986) The micro-economic effects of profit sharing : the British experience, Centre for Labour Economics Discussion Paper No.247.

Faith,R.L. and Reid,J.D.(1987) An agency theory of unionism, Journal of Economic Behaviour and Organisation, 8, pp.39-60.

Fisher,F.M.(1987) On the misuse of the profit-sales ratio to infer monopoly power, Rand Journal of Economics, 18, pp.384-96.

Fisher,F.M. and McGowan,J.J.(1983) On the misuse of accounting rates of return to infer monopoly profits, American Economic Review, 73, pp.82.97.

Frantz,R.S.(1988) X-efficiency : theory, evidence and applications, Kluwer Academic Publishers.

Freeman,R.B.(1976) Individual mobility and union voice in the labour market, American Economic Review Papers and Proceedings, 66, pp.361-8.

Freeman,R.B.(1980a) The effect of unionism on worker attachment to firms, Journal of Labor Research, 1, pp.29-62.

Freeman,R.B.(1980b) The exit-voice trade-off in the labor market : unionism, job tenure, quits and separations, Quarterly Journal of Economics, 94, pp.643-74.

Freeman,R.B.(1983) Unionism, price-cost margins and the return to capital, National Bureau of Economic Research Working Paper No.1164.

Freeman,R.B. and Medoff,J.L.(1979) The two faces of unionism, Public Interest, 57, pp.69-93.

Freeman,R.B. and Medoff,J.L.(1982) Substitution between production labour and other inputs in unionized and non-unionized manufacturing, Review of Economics and Statistics, 64, pp.220-32.

Freeman,R.B. and Medoff,J.L.(1984) What do unions do ?, Basic Books.

Gale,B.T. and Branch,B.S.(1982) Concentration versus market share : which determines performance and why does it matter, The Antitrust Bulletin, 27, pp.83-106.

Geroski,P.A.(1981) Specification and testing the profits-concentration relationship for the UK, Economica, 48, pp.279-88.

Geroski,P.A.(1988) In pursuit of monopoly : recent quantitative work in industrial economics, Journal of Applied Econometrics, 3, pp.107-23.

Geroski,P.A. and Stewart,M.B.(1986) Specification-induced uncertainty in the estimation of trade union wage differentials from industry level data, Economica, 53, pp.29-39.

Gourieroux,C., Montfort,A., Renault,E. and Trognon,A.(1987) Generalised residuals, Journal of Econometrics, 34, pp.5-32.

Greene,W.H.(1985) LIMDEP, New York University.

Gregg,P.A. and Machin,S.J.(1988) Unions and the incidence of performance linked pay schemes in Britain, International Journal of Industrial Organisation, 6, pp.91-108.

Grout,P.A.(1984) Investment and wages in the absence of binding contracts : a Nash bargaining approach, Econometrica, 52, pp.449-60.

Hall,A.(1987) The information matrix test for the linear model, Review of Economic Studies, 54, pp.257-64.

Hart,O.(1983) Optimal contracts under asymmetric information : an introduction, Review of Economic Studies, 50, pp.3-35.

Hausman,J.A.(1978) Specification tests in econometrics, Econometrica, 46, pp.1251-72.

Hausman,J.A. and Taylor,W.E.(1981) Panel data and unobservable fixed effects, Econometrica, 49, pp.1377-98.

Henley,A.(1984) Collective bargaining structure, wage levels and the functional distribution of income, Warwick Economic Research Papers No.249.

Henley,A.(1987a) Trades unions, market concentration and income distribution in United States manufacturing industry, International Journal of Industrial Organisation, 5, pp.193-210.

Henley,A.(1987b) Unions, bargaining and profitability : evidence for the U.S. automobile industry, University of Kent Discussion Paper No. 87/9.

Hill,S.(1981) Competition and control at work, Heinemann.

Hirsch,B.T. and Addison,J.T.(1986) The economic analysis of unions : new approaches and evidence, Allen and Unwin.

Hirsch,B.T. and Connolly,R.A.(1987) Do unions capture monopoly profits ?, Industrial and Labor Relations Review, 41, pp.118-35.

Hirsch,B.T. and Link,A.N.(1984) Unions, productivity and productivity growth, Journal of Labor Research, 5, pp.29-37.

Hirsch,B.T. and Link,A.N.(1987) Labor union effects on innovative activity, Journal of Labor Research, 8, pp.322-32.

Hirschman,A.O.(1970) Exit, voice and loyalty, Harvard University Press.

Holt,C.C.(1970) Job search, Phillips' wage relation and union influence : theory and evidence ,in Phelps,E.S.(1970) 'Microeconomic foundations of employment and inflation theory', W.W. Norton & Co., pp.53-123.

