Wages, Trade Unions and the Labour Market

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Declaration

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1. Gosling, Amanda (1997) 'How sharp is the sword of justice?; the influence of trade unions on the dispersion of earnings' IFS mimeo

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I affirm that Amanda Gosling contributed at least 33% of the papers written with me and Stephen Machin which are included in this PhD.

Professor Richard Disney

I affirm that Amanda Gosling contributed at least 33% of the papers written with me and Stephen Machin which are included in this PhD.

Professor Costas Meghir

I affirm that Amanda Gosling contributed at least 50% of the paper written with me and 33% of the papers written with Costas Meghir and Richard Disney and myself included in this PhD.

Professor Stephen Machin

I affirm that no part of this thesis has been submitted to a university for any degree

Amanda Gosling
Abstract

This thesis examines the links between unions, labour market outcomes and changes in the structure of demand for labour. It is split up into three self contained sections.

The first looks at the determination of union presence in the private sector workplaces. Given the decentralised structure of wage bargaining in the U.K industrial relation system, the focus is on the presence of a union recognised for the purposes of bargaining over pay and conditions at the workplace. This is found to be determined historically by the characteristics of the labour and product market at the time the workplace is created. This means that unions may still have influence over wages in some industries and markets where their current relative power is weak. It is also shown that the presence of a recognised union at the workplace is the crucial determinant of union membership. Variations in union density, conditional on union coverage, in the workplace appear to be fairly random.

The second part of the thesis looks at the relationship between unions and the structure of wages. It presents results suggesting that wage differentials between and within groups are narrower in the union than in the non union sector. It then exploits the finding that union presence in the workplace is determined separately (at a different time) from wages to test whether unions actually alter the wage policies in workplaces or whether negotiations only take place when they are deemed by management to have no effect. It is shown that part of the "sword of justice" role of trade unions, compressing wage differentials amongst semi-skilled workers can be explained by the different composition of the union sector. There still remains some evidence, however, that unions do compress the wage distribution.

The last part of the thesis looks directly at the recent changes in the distribution of wages. It is shown that increases in the return to education can explain about half the overall increase in wage inequality and that there has been a sharp drop in the relative wages of new entrants into the labour market without post compulsory schooling. It is also shown that the decline in trade union coverage can explain a significant part of this increase in
inequality, although it is accepted that economic factors (such as changes in technology) might have caused both the fall in union presence and the rise in wage inequality. Finally a comparison with West Germany from 1984-1992 reveals the importance of other labour market institutions such as the education and training system in determining the response of an economy to changes in the structure of demand.
Part I

The Determination of Trade Union Status
SUMMARY OF PART 1

1. **Background and Context;**
   This will summarize the reasons for looking at the determination of union coverage and membership and briefly discuss the legal and institutional framework in which trade unions operate.

2. **The Unionisation Process;**
   This will discuss existing work on the process of unionisation, in particular the determinants of union negotiating rights in a given workplaces and whether an individual worker works in the union sector. First models that use individual level data to identify separately the demand for and supply of union jobs across different sorts of workers will be critically evaluated. Second I will discuss the attempt of unions to organise and firms to resist unionisation of workplaces. Given that these relationships may be impossible to identify separately, I will then present a model which will allow reduced form estimation of the outcome of the struggle over recognition relating it to the legal environment, and the structure of the labour and product markets at the time the workplace is set up.

3. **The Recognition Process;**
   Here the model described in the last section will be estimated on micro-economic data from the three Workplace Industrial Relations Surveys. The empirical results give strong support for the theoretical model. The source of decline in union recognition over time is seen to be in a 1980s "shift effect" which can be attributed to the legal changes of the early 1980s which have served to reduce the credibility of a strike over recognition.

4. **The Membership Process: Theory**
   The numbers of workers belonging to a trade union may affect its bargaining power or its ability to organise new workplaces. Thus, while the effect of trade unions on wages and other outcomes depends on coverage more than membership, the determination of union density is still of interest. Moreover, given that most of the benefits of union activity are not excludable, the reasons why any rational agents will join a union rather than free ride is a puzzle. Both theoretical and empirical literature on this issue will be discussed and then a model will be presented which will allow the effect of recognition on union density to be estimated at the workplace, allowing for possible endogeneity. It
is stressed however, that the major source of bias in the estimated effect of recognition on union density will be the fact that union and non union workers will be systematically different and that this will not be picked up in the model.

5. The Membership Process; Empirics
Here the model described above will be estimated. We find that unobserved factors that affect union recognition do not determine union density. As a major source of this bias would be changes in union recognition status over time, it is concluded that this provides strong support for the use of time dated regressors to instrument union status in the determination of union effects on wages or employment at the level of the workplace.
Chapter 1

Background and Context

1.1 Introduction

The historical strength of the British Union movement should be something of a puzzle. At first glance, neither the economic nor the legislative framework over the last 200 years would seem to be conducive to collective organisation. Even up to the beginning of the 20th century, when unions had made inroads into most of industry (see Pelling (1986)), production was still in small scale enterprises with little opportunities to exploit economies of scale in organisation. (see Elbaum and Lazonick 1986). British workers have never had a positive right to belong to a trade union or to have employers negotiate with their representatives over pay and conditions. (see Wedderburn 1986). The aim of this chapter is thus to develop a model which can explain the presence of unions in the UK and to discuss the reasons why we should expect the weakening of the union movement that we have observed in Britain over the last few years.

There exists a large literature on the determination of union effects on wages, productivity, investment, effort, profitability in both the UK and the US. The question of “What Unions Do?” is, however, intrinsically linked to why they exist in the first place both because the overall significance of their actions is dependent on how much of the workforce they can incorporate
and because it is necessary to understand how trade union workers or firms might be different from non trade union workers or firms for other reasons aside from trade union action.

The 1970s and 1980s saw big changes in the level of union presence. During the 1970s, female part time workers and workers in the service sectors began to join unions in increasing numbers. It is the fact that trade unions were able to organise these sorts of 'typical non union' workers, which constituted a growing proportion of the overall workforce as well as of the overall growth in the trade union membership that is the one of the unusual things about the 1970s. After 1979, trade union membership began to drop dramatically. Only a small part of this decline can be attributed to compositional change in the economy, most of the decline occurred in the sorts of workplaces and industries that were typically highly organised. The large within group changes over this period thus provide an interesting test of explanations for and models of union presence.

After the election of 1979, there was a sharp reversal of government policy toward trade unions, the aim was to use a “step by step” approach to reduce their power as they were considered to be harmful both to micro and macro economic performance. There is much debate in the literature about the effectiveness of these policies, many argue that the changes that we observed in the 1980s would have occurred anyway. The models and the results that I shall present in this chapter do, however give evidence of a secular down-turn in the probability of organisation of new workplaces in the 1980s which could be explained by this legislation.

While the work I shall present in this chapter is not the first to look at the determination of union status in the UK and the reasons for the steep decline in the 1980s, it is novel in the sense that it uses economic analysis to develop and test a model of union presence at the workplace that is applicable

\(^1\) existing work is summarised below
to the British institutional framework.

1.2 The Legal Framework

The law plays formally little role in governing relationships between workers and employers in the United Kingdom. This is what has come to be known in labour law as the "absentionist tradition". While most workers have the right to join a trade union and strikes are legal\(^2\), there is no law obliging employers to negotiate with them and collective agreements between unions and firms are only agreed to on a voluntary basis. This contrasts with most other OECD countries, even in the United States employers have a duty to bargain with a union if it wins a majority of votes in a workplace election supervised by the National Labour Relations Board.

Unions funds are immune from damages arising from a breach of contract occurring during a "legitimate trade dispute". This means that the threat of a strike is credible and bargaining will occur. The absence of the law in the actual determination of any particular bargain between workers and firms and in particular the bargain over "recognition" means that economic considerations such as the costs of unions in terms of profits and the costs that they can impose on management during a dispute must play an important role in the determination of union status in the UK.

There was a remarkable stability in the legal framework surrounding trade unions from the act of 1906 until 1980. While there were provisions made in both the Industrial Relations Act (IRA) of 1971 and the Trade Union and Labour Relations Act (TLRA) 1975 to encourage employers to negotiate with trade unions, case law and a judgment in the House of Lords showed these to have little power. The Conservative government elected in 1979, instituted a major change of approach to the laws surrounding trade unions (see Metcalf

\(^2\)Police and Army officers and those working in parts of the defence industry are prohibited from joining a union.
1992 for a summary). Underpinning much of the legislation in the twentieth century was a belief that trade unions, if properly controlled, were a good thing, restoring the balance of power in the workplace between employers and workers. The view of the new government was not only that unions were harmful to both micro and macro economic performance but they were a restriction of the rights of individual workers to negotiate the best deal with their employers. The definition of a "legitimate trade dispute" was successively narrowed over the 1980s. It seems that the changes of the 1980s, in particular the provision of the 1980 and 1982 Acts removing legal immunities from strikes over a recognition disputes, would have been likely to have shifted bargaining power toward employers and made collective negotiations over pay and conditions less likely. One of the aims of this thesis is to see whether these changes have effected the extent of unionisation in Britain.

1.3 The Determination of Union Status

The proportion of the workforce belonging to a trade union at any point in time can be thought of as being determined by the following behavioural processes. First, the ability of unions to gain negotiating rights in workplaces; (recognition or coverage), second the relative utility to workers of unions versus non union jobs; third the probability that individual workers will be offered a job in the union sector and last the decision to join a trade union which will obviously differ depending on the union status of the job. In terms of the influence of trade unions on economic outcomes, for example the distribution of wages, work intensity and the distribution of income between labour and capital, it is the proportion of the workforce that is covered by a trade union that is crucial. Membership only matters in so far as it affects the bargaining power of a trade union.
1.3.1 The Recognition Decision

In the UK managers make a choice whether or not to negotiate with a trade union, to recognise a union for the purposes of determining pay and conditions of employment. This appears to be a once and for all decision, there are few changes in the union status of workplaces over time. In the Workplace Industrial Relations Survey of 1984, for example, 93 percent of establishments did not change their recognition status in the 1980-1984 period (Millward and Stevens, 1986 see also Beaumont and Harris 1989). A retrospective survey in 1990 of UK firms (Gregg and Yates, 1991) found very few cases of complete derecognition in the 1980s, although towards the end of the decade there were more partial derecognitions (i.e. derecognition of a single union for a particular skill group in a multi-union plant or of a union in a single plant of a multi-plant enterprise). The 1990 Workplace Industrial Relations Survey shows a similar picture: only about 2 percent of private sector non-union establishments in 1990 recognised a union in 1984.\(^3\) Indeed, private sector changes in recognition status were almost unheard of until some well publicised cases of derecognition that occurred in the late 1980s (Claydon, 1989).\(^4\) Still, these derecognitions appear to be the exception rather than the rule.

The small number of changes in recognition status in existing establishments subsequent to set up date can be explained in part by the lack of a formal recognition procedure under current British industrial relations law. In a similar vein, derecognitions in British establishments are presumably

\(^3\)The WIRS panel of 537 establishments common to both the 1984 and 1990 surveys identifies a slightly higher proportion of derecognitions, but the absolute numbers are small and the presence of measurement error is indicated by inconsistencies in the recall and panel answers. Furthermore, the panel is selected over several characteristics (primarily age of establishment and sector) which makes direct comparisons with the full (nationally representative) sample results problematic.

\(^4\)Purcell (1991) suggests that the change in the management of labour relations in the 1980s has taken the form of greater decentralization of bargaining and pressure on unions to accept changing management methods and higher productivity levels, rather than changes in recognition status per se. See also Machin and Wadhwani (1991).
uncommon (at least up to the late 1980s), because a union once organised in an establishment can impose large costs on a management that refuses to negotiate with it. Smith and Morton (1993) provide some recent discussion of this arguing that union exclusion in newer workplaces, rather than downgrading of union activity in existing workplaces, is of most importance in the 1980s fall in unionization. Overall, it seems that composition of births of establishments seem to be the most important factor in explaining changes in the extent of trade union recognition. Chapter 3 of this thesis therefore estimates the probability that unions will gain negotiating rights in new establishments.

1.3.2 The membership decision

The relationship between the proportion of workplaces in which unions are recognised and the probability that an individual worker belongs to a trade union is complex. Pencavel (1971) argued that unions provided three sorts of services to members.

Collective Goods These are the effects of union negotiations on workplace rules and payment systems. They will not influence the choice of an individual to join a trade union however as they are non-excludable (all workers in a union workplace will receive the union wage) but will affect the relative attractiveness of a union versus a non-union job.

Semi-Collective Goods In many workplaces unions help to enforce employment protection and health and safety legislation. If, as seems plausible, they are more willing to help union workers than non-union workers then their provision will influence the probability that an individual worker will belong to a trade union.

Private Goods Unions often provide insurance to members against unemployment and sickness and are recently beginning to provide mortgage
advice, credit cards etc. (see Booth 1989). How these services influence workers choices to belong to a trade union will depend on how much of a comparative advantage unions have versus financial institutions in their provision.

Thus while in theory the different sorts of provision may allow us to differentiate between the choice to queue for a union job and the choice to join a union, empirical estimation must rely on assumptions about how tastes for these collective, semi collective and private goods are correlated. If those workers who have a greater demand for employment protection also prefer union to non union wage setting for example, then identification is impossible. Similarly if the supply of union jobs differs across workers from the supply of non-union jobs then it will be difficult to identify differences in the probability of being covered by a trade union that are attributable to tastes from those that are attributable to productivities.

The work in this part of the thesis on union membership therefore does not attempt to separate out these relationships, although work in this field will be discussed. Booth (1985) argues that one way in which unions can overcome the free-rider problem is for union members to impose a social penalty on non union members. This suggests that the demand for union membership is linked not only to individual preferences but is endogenous to the characteristics of the workplace. Models presented here will allow this to be tested explicitly by modelling membership at the workplace conditioned on its (historically determined) union status.

1.4 Non-Economic Approaches to Union Growth

A branch of literature which may be relevant is the discussion in the political sciences on the development of “neo-corporatist” institutions, these being central negotiations over pay, work regulations and social policy between “peak” organisations representing labour (i.e. unions), capital (i.e. employer
organisations) and government. This work essentially endogenises the determination of government policy towards these institutions and discusses how they arise in the first place and can be maintained in the face of external shocks. The analysis demonstrates how technical change can be related to changes in labour market institutions and thus provides an important explanations of the directions of trends in union power. Moreover, it also suggests why the interpretation of any coefficient capturing a policy change may not be obvious as it may pick up changes within these organisation themselves and changes in tastes.

One of the basic ideas is that corporatist institutions may deliver high wages, job security and low unemployment at a cost of little individual control over work efforts, job design etc. Thus they will remain powerful so long as workers/people are prepared to sacrifice the latter for the former. In the face of technological change, increase in income, reduced fear of unemployment such sacrifices are seen to be more costly and are less often made. There is thus pressure within these institutions for more individual/ workgroup control which creates unsustainable conflict and the models break up. Increased competition from abroad or macro shocks such as the oil crisis may make it harder for the system to deliver its goals and thus conflicts will be created. Examples of this can be found in the work of Crouch (1982), Lash and Urry (1983), Sorge and Streeck (1988).

Some of the UK industrial relations literature is focused around identification of "managerial style" of which recognition is only a part (see Deaton (1985), Purcell (1991), Purcell and Gray 1986). The focus of interest is more on the balance of power within the workplace, the relationship between individual and collective rights rather than on the presence of negotiations over pay. Indeed it is not clear where union recognition fits into the split between unitarist and pluralist industrial relations that is the framework often used in much case-study work in this field.

The development of the trade union movement has also been looked at
from a purely historical perspective. The question in this literature is, how­ever, not so much why trade unions developed, the assumption being that unions are an intrinsic part of developed capitalist economies but why they developed as they did and whether their history indicates the presence of class consciousness in the 19th and early 90th Centuries during the period of rapid union growth. For example Thompson (1968) sees the machine break­ers (or “Luddites” ) of the Napoleonic era as early revolutionaries, striking against technical change, while Hobsbawn (1964) argues that their action was purely mercenary “collective bargaining by riot” (p 7) and that they were the fathers of the present union movement. The work of the Webbs (1894,1920) shows how the growth of trade unions was linked to their role as the friendly societies who provided insurance against unemployment and sickness and that over time the balance of the provision of public goods (collective bargaining) and private goods (insurance) shifted. This literature therefore does not tell us much about how recent and future changes will effect the union movement.
Chapter 2

The Unionisation Process

2.1 Introduction

The aim of this section is to look at the determination of the percentage of the workforce covered by collective bargaining. The structure is as follows. The general framework of the demand and supply for union status is set up following the queuing model of Abowd and Farber (1982). As it will be shown that the prediction of this model is that it is the supply of union jobs that is the crucial determinant of the size of the union sector, the determinants of this will then be looked at. First I will discuss the effects of union activity on the demand for labour in the union sector, then I will look at the organisation strategies of unions, then the resistance of firms. Last I will set up a model of the determination of the outcome of the struggle over recognition, which will be tested in the next chapter.

2.2 The Selection of Workers into the Union sector

Abowd and Farber (1982) argued that the determinants of the selection of individuals into the union sector should be thought of us both a desire of individuals for union status, and a job offer in the union sector.. This can be expressed formally as:
\[ \Pr(U_i = 1) = \Pr(Q_i = 1) \times \Pr(A_i = 1) \]

where \( U_i \) is the union status of individual \( i \), \( Q_i \) is an indicator of whether she would accept a union job. In the Abowd and Farber framework this would be whether she is in the queue for a union job and \( A_i \) is an indicator of whether she has been offered a job in the union sector.