Ichniowski,C.(1984) Ruling out productivity ? Labour contract pages and plant performance, National Bureau of Economic Research Working Paper No.1368.

Jackman,R.(1988) Profit-sharing in a unionized economy with imperfect competition, International Journal of Industrial Organisation, 6, pp.47-58.

Jolliffe,I.(1986) Principal component analysis, Springer Verlag.

Jones,D.C. and Svejnar,J.(1985) Participation, profit sharing, worker ownership and efficiency in Italian producer cooperatives, Economica, 52, pp.449-65.

Kalecki,M.(1971) Class struggle and the distribution of income, Kyklos, 24, pp.1-9.

Karier,T.(1985) Unions and monopoly profits, Review of Economics and Statistics, 67, pp.34-42.

Karier,T.(1988) New evidence on the effect of unions and imports on monopoly power, Journal of Post Keynesian Economics, 10, pp.414-27.

Katz,H.C., Kochan,T.A. and Gobeille,K.R.(1983) Industrial relations performance, economic performance and QWL programs : an interplant analysis, Industrial and Labor Relations Review, 37, pp.3-17.

Kay,J.A. and Mayer,C.P.(1986) On the application of accounting rates of return, Economic Journal, 96, pp.199-207.

Kiefer,N. and Salmon,M.(1983) Testing for normality in econometric models, Economics Letters, 11, pp.123-27.

Kmenta,J.(1967) On estimation of the CES production function, International Economic Review, 8, pp.180-89.

Knight,K.G.(1988) Labour productivity and industrial relations in British production industries : some quantitative evidence, forthcoming British Journal of Industrial Relations.

Kwoka,J.E.(1983) Monopoly, plant and union effects on worker wages, Industrial and Labor Relations Review, 36, pp.251-7.

Kwoka,J.E. and Ravenscraft,D.J.(1986) Cooperation vs. rivalry : Price-cost margins by line of business, Economica, 53, pp.351-63.

Leibenstein,H.(1966) Allocative efficiency vs. 'X-efficiency', American Economic Review, 56, pp.392-415.

Leibowitz,S.J.(1982) What do Census price-cost margins measure ?, Journal of Law and Economics, 25, pp.231-46.

Leigh,D.E.(1986) Union preferences, job satisfaction and the union voice hypothesis, Industrial Relations, 25, pp.65-72.

Levinson,H.M.(1967) Unionism, concentration and wage changes : towards a unified theory, Industrial and Labor relations Review, 20, pp.198-205.

Lewis,H.G.(1983) Union relative wage effects : a survey of macro estimates, Journal of Labor Economics, 1, pp.1-27.

Lewis,H.G.(1986) Union relative wage effects : a survey, University of Chicago Press.

Machin,S.J. and Stewart,M.B.(1988) Unions and the financial performance of British private sector establishments, University of Warwick mimeo.

MaCurdy,T.E. and Pencavel,J.H.(1986) Testing between competing models of wage and employment determination, Journal of Political Economy, 94, Supplement, pp.1-39.

Maddala,G.S.(1983) Limited dependent and qualitative variables in econometrics, Cambridge University Press.

Maddala,G.S.(1988) Introductory econometrics, MacMillan Press.

Manning,A.(1987) An integration of trade union models in a sequential bargaining framework, Economic Journal, 97, pp.121-39.

Marsh,A., Hackmann,M. and Miller,D.(1981) Workplace relations in the Engineering industry in the U.K. and the Federal Republic of Germany, Anglo-German Foundation for the Study of Industrial Society.

Martin,S.(1983) Market, firm and economic performance, Salomon Brothers Center for the Study of Financial Institutions Monograph 1983-1, Graduate School of Business Administration New York University.

McDonald,I.M. and Solow,R.M.(1981) Wage bargaining and employment, American Economic Review, 71, pp.896-908.

Mellow,W.(1983) Employer size, unionism and wages, Research in Labor Economics, Supplement 2, pp.253-82.

Metcalf,D.(1988) Water notes dry up : the impact of the Donovan reform proposals and Thatcherism on labour productivity in British manufacturing industry, London School of Economics mimeo.

Millward,N. and Stevens,M.(1986) British Workplace Industrial Relations 1980-1984 : the DE/ESRC/ACAS surveys, Gower Publishing.

Mitchell,D.J.B.(1987) The share economy and industrial relations, Industrial Relations ,26, pp.1-17.

Nickell,S.J. and Andrews,M.(1982) Unions, real wages and employment in Britain 1951-79, Oxford Economic Papers, 35, pp.507-30.

Nickell,S.J. and Wadhwani,S.(1987) Unions, wages and employment : tests based on U.K. firm-level data, Centre for Labour Economics Discussion Paper No. 291.

Nickell,S.J. and Wadhwani,S.(1988) Financial factors, efficiency wages and employment : investigations using micro-data, Centre for Labour Economics Discussion Paper No.295.

Neumann,G.R. and Rader,M.W.(1984) Output and strike activity in U.S. manufacturing : how large are the losses ?, Industrial and Labor Relations Review, 37, pp.197-212.

Norsworthy,J.R. and Zabala,C.A.(1985a) Effects of worker attitudes on production costs and the value of capital input, Economic Journal, 95, pp.992-1002.

Norsworthy,J.R. and Zabala,C.A.(1985b) Worker attitudes, worker behaviour and productivity in the U.S. automobile industry, Industrial and Labor Relations Review, 38, pp.544-57.

Oswald,A.J.(1985) The economic theory of trade unions : an introductory survey, Scandinavian Journal of Economics, 87, pp.160-93.

Oswald,A.J.(1987a) Efficient contracts are on the labour demand curve : theory and facts, Centre for Labour Economics Discussion Paper No.284.

Oswald,A.J.(1987b) New research on the economics of trade unions and labor contracts, Industrial Relations, 26, pp.30-45.

Oulton,N.(1987) Plant closures and the productivity miracle in manufacturing, National Institute Economic Review, 121,pp.53-59.

Pencavel,J.H.(1974) Analysis of an index of industrial morale, British Journal of Industrial Relations, 12, pp.48-55.

Pencavel,J.H.(1977) The distributional and efficiency effects of trade unions in Britain, British Journal of Industrial Relations, 15, pp.137-56.

Pohjola,M.(1987) Profit-sharing, collective bargaining and employment, Journal of Institutional and Theoretical Economics, 143, pp.334-42.

Poole, M.(1988) Factors affecting the development of employee financial participation in contemporary Britain : evidence from a National survey, British Journal of Industrial Relations, 26, pp.21-36.

Pratt,J.W.(1981) Concavity of the log-likelihood, Journal of the American Statistical Association, 76, pp.103-106.

Prais,C.F.(1976) Labour productivity differentials within international companies, University of Cambridge Department of Applied Economics Occasional Paper No.50.

Price,R. and Bain,G.S.(1983) Union growth in Britain : retrospect and prospect, British Journal of Industrial Relations, 21, pp.46-88.

Ramsey,J.B.(1969) Tests for specification error in classical linear least squares regression analysis, Journal of the Royal Statistical Society, Series B, 31, pp.250-72.

Ramsey,J.B. and Schmidt,P.(1976) Some further results on the use of OLS and BLUS residuals in specification error tests, Journal of the American Statistical Association, 71, pp.389-90.

Rapping,L.A.(1967) Monopoly rents, wage rates and union wage effectiveness, Quarterly Review of Economics and Business, 7, pp.31-47.

Ravenscraft,D.J.(1983) Structure-profit relationships at the line of business and industry level, Review of Economics and Statistics, 65, pp.22-32.

Rees,A.(1963) The effects of unions on resource allocation, Journal of Law and Economics, 6, pp.69-78.

Reynolds,M.O.(1981) Whatever happened to the monopoly theory of labor unions, Journal of Labor Research, 2, pp.163-73.

Richardson,R. and Nejad,A.(1986) Employee share ownership schemes in the U.K. : an evaluation, British Journal of Industrial Relations, 24, pp.233-50.

Ross,A.(1948) The economics of trade unions, Cambridge University Press.

Ruback,R. and Zimmerman,M.B.(1984) Unionisation and profitability : evidence from the capital market, Journal of Political Economy, 92, pp.1134-57.

Salinger,M.A.(1984) Tobin's q, unionisation and the concentration-profits relationship, Rand Journal of Economics, 15, pp.159-70.

Scherer,F.M.(1980) Industrial market structure and economic performance, Rand-McNally, Chicago.

Scherer,F.M., Long,W.F., Martin,S., Mueller,D.C., Pascoe,G., Ravenscraft,D.J., Scott,J.T. and Weiss,L.W.(1987) The validity of studies with line of business data : comment, American Economic Review, 74, pp.1051-60.

Schmalansee,R.(1986) Inter-industry studies of structure and performance, in Schmalansee,R. and Willig,R.(eds.) 'Handbook of Industrial Economics', North Holland Press.

Schmidt,P. and Strauss,R.P.(1976) The effects of unions on earnings and earnings on unions : a mixed logit approach, International Economic Review, 17, pp.204-12.