Utility maximising workers will accept a union job if the pecuniary and non pecuniary benefits are greater than those in the non union sector. Thus

\[ \Pr(Q_i = 1) = F(X_i \beta + W_i \phi) \]

where \( F(x) \) is the probability that \( x \) is greater than zero, \( X_i \beta \) is the union mark-up for an individual with the set of characteristics \( X_i \) and \( W_i \phi \) are tastes which will vary across individuals depending on their endowment of \( W \). This last can be thought of as political preference and/or risk aversion. Similarly the probability of a job offer in the union sector can be expressed as:

\[ \Pr(A_i = 1) = G(X_i \beta) \]

where \( G(x) \) can be thought of as a labour demand curve, relating the set of union wage differentials to the structure of demand for labour in the union sector. This will depend upon production techniques, the structure of the product market, the numbers of workplaces actually organised and the presence or otherwise of discriminatory tastes by employers.

At first glance this looks like a demand and supply framework and empirical estimation would be possible through the fact that tastes do not determine \( \Pr(A_i = 1) \) and the fact that the percentage of workplaces unionised will not directly affect \( \Pr(Q_i = 1) \). However, because there is no direct mechanism by which “frustrated demand” for union jobs or “frustrated supply”
for union workers will influence the union mark up, there is no reason why
the demand for union jobs will equal the supply. This suggests that some
groups of workers will be supply constrained or rationed, in the sense that
some of them would like to work in the union sector at the current mark-up
for their characteristics but are not offered employment. It might also be the
case that union firms will be demand constrained in the sense that at current
union sector prices for certain skills they wish to employ more workers than
are willing to work in the union sector. Estimation and predictions of this
model are thus very difficult.

2.2.1 The Sources of Variation in the Probability of
Unionisation Across Individuals and over Time

If workers are homogenous, and unions do nothing but raise the average rate
of pay, then the probability of unionisation will be the same across workers
and the percent of workers in the union sector will be determined solely by
the relative number of unionised firms and the demand for labour in those
firms. If workers differ in terms of their tastes or their skill levels and the
union mark-up differs across workers depending on their characteristics, then
the probability of unionisation will vary across individuals.

There have been many "reduced form" estimates of the probability of
unionisation across individuals. These implicitly or explicitly adopt this de­
mand and supply framework where variables are included which proxy the
gain to unionisation and the probability of obtaining a union job. Green
(1992) for example uses the 1983 General Household Survey and the 1989
LFS to see what role the changing "supply" of union jobs had in the overall
fall in union membership.

Given the possibility that union jobs are rationed, however, interpreta­
tion of these results is not easy even if one does not wish to identity the
demand and supply effects separately. The estimated union wage differential
will, for example be negatively related to the probability of unionisation for
those workers who are rationed or in the queue, and positively related to the probability of unionisation for those workers who are not. Tastes will only affect the probability of unionisation for those workers who can get a union job if they want one\(^1\). Explanations of the variation in unionisation across individuals can therefore only come from assumptions about how the union mark-up might vary across individuals.

**Time Series Variation**

Just as tastes will only affect selection into the union sector, for those workers who are not “rationed”, variations in union coverage over time must be driven by changes in the supply of union jobs if significant queues for union jobs exist. Farber and Kreugar (1992) present evidence from the 1977 Quality of Employment Survey (QES), the survey conducted by the American Federation of Labour (AFL) in 1984 and the 1991 General Social Survey. They suggested that it is shifts in the demand for union jobs that have driven the decline in proportion of workers in the union sector in the US. They argue that because the level of “frustrated demand”, measured as the proportion of the workforce who would like a union job but cannot get one, has remained constant while the overall number of union jobs has fallen, the demand for union services must have fallen. This may certainly be the case, but the graph below shows that there is another interpretation of this results.

In this comparative static model the union wage effect conditioned on \(X\) is given on the vertical axis and assumed to be constant at \(W^*\). The supply of union jobs is determined by the set of labour demand curves and the actual number of workplaces in the union sector. The demand for union jobs is determined by the mark-up and tastes. The number of people in this model in the first period who want union jobs is \(D\), but at that union wage mark-up only \(B\) jobs are offered, thus there is rationing of jobs in the

\(^1\)An illustration of this might be to compare the conditional correlation between union status and lagged political opinions across education groups
union sector and the level of frustrated demand can be expressed as BD. If the demand for union jobs fell to C at the same mark-up, this would not reduce the number of workers in the union sector, but reduce the extent of frustrated demand to CD. In this model the number of union jobs accepted can only fall with shifts in the supply of union jobs. The fact that the level of frustrated demand has remained constant in the US and the number of union jobs has fallen is thus consistent with moves in both the demand and the supply curve. The change in the number of union jobs could still have been solely determined by shifts in the supply curve.

More generally if the return to skill is lower in the union sector than in the non union sector, changes in the relative productivity of skilled versus unskilled workers such as may have occurred in the US and the UK through technical change and globalisation of product markets will have important impacts on the size of the union sector. Unskilled workers will be less and skilled workers will be more likely to be offered jobs in the union sector.
This will increase the degree to which union jobs are rationed for unskilled workers. As skilled workers are not rationed, increases in the numbers of jobs they get offered in the union sector will not increase the number of union jobs accepted.

2.2.2 Conclusions and Implications

It is clear that providing most workers are supply constrained in the sense that they would like a union job but cannot obtain one, then the crucial determinant will be the supply of jobs across individuals. The next section looks at the determination of the allocation of workplaces into the union sector.

2.3 Union Behaviour and the Size of the Union Sector

2.3.1 Union Effects on Firm Performance and Survival

Union effects on wages, employment, investment, productivity and profits will have implications for the proportion of workers that are union members or are covered by trade union arrangements. If unions reduce employment and kill firms then the union sector will shrink over time unless the unionisation rate of new firms increases. The next discussion demonstrates that the evidence is not conclusive on this, suggesting no reason why the recent decline in the union sector is inevitable.

Unions reduce employment?

What empirical work exists in the UK and the US relates union presence to changes in employment, although it might be thought that the true relationship should be in terms of levels.

Union might be expected to reduce employment growth for the following reasons:
1. If firms in the non-union sector face perfectly elastic supply curves for labour, then any change in demand will transmit to changes in employment. Under unionisation, in a right to manage model or a monopoly union model, however, some of this increase will be expropriated in the form of higher wages. This also suggests that employment falls should be smaller in the union sector. If unions affect employment growth through this route then the relationship of interest is between union presence and the absolute value rather than the size of changes in employment.

2. If unions affect adjustment costs through employment protection rules, fluctuations in employment will also be smaller in the union sector.

3. If unions affect investment or productivity growth, then the growth in labour demand will differ between the union and the non union sectors.

There is not much evidence on this and what there is, is not conclusive. For the UK two studies which use the same data source (the 1984 Workplace Industrial Relations Survey) give conflicting results. Blanchflower, Milward and Oswald (1991) present evidence that employment growth was about 3% points lower in the union sector ceteris paribus (similar results were reached for the US by Leanord (1992) and for Canada by Long (1993)). Machin and Wadwhani (1991) show, however that the union effect described in Blanchflower et al. (1991) is entirely driven by the fact the union workplaces were much more likely to experience organisation change and removal of restrictive practices during the early 1980s. These decreased employment. Boal and Pencavel (1994) used data from the coal mining industry for the years 1897-1938. They find a positive effect of unions on wages, a insignificant effect of unions on employment but a small but significant operating days differential. More interestingly they find that production functions are systematically different across the two sectors.
Unions kill firms?

If unions are myopic, or have high discount rates, then they will not necessarily care about the survival of the firm in which they operate. If unions are very powerful, then they might expropriate all the short term rents accruing to production, even including payments to capital. (Freeman and Kleiner (1990)). This suggests that unions will need to organise more and more new establishments to stay in business. There is however little evidence for this. Machin (1995) related union status to workplace survival rates between 1984 and 1990 using the WIRS 1984-1990 panel. He found that the closure rate was in fact slightly lower for union firms. Controlling for other characteristics reduced the negative effect of unions on closures but did not turn the coefficient around.

Moreover, even if union do kill firms, this can only be an explanation for the decline in unionisation over time if a) unions ability to extract rents from firms rose, b) the birth-rate of new establishments fell. Layard, Jackman and Nickell (1991) suggest that the union mark-up rose after the late 1960s and remained stable after that. The 1970s, however were a period when union membership and coverage rose.

2.3.2 Models with Endogenous Membership

Over the last 15 years, a group of models have developed in which the union mark-up and the size of the union sector are allowed to be simultaneously determined. In these models there is a membership equation in which the demand for union services is related to the union mark-up and a wage setting equation in which the union mark-up is determined by the level of membership. Equilibrium will be at the point of intersection of these two curves. (see Grossman 1983, Disney and Mudambi 1989, Booth and Charterji 1993)

The model of Grossman (1983) and the extension of Disney and Mudambi (1989) use essentially a monopoly union framework where the closed shop is
universal so that changes in membership can only result from employment shifts between the union and the non-union sector and all workers in the union sector have a say in determining the optimal wage, which will serve to maximise the utility of the median worker whose expected income can be defined as:

\[ E(Y) = [W_u \times \Pr(U = 1)] + [b \times \Pr(U = 0)] \]

\( b \) is the benefit level (workers have a choice between queuing for a job in the union sector and becoming unemployed if they are not successful).

\[ \Pr(U_t = 1) = \Pr \left( \frac{M_t - N_{t+1}^c}{M_t} < 0.5 \right) \]

\[ N_{t+1} = f(W_u, \theta), \quad f'(x) < 0 \]

where \( M_t \) denotes union membership in time \( t \), and \( N_{t+1}^c \) expected employment in time \( t \) and \( \theta \) is a demand shock whose distribution is known by the union a priori with mean such that

\[ N_{t+1} = f(W_u) \]

The change in the wage preferred by the median voter with changes in membership (the \( VV \) curve) is then a function of \( \theta \) (the distribution of demand shocks) and the level of risk aversion. Given that a smaller membership means that it is more likely that the median voter will be employed, however the models predict that the \( VV \) curve will slope downwards (see below).

Workers also choose to queue for work in the union sector and receive the union wage \( (W_u) \) providing that they get hired or unemployment benefit \( (b) \) if they do not. Otherwise they work in the non-union sector and receive a wage \( (W_n) \). The higher the union wage, the smaller the probability that the marginal worker will find work in the union sector. Thus again depending on the distribution of demand shocks (known in advance), the degree of risk
aversion and the relationship between unemployment benefit and the union wage, the change in the number of workers queuing for union jobs (the MM curve) will slope downwards in wage membership space. The MM and VV schedules are shown below.  

Disney and Mudambi (ibid.) used UK data to estimate a macro model of this using legal changes to identify the two equations. However, it is based round the monopoly union model and so cannot incorporate changes in union power. Thus it makes it difficult to explain the late 1980s when the union mark-up fell (see Stewart 1995, Gregg and Machin 1991) and union membership continued to fall (see Waddington 1992). Moreover, the dynamics of this model rest on the fact that changes in union policy are determined by employment shifts between the two sector as all workers vote in the union, thus it may not be relevant to the UK experience where the closed shop is not widespread.

\[^2\text{Providing the MM curve is steeper than the VV curve, there will be a unique and stable equilibrium}\]

Figure 2.2: The “Grossman” model
In summary therefore, while there is a two way relationship between the size of the union sector and union behaviour it is clear that explanations for the decline in unionisation need to focus more on the actual process of unionisation itself. In other words what determines whether a given workplace will be organised or whether an individual works in the union sector?

2.4 Trade Union Organising Activity

What factors determine whether a union will attempt to organise a workplace or a groups of workers in a workplace? If a union is a maximising agent, then according to economic theory it should attempt to organise up the point at which the marginal cost of organising another workplace is equal to the marginal benefit. The components of the union utility function will not be discussed in this review as all models assume that it is rising in the unions ability to extract rents from the firm (see Booth (1994), Oswald (1985) or Hirsh and Addison 1986).

2.4.1 Financial Constraints and Union Power

Willman (1990), Willman, Morris and Aston (1993) and Willman and Morris (1995) show how the financial situation of unions is important in determining their power. They also argue that merger activity between unions can be considered almost as a substitute for organising new establishments. Their model has important implications for explaining the decline in union membership in the UK over the 1980s and also for economists modelling the process of union organisation. Their arguments are summarised below.

Unions have the following sources of finances; subscriptions, income from assets and in addition they have the option of running down their wealth. Unions face costs over time in providing services to members (insurance, legal protection), negotiating over pay and conditions and in financing strikes. Wilman et al. argue that during the 1970s more and more of these costs were
met from running down wealth. This was for two reasons. First subscriptions failed to rise in line with costs (because of many expensive disputes in the 19790s), and second assets held by trade unions were treated just the same as assets held by individuals in the stock market, in other words their value fell.

In terms of financing disputes, or providing convincing threats of action, the level of wealth held by unions is crucial. If unions need to threaten industrial action to obtain recognition deals, then it is clear that unions with low levels of assets will be less likely to achieve recognition. If as seems likely, there are significant fixed costs and economies of scale in providing union services, falls in union assets may then start a vicious circle of decline with failures to organise new workplaces causing membership falls and hence falls in wealth. Willman et al. argue that the big union mergers over the 1980s and early 1990s can be considered as an attempt to stem this decline. This explains why unions may have concentrated on increasing their relative market share rather than engaged in costly recognition disputes. The decline in union wealth is thus another reason why recognition probabilities should have fallen in the 1980s, and perhaps a reason why the resistance to the new legislation was weak especially when one compares it to the resistance to the 1971 Industrial Relations Act.

The presence of fixed costs in organisation and representation at the workplace level also implies that unions will always prefer to organise a large than a small group of workers. In this framework, the tactic of most unions to fight directly for recognition in new workplaces rather then wait for membership to build up seems perfectly rational.

3In this way a strike differs from other investment decision in the sense that unions have to finance them from retained earnings. It is unlikely that banks will lend them the money or that they could sell shares in themselves to the stock market!
2.4.2 The Capture of Rents

Abowd and Farber (1990) related both union organising intensity and employer resistance (discussed below) to the level of quasi-rents available in the industry. Quasi-rents are defined as sales revenue minus wage costs and the costs of raw materials. Industries with higher quasi-rents will be the ones where unions have the biggest opportunity to raise the wage and so increase the welfare of their members.

Labour's share of these industry rents in industry \( j \) \( (Q_{Lj}) \) can be written as:

\[
Q_{Lj} = L_j [W_{uj} - W_{aj}]
\]  

(2.1)

where \( W_u \) is the wage under unionisation and \( W_a \) is the opportunity wage and \( L \) is the size of the labour force. The value to the union of \( Q_L \) is:

\[
V_{uj} = Q_{Lj} - C_j
\]  

(2.2)

where \( C \) is the cost of maintaining the level of unionisation. Labour's share is also determined by the level of unionisation itself, higher unionisation means that more rents can be expropriated:

\[
Q_{Lj} = Q_j h(U_j)
\]  

(2.3)

Organising a new workplace and representing workers entails a cost which is a function of the level of unionisation itself and employer resistance \( (S) \)

\[
C_j = L_j g(U_j, S_j)
\]  

(2.4)

The union objective function can then be written:

\[
V_{uJ} = Q_j h(U_j) - N_j U_j g(U_j, S_j)
\]  

(2.5)

dividing through by \( L \) gives:
\[ q_j h'(U_j) - U_j g(U_j, S_j) \]  

The optimal level of unionisation \( U^* \) can then be derived:

\[ \frac{\delta V}{\delta U} = q_j h'(U_j) - \left[ g(U_j, S_j) + U_j \frac{\delta g(U_j, S_j)}{\delta U_j} \right] \]

\( q_j h'(U_j) = g(U_j, S_j) + U_j \frac{\delta g(U_j, S_j)}{\delta U_j} \)  

(2.7)

hold \( S \) fixed so that

\[ U_j^* = \frac{q_j h'(U_j) - g(U_j, S_j)}{g'(U_j)} \]

(2.8)

This implies

\[ \frac{\delta U^*}{\delta q} = \frac{h'(U_j)}{g'(U_j)} \]

(2.9)

which is positive so long as \( h'(x) > 0 \).

The model thus predicts that unions will devote more resources to organising industries with higher quasi rents\(^4\). Abowd and Farber then estimate this model using data on expenditures in union representative elections. It is impossible to replicate their model on UK data because we believe that unions obtain recognition by the threat of a strike. This is not observed and may not even be explicitly made. What the model discussed below does is to predict a reduced form outcome of both the organisation intensity of unions and the resistance of firms.

### 2.5 Employer Resistance

Just as unions make a choice either implicit or explicit whether or not to organise a new workplace, it is clear that managers must decide on how

\(^4\)Whether unions try to expropriate quasi-rents or economic rents (rents exclude transfer payments to capital) is of course an important issue and intrinsically linked to the question of whether unions 'kill' firms. The empirical modelling on the determination of recognition in new workplaces in Chapter 3 tries to answer this question.
much effort to incur to resist unionisation. The Abowd and Farber paper, cited above, also looked at the determinants of this again relating them to the level of available rents in the industry. Taking the same formulation as in equations 2.1 to 2.9 employers resistance gives:

\[ V_e = Q \cdot [1 - h(U)] - S \]  

where \( S \) is the cost of resistance normalised to 1 per unit of resistance. In this model, the firms take into account any change in unionisation resultant from changes in the amount of resistance. Thus the constrained maximum can be written as

\[ L_e = \max Q \cdot [1 - h(U)] - S + \lambda [U - f(q, S)] \]  

(2.11)

This gives the following first order conditions:

\[ 1 = -\lambda \left( \frac{\delta f(q, S)}{\delta S} \right) \]

\[ \lambda = Q \cdot \left( \frac{\delta h(U)}{\delta U} \right) = Q \cdot h'(U) \]

\[ U = f(q, S) \]

This implies that the reaction function of the firm is entirely dependent on the cost of resisting unionisation \( \frac{\delta f(q, S)}{\delta S} \), the rent extraction function \( h'(U) \), and the change in the optimal level of unionisation for the union with respect to changes in rents \( q \) and resistance \( S \). This can only be predicted with knowledge of the second and third derivatives of the functions 2.1 to 2.9 above. Abowd and Farber thus conclude that although it is possible to predict the relationship between quasi-rents and the desired level of unionisation for the unions, the reaction of employers is less clear cut. Increases in rents make unions both more costly to the firm and harder to resist.
2.5.1 Attitudes of Employers

The expected effect of unions on profits

The cost of recognition may not only depend upon the unions mark-up, unions may influence the profitability of production in other ways. The crucial thing here is that the expected effect of unions on profits differs across workplaces depending not only on the structure of the labour and product market but also on the characteristics of the workplace and the technologies of production.

Hirshman (1970) argued that there are two mechanisms by which agents can control each others behaviour and register discontent; exit and voice. Exit involves removing oneself from the organisation or relationship, by firing quitting, tearing up a contract etc. and voice involves negotiation. If there are significant sunk costs in any exchange relationship, it is clear that exit may be inefficient. Freeman and Medoff (1984) argued that unions give workers access to collective voice. This means that they may reduce turnover, improve morale and hence productivity and profits. It is clear that such effects will differ across firms depending on their size and technologies. Communication between workers and management may be worse in large workplaces and fixed costs of hiring will differ across firm for example. If it is true that unions have a “voice” effect as well as a monopoly effect (as suggested by Freeman and Medoff), then firms will be less likely to resist unionisation the more turnover and worker morale matters.

If unions make it harder for firms to hire and fire workers with changes in the pattern of demand, push for payment schemes based round seniority, resist organisation and technological change, then they will reduce potential productivity growth. Recent UK evidence (see Metcalf (1993), Gregg, Machin and Metcalf (1993)) suggests that unions were associated with faster

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5Although an empirical sociological study by Rainne (1985) looking at the clothing industry gives some evidence that communication may be worse in small firms.
productivity growth during the 1980s but the authors argue that this is a once and for all shift effect resultant from the reduction in union bargaining power. Grout (1984) suggests that union rent-seeking activities will reduce investment in capital and Research and Development. The evidence for this is not conclusive however. (Van Reenen 1992, Menezes-Filho, Ulph and Van Reenen 1997). It seems likely that this effect will differ across firms, according to their technologies and thus will make managers in some workplaces more eager to resist unionisation than in others.

Attitudinal Evidence

Poole and Mansfield (1993) conducted two surveys of UK managers concerning their attitude to unions and industrial relations. The results here are illuminating because they indicate what on average managers think of trade unions and see whether or not they have changed. It was found that the views of managers interviewed in 1990 was not different to those interviewed in 1980 on the desirability of trade unions. Unions were perceived among respondents to be much less powerful in 1990 than in 1980, however. This would suggest that managers might be more willing to negotiate with unions in 1990 than in 1980 because the perceived costs are lower. The reduction in recognition probabilities over the 1980s may therefore have been function not of increases in the costs of unions but more of a shift in the balance of power between unions and employers.

Evidence from the 1990 workplace industrial relations survey, gives a slightly different story. Here managers in workplaces with no union members were asked to give their views of trade unions. Table 2.1 suggests that unions are perceived to be more costly in the private sector than the public sector and more costly still in manufacturing. Table 2.2 suggests that managers in new manufacturing establishments in the 1980s are significantly more likely not to be in favour of unions. Perhaps some of the decline in the probability of recognition in the 1980s can be attributed to this.
Table 2.1: Managerial Attitudes to Unions where No Union Members present

<table>
<thead>
<tr>
<th></th>
<th>In Favour of Unions</th>
<th>Not In Favour of Unions</th>
<th>Neutral</th>
<th>Number of Establ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Establishments</td>
<td>0.020</td>
<td>0.318</td>
<td>0.663</td>
<td>476</td>
</tr>
<tr>
<td>Public sector</td>
<td>0.000</td>
<td>0.082</td>
<td>0.918</td>
<td>5</td>
</tr>
<tr>
<td>Private manufacturing</td>
<td>0.008</td>
<td>0.462</td>
<td>0.531</td>
<td>136</td>
</tr>
<tr>
<td>Other private sector</td>
<td>0.024</td>
<td>0.270</td>
<td>0.706</td>
<td>335</td>
</tr>
</tbody>
</table>

Notes.
1. Calculated from the 1990 Workplace Industrial Relations Survey.
2. Based on managerial responses in establishments with no union members.
3. Weighted proportions given
Table 2.2: Logit Estimates of Managers Unfavourable views of Trade Unions

<table>
<thead>
<tr>
<th></th>
<th>Private Manufacturing</th>
<th>Other Private Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established in the 1980s</td>
<td>0.916</td>
<td>-0.049</td>
</tr>
<tr>
<td></td>
<td>0.450</td>
<td>0.319</td>
</tr>
<tr>
<td>Controls included</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-80.827</td>
<td>-148.170</td>
</tr>
<tr>
<td>Number of establishments</td>
<td>133</td>
<td>252</td>
</tr>
<tr>
<td>Marginal effect for</td>
<td>Established in the 1980s</td>
<td>0.227</td>
</tr>
</tbody>
</table>

Notes.
1. Logit estimates. Asymptotic standard errors in italics
2. Controls for plant size, workforce composition and ownership status

2.6 The Outcome of the Struggle over Workplaces

In the UK, unions can push for recognition by the threat of a strike. Firms can resist it by threatening to relocate, or by hiring a different group of workers. It is clear that in this framework the behavioural relationships discussed above will never be measured directly and the threats may never be made explicitly. Even in under the more formal arrangements operating in the US where firms and unions can also use elections to obtain their ends, it still may be the case that these expenditures will never be made. Indeed, despite the growing literature on contested recognition in the US (studies also include Dickens and Leanord, 1985; and are surveyed by Lawler, 1990), there is a clear selectivity problem in basing a study of recognition on contested cases. Instead the reduced form outcome can be modelled directly, the parameters of which might be shifted by the legislative framework, the business cycle, by technology and by the structure of the product market.
The union status of British establishments does not change over time, it could thus be modelled as a game between workers and managers at the time of set up.

Firms wants to maximize
\[
\sum_{t=1}^{T^*} \frac{\Pi_t}{(1 + r^F_t)^t} > \Pi_o
\]

Unions wants to maximize
\[
\sum_{t=1}^{T^*} \frac{W_t}{(1 + r^U_t)^t}
\]
where \( \Pi_t \) are expected profits in time \( t \), \( \Pi_o \) is the level of profits needed for the initial investment, \( W_t \) is the wage mark-up, and \( r^U_t \) refers to a discount factor for group \( j \).

\( W_t = f(U, q, z) \)

\( \Pi_t = g(W_t, U, q, x) \)

wages are thus a function of unionisation \( U \), the level of quasi-rent pre worker \( q \) and a set of technological variables \( z \), profits are a function of wages, unionisation and a set of technological and product market variables \( x \). Unionisation in this model affects profits not only through the wage but also directly. The expected sign of \( g(U) \) is negative but it may well differ across workplaces and in some instances be positive: (see above)

The expected quasi-rent \( q \) is to be allocated among unions, managers, shareholders and fixed investment. Firms will attempt to retain the rent by resisting recognition; unions to capture the rent by aggressive organising activities. Clearly the probability of recognition will depend on the expected level of quasi-rents to be captured, but it is not necessarily clear in what direction as increases in expected quasi-rents may escalate both management
opposition and pressure from unions as discussed above. Thus if quasi-rents only affected the marginal benefits to the firm and union of recognition, any predictions of the model on the probability of recognition would have to come from assumptions about the utility functions of the two parties, their relative discount rates, risk aversion and so on.

2.6.1 Quasi-Rents and Relative Organising Success

It does, however, seem plausible that the level of quasi-rents will affect the marginal cost of resisting (achieving) recognition through the fall back positions of both parties. Where the expected level of quasi-rents in the plant is low relative to other establishments, management can credibly argue that recognising unions will drain the plant of the minimum rent needed in order to invest to maintain the capital stock, and can thus threaten bankruptcy. This minimum quasi-rent may vary across establishments. Similarly if very high relative quasi-rents are the result of high collusion, with all firms in the industry acting like a multi-plant monopolist, the threat of withdrawing production away from union establishments is credible. Finally, if we assume that firms which expect to have high quasi-rents have access to greater resources than unions (through capital markets or existing cash flow in multi-plant firms), then unions can be more easily resisted in such plants, either by offering workers higher pay or benefits as an alternative to unionism, or simply by strong lobbying and investment in techniques designed to resist unions. It might be expected, therefore, that the relationship between the probability of recognition and expected relative quasi-rents is non-linear: low in both low and high quasi-rent plants.

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6This is an extension of Dowrick (1989) who demonstrates an inverse "U" shape between wages and product market collusion.

7The findings of Wilman et al. (1990, 1993 and 1995) are crucial here.
2.6.2 The role of Legislative Factors

In the 1980 and 1982 Employment Acts, the definition of a "legitimate trade dispute" was narrowed to exclude a dispute over recognition. The threat of a strike from a union of a group of workers over recognition thus became credible only when their finances were strong enough to withstand legal action. This is a clear case of the bargaining power of unions being shifted downwards. We should thus predict a downward probability of recognition for workplaces established in the 1980s. The effect of other reforms is less clear cut, the changes in the legislation surrounding strikes, if it served to reduce the ability of unions to push up wages should make recognition less costly and so more likely. Freeman and Pelletier (1990) present evidence that part of the decline in union density over the 1980s is attributable to these legislative changes. However, they do not relate them to the propensity of new workplaces to be organised. One aim of this chapter is to test this explicitly.

2.6.3 Labour Market Factors

Industry level unionisation, at the time of set up will be an important determinant of the probability of recognition for the following reasons:

1. Firms setting up a workplace in a predominantly non-union industry will find it much easier to move production elsewhere.

2. Unions in a heavily unionised industry will be more likely to have the combined resources to stay on strike for longer and workers will find it easier to obtain other jobs in union firms.

3. Some industries, perhaps because of the time of development may be more easier to organise than others, this effect will be picked up by the level of union membership in the industry.

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8 The action of the courts during the 1984/5 miners strike demonstrated that such legal action could be successful. Again the fall in their financial wealth (see above) would make them even more vulnerable.
4. If there are spillover effects on wages at an industry level, the private cost of recognition to the firm may well be lower in a unionised industry.

It is also clear that organising another plant in an industry also provides an external benefit for the union, which by doing so strengthens its bargaining ability across the industry as a whole (Abowd and Farber, 1990). A role for industry unionisation is also considered in the empirical work.
Chapter 3

Estimates of The Recognition Process

3.1 Data Description

The three Workplace Industrial Relations Surveys of 1980, 1984 and 1990 are the most widely-used and commonly cited surveys on industrial relations issues in Britain. They are nationally representative surveys of establishments that employ at least 25 workers, the sampling frame being based on the Census of Employment dated three years before each survey.\(^1\) In recent years, the data have been extensively used by both labour economists and industrial relations researchers to examine a variety of issues.\(^2\)

Table 3.1 uses this establishment-level data to document the decline of union recognition for both manual and non-manual workers across all establishments and in different sectors of the economy (the public sector, private sector manufacturing and non-manufacturing). Between 1980 and 1990 the proportion of establishments which recognised trade unions for manual workers fell by around 13 percentage points or 21 percent of the 1980 mean (from 0.61 to 0.48); non-manual recognition fell by about 7 percentage points or

\(^1\)Of course, the 25 employee cut-off point excludes a sizable (considerably less unionized) proportion of aggregate employment and this should be borne in mind when interpreting the results reported in this paper.

\(^2\)See Millward et al. (1992) for an extremely comprehensive review of these data sources.
15 percent (from 0.50 to 0.43). Declines in the proportion of establishments with recognised unions are observed between 1980 and 1990 for all the disaggregated groups reported in the Table for both manuals and non-manuals. The sharpest declines have appeared within the areas where unions have been traditionally strong, namely for manual workers in manufacturing (the decline there is a massive 25 percentage points fall or 34 percent compared to the 1980 mean).
Table 3.1: Proportion of Establishments with Recognised Unions for Manual Workers

<table>
<thead>
<tr>
<th>Sector</th>
<th>1980 Proportion</th>
<th>Number of Establishments</th>
<th>1984 Proportion</th>
<th>Number of Establishments</th>
<th>1990 Proportion</th>
<th>Number of Establishments</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Establishments</td>
<td>0.61</td>
<td>1780</td>
<td>0.62</td>
<td>1853</td>
<td>0.48</td>
<td>1831</td>
</tr>
<tr>
<td>Public Sector</td>
<td>0.84</td>
<td>611</td>
<td>0.91</td>
<td>758</td>
<td>0.78</td>
<td>561</td>
</tr>
<tr>
<td>Private Sector</td>
<td>0.50</td>
<td>1169</td>
<td>0.44</td>
<td>1095</td>
<td>0.37</td>
<td>1270</td>
</tr>
<tr>
<td>Private Sector Manufacturing</td>
<td>0.69</td>
<td>703</td>
<td>0.56</td>
<td>580</td>
<td>0.44</td>
<td>616</td>
</tr>
<tr>
<td>Other Private Sector</td>
<td>0.38</td>
<td>466</td>
<td>0.38</td>
<td>515</td>
<td>0.31</td>
<td>654</td>
</tr>
<tr>
<td>All Establishments</td>
<td>0.50</td>
<td>1934</td>
<td>0.54</td>
<td>2010</td>
<td>0.43</td>
<td>2058</td>
</tr>
<tr>
<td>Public Sector</td>
<td>0.91</td>
<td>702</td>
<td>0.98</td>
<td>825</td>
<td>0.84</td>
<td>630</td>
</tr>
<tr>
<td>Private Sector</td>
<td>0.29</td>
<td>1232</td>
<td>0.28</td>
<td>1185</td>
<td>0.25</td>
<td>1429</td>
</tr>
<tr>
<td>Private Sector Manufacturing</td>
<td>0.28</td>
<td>702</td>
<td>0.26</td>
<td>592</td>
<td>0.23</td>
<td>630</td>
</tr>
<tr>
<td>Other Private Sector</td>
<td>0.30</td>
<td>530</td>
<td>0.30</td>
<td>593</td>
<td>0.26</td>
<td>798</td>
</tr>
</tbody>
</table>

Notes. 1. Calculated from the 1980, 1984 and 1990 Workplace Industrial Relations Surveys. Weighted proportions (weights are from WIRS, based on the Census of Employment three years prior to the survey, to allow for the deliberate oversampling of larger establishments).
2. Numbers differ in 1980 from those reported in the WIRS reference books (Millward and Stevens, 1986; Millward et al., 1992) due to different treatment of missing values (assigned to non-recognition in the books, but treated as missing here).
3. The number of establishments are the unweighted numbers.
3.1.1 Decomposition of Changes in Union Recognition Status

It is well known that changes in the composition of employment have simultaneously occurred as the 1980s saw a continuation of post-war shifts away from manufacturing to services, away from manual to non-manual employment, from full-time to part-time work, male to female employment and so on. As such the changing nature of employment has involved a shift towards those areas where unions have traditionally been less well represented (see, for example, Green, 1992).

The relative importance of declines within the three groups in Table 3.1 versus declines arising from compositional changes in the nature of the workforce can be easily evaluated. One can decompose the aggregate change in the proportion of establishments with recognised unions, say $\Delta X$, in the following manner

$$
\Delta X = \Delta X_1 \bar{f}_1 + \Delta X_2 \bar{f}_2 + \Delta X_3 \bar{f}_3 \\
+ (\bar{X}_1 - \bar{X}_2) \Delta f_1 + (\bar{X}_2 - \bar{X}_3) \Delta f_2
$$

where a bar denotes a 1980-1990 mean, $X_i$ is the proportion of establishments with recognised unions amongst the establishments in group $i$ and $f_i$ is the relative frequency of group $i$ among all establishments. The first three terms relate to within-group changes and the last two terms reflect between-group, across-sector, shifts.

The results of the decomposition are shown in table 3.2 and pictured in Figure 3.1. Half of the decline in manual recognition is explained by the decline inside the manufacturing sector. For manual workers compositional changes between these three broad sectors explain less than 15 percent of the total 1980 to 1990 change. For non-manual workers both the decline within the public sector and the declining share of public sector employment in total employment are important, but no single effect dominates.
Table 3.2: Decomposition of the Aggregate Decline in Recognition 1980-1990

<table>
<thead>
<tr>
<th>Percentage Point Change in Recognition Resulting from</th>
<th>Manual Trade Union Recognition</th>
<th>Non Manual Trade Union Recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decline within manufacturing</td>
<td>6.39 (50)</td>
<td>1.10 (15)</td>
</tr>
<tr>
<td>Decline within services</td>
<td>2.85 (22)</td>
<td>1.76 (24)</td>
</tr>
<tr>
<td>Decline within public sector</td>
<td>1.87 (15)</td>
<td>2.42 (33)</td>
</tr>
<tr>
<td>Compositional changes (between sectors)</td>
<td>1.71 (13)</td>
<td>2.04 (28)</td>
</tr>
<tr>
<td>Total changes 1980-1990</td>
<td>12.79 (100)</td>
<td>7.32 (100)</td>
</tr>
</tbody>
</table>

Notes. 1. Based on decomposition described in text.

Figure 3.1: Decomposition of the 1980s decline in union recognition
3.1.2 Cohort effects on recognition probabilities

The discussion of the recognition process in the previous chapter suggested that it is the characteristics of the product and labour market in which the workplace is set up which are the crucial determinants of union recognition. This being so it should be expected that older plants to differ from younger ones in terms of their recognition probabilities.

Table 3.3 reports weighted means of trade union recognition broken down by this measure of establishment age. It is evident that older plants are much more likely to recognise trade unions for manual or non-manual employees. Moreover, for the panel reporting "All Establishments" it is apparent that the probability of recognition in old establishments remains more or less constant across the surveys and it is the decline in the recognition probability among new establishments which, operating through a weighted cohort effect, largely explains the falling recognition probability in the stock as a whole. This suggests that the birth process of recognitions described here may be sufficient to explain the recognition trend overall. However, for the panel "Private Sector Manufacturing", particularly among manuals, this process is probably not the whole story: the decline in reported recognition is sharper than would merely be explained by the declining probability of new recognition.  

Figures 3.2 and 3.3 reports a smoothed moving average plot of whether plants 'born' between 1970 and 1990 currently recognise unions, based on 1990 Workplace Industrial Relations Survey data, for all establishments and for those in private sector manufacturing. It is apparent that variation in the incidence of recognition over time is considerable. Across all establishments there is a clear decline in the likelihood that establishments recognise

---

3A simple calculation is that the declining probability of recognition in plants less than 10 years old and the increase in the proportion of younger plants in the sample together account for 60 percent of the decline in manual recognition across the sample of manufacturing plants, and all the change in non-manual recognition.
Table 3.3: Union Status by Age of Workplace 1980-1990

<table>
<thead>
<tr>
<th>Age</th>
<th>Age Distribution (%)</th>
<th>Manual Recognition (%)</th>
<th>Non Manual Recognition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 years</td>
<td>2.4 2.5 5.7</td>
<td>52 44 34</td>
<td>41 37 32</td>
</tr>
<tr>
<td>≥3 and &lt; 5 year</td>
<td>3.9 3.8 10.6</td>
<td>54 62 32</td>
<td>45 45 28</td>
</tr>
<tr>
<td>≥5 and &lt;10 years</td>
<td>13 12.2 14.6</td>
<td>58 49 29</td>
<td>47 49 25</td>
</tr>
<tr>
<td>≥10 and &lt;20 years</td>
<td>- - 23.5</td>
<td>- - 49</td>
<td>- - 42</td>
</tr>
<tr>
<td>≥10 and &lt;25 years</td>
<td>27.6 29.9 -</td>
<td>59 60 -</td>
<td>50 53 -</td>
</tr>
<tr>
<td>≥20 years</td>
<td>- - 47.2</td>
<td>- - 57</td>
<td>- - 51</td>
</tr>
<tr>
<td>≥25 years</td>
<td>53.1 51.2 -</td>
<td>64 65 -</td>
<td>50 56 -</td>
</tr>
<tr>
<td>All</td>
<td>100 100 100</td>
<td>61 62 48</td>
<td>50 54 43</td>
</tr>
</tbody>
</table>

All Establishments

Private Sector Manufacturing

<table>
<thead>
<tr>
<th>Age</th>
<th>Age Distribution (%)</th>
<th>Manual Recognition (%)</th>
<th>Non Manual Recognition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 years</td>
<td>2.6 2.8 6.5</td>
<td>44 40 31</td>
<td>24 3 19</td>
</tr>
<tr>
<td>≥3 and &lt; 5 year</td>
<td>3.3 4 11.4</td>
<td>64 63 26</td>
<td>46 28 17</td>
</tr>
<tr>
<td>≥5 and &lt;10 years</td>
<td>13.9 12.6 20.9</td>
<td>57 28 21</td>
<td>25 9 8</td>
</tr>
<tr>
<td>≥10 and &lt;20 years</td>
<td>- - 21.4</td>
<td>- - 42</td>
<td>- - 23</td>
</tr>
<tr>
<td>≥10 and &lt;25 years</td>
<td>25.6 31.8 -</td>
<td>68 42 -</td>
<td>31 20 -</td>
</tr>
<tr>
<td>≥20 years</td>
<td>- - 43.6</td>
<td>- - 61</td>
<td>- - 32</td>
</tr>
<tr>
<td>≥25 years</td>
<td>54.5 48.8 -</td>
<td>75 71 -</td>
<td>27 35 -</td>
</tr>
<tr>
<td>All</td>
<td>100 100 100</td>
<td>69 56 44</td>
<td>28 26 23</td>
</tr>
</tbody>
</table>

Notes. 1. Weighted percentages reported.
manual or non-manual unions from the mid-1970s onwards. The most noticeable decline since the late 1970s has been in private sector manufacturing (especially among manual workers).
Figure 3.2: Cohort effects on recognition in the private manufacturing sector

Simple Logit Models of Union Recognition Status

Evidence is now presented that the cohort effects remain an important determinant of union status, even after controlling for other characteristics. Several important results emerge from consideration of the regressions in Table 3.4 and 3.5. First, the cross sectional decline in union recognition between 1980 and 1990 is not fully explained by the estimated models. In the pooled sample for both manuals and non-manuals, the estimated coefficients on the 1980 and 1984 sample dummies are large, statistically significant and positive, indicating that the trend in unionization is not entirely explained by the decline in the relative share of public sector establishments, manufacturing establishments, and the other controls.

Secondly, in most specifications recognition appears to be determined differently in private sector manufacturing than in private sector non-manufacturing and in the public as compared to the private sector as the $\chi^2$ parameter stability tests at the base of tables 3.4 and 3.5 show. For manual recognition,
the estimated coefficient on the dummy variables indicating private manufacturing status shows a sharp decline from 0.814 (marginal effect = 0.143) to 0.259 (marginal effect = 0.056) between 1980 and 1990 reinforcing the result that there have been large declines within manufacturing that are not explained by the independent variables included in the logit models.4

The third result of note is that establishment age/cohort is found to be an extremely important determinant of recognition in all years (for manuals) and its effect is clearly increasing over time (for both groups of workers). One should be a little careful here since the definition of the age variable differs across years5 but, even given this, there does appear to be an important

Figure 3.3: Cohort effects on recognition in the rest of the private sector

\[ \text{Proportion with recognised unions in 1990} \]

\[ \text{Establishment set up year} \]

---

4In logit models marginal effects are computed as \[ \beta \times P(1 - P) \] where \( P \) is the mean of the dependent variable and \( \beta \) is the relevant estimated coefficient.

5The precise wording of the survey question is as follows: in 1980 and 1984 “How long ago did this establishment first engage in its main activity?”; in 1990 “How long has this establishment been operating here at this address?”. The range of responses also differs. In 1980 and 1984 responses were banded into 1-3 years, 3-5 years, 5-10 years, 10-25 years and 25 or more years. In 1990 responses were continuous up to 20 years and then open-ended as 20 or more years.
shift. For example, in the manual specifications in Table 3.4, the marginal effect associated with the coefficient on age more than doubles, rising from 0.07 in 1980 to 0.18 in 1990.\textsuperscript{6} Hence, between 1980 and 1990 there is a large ceteris paribus increase in the probability that unions are recognised in older establishments. The fact that the cross sectional relationship between recognition and age has changed emphasises the importance of cohort effects.

The next sections look more deeply at these cohort effects on recognition and see if they can be explained by dated variables proxing the characteristics of the labour and product market in which the workplace was established.

\section*{3.2 Model Specification}

\subsection*{3.2.1 Identification Issues}

The discussion above suggests that it is the characteristics of the product and labour market in which the workplace is set up that are the crucial determinant of its union status. To test this, cohort effects need to be separated from life-cycle effects. This can be done in the following way:

1. If it can be assumed that the change in the probability of unionisation over the life of the establishment does not shift over time, then all moves in the coefficient on age in a discrete choice model of recognition probabilities can be attributed to cohort effects

2. The stability of time dated regressors across different cross sectional regressions over time, corresponding to workplaces of different ages will imply that it is cohort effects that are predominant

3. Most importantly evidence has been presented in the introduction suggesting that the union status of establishments does not change over

\textsuperscript{6}For completeness, note that for non-manual recognition the comparable rise in the marginal effect associated with age demonstrates an even sharper increase from 0.04 to 0.16.
Table 3.4: Logit Estimates of the Determinants of Manual Union Recognition, 1980-1990

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>1984</th>
<th>1990</th>
<th>POOLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.141</td>
<td>-2.230</td>
<td>-2.021</td>
<td>-2.384</td>
</tr>
<tr>
<td></td>
<td>0.269</td>
<td>0.256</td>
<td>0.236</td>
<td>0.158</td>
</tr>
<tr>
<td>Public Sector</td>
<td>2.276</td>
<td>3.035</td>
<td>2.311</td>
<td>2.501</td>
</tr>
<tr>
<td></td>
<td>0.207</td>
<td>0.210</td>
<td>0.188</td>
<td>0.114</td>
</tr>
<tr>
<td>Private Sector Manufacturing</td>
<td>0.814</td>
<td>0.538</td>
<td>0.259</td>
<td>0.493</td>
</tr>
<tr>
<td></td>
<td>0.185</td>
<td>0.205</td>
<td>0.159</td>
<td>0.098</td>
</tr>
<tr>
<td>Over 25 years old</td>
<td>0.392</td>
<td>0.376</td>
<td>0.813</td>
<td>0.564</td>
</tr>
<tr>
<td>(20 years old in 1990 survey)</td>
<td>0.147</td>
<td>0.142</td>
<td>0.127</td>
<td>0.079</td>
</tr>
<tr>
<td>50-99 Employees</td>
<td>0.584</td>
<td>0.538</td>
<td>0.430</td>
<td>0.507</td>
</tr>
<tr>
<td></td>
<td>0.203</td>
<td>0.205</td>
<td>0.230</td>
<td>0.116</td>
</tr>
<tr>
<td>100-199 Employees</td>
<td>1.010</td>
<td>1.301</td>
<td>0.915</td>
<td>1.042</td>
</tr>
<tr>
<td></td>
<td>0.217</td>
<td>0.222</td>
<td>0.205</td>
<td>0.121</td>
</tr>
<tr>
<td>200-499 Employees</td>
<td>1.611</td>
<td>1.271</td>
<td>1.687</td>
<td>1.526</td>
</tr>
<tr>
<td></td>
<td>0.239</td>
<td>0.223</td>
<td>0.221</td>
<td>0.130</td>
</tr>
<tr>
<td>500-999 Employees</td>
<td>2.630</td>
<td>2.096</td>
<td>2.330</td>
<td>2.285</td>
</tr>
<tr>
<td></td>
<td>0.348</td>
<td>0.276</td>
<td>0.266</td>
<td>0.164</td>
</tr>
<tr>
<td>1000 or more Employees</td>
<td>3.419</td>
<td>3.278</td>
<td>2.266</td>
<td>2.754</td>
</tr>
<tr>
<td></td>
<td>0.444</td>
<td>0.369</td>
<td>0.245</td>
<td>0.175</td>
</tr>
<tr>
<td>Manual Proportion</td>
<td>3.172</td>
<td>2.917</td>
<td>1.912</td>
<td>2.545</td>
</tr>
<tr>
<td></td>
<td>0.304</td>
<td>0.283</td>
<td>0.240</td>
<td>0.154</td>
</tr>
<tr>
<td>Part time Proportion</td>
<td>-1.897</td>
<td>-1.596</td>
<td>-1.788</td>
<td>-1.762</td>
</tr>
<tr>
<td></td>
<td>0.978</td>
<td>0.347</td>
<td>0.301</td>
<td>0.192</td>
</tr>
<tr>
<td>Foreign Owned</td>
<td>-0.757</td>
<td>-0.293</td>
<td>-0.167</td>
<td>-0.264</td>
</tr>
<tr>
<td></td>
<td>0.264</td>
<td>0.225</td>
<td>0.180</td>
<td>0.112</td>
</tr>
<tr>
<td>Single Establishment</td>
<td>-1.346</td>
<td>-0.663</td>
<td>-0.972</td>
<td>-1.004</td>
</tr>
<tr>
<td></td>
<td>0.194</td>
<td>0.270</td>
<td>0.180</td>
<td>0.110</td>
</tr>
<tr>
<td>1980 Survey</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.507</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.096</td>
</tr>
<tr>
<td>1984 Survey</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.465</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.095</td>
</tr>
<tr>
<td>Number of Establishments</td>
<td>1715</td>
<td>1785</td>
<td>1727</td>
<td>5227</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-614.147</td>
<td>-648.581</td>
<td>-785.213</td>
<td>-2083.715</td>
</tr>
<tr>
<td>( H_0 : \beta_{\text{private}} = \beta_{\text{public}} )</td>
<td>( \chi^2(11) = 20.52 )</td>
<td>( \chi^2(11) = 47.01 )</td>
<td>( \chi^2(11) = 29.34 )</td>
<td>( \chi^2(13) = 94.93 )</td>
</tr>
<tr>
<td></td>
<td>P-value&lt;0.01</td>
<td>P-value&lt;0.01</td>
<td>P-value&lt;0.01</td>
<td>P-value&lt;0.01</td>
</tr>
<tr>
<td>( H_0 : \beta_{\text{manuf}} = \beta_{\text{non-manuf}} ) in private sector model</td>
<td>( \chi^2(10) = 12.78 )</td>
<td>( \chi^2(10) = 31.34 )</td>
<td>( \chi^2(10) = 13.49 )</td>
<td>( \chi^2(12) = 42.85 )</td>
</tr>
<tr>
<td></td>
<td>P-value=0.38</td>
<td>P-value&lt;0.01</td>
<td>P-value=0.31</td>
<td>P-value&lt;0.01</td>
</tr>
<tr>
<td>( H_0 : \beta_{\text{w}1980} = \beta_{\text{w}1984} = \beta_{\text{w}1990} )</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>( \chi^2(24) = 71.55 )</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>P-value&lt;0.01</td>
</tr>
</tbody>
</table>
Table 3.5: Logit Estimates of the Determinants of Non-Manual Union Recognition, 1980-1990

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>1984</th>
<th>1990</th>
<th>POOLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.681</td>
<td>-1.178</td>
<td>-1.284</td>
<td>-1.311</td>
</tr>
<tr>
<td></td>
<td>0.213</td>
<td>0.221</td>
<td>0.193</td>
<td>0.128</td>
</tr>
<tr>
<td>Public Sector</td>
<td>2.932</td>
<td>4.972</td>
<td>2.858</td>
<td>3.318</td>
</tr>
<tr>
<td></td>
<td>0.202</td>
<td>0.397</td>
<td>0.188</td>
<td>0.125</td>
</tr>
<tr>
<td>Private Sector</td>
<td>0.069</td>
<td>0.179</td>
<td>0.150</td>
<td>0.124</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.162</td>
<td>0.167</td>
<td>0.150</td>
<td>0.091</td>
</tr>
<tr>
<td>Establishment over</td>
<td>0.173</td>
<td>0.317</td>
<td>0.670</td>
<td>0.408</td>
</tr>
<tr>
<td>25 years old</td>
<td>0.130</td>
<td>0.137</td>
<td>0.121</td>
<td>0.074</td>
</tr>
<tr>
<td>50-99 Employees</td>
<td>0.395</td>
<td>0.484</td>
<td>0.193</td>
<td>0.356</td>
</tr>
<tr>
<td></td>
<td>0.199</td>
<td>0.219</td>
<td>0.202</td>
<td>0.118</td>
</tr>
<tr>
<td>100-199 Employees</td>
<td>0.572</td>
<td>0.854</td>
<td>0.654</td>
<td>0.674</td>
</tr>
<tr>
<td></td>
<td>0.198</td>
<td>0.221</td>
<td>0.199</td>
<td>0.117</td>
</tr>
<tr>
<td>200-499 Employees</td>
<td>1.716</td>
<td>1.412</td>
<td>1.484</td>
<td>1.543</td>
</tr>
<tr>
<td></td>
<td>0.214</td>
<td>0.226</td>
<td>0.205</td>
<td>0.123</td>
</tr>
<tr>
<td>500-999 Employees</td>
<td>2.055</td>
<td>2.043</td>
<td>1.908</td>
<td>1.969</td>
</tr>
<tr>
<td></td>
<td>0.232</td>
<td>0.258</td>
<td>0.254</td>
<td>0.141</td>
</tr>
<tr>
<td>1000 or more</td>
<td>3.449</td>
<td>3.237</td>
<td>2.032</td>
<td>2.679</td>
</tr>
<tr>
<td>Employees</td>
<td>0.331</td>
<td>0.335</td>
<td>0.226</td>
<td>0.155</td>
</tr>
<tr>
<td>Manual Proportion</td>
<td>-0.382</td>
<td>0.089</td>
<td>0.051</td>
<td>-0.031</td>
</tr>
<tr>
<td></td>
<td>0.228</td>
<td>0.228</td>
<td>0.195</td>
<td>0.125</td>
</tr>
<tr>
<td>Part time Proportion</td>
<td>-0.802</td>
<td>-0.827</td>
<td>-1.107</td>
<td>-0.980</td>
</tr>
<tr>
<td></td>
<td>0.359</td>
<td>0.361</td>
<td>0.283</td>
<td>0.187</td>
</tr>
<tr>
<td>Foreign Owned</td>
<td>-0.621</td>
<td>-0.298</td>
<td>-0.345</td>
<td>-0.356</td>
</tr>
<tr>
<td></td>
<td>0.813</td>
<td>0.193</td>
<td>0.159</td>
<td>0.099</td>
</tr>
<tr>
<td>Single Establishment</td>
<td>-0.992</td>
<td>-0.696</td>
<td>-1.143</td>
<td>-0.965</td>
</tr>
<tr>
<td></td>
<td>0.179</td>
<td>0.263</td>
<td>0.193</td>
<td>0.122</td>
</tr>
<tr>
<td>1980 Survey</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.288</td>
</tr>
<tr>
<td>1984 Survey</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.088</td>
</tr>
<tr>
<td>Number of Establishments</td>
<td>1856</td>
<td>1935</td>
<td>1925</td>
<td>5716</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-779.858</td>
<td>-693.140</td>
<td>-891.757</td>
<td>-2394.089</td>
</tr>
<tr>
<td>$H_0: \beta_{private} = \beta_{public}$</td>
<td>$\chi^2(11)=9.23$</td>
<td>$\chi^2(11)=4.11$</td>
<td>$\chi^2(11)=17.54$</td>
<td>$\chi^2(13)=49.37$</td>
</tr>
<tr>
<td></td>
<td>P-value=0.72</td>
<td>P-value=0.97</td>
<td>P-value=0.14</td>
<td>P-value&lt;0.01</td>
</tr>
<tr>
<td>$H_0: \beta_{manuf} = \beta_{non-manuf}$</td>
<td>$\chi^2(10)=45.85$</td>
<td>$\chi^2(10)=60.51$</td>
<td>$\chi^2(10)=30.98$</td>
<td>$\chi^2(12)=107.73$</td>
</tr>
<tr>
<td>in private sector model</td>
<td>P-value&lt;0.01</td>
<td>P-value&lt;0.01</td>
<td>P-value&lt;0.01</td>
<td>P-value&lt;0.01</td>
</tr>
<tr>
<td>$H_0: \beta_{wire80} = \beta_{wire84} = \beta_{wire90}$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>$\chi^2(24)=78.67$</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>P-value&lt;0.01</td>
</tr>
</tbody>
</table>
time (i.e. age effects are zero). This last implies that there should be no life cycle effects on recognition probabilities, the difference in recognition between old and young workplaces is driven by cohort effects.

Estimating cohort effects from cross sections will also be problematic if attrition, (bankruptcy) is non-random, if the expected lifetime of the establishment determines the probability that it will be recognised or if the threat of unionisation actually effects whether the initial investment takes place. While we have no evidence on the last two points, the theory discussed below suggests that on balance these two are unlikely, given that production should always take place if there is no asymmetry of information. On the last, the effect of unions on the expected life cycle of the establishment, the evidence is unclear. Machin (1995) suggested there to be no effect, a finding consistent with unions maximising rents and not quasi-rents.

3.3 Empirical Implementation

As discussed in the last chapter, recognition will be treated as a function of three sets of variables:

1. age-dated industry level measures of expected quasi-rents and union density, as discussed above, plus any other time-period specific factor (e.g. stochastic shocks to aggregate demand; macroeconomic factors; legislative factors; general economy-wide feelings on trade unions and so on).

2. establishment characteristics such as plant size and the proportion of manual workers which affect the expected costs and benefits to management of unionization. Although in principle these could be time-dated variables as in (1), they may also take time to reach their steady state size (notably employment size).
3. the (predominantly time-invariant) characteristics of management and
the structure of the firm, which condition the resources available to
management and their willingness to resist unions. Foreign ownership,
for example, is expected to reduce the probability of recognition given
the greater threat of relocation.

Under the UK institutional framework where employers are the ones that
make the choice to negotiate with unions, it seems reasonable to model the
probability of recognition as follows:

\[ \Pr(U_i = 1) = F((\Pi_i^u - \Pi_i^p) + S) \]

where \( U_i \) is the union status of workplace \( i \), \( F(x) \) is a cumulative distrib­
ution function, \( (\Pi_i^u - \Pi_i^p) \) is the expected profit loss due to unionisation and
\( S \) is the cost of resistance. This model lends itself empirical estimation in
the following way.

The discussion in the previous chapter suggested that the level of quasi­
rents per worker should influence the probability of recognition both through
the profitability cost of unionisation \( (\Pi_i^u - \Pi_i^p) \) and through the cost of resis­
tance \( S \). It should thus be expected that the relationship between recognition
and these variables will be non-linear. What matters in terms of the prob­
ability of recognition is the expected life time level of quasi-rents and these
can be proxied by the relative industry quasi-rents at the time of set-up.
Dated industry level union density will affect recognition mostly through the
costs of resistance. As economic rents per-head are only observed in manu­
facturing in the UK, this is the only time dated industry level variable that is
available for the other industries in the private sector. Macro level variables
such as growth rates, the rate of inflation if they proxy the tightness of the
labour market may influence the relative bargaining strengths of union and
employers at the time of set up and so influence the probability of recognition.

The effect of legislative factors can be estimated by considering whether or
not a post-1979 shift in the probability of recognition occurred. Specifically,
we incorporate a dummy variable equal to one if the establishment was set up after 1979 in our logit regressions of the determinants of union recognition recognition.\(^7\)

As mentioned before the technology of production and the composition of the workforce will affect the relative productivity costs of unionisation, thus it is important to control for size and composition effects in the empirical models. Ownership status may also influence the costs of resistance to unions. Multinationals will find it much easier to threaten to relocate for example.

\(^7\)Rather than simply use this "Established in the 1980s" variable we also included a set of dummy variables indicating the year of set-up in the 1980s (except for 1989 where all new establishments did not have recognition). These results (available on request) pointed to a negative effect in each year after 1979.
3.4 Results

Table 3.6 is a simple logit regression of manual recognition in the manufacturing sector on age-dated quasi-rents and its square which indicates clearly the raw relationship between dated industry level rents. Indeed although a formal χ² test of parameter stability is rejected none of the coefficients are individually significantly different and it is likely that the differences are driven by other compositional factors.

Table 3.6: Logit Models of Union Recognition in Private Sector Manufacturing 1980-1990

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>1984</th>
<th>1990</th>
<th>POOLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.807</td>
<td>-0.570</td>
<td>-0.579</td>
<td>0.689</td>
</tr>
<tr>
<td></td>
<td>1.028</td>
<td>0.664</td>
<td>0.663</td>
<td>0.430</td>
</tr>
<tr>
<td>Industry Quasi-rents</td>
<td>2.616</td>
<td>3.568</td>
<td>2.378</td>
<td>2.137</td>
</tr>
<tr>
<td>per head</td>
<td>1.750</td>
<td>1.139</td>
<td>1.064</td>
<td>0.681</td>
</tr>
<tr>
<td>Industry Quasi-rents</td>
<td>-1.285</td>
<td>-1.401</td>
<td>-0.746</td>
<td>-0.829</td>
</tr>
<tr>
<td>per head squared</td>
<td>0.656</td>
<td>0.432</td>
<td>0.361</td>
<td>0.245</td>
</tr>
<tr>
<td>1984 Dummy</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.155</td>
</tr>
<tr>
<td>1990 Dummy</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.149</td>
</tr>
<tr>
<td>Number of Establishments</td>
<td>673</td>
<td>562</td>
<td>558</td>
<td>1793</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-256.64</td>
<td>-278.42</td>
<td>-328.89</td>
<td>-871.91</td>
</tr>
</tbody>
</table>

χ²(4) Test of Equality of Coefficients over the three samples = 15.92 (p-value=0.003)

In this light, table 3.7 reports a specification which also includes age-dated industry union density, an "Established in the 1980s" dummy variable and the full set of controls. As can be seen, the model works well across all four samples and the coefficients are mostly similar. There is a strong inverse "U" shaped relationship between quasi-rents at set-up date and recognition probabilities. Other support for the model is received from the positive
statistically significant coefficient on industry union density at the time of set-up.

It is reassuring that the principal features of the model are consistent with the data from all three Workplace Industrial Relations Surveys. There is, however, one extremely dramatic result that emerges. The coefficient on the dummy variable indicating that an establishment was set up in the 1980s is estimated to be negative and strongly significant. The size of the effect is big, a plant established in the 1980s is ceteris paribus some 16.4 percent less likely to recognize manual unions for collective bargaining purposes. In the 1990 model the effect is even more striking at 26.5 percent. Hence, there appears to have been an important shift in the probability of recognition of trade unions for manual workers in the 1980s. Given the structure of our models, this suggests that the 1980s saw a big increase in the failure of unions to achieve recognition in new plants.

\[ \text{This marginal effect is computed as } \beta(80s) \cdot P \cdot (1 - P) \text{ where } \beta(80s) \text{ is the estimated logit coefficient on the "Established in the 1980s" variable and } P \text{ is the mean of the dependent variable.} \]
Table 3.7: Logit Models of Union Recognition in Private Sector Manufacturing 1980-1990 Further Specifications

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>1984</th>
<th>1990</th>
<th>POOLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-4.986</td>
<td>-3.447</td>
<td>-5.742</td>
<td>-4.269</td>
</tr>
<tr>
<td>Industry quasi-rents per head</td>
<td>3.523</td>
<td>4.095</td>
<td>3.523</td>
<td>2.435</td>
</tr>
<tr>
<td>Industry quasi-rents per head squared</td>
<td>-1.591</td>
<td>-1.762</td>
<td>-1.191</td>
<td>-0.991</td>
</tr>
<tr>
<td>Industry union density</td>
<td>0.849</td>
<td>0.698</td>
<td>0.511</td>
<td>0.325</td>
</tr>
<tr>
<td>Established in the 1980s</td>
<td>-0.116</td>
<td>-1.309</td>
<td>-1.023</td>
<td>-0.648</td>
</tr>
<tr>
<td>50-99 employees</td>
<td>0.937</td>
<td>0.188</td>
<td>1.168</td>
<td>0.641</td>
</tr>
<tr>
<td>100-199 employees</td>
<td>1.922</td>
<td>1.200</td>
<td>1.664</td>
<td>1.498</td>
</tr>
<tr>
<td>200-499 employees</td>
<td>2.422</td>
<td>1.494</td>
<td>2.674</td>
<td>2.086</td>
</tr>
<tr>
<td>500-999 employees</td>
<td>4.143</td>
<td>3.712</td>
<td>4.064</td>
<td>3.667</td>
</tr>
<tr>
<td>1000 + employees</td>
<td>4.119</td>
<td>4.966</td>
<td>3.852</td>
<td>3.819</td>
</tr>
<tr>
<td>Manual proportion</td>
<td>2.967</td>
<td>1.643</td>
<td>2.853</td>
<td>2.518</td>
</tr>
<tr>
<td>Part-time proportion</td>
<td>-2.925</td>
<td>-4.504</td>
<td>-4.884</td>
<td>-3.810</td>
</tr>
<tr>
<td>Single Site</td>
<td>-0.664</td>
<td>-1.147</td>
<td>-0.729</td>
<td>-0.871</td>
</tr>
<tr>
<td>Foreign Owned</td>
<td>-1.122</td>
<td>-0.402</td>
<td>0.065</td>
<td>-0.354</td>
</tr>
<tr>
<td>Affiliated to employer's association</td>
<td>0.870</td>
<td>1.684</td>
<td>1.274</td>
<td>1.262</td>
</tr>
<tr>
<td>Regional Dummies (9)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sample Dummies (2)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Plants</td>
<td>673</td>
<td>562</td>
<td>558</td>
<td>1793</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-174.80</td>
<td>-160.91</td>
<td>-214.54</td>
<td>-581.77</td>
</tr>
</tbody>
</table>

Notes: 1. Logit coefficient estimates standard errors are in italics. 
\( \chi^2(46) \) Test of equality of parameters across years = 63.04, p value = 0.05
Table 3.8 now compares results for manual and non-manual workers using the 1990 WIRS. Both manual and non-manual specifications are very similar. Industry quasi-rents (as before, entering non-linearly) and union density at time of set-up are important for both models. There is a strongly significant downward shift in the probability of recognition after 1979 in both models. The only noteworthy differences between the manual and non-manual equations concern the weaker (though similar) coefficients on the quasi-rents variables in the non-manual model and the more marked 80s negative effect for manuals: (absolute) marginal effects associated with the "Established in the 1980s" variables are 26.5 percent for manual recognition and 16.1 percent for non-manual recognition.

An important issue raised above concerns the definition of quasi-rents at set-up date. Columns (3) and (6) of Table 3.8 therefore reports specifications that include industry rents measures which net out capital costs. The pattern of estimated effects remain very similar for this definition with a quadratic, statistically significant, relation between recognition and industry rents at date of set up. Furthermore, the effects of the "Established in the 1980s" variable and the industry union density variable remain extremely robust to the alternative definition.

There are also several other issues regarding the empirical modelling strategy adopted here. Hence, a number of robustness checks are now reported.

3.4.1 Robustness Checks

Dating of the Recognition Decision

So far, it has been assumed that the date at which the establishment was set up roughly corresponds to the time that decisions over recognition took place. To the extent that the decision took place after set-up date this weakens the approach. However, the previous discussion suggests that (at least in most cases) the decision over whether to grant recognition will be closer to the
Table 3.8: Logit Models of Manual and Non Manual Recognition WIRS 1990

<table>
<thead>
<tr>
<th></th>
<th>Manuals</th>
<th>Non Manuals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.579</td>
<td>-5.479</td>
</tr>
<tr>
<td></td>
<td>0.662</td>
<td>1.346</td>
</tr>
<tr>
<td>Industry quasi-rents</td>
<td>2.375</td>
<td>3.530</td>
</tr>
<tr>
<td>per head</td>
<td>1.064</td>
<td>1.514</td>
</tr>
<tr>
<td>Industry quasi-rents</td>
<td>-0.746</td>
<td>-1.193</td>
</tr>
<tr>
<td>per head squared</td>
<td>0.361</td>
<td>0.511</td>
</tr>
<tr>
<td>Industry rents per head</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Industry rents per head</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Industry rents squared</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Industry union density</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.361</td>
</tr>
<tr>
<td>Established in the 1980s</td>
<td>-</td>
<td>-1.306</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.316</td>
</tr>
<tr>
<td>50-99 employees</td>
<td>-</td>
<td>1.160</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.494</td>
</tr>
<tr>
<td>100-199 employees</td>
<td>-</td>
<td>1.654</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.500</td>
</tr>
<tr>
<td>200-499 employees</td>
<td>-</td>
<td>2.674</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.527</td>
</tr>
<tr>
<td>500-999 employees</td>
<td>-</td>
<td>4.058</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.628</td>
</tr>
<tr>
<td>1000+ employees</td>
<td>-</td>
<td>3.848</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.590</td>
</tr>
<tr>
<td>Manual proportion</td>
<td>-</td>
<td>2.848</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.665</td>
</tr>
<tr>
<td>Part-time proportion</td>
<td>-</td>
<td>4.893</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>1.284</td>
</tr>
<tr>
<td>Single Site</td>
<td>-0.723</td>
<td>-0.737</td>
</tr>
<tr>
<td></td>
<td>0.310</td>
<td>0.317</td>
</tr>
<tr>
<td>Foreign Owned</td>
<td>-0.070</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>0.288</td>
<td>0.288</td>
</tr>
<tr>
<td>Affiliated to employer's association</td>
<td>-1.278</td>
<td>1.295</td>
</tr>
<tr>
<td></td>
<td>0.342</td>
<td>0.344</td>
</tr>
<tr>
<td>Regional Dummies (10)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Establishments</td>
<td>558</td>
<td>558</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-328.89</td>
<td>-214.49</td>
</tr>
</tbody>
</table>

Notes: 1.Logit coefficients standard errors. Column (2) is slightly different from column (3) of Table II because an extra regional dummy is included (in 1980 London and the South East were coded together so the 1984 and 1990 models in Table II do the same for comparability).
More important is the issue of establishments moving location. For the 1990 data, where we know whether or not an establishment moved location, we carried out several experiments. First, a dummy variable for whether a plant had moved to its current location from another address: was included in a specification comparable to column (2) of Table 3.8. This attracted an insignificant coefficient of -.359 (standard error =.330), whilst the linear and squared quasi-rents terms remained significant (coefficients and standard errors of 3.835(1.407) and -1.299(.482) respectively). Secondly, the coefficient on the age-dated quasi-rents, density terms and the eighties dummy was allowed to differ with the dummy for moving location: The null hypothesis of equal coefficient estimates ($\chi^2(4) = 4.68$, 5% critical value=9.49) could not be rejected, nor did any of the individual coefficients differ significantly with the moving dummy variable.

**Specification of quasi-rents**

The measure of quasi-rents used is revenues less material costs less industry average labour costs. To check the labour cost term (a) an industry average wage weighted by regional unemployment rates at time of inception; (b) a manual or non-manual average wage in the appropriate manual or non-manual recognition equation; and (c) including industry revenues per head and industry wage per head were all used as separate regressors. In all cases, similar results were obtained but the specifications are dominated by those in Tables 3.7 and 3.8

**Industry Effects**

The key variables of interest are matched to establishments by industry and year of set up. It is, however, conceivable that there exist other (unobserved)
industry or year-specific factors that may affect the probability of recognition in a given establishment. This possibility was also considered, but the main thrust of the overall results remains robust to their inclusion (although not surprisingly standard errors rise). Manual and non-manual recognition remain more likely in establishments that were set up before the 1980s and there is still a quadratic recognition-quasi rents profile. Also, not surprisingly, the proposition that only the industry dummies are significant is easily rejected; we are not simply observing compositional shifts in industry structure.

The 1980s effect

The interpretation of the above results is that there has been a structural shift in the probability of recognition in new establishments after 1979. It could also be that there are other time varying affects that are important. We replicated the model implied by column (2) of table 3.8 but also included a full set of year dummies. Again, the quadratic recognition-rents relation remains, as does the positive industry density effect. Formal \( \chi^2 \) tests of the full model reject replacing the decade dummies for “Established in the 1970s” and “the 1980s” by a full set of individual year dummies; indeed since the 1970s effect is itself insignificant, the “Established in the 1980s” dummy remains the only significant time-specific effect other than the time-dated regressors themselves. These coefficients are plotted in figure 3.4 below.

It may also be possible to conclude that this shift variable is picking up cyclical economic factors, rather than being a structural shift. This is tested in table 3.9 below. Columns (3) and (6) of this table suggest that the only really important cyclical variable was GDP growth but the inclusion of this variable does not effect the size or the significance of the 1980s effect.

Service sector establishments
Figure 3.4: Year effects on recognition probabilities for manual workers.

Table 3.9 also tests the possibility that the model estimated in tables 3.7 and 3.8 is really only applicable to manufacturing which is growing to be less and less representative of employment as a whole. While measures of rents and quasi rents are not available for services, the dated industry union density variable is. It is not surprising, however, given the time series profile of establishment age dated recognition illustrated in Figures 3.2 and 3.3, that the variable indicating whether or not the establishment was set up in the 1980s does prove to be extremely important for the whole of the private sector. Establishments that were set up in the eighties are significantly less likely to recognise trade unions. As noted above it is hard to reconcile this with the life-cycle and attrition explanations of the importance of establishment age. Hence, much of the focus in Table 3.9 is on the importance of this 80s effect in conjunction with the other time-dated variables.

The magnitude of the effect is sizable: private sector manufacturing establishments set up in the 1980s were ceteris paribus some 30 percent less likely
to recognise manual unions than other private sector manufacturing establishments (column (2)); within non-manufacturing the analogous probability was about 18 percent (column (5)). This drives home the point made above that much of the union decline is going on within sectors. Unions are finding it harder to achieve recognition status both where they used to be strong (private sector manufacturing) and in the newer sorts of establishments that are becoming increasingly more typical of the British labour market (private sector non manufacturing).

\[\text{Despite the fact that one of the included controls is a single-site dummy variable it is also possible that effects may be different in newly established single independent establishments as compared to those that are part of a multi-establishment enterprise (we thank a referee for this comment). Estimating separate equations comparable to column (1) of Table V for single-site establishments and for establishments that belong to a multi-plant organisation produced very similar marginal effects associated with the "Established in the 1980s" variable. Hence, the failure to organise new establishments seems to hold for new firms and for newly set up establishments in existing firms.}\]
Table 3.9: Estimates of the 1980s Effect on Manual Recognition WIRS 1990

<table>
<thead>
<tr>
<th></th>
<th>Manufacturing</th>
<th>Non Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Established in the 1980s</td>
<td>-1.743</td>
<td>-1.504</td>
</tr>
<tr>
<td></td>
<td>0.219</td>
<td>0.306</td>
</tr>
<tr>
<td>Industry union density</td>
<td>-</td>
<td>1.229</td>
</tr>
<tr>
<td>at time of set up</td>
<td>-</td>
<td>0.353</td>
</tr>
<tr>
<td>Industry quasi-rents per head</td>
<td>-</td>
<td>2.858</td>
</tr>
<tr>
<td>at time of set-up</td>
<td>-</td>
<td>1.385</td>
</tr>
<tr>
<td>Industry quasi-rents per head</td>
<td>-</td>
<td>-1.032</td>
</tr>
<tr>
<td>at time of set-up squared</td>
<td>-</td>
<td>0.469</td>
</tr>
<tr>
<td>GDP growth</td>
<td>-</td>
<td>0.160</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>0.105</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-313.30</td>
<td>-230.31</td>
</tr>
<tr>
<td>Number of Establishments</td>
<td>584</td>
<td>584</td>
</tr>
<tr>
<td>$\chi^2(1)$ test for inclusion of aggregate unemployment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$\chi^2(1)$ test for inclusion of aggregate inflation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Marginal effect for</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Established in the 1980s</td>
<td>-0.351</td>
<td>-0.303</td>
</tr>
</tbody>
</table>

2. The second two specifications for each group includes the following controls: establishment size dummies; manual, part-time proportions; whether UK owned; single-site; 10 regional dummies.
3.5 The Construction of the Dated Determinants of Recognition

To construct the set-up date based quasi-rents measure, data from the Census of Production for the relevant birth year and 2-digit industry. Because the information on age is banded in 1980 and 1984 we assigned all establishments to the midpoint of the relevant age band. Since almost half the establishments are in the oldest category in each of the WIRS, we experimented with the sensitivity of measured quasi-rents to the year of Census of Production data used for that oldest category. For example, it was found that replacing the 1954 Census data with data from 1948 made only minor differences to the constructed quasi-rents for the WIRS84 oldest category (over 25 years old). For the set-up date based industry union density variable we used the series constructed by Bain and Price (1980), Price and Bain (1983) and extended by Waddington (1992).

The measure of gross quasi-rents used is revenues less material costs less labour costs. Unlike Abowd and Farber's (1990) industry-level analysis where they constructed an opportunity wage using an instrumental variables approach, the average industry wage at the time of inception was incorporated as the appropriate labour input price. Experiments with other measures were also conducted and these are discussed in the text. Also, note that capital costs are not netted out: this is because it was not possible to get a consistent capital stock series to match to all 2-digit manufacturing industries. Because one may think that union capture of quasi-rents on capital will lead to the long term destruction of firms then we have also constructed a measure of rents that nets out capital costs at a slightly more aggregated level (covering 13 rather than 17 or 18 industry groups). Results on this are also reported.

10The availability of Census of Production data for manufacturing plants alone is the reason for our focus on the manufacturing sector.
A final empirical point concerns the fact that we have data on industrial quasi-rents per head over different years. We circumvent any problems of year-to-year comparability (since quasi-rents are a nominal measure) by defining a relative quasi-rents variable for each year. It is also conceivable that the expected lifetime stream of quasi-rents is best proxied by a relative measure. The measure of this expected stream that we use is the ratio of industry quasi-rents per head divided by that of the whole manufacturing sector in the appropriate year.
Chapter 4

The Membership Process
-Theory

4.1 Introduction

The aim of this section is to look at the individual's membership decision.

4.2 The influence of tastes on union membership

Workers with a greater preference for the sorts of private (insurance, "reputation") and semi-collective goods (protection against dismissal) that union provide will be more likely, ceteris paribus to join them. Many studies have thus tried to estimate the effect of tastes on the demand for union services by seeing whether factors that may proxy differences in tastes (gender, political affiliation) can explain variations in individual membership. The perceived differences in tastes of workers towards unions across gender and cohort has been often used to suggest why the changing composition of the workforce may have led to the decline in union membership over time.

As figure 4.1\(^1\) shows, changes in attitudes of the population as a whole

\(^1\)Sources:

*Popularity:* Gallup political and economic index. "Net popularity" is defined as the difference between those that think trade unions are a bad thing from those that think
towards unions can have had little role to play in explaining the overall decline. The downward trend in support for trade unions has been reversed in the 1980s.

One explanation for this that has been cited in the literature (Edwards and Bain 1988) is that the distrust of unions is negatively related to their power. Thus the fall in power and influence of trade unions itself means that they are more popular. This, however, says nothing about the individuals decision to join a trade union.

they are a good thing.

Density Bain and Price (1982), Price and Bain (1983), Waddington (1992) and Employment Gazette. Definition of density is membership over workforce
4.3 Workplace level models of union membership

Social Custom Models

Olson (1965) noted that in the absence of compulsion (i.e. the closed shop) union membership should tend to zero as the goods that it provides are non excludable. It is possible that the union could provide private goods (see Booth 1989) or semi-collective goods (see Pencavel 1971) in order to encourage people to join, but there still remains the essential problem The social benefits\(^2\) of joining a union will always exceed the private ones and the effective demand for union services will be lower than the optimal.

Booth (1985) and Naylor and Cripps (1988) have developed models which can explain union membership in the absence of compulsion. They extend the work of Akerlof (1980) which looked at the importance of social customs in explaining why unemployed workers will not always bid down wages. A social custom is defined as

"An act whose utility to the agent performing it depends in some way on the beliefs and actions of other members of the community" (Akerlof 1980)

In these models, workers join unions because they want others to think well of them. Unions provide "reputation" to their members which is a private good. Unions may also provide a social penalty to those workers who free-ride.

These models can be generalised as in figure 4.2 which shows four possible scenarios for a particular workplace or firm. In each panel there is a demand and a supply function. The "demand" function joins the points at which for a given penalty to free-riders the marginal worker is indifferent between joining

\(^2\) Social benefits here refers to those covered by union agreements. It is not meant to refer to other externalities of union activity.
or not joining a union. The “supply” function shows how the amount of penalty that is given to free-riders depends on the proportion of the workforce belonging to a trade union.\footnote{This can be interpreted as the proportion observed to believe in the social custom of joining a union.}

In the first panel workers have identical tastes, thus there is a threshold penalty above which they will all join and below which none of them will join. The amount of penalty to free-riders is rising in the amount of workers in the trade union. It is clear that point $x^*$ at which the marginal workers is indifferent between joining or not joining the union is not stable. At level of membership above this point membership will tend to increase and membership will tend to fall at levels below $x^*$. Similarly in the third panel, because the ability of the union to provide reputation falls faster than changes in reputation encourage workers to join, there is a tendency to move away from $x^*$. In these situations membership level of zero and 100% of employment are both possible and stable so long as changes in employment do not ever move the firm to the other side of $x^*$. Long run union density in workplaces like these will either be zero or 100%.

In the second panel workers are different, but the amount of penalty or reputation does not change with changes in membership. Panel four can be seen as a less extreme case of this with increased membership changing the amount of reputation slower than changes in reputation change the demand for union services. Here intermediate levels of union density are stable. Membership will tends towards $x^*$, that is the point at which the marginal worker is indifferent between joining or not joining a union.

The models of Booth (which predicts either zero or 100 percent membership) and that of Naylor and Cripps (which predicts stable membership level between zero and a hundred percent) can thus be incorporated into these framework.

The predictions of these models are as follows. If workers' perceived
Figure 4.2: Four possible scenarios in a social custom model of trade unions beliefs depend a lot on their actions, or if tastes are quite similar across workers in the same workplace, then union membership will either be zero or 100 percent. On the other hand, if the proportion seen to be believing in the social custom of joining unions varies less with changes in membership or if tastes are quite different, then intermediate levels of union membership are quite possible.

Possible empirical Implementation

The fact that preferences of workers for unions are seen to be interdependent in this model means that individual level studies of union membership are inappropriate. If the reference group for each worker are those with whom she works then union membership is determined at the level of the workplace. The problem with these approaches, however, is that the predictions of union density at the workplace depend upon things which are not observed (the distribution of tastes in the workplace, the ability of unions to penalize free-riders). Only if stable intermediate levels of union density are possible
(i.e. as in panel 2 or panel 4) will the effect of observed factors such as union subscriptions, real wages which might shift the demand and supply lines around be obvious. This suggests that if social customs are important, investigation of the determinants of union membership across workplaces will only be possible with restrictions on the possible relative slopes of the demand and supply functions.

Evidence from the workplace industrial relations survey, however, suggests that such restrictions may be valid. Figures 4.3 and 4.4 which report density just for the private sector show that intermediate levels of union density exist. In the union sector (defined as workplace where there exists a union with negotiating rights over pay), most establishments are in the 50-89% region of union density. Not surprisingly in the non union sector most workplaces have no union members. Evidence from the 1984-1990 panel again suggest stability of union density within workplaces.

4.4 Union density and union recognition in the workplace

If the choice of worker to join a union is dependent on whether her wages are negotiated by unions then union density at the workplace must be dependent on the presence of a recognised union. Figures 4.3 and 4.4 show that much of the variation in union density across workplaces can be explained by the presence of a recognised union. Despite this, the importance of whether or not a trade union is recognised at a given workplace has barely been acknowledged in most studies of the union membership decision based on UK microdata. From an econometric point of view, there are obvious problems arising from the omission of a union recognition or availability variable in an empirical study of the determinants of union membership. Omission will not

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4Gregg and Naylor 1992 report similar findings for the 1984 survey
5see Milward and Stevens (1992) Table 3.5
Figure 4.3: The distribution of manual union density from the 1990 Workplace Industrial Relations Survey

Figure 4.4: The distribution of non-manual union density from the 1990 Workplace Industrial Relations Survey
only reduce the predictive power of the model but more seriously, if recognition probabilities are correlated with any of the variables thought to affect establishment-level union density, a severe bias would be expected in the estimated coefficients. Moreover, if the determinants of union membership differ between union and non union establishments, imposition of equal coefficients across both sectors will severely undermine the value of the results. This restriction should be tested explicitly. But even sample-separation of the determination of union density according to whether unions are recognised in the establishment is only valid if the determination of union recognition or coverage status is exogenous to the determination of union density or membership.

There are two possible reasons why we should expect unobserved factors that determine union density to differ across union and non union workplaces. First union membership and union recognition at the workplace might be jointly determined or determined by the similar factors which might not change over time such as the organising intensity of a industry union. Second, workers with greater preferences for unionisation may be more likely to select themselves into the union sector.

Micro-economic data on the characteristics of workers, the characteristics of workplaces and the selection process of workers into different occupations is needed to deal with both these problems at the same time. Workplace level studies of union density can only possibly control for the first source of bias. Part of the estimated effect of recognition on union density in these models must be driven by the fact that the union sector may attract workers with different tastes.

Beaumont and Harris (1995), present a model in which union recognition is driven by union membership. If this was the case, then it would be inconsistent to include union recognition as a explanatory variable in an empirical model of union density. In this framework the coefficient on union recognition would just pick up unobserved factors that determine union density.
They then present evidence from the 1984-1990 WIRS panel suggesting that changes in union recognition status are strongly correlated with changes in union density. Actual changes in union recognition status are uncommon in this panel and even less common in the more representative questionnaire, however, and they do not present any evidence on the direction of causality between union recognition and union density. Their results could have been driven by the few changes in union recognition status between 1984 and 1990 driving big changes in union density.

A model is next presented where unobserved factors effecting recognition are also allowed to affect union density. Given that one of these unobserved factors might be changes in recognition status over time, we can thus test whether changes in union density drive changes in union recognition.

4.4.1 The Model

As discussed above, we model recognition as being determined by a game between management/employers and unions/workers at the beginning of the life time of the establishments. Union density is determined by the tastes of the workforce, the organising intensity of the union, the attitude of management to union members and the net utility associated with existence outside the establishment.

Consider the following model of the recognition/density determination process for establishment i:

\[ R_i^* = Z_i \gamma + \nu_i \]  \hspace{1cm} (4.1)

\[ D_i^u = X_i \beta^u + \epsilon_i^u \] \hspace{1cm} (4.2)

As is reported below only 2% of the non union sample in the 1990 Workplace Industrial Relations Survey recognised a union in the past. Moreover, the fact that union density rose in the panel sample while it declined in the workforce as a whole and between the two cross sections suggests that the panel element of WIRS is not the right dataset to test models of union membership decline.
\[ D^n_i = X_i \beta^n + \varepsilon_i^n \]  \hspace{1cm} (4.3)

where \( R^* \) is the (net) utility (i.e. the expected gain or loss from union status net of the resistance costs) associated with the union-management bargain over recognition and is related to the observable union recognition outcome as \( R = 1 \) if \( R^* > 0 \) and \( R = 0 \) otherwise. \( D \) is union density, \( U \) and \( N \) superscripts denote union and non-union status respectively and \( X \) and \( Z \) are variables that determine recognition and density. The possible non-zero covariance between the errors in equations 4.2 and 4.3 and that in 4.1 formally illustrates the endogenous nature of recognition for the determination of density.

As discussed before, recognition is determined (at least partially) by the characteristics of the labour and product market in which the workplace is set up. Union density is determined by the tastes of the workforce, managerial attitudes and factors such as unemployment which might influence that possible gain to belonging to a union.

The best way to see why we expect that \( \text{cov}(u_i, \varepsilon_i^j) \neq 0 \) (for \( j = U, N \)) is to establish the sorts of variables that might be expected to be in \( u_i \) (the error term in equation 4.1) and \( \varepsilon_i^j \) the error terms in equations 4.2 and 4.3.

In \( u_i \) will be the following:

1. Measurement error on the dated product and labour market variables.
2. Possible changes in recognition status over time.
3. Costs of unions to employers which are determined by things that we cannot observe
4. The attitude of employers towards unions at set up date
5. The organising intensity of the union at the time of set up which again is determined in part by unobserved factors.
In $c_i^t$ will be

1. **Managerial policy towards unions**, for example whether union members are victimised or there is a informal closed shop arrangement. This will introduce bias in the estimate of the effect of recognition on union density if it is determined by the costs of unions to the firm or by managerial tastes both of which may be correlated over time. Whether this is a problem in empirical studies of union density, however, depends on the interpretation to be placed on the recognition coefficient.

2. **The current organising intensity of the union.** This will introduce bias if it is correlated over time, the estimated effect of recognition on union membership will also pick up the fact that the labour market in which the workplaces is operating is one with a highly efficient union. It is likely that a union which is good at obtaining recognition deals is also good at recruiting members.

3. **The unobserved tastes of the workforce.** If workers that queue for union jobs are different from those that will accept work in the non union sector, or if the hiring and recruitment policies are different under unionisation, then the tastes of union workers may differ from those of non union workers. The estimated effect of recognition on union density will then be biased. It is important to stress, however, that as the different employer strategies towards recruitment and the difference in utility to employees of jobs between the union and the non union sectors does not directly enter into equation 4.1, the procedure that we use to test for selection bias does not deal with this problem.

4. In addition any unobserved factor that determines union density will introduce bias into the model if union recognition changes over time. Thus one can see our model as including a weak test of the view that changes in union density drive changes in union recognition.
To correct for this bias we adopt the well-known approach initially advocated by Heckman (1979) or Lee (1978) which enables us to obtain consistent estimates of the $\beta$'s in equations 4.2 and 4.3. The essential intuition is that an estimated residual from equation 4.1 is included in equations 4.2 and 4.3 to correct for the fact that the unobserved factors determining union density may also determine union recognition. The estimation results from this model can be thought of as testing whether managerial and union strategies are correlated over time and whether changes in union density drive changes in union recognition. Thus the viability of the use of time dated variables to instrument union status in models of wage determination will be dependent on finding no evidence of selection bias.

It is important to stress that our procedure can not deal with the major source of bias, that is that union workers will be systematically different from non union workers. To control for this one needs complete knowledge of the full set of wage offers that an individual faces in both the union and the non union sector and knowledge of all the characteristics of these workplaces.
Chapter 5

The Membership Process

-Empirics

5.1 Data Description

The data source to be used is, just as in the earlier results on recognitions, the 1990 Workplace Industrial Relations Survey. The determinants of recognition and density for private sector manufacturing plants in 1990, for both manual and non-manual workers are focused on in the following analysis. Table 5.1 reports means of union density for all plants and stratified by whether or not unions are recognised for collective bargaining purposes. The notion that recognition is the key prerequisite for high density receives strong support: for instance, in private sector manufacturing establishments with manual recognition, average manual density is 78%, as compared to 8% in non-union plants.

5.2 Results

The central identification restriction is that the dated variables only affect union density through the probability of recognition. These age dated variables we include in the recognition equation are:
Table 5.1: Union Density in British Establishments

<table>
<thead>
<tr>
<th>Sector</th>
<th>All Workplaces</th>
<th>Union Sector</th>
<th>Non Union Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Whole Economy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Union Density</td>
<td>38.24 %</td>
<td>67.92 %</td>
<td>7.35 %</td>
</tr>
<tr>
<td></td>
<td>1848</td>
<td>1231</td>
<td>617</td>
</tr>
<tr>
<td>Manual Union Density</td>
<td>36.10 %</td>
<td>72.50 %</td>
<td>5.01 %</td>
</tr>
<tr>
<td></td>
<td>1651</td>
<td>1085</td>
<td>566</td>
</tr>
<tr>
<td>Non-Manual Union Density</td>
<td>32.40 %</td>
<td>72.63 %</td>
<td>3.94 %</td>
</tr>
<tr>
<td></td>
<td>1852</td>
<td>1058</td>
<td>794</td>
</tr>
<tr>
<td><strong>Public Sector</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Union Density</td>
<td>72.70 %</td>
<td>74.93 %</td>
<td>58.09 %</td>
</tr>
<tr>
<td></td>
<td>529</td>
<td>495</td>
<td>34</td>
</tr>
<tr>
<td>Manual Union Density</td>
<td>57.45 %</td>
<td>71.97 %</td>
<td>10.37 %</td>
</tr>
<tr>
<td></td>
<td>469</td>
<td>410</td>
<td>59</td>
</tr>
<tr>
<td>Non-Manual Union Density</td>
<td>78.06 %</td>
<td>80.79 %</td>
<td>55.30 %</td>
</tr>
<tr>
<td></td>
<td>587</td>
<td>496</td>
<td>31</td>
</tr>
<tr>
<td><strong>Private Manufacturing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Union Density</td>
<td>30.04 %</td>
<td>60.65 %</td>
<td>6.55 %</td>
</tr>
<tr>
<td></td>
<td>584</td>
<td>413</td>
<td>171</td>
</tr>
<tr>
<td>Manual Union Density</td>
<td>38.49 %</td>
<td>77.98 %</td>
<td>7.99 %</td>
</tr>
<tr>
<td></td>
<td>582</td>
<td>419</td>
<td>163</td>
</tr>
<tr>
<td>Non-Manual Union Density</td>
<td>10.08 %</td>
<td>41.48 %</td>
<td>1.05 %</td>
</tr>
<tr>
<td></td>
<td>596</td>
<td>311</td>
<td>285</td>
</tr>
<tr>
<td><strong>Other Private Sector</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Union Density</td>
<td>22.75 %</td>
<td>62.16 %</td>
<td>1.98 %</td>
</tr>
<tr>
<td></td>
<td>739</td>
<td>323</td>
<td>412</td>
</tr>
<tr>
<td>Manual Union Density</td>
<td>22.27 %</td>
<td>68.99 %</td>
<td>2.69 %</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>256</td>
<td>344</td>
</tr>
<tr>
<td>Non-Manual Union Density</td>
<td>17.94 %</td>
<td>69.41 %</td>
<td>1.37 %</td>
</tr>
<tr>
<td></td>
<td>729</td>
<td>251</td>
<td>478</td>
</tr>
</tbody>
</table>

Notes:
Numbers in brackets refer to the number of plants from which these figures were calculated.
Weighted proportions given
A workplace is defined as being in the union sector if it recognises a union for the purposes of negotiating pay for this group of workers.
1. Industry quasi rents per head, where quasi-rents are defined as in Abowd and Farber (1990) as the difference between total industry revenues net of raw material costs and labour costs evaluated at the 'outside' wage. These quasi-rent variables were mapped in from the Census of Production for the relevant year (hence the focus on manufacturing).

2. Industry union density, data which was obtained from the series initially constructed up to the early 1980s by Bain and Price (1983) and extended to the late 1980s by Waddington (1992).

3. A dummy variable equal to one if the establishment was set up in the 1980s, which is the only significant age band once (i) and (ii) are included.

Table 5.2 reports probit models of the determination of recognition status for manuals and non-manuals. The quadratic quasi-rents per head specification was suggested by the theory discussed earlier where recognition is more likely if rents are higher, except where employers have excessive rents with which they can fight union organisation. The joint terms work strongly in the inverse "U" shape that we have found in our earlier work for both manual and non-manuals. As also expected, high union density in the plant's operating industry at the time of set-up is positively correlated with recognition status. Over and above these effects, plants set up in the 1980s are significantly less likely to have recognised trade unions.

As establishment-level union density lies in the range 0 to 1 the usual problems of estimating models with limited dependent variables by least squares methods are relevant here. To estimate the union density equations we therefore adopt the usual logistic transformation and compute a log-odds variable \( \log(A/1-A) \) for a variable \( A \) defined in the 0-1 range. Because we may have some establishments at either end of the range (i.e. with density exactly at 0 or 1) we adopt the correction of Cox (1970) which adds \( 1/2N \)
Table 5.2: Union Recognition Equations

<table>
<thead>
<tr>
<th></th>
<th>Manual Equation</th>
<th>Non Manual Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>-3.027</td>
<td>0.664</td>
</tr>
<tr>
<td><strong>Dated Instruments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dated Industry Level Rents</td>
<td>1.221</td>
<td>0.259</td>
</tr>
<tr>
<td>Dated Industry Level Rents Squared</td>
<td>-0.39</td>
<td>-0.188</td>
</tr>
<tr>
<td>Dated Industry Level Union Density</td>
<td>0.727</td>
<td>0.545</td>
</tr>
<tr>
<td><strong>Workplace Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 to 99 Employees</td>
<td>0.858</td>
<td>0.272</td>
</tr>
<tr>
<td>100 to 199 Employees</td>
<td>1.178</td>
<td>0.275</td>
</tr>
<tr>
<td>200 to 499 Employees</td>
<td>1.991</td>
<td>0.291</td>
</tr>
<tr>
<td>500 to 999 Employees</td>
<td>2.494</td>
<td>0.325</td>
</tr>
<tr>
<td>1000+ Employees</td>
<td>2.511</td>
<td>0.322</td>
</tr>
<tr>
<td>Established in the 1980s</td>
<td>-0.822</td>
<td>0.176</td>
</tr>
<tr>
<td>Manual Proportion</td>
<td>1.127</td>
<td>0.393</td>
</tr>
<tr>
<td>Part Time Proportion</td>
<td>-1.679</td>
<td>0.775</td>
</tr>
<tr>
<td>Female Proportion</td>
<td>-0.957</td>
<td>0.362</td>
</tr>
<tr>
<td>Semi-skilled Proportion</td>
<td>0.533</td>
<td>0.357</td>
</tr>
<tr>
<td>Skilled Proportion</td>
<td>1.167</td>
<td>0.424</td>
</tr>
<tr>
<td>Northern Establishment</td>
<td>0.327</td>
<td>0.158</td>
</tr>
<tr>
<td>Number of observations</td>
<td>525</td>
<td>534</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-207.9851</td>
<td>-262.83994</td>
</tr>
<tr>
<td>$\chi^2(3)$ Test of Instruments</td>
<td>14.877</td>
<td>13.046</td>
</tr>
<tr>
<td>$P$ Value</td>
<td>0.002</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Notes:
1. Probit estimates, asymptotic standard errors in italics
2. Sample sizes are marginally different from those in Table I due to missing values of some of the explanatory variables.
to both the numerator and denominator, where N is the sample size, so that
the log-odds ratio can be computed for the upper and lower end of the range.

The union density regressions reported in Tables 5.3 and 5.4 indicate
quite clearly indicate the importance of conditioning on union recognition.
First, a comparison of columns (1) and (2) shows that the inclusion of the
union recognition status of the establishment not only results in a strongly
significant coefficient on that variable, but also affects the coefficients on
other variables: for example, the plant size effects are much less significant
when recognition is included The estimated coefficients on the current dated
quadratic industry quasi-rents and union density variables are also weakened
by the inclusion of recognition status, as compared to column (1) where their
impact on density was very strong.

Columns (3) and (5) of Tables 5.3 and 5.4 presents estimates of union
density equations for manual and non manual workers respectively restricting
the correlation between the union density equations and the union recognition
equations to be zero. These restrictions are relaxed in Columns (4) and (6)
report the same regressions and tested by the \( \rho^2 \) term.

Considering the manual specifications first, the statistical insignificance
of \( \rho^2 \) in both columns (4) and (6) does not point to an important endogeneity
bias associated with the models in column (3) and (5) of Table 5.3. The null
test of exogeneity of the determination of recognition in the determination
of union density cannot be rejected at usual significance levels (Probability
values under the null are 65% for establishments where unions are recognised
for example). In fact this is not surprising given the lack of statistical signifi-
cance of most of the explanatory variables in columns (3) and (5). For union
establishments the only significant covariates are establishment size and some
of the workforce composition variables. For non union establishments, the
only significant variable in the proportion of workers that are skilled. Thus it
appears that the only important variable that determines union membership
at establishment level is the presence of a union of collective bargaining pur-
poses. Everything else appears to be just noise. For non-manuals (table 5.4), there again appears to be little evidence of an important endogeneity bias but, like the manual equations, several estimated coefficients are affected by conditioning on recognition status. In particular, the positive relationship between plant size and non-manual union density disappears.
Table 5.3: Manual Union Density Equations

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Union is Recognised</th>
<th>Union is not Recognised</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Constant</td>
<td>-10.879</td>
<td>1.616</td>
<td>-1.541</td>
</tr>
<tr>
<td>Recognition</td>
<td>- 8.795</td>
<td>- 0.323</td>
<td>-</td>
</tr>
<tr>
<td>50 to 99 Employees</td>
<td>2.339</td>
<td>0.771</td>
<td>0.998</td>
</tr>
<tr>
<td>100 to 199 Employees</td>
<td>3.317</td>
<td>0.777</td>
<td>1.016</td>
</tr>
<tr>
<td>200 to 499 Employees</td>
<td>6.085</td>
<td>0.778</td>
<td>2.409</td>
</tr>
<tr>
<td>500 to 999 Employees</td>
<td>6.516</td>
<td>0.793</td>
<td>2.822</td>
</tr>
<tr>
<td>1000+ Employees</td>
<td>6.729</td>
<td>0.790</td>
<td>2.658</td>
</tr>
<tr>
<td>Established in the 1980s</td>
<td>-1.605</td>
<td>0.490</td>
<td>0.150</td>
</tr>
<tr>
<td>Manual Proportion</td>
<td>1.886</td>
<td>1.100</td>
<td>0.110</td>
</tr>
<tr>
<td>Part Time Proportion</td>
<td>-3.438</td>
<td>2.080</td>
<td>-1.365</td>
</tr>
<tr>
<td>Female Proportion</td>
<td>-2.192</td>
<td>1.291</td>
<td>-1.392</td>
</tr>
<tr>
<td>Semi-skilled Proportion</td>
<td>1.097</td>
<td>0.972</td>
<td>0.092</td>
</tr>
<tr>
<td>Skilled Proportion</td>
<td>5.062</td>
<td>1.124</td>
<td>2.472</td>
</tr>
<tr>
<td>Northern Establishment</td>
<td>0.634</td>
<td>0.505</td>
<td>0.336</td>
</tr>
<tr>
<td>Current Industry Level</td>
<td>1.234</td>
<td>0.595</td>
<td>0.244</td>
</tr>
<tr>
<td>Rents</td>
<td>1.859</td>
<td>0.815</td>
<td>1.187</td>
</tr>
<tr>
<td>Current Industry Level</td>
<td>-0.158</td>
<td>0.679</td>
<td>0.055</td>
</tr>
<tr>
<td>Rents Squared</td>
<td>2.946</td>
<td>0.986</td>
<td>1.159</td>
</tr>
<tr>
<td>Current Industry Level</td>
<td>0.986</td>
<td>0.214</td>
<td>0.633</td>
</tr>
<tr>
<td>Union Density</td>
<td>525</td>
<td>0.093</td>
<td>525</td>
</tr>
<tr>
<td>Number of observation</td>
<td>373</td>
<td>525</td>
<td>373</td>
</tr>
<tr>
<td>Union density  $\sigma$</td>
<td>4.211</td>
<td>0.07</td>
<td>2.688</td>
</tr>
<tr>
<td>$\rho^2$</td>
<td>0.654</td>
<td>0.891</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. OLS Estimates; Standard errors in italics
2. The dependent variable is the logistic transformation in equation (4) of the text.
5.3 Concluding Remarks

Overall, the model, estimated above, suggests that variations in manual union density across establishments arise largely from variations in recognition probabilities. Variables such as size appear only to affect union density insofar as they are correlated with unobservables that both increase the propensity of the workforce to join a union and management to recognise a union. Consequently, variables such as industry level profits per head which determine the potential gains to unionisation for the workforce as a whole in unionization do not influence the individual's membership decision. In one sense this is encouraging, because it suggests that union density, as a variable, bears no relation to variables which serve as instruments for potential gains to the workforce of unionisation, once establishment union status has been controlled for, and thus can be used as an argument in a model of the determination of the union mark-up. However, the fundamental question of what makes manual workers join trade unions still has yet to be answered. In particular, variables which are sometimes used to proxy social cohesion or 'reputation' effects, such as plant size or part-time status, are generally insignificant once the model is correctly specified.

For non manuals the story is slightly different. Given that union density in non-recognised plants is so small, the results for these plants can largely be discounted. For plants where unions are recognised, the current level of union density in the industry is significant although other variables are largely insignificant. Given that the $p^2$ terms are not significant, it seems likely that any simultaneous aspect of the determination of union recognition and density through establishment-specific effects is not being identified through the time-dating procedure is this case. However, this does not detract from our criticism of previous reduced form studies of union density.

For trade unions, concerned as to the 3.7 million decline in union membership since 1979 (Department of Employment, 1993), our results suggest
Table 5.4: Non Manual Union Density Equations

<table>
<thead>
<tr>
<th></th>
<th>All Workplaces</th>
<th>Union is Recognised</th>
<th>Union is not Recognised</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Constant</td>
<td>-10.653</td>
<td>-8.238</td>
<td>-2.881</td>
</tr>
<tr>
<td></td>
<td>1.051</td>
<td>0.568</td>
<td>1.319</td>
</tr>
<tr>
<td>Recognition</td>
<td>-6.324</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-0.177</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50 to 99 Employees</td>
<td>0.992</td>
<td>0.224</td>
<td>1.429</td>
</tr>
<tr>
<td></td>
<td>0.550</td>
<td>0.296</td>
<td>1.115</td>
</tr>
<tr>
<td>100 to 199 Employees</td>
<td>2.078</td>
<td>0.377</td>
<td>0.519</td>
</tr>
<tr>
<td></td>
<td>0.552</td>
<td>0.300</td>
<td>1.103</td>
</tr>
<tr>
<td>200 to 499 Employees</td>
<td>3.658</td>
<td>0.524</td>
<td>1.228</td>
</tr>
<tr>
<td></td>
<td>0.549</td>
<td>0.308</td>
<td>1.084</td>
</tr>
<tr>
<td>500 to 999 Employees</td>
<td>5.123</td>
<td>0.907</td>
<td>1.471</td>
</tr>
<tr>
<td></td>
<td>0.567</td>
<td>0.827</td>
<td>1.08</td>
</tr>
<tr>
<td>1000+ Employees</td>
<td>5.255</td>
<td>0.929</td>
<td>1.461</td>
</tr>
<tr>
<td>Established in the 1980s</td>
<td>-0.464</td>
<td>0.238</td>
<td>0.407</td>
</tr>
<tr>
<td></td>
<td>0.348</td>
<td>0.188</td>
<td>0.348</td>
</tr>
<tr>
<td>Manual Proportion</td>
<td>0.475</td>
<td>0.114</td>
<td>1.091</td>
</tr>
<tr>
<td></td>
<td>0.766</td>
<td>0.411</td>
<td>0.622</td>
</tr>
<tr>
<td>Part Time Propotion</td>
<td>-3.140</td>
<td>-0.637</td>
<td>-1.763</td>
</tr>
<tr>
<td></td>
<td>1.462</td>
<td>0.788</td>
<td>1.127</td>
</tr>
<tr>
<td>Female Proportion</td>
<td>-0.584</td>
<td>-0.458</td>
<td>-0.885</td>
</tr>
<tr>
<td></td>
<td>0.715</td>
<td>0.384</td>
<td>0.611</td>
</tr>
<tr>
<td>Semi-skilled Proportion</td>
<td>0.284</td>
<td>-0.167</td>
<td>-0.66</td>
</tr>
<tr>
<td></td>
<td>0.663</td>
<td>0.356</td>
<td>0.539</td>
</tr>
<tr>
<td>Skilled Proportion</td>
<td>2.169</td>
<td>0.390</td>
<td>0.165</td>
</tr>
<tr>
<td></td>
<td>0.821</td>
<td>0.444</td>
<td>0.759</td>
</tr>
<tr>
<td>Northern Establishment</td>
<td>0.584</td>
<td>-0.118</td>
<td>0.152</td>
</tr>
<tr>
<td></td>
<td>0.364</td>
<td>0.197</td>
<td>0.301</td>
</tr>
<tr>
<td>Current Industry Level</td>
<td>0.968</td>
<td>-0.535</td>
<td>-2.014</td>
</tr>
<tr>
<td>Rents</td>
<td>0.862</td>
<td>0.465</td>
<td>0.722</td>
</tr>
<tr>
<td>Current Industry Level</td>
<td>-0.335</td>
<td>0.094</td>
<td>0.498</td>
</tr>
<tr>
<td>Rents Squared</td>
<td>0.296</td>
<td>0.159</td>
<td>0.242</td>
</tr>
<tr>
<td>Current Industry Level</td>
<td>2.135</td>
<td>1.106</td>
<td>1.637</td>
</tr>
<tr>
<td>Union Density</td>
<td>0.727</td>
<td>0.891</td>
<td>0.532</td>
</tr>
<tr>
<td>Local Labour Market</td>
<td>0.144</td>
<td>0.098</td>
<td>0.137</td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.069</td>
<td>0.087</td>
<td>0.052</td>
</tr>
<tr>
<td>Number of observations</td>
<td>534</td>
<td>534</td>
<td>279</td>
</tr>
<tr>
<td>( \sigma^2 )</td>
<td>3.0813</td>
<td>1.6549</td>
<td>1.772</td>
</tr>
<tr>
<td>( p^2 )</td>
<td>0.199</td>
<td>0.701</td>
<td>0.103</td>
</tr>
</tbody>
</table>

Note:
1. OLS Estimates; Standard errors in italics
2. The dependent variable is the logistic transformation in equation (4) of the text.
that studies which focus on the role of workforce characteristics as the source of the decline in the propensity to join unions, are largely missing the point. The reasons for membership decline are closely linked to the time-path of union recognition. And given the relative paucity of changes in recognition status, as described briefly in earlier, it is the 'deaths' of existing recognised plants and the trend in 'births' of new recognised plants which are crucial.
Part II

Unions and the Structure of Wages
Chapter 6

Introduction

In Britain, as is discussed in previous chapters, there exists no legal duty on the part of employers to negotiate with unions. If negotiations between unions and managers take place for the purpose of determining pay and conditions of employment, then this must be because it is in the “interests” of firms to do so. This necessarily means that unions will only have an effect on the distribution of wages if they have been strong enough in the past to force firms to negotiate with them. Whether a significant relationship between unions and the structure of wages can be found once one controls for the non random allocation of establishments into the union sector is therefore a problem for empirical research.

Another important finding, discussed in the previous section of the thesis, is that the decision to recognise a union appears to be a once and for all choice made at the time the establishment is set up. Changes in union status within the life time of an establishment are rare. This means that it is possible to separate out the determination of union status from the determination of wages. Union status can be instrumented by variables determining the threat of unionisation at the time of set up while wages are related only to current conditions in the labour and product markets.

It is important to stress at the outset that this research is only a very weak test of whether unions affect the shape of the distribution of earnings.
A stronger one would involve controlling for the characteristics of workers as well as the places in which they work. However, a finding that unions affect the wage setting process in the workplace is, I believe, suggestive of a causal link between unions and the distribution of wages.

The structure of this part of the thesis is as follows. The next two chapters give some evidence of the correlations between unions and wages, in particular differentials in wages within and across different sorts of workers and establishments. Next, the problems of controlling for non random selection into the union sector are discussed and the econometric model to be estimated is described. Finally some results are presented.
Chapter 7

Existing Evidence on the Role of Trade Unions in the Wage Structure

The raw difference in the distribution of pay between the union and the non union sectors is striking. The distributions in Figures 7.1 and 7.2 show this quite clearly. Figure 7.1 uses data on log male hourly earnings from the family expenditure survey (1990)\(^1\) and Figure 7.2 on log hourly earnings of all workers from the British Household Panel Survey (1991).\(^2\) For both datasets, the mean wage is higher in the union sector and the spread of the distribution is much narrower. In particular the density at the extremes of the distribution is much smaller in the union sector.

Table 7.1 looks at the effect of unions on wage dispersion after controlling for observable skill. It might be, for example that the differences in the distributions shown above are entirely driven by the fact that very few highly skilled workers are in the union sector. This is not the case. Looking at the

\(^1\)There are many problems with the FES measure of unionisation, the major one being that it asks not whether the respondent is a union member but whether they make deductions from pay towards membership subscriptions. As this was correlated strongly with union density and coverage in 1990 (see Millward et al. 1992), however, we feel that it is a safe measure to use in a cross section in 1990. It is less than helpful for looking at changes over time and at union effects during the 1970s and 1980s.

\(^2\)Both these distributions were computed non parametrically using a gaussian kernel with a fixed bandwidth of 0.25 × the sample standard deviation.
Figure 7.1: Distribution of log(Hourly Wages) from the 1990 FES
Figure 7.2: Distribution of log(Hourly Wages) from the 1991 BHPS
individual level evidence first, the average log difference between the pay of high grade non manual workers and that of unskilled manual workers is 0.644 (=90% differential) in the non union sector and 0.397 (= 50% differential) in the union sector. The level of dispersion within each skill level is also lower in the union sector. The establishment level information comes from the 1990 Workplace Industrial Relations Survey and it demonstrates the same finding, namely that differentials are lower both between and within skill groups in the union sector.

Very highly paid and very low paid workers are more often found in the non union sector and union establishments are much less likely to pay very high or very low wages. This finding is robust to the choice of dataset and to whether the variable in question is hourly or weekly earnings, or whether the pay distributions of workers or the pay policies of establishments is looked at.

Other empirical research using UK data has also found the structure of wages to be different across the union and the non union sector. Metcalf (1977, 1982) shows how the estimated union “mark-up” varies across workers of different types and industries. Stewart (1983b) using data from the 1975 National Training Survey shows educational and skill attainment to have different affects on wages in the union and the non union sector, and argues that this difference makes estimates of the average “mark-up” misleading. Stewart (1987, 1990 and 1991) using the same data as I use in the empirical section of this chapter again finds the conditional standard deviation of log(wages) to be lower in the union sector. These studies assume that union status is exogenous, that there is no reason to suppose the distribution of unobserved factors affecting wages to be different for union and non union workers. However, as shall be argued below, either if the unobserved determinants of wages are important, or if unions effect the return to unobserved skill or intra-skill wage inequality then it is inconsistent to assume that selection will not take place on these attributes.
Table 7.1: Raw Union Effects on Dispersion

<table>
<thead>
<tr>
<th>Non Union Sector</th>
<th>Union Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BHPS 1991</strong></td>
<td></td>
</tr>
<tr>
<td><em>High grade Non Manual Occupations</em></td>
<td></td>
</tr>
<tr>
<td>Mean log Wage</td>
<td>1.882</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.586</td>
</tr>
<tr>
<td>&quot;Raw&quot; Skill mark up (^a)</td>
<td>0.644</td>
</tr>
<tr>
<td><strong>Low grade Non Manual Occupations</strong></td>
<td></td>
</tr>
<tr>
<td>Mean log Wage</td>
<td>1.459</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.434</td>
</tr>
<tr>
<td>&quot;Raw&quot; Skill mark up</td>
<td>0.220</td>
</tr>
<tr>
<td><strong>Skilled Manual Occupations</strong></td>
<td></td>
</tr>
<tr>
<td>Mean log Wage</td>
<td>1.460</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.473</td>
</tr>
<tr>
<td>&quot;Raw&quot; Skill mark up</td>
<td>0.222</td>
</tr>
<tr>
<td><strong>Unskilled Manual Occupations</strong></td>
<td></td>
</tr>
<tr>
<td>Mean log Wage</td>
<td>1.238</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.529</td>
</tr>
<tr>
<td>&quot;Raw&quot; Skill mark up</td>
<td>-</td>
</tr>
</tbody>
</table>

| WIRS 1990        |              |
| **Skilled Manual Workers** |              |
| Mean log Wage    | 5.297        | 5.384        |
| Standard Deviation | 0.320    | 0.278        |
| "Raw" Skill mark up | 0.287  | 0.200        |
| **Unskilled manual workers** |            |
| Mean log Wage    | 5.010        | 5.184        |
| Standard Deviation | 0.356    | 0.290        |
| "Raw" Skill mark up | -     | -            |

Notes
\(^a\) The raw skill mark up is calculated as the mean log wage of that group minus the mean log wage of the unskilled group
It is also interesting to note, as an aside, that this 'sword of justice' role for trade unions is not universal. In Australia, for example, union activity at workplace level is associated with higher wage dispersion within skill groups between establishments. (see Apps et al. 1994). As pay in Australia for most (90 percent of) workers is determined by legally binding pay awards negotiated centrally by unions, employers and government representatives, this may be an exception that proves the rule. Local union activity may only occur when and where supra (i.e. supplementary) award payments are being decided. It is not surprising that there is a higher variance of pay where these decisions are taking place.

\footnote{All this may change with the recent changes to pay setting systems in Australia}
Chapter 8

Raw Estimates of the Union Effect on Earnings Dispersion in 1990

In this section the relationship between unions and the dispersion of earnings is investigated using data from the 1990 Workplace Industrial Relations Survey. This issue is approached in two ways. The first is to consider the relationship between union status and the within-skill, across-establishment dispersion of the earnings of skilled and semi-skilled manual workers. The second is to analyse across skill, within-establishment inequality using a question which gives a measure of both the upper and lower tails of the pay distribution of all full-time workers employed in the establishment. These results make no attempt to control for selection

Across-Establishment Manual Earnings Inequality

Managers were asked to report median weekly earnings of the typical majority sex worker in the relevant skill group and, as in both previous surveys, the data are banded into eleven categories, with the bottom and top pay bands being open-ended. To compute unconditional means and standard deviations midpoints are allocated to each of the closed bands and Stewart's (1983a) Maximum Likelihood estimator (described below) is used to estimate the
bottom and top pay levels. This estimator is then exploited to compute conditional standard deviations from the various earnings regressions reported on below.

The upper panel of Table 8.1 reports the raw standard deviation of \( \ln(\text{earnings}) \) for skilled and semi-skilled manual workers in the union and non-union segments of the private sector in 1990. Union status is defined as the recognition of manual trade unions for collective bargaining purposes. In both cases the standard deviation is lower in the union sector: 13% (skilled) and 19% (semi-skilled) lower than the non-union standard deviation. The gap is significant at the 5% level of significance in both cases.

There are a number of other possible reasons, beyond union status, why earnings dispersion may be lower in the union sector. Establishment-level characteristics such as size, ownership status and workforce composition are clearly important determinants of earnings and their variability. These can be standardised by computing regression-corrected Maximum Likelihood estimates of the conditional standard deviation of \( \ln(\text{earnings}) \). As the earnings data are grouped, simple least-squares estimation procedures are inconsistent, so Stewart’s (1983a) Maximum Likelihood estimator for grouped dependent variable models is used. This is a limited dependent variable procedure which estimates the overall and unobserved distribution as well as the conditional expectations. This estimator is based on using the available information on establishment characteristics to form the conditional expectation of earnings for each observation in the sample. One can then compute estimated standard deviations in the usual manner.

We estimated separate union and non-union semi-logarithmic earnings equations controlling for plant size, various workforce plant and union characteristics (precise details on the controls are given in the notes to Table 8.1). After including this (very stringent) set of controls, the estimated conditional standard deviation of \( \ln(\text{earnings}) \) is higher in the non-union sector, though only by a little and not significantly so for skilled workers. For
Table 8.1: Unions and Wage Dispersion (1990 WIRS)

<table>
<thead>
<tr>
<th></th>
<th>Union</th>
<th>Non-union</th>
<th>Difference</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>0.278</td>
<td>0.320</td>
<td>-0.042</td>
<td>0.019</td>
</tr>
<tr>
<td>Semi-skilled</td>
<td>0.290</td>
<td>0.356</td>
<td>-0.066</td>
<td>0.021</td>
</tr>
</tbody>
</table>

2. Maximum Likelihood estimates of conditional standard deviation from ln(earnings) regression

<table>
<thead>
<tr>
<th></th>
<th>Union</th>
<th>Non-union</th>
<th>Difference</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>0.224</td>
<td>0.237</td>
<td>-0.013</td>
<td>0.015</td>
</tr>
<tr>
<td>Semi-skilled</td>
<td>0.211</td>
<td>0.270</td>
<td>-0.058</td>
<td>0.021</td>
</tr>
</tbody>
</table>

3. Number of establishments (unweighted / weighted)

<table>
<thead>
<tr>
<th></th>
<th>Union</th>
<th>Non-union</th>
<th>Percentage Union</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>473 / 257</td>
<td>216 / 306</td>
<td>68.7 / 45.7</td>
</tr>
<tr>
<td>Semi-skilled</td>
<td>395 / 201</td>
<td>219 / 286</td>
<td>64.3 / 41.3</td>
</tr>
</tbody>
</table>

Notes
1. Union status is defined as any union recognised for collective bargaining purposes for manual workers.
2. The regressions are Maximum Likelihood estimates for union and non-union sectors. Controls included are: 5 plant size dummies, manual, part-time, skilled, semi-skilled and female proportions, dummy variables for majority sex male, manufacturing, single site, shift work, payment-by-results, UK owned, employer’s association and (in the union sector) existence of pre- or post-entry closed shop arrangements.

semi-skilled workers, however, the gap is large and statistically significant, providing strong evidence for the ‘sword of justice’ role of trade unions.

Within-Establishment Earnings Inequality

The 1990 WIRS survey contained a question on within-establishment dispersion. The precise question had two parts - for the lower and upper ends of the earnings distribution - and is reproduced here:
"Please consider the average gross earnings of all full-time employees (including managers) at this establishment. Approximately what proportion of full-time employees earn half that amount or less? Approximately what proportion of full-time employees earn twice that amount or more?"

The nature of the question makes it evident that, in some plants with highly compressed earnings structures (with no very low-paid or high-paid employees), the proportion earning twice or more/half or less than average will be zero. The data are thus censored at zero and thus a Tobit estimator is used.

Table 8.2 reports Tobit estimates of the relation between within-establishment earnings dispersion and trade union recognition. Columns (1)-(3) consider the bottom end of the distribution (the <50% question) and columns (4)-(6) consider the top end (>200%). In each case, the first column is a simple regression on a recognition dummy, the second includes plant and worker characteristics and the third additionally includes eight one-digit industry dummies.

For both questions, the estimated coefficient on the recognition dummy is negative and statistically significant (though only at the 10% level in column (1)). The effect at the top of the distribution is extremely precisely determined across all three specifications. Other noteworthy results include the significant impact of local labour market unemployment at the bottom end of the distribution and the important workforce composition and plant size effects.

It appears therefore that within-establishment earnings dispersion is also lower in the presence of unions. Trade unions have an equalising impact at both ends of the within-establishment distribution of earnings. The 'sword of justice' effect appears to receive support from the relationship between unions and earnings dispersion, both in across-establishment and within-
Table 8.2: The Determinants of Within Establishment Wage Inequality

<table>
<thead>
<tr>
<th></th>
<th>Proportion with earnings of 50% or less than average</th>
<th>Proportion with earnings of 200% or more than average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.008</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td>0.017</td>
<td>0.064</td>
</tr>
<tr>
<td>Union recognised</td>
<td>-0.038</td>
<td>-0.076</td>
</tr>
<tr>
<td></td>
<td>0.021</td>
<td>0.025</td>
</tr>
<tr>
<td>50-99 employees</td>
<td>-</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.017</td>
</tr>
<tr>
<td>100-199 employees</td>
<td>-</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.027</td>
</tr>
<tr>
<td>200-499 employees</td>
<td>-</td>
<td>0.065</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.038</td>
</tr>
<tr>
<td>500-999 employees</td>
<td>-</td>
<td>0.043</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.043</td>
</tr>
<tr>
<td>1000+ employees</td>
<td>-</td>
<td>0.060</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.042</td>
</tr>
<tr>
<td>Part-time proportion</td>
<td>-0.249</td>
<td>-0.287</td>
</tr>
<tr>
<td></td>
<td>-0.058</td>
<td>0.056</td>
</tr>
<tr>
<td>Female proportion</td>
<td>-0.119</td>
<td>0.103</td>
</tr>
<tr>
<td></td>
<td>-0.059</td>
<td>0.065</td>
</tr>
<tr>
<td>Manual proportion</td>
<td>-0.085</td>
<td>-0.097</td>
</tr>
<tr>
<td></td>
<td>-0.045</td>
<td>0.047</td>
</tr>
<tr>
<td>No manual workers</td>
<td>-0.080</td>
<td>-0.082</td>
</tr>
<tr>
<td></td>
<td>-0.043</td>
<td>0.044</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>-0.003</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>0.026</td>
<td>0.032</td>
</tr>
<tr>
<td>UK-owned</td>
<td>-0.033</td>
<td>-0.036</td>
</tr>
<tr>
<td></td>
<td>0.043</td>
<td>0.044</td>
</tr>
<tr>
<td>Local labour market</td>
<td>0.009</td>
<td>0.010</td>
</tr>
<tr>
<td>unemployment rate</td>
<td>0.004</td>
<td>0.004</td>
</tr>
<tr>
<td>Industry dummies</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Log-Likelihood</td>
<td>-3046.77</td>
<td>-3023.29</td>
</tr>
<tr>
<td>Number of establishments</td>
<td>1076</td>
<td>1076</td>
</tr>
<tr>
<td>with proportion = 0</td>
<td>526</td>
<td>526</td>
</tr>
</tbody>
</table>

Notes
1. These are Tobit estimates; asymptotic standard errors in parentheses.
2. Other variables that were included but were always insignificant and were therefore omitted from the reported