Segal,M.(1964) The relation between union wage impact and market structure, Quarterly Journal of Economics, 78, pp.96-114.

Shepherd,W.G.(1972) The elements of market structure, Review of Economics and Statistics, 54, pp.25-37.

Shepherd,W.G.(1986) Tobin's q and the structure-performance relationship : comment, American Economic Review, 76, pp.1205-10.

Smirlock,M., Gilligan,T. and Marshall,W.(1984) Tobin's q and the structure-performance relationship, American Economic Review, 74, pp.1051-60.

Standing,G.(1988) Would revenue sharing pay cure unemployment ?, International Labour Review, 127, pp.1-18.

Stewart,M.B.(1983a) Relative earnings and individual union membership in the United Kingdom, Economica, 50, pp.111-25

Stewart,M.B.(1983b) The estimation of union wage differentials form panel data : the problem of not-so-fixed effects, Paper presented to the National Bureau of Economic Research Conference on the Economics of Trade Unions, May 6th and 7th 1983.

Stewart,M.B.(1983c) On least squares estimation when the dependent variable is grouped, Review of Economic Studies, 50, pp.737-53.

Stewart,M.B.(1986) Comments, British Journal of Industrial Relations, 24, pp.205-208.

Stewart,M.B.(1987a) Collective bargaining arrangements, closed shops and relative pay, Economic Journal, 97, pp.140-56.

Stewart,M.B.(1987b) Job tenure, labour turnover and trade unions, University of Warwick mimeo.

Stewart,M.B.(1987c) Union wage differentials in the face of changes in the economic and legal environment, University of Warwick mimeo.

Stewart,M.B.(1988) Union wage differentials, product market influences and the division of rents, University of Warwick mimeo.

Svejnar,J.(1986) Bargaining power, fear of disagreement and wage settlements : theory and evidence from U.S. industry, Econometrica, 54, pp.1055-78.

Tauman,Y. and Weiss,Y.(1987) Labor unions and the adoption of new technology, Journal of Labor Economics, 5, pp.477-501.

Turnbull,P.J.(1988) The economic theory of trade union behaviour : a critique, British Journal of Industrial Relations, 26, pp.99-118.

Ulph,A.N. and Ulph,D.T.(1988) Union bargaining : a survey of recent work, University of Southampton Discussion Paper No.88/05.

Voos,P.B. and Mishel,L.R.(1986) The union impact on profits : evidence from industry price-cost margin data, Journal of Labor Economics, 4, pp.105-33.

Waddington,J.(1987) The trade union merger process : a study of trade union structural dynamics, unpublished Ph.D. thesis, Department of Industrial Relations, University of Warwick.

Wadhwani,S.(1987a) Profit-sharing and Meade's Discriminating Labour-Capital partnerships, Centre for Labour Economics Discussion Paper No. 276.

Wadhwani,S.(1987b) The macroeconomic implications of profit-sharing : some empirical evidence, Economic Journal, 97, pp.171-83.

Wadhwani,S.(1988) Profit-sharing as a cure for unemployment : some doubts, International Journal of Industrial Organisation, 6, pp.59-68.

Wadhwani,S. and Wall,M.(1988) The effects of profit sharing on employment, wages, stock returns and productivity : evidence from U.K. micro-data, Centre for Labour Economics Working Paper No.1030.

Weiss,L.(1966) Concentration and labor earnings, American Economic Review, 56, pp.96-117.

Weitzman,M.L.(1984) The share economy, Harvard University Press.

Weitzman,M.L.(1985) The simple macroeconomics of profit sharing, American Economic Review, 75, pp.937-53.

Weitzman,M.L.(1987) Steady state unemployment under profit sharing, Economic Journal, 97, pp.86-105.

White,H.(1980) A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, Econometrica, 50, pp.1-26.

White,H.(1982) Maximum likelihood estimation of misspecified models, Econometrica, 52,pp.1-26.

White,L.(1976) Searching for the critical industrial concentration ratio : an application of the switching of regimes technique, in Goldfeld,S. and Quandt, R.(eds.) 'Studies in Non-Linear Estimation', Ballinger, pp.5-35.

Whittington,G.(1980) The profitability and size of United Kingdom companies, 1960-74, Journal of Industrial Economics, 28, pp.335-52.

Wilson,N.(1987) Unionisation, wages and productivity : some British evidence, University of Bradford Management Centre Discussion Paper No. 87-3.

TITLE THE IMPACT OF UNIONS ON ECONOMIC PERFORMANCE : EMPIRICAL TESTS USING BRITISH MICRO-DATA.

AUTHOR S.J.MACHIN.

INSTITUTION and DATE University of Warwick. (1988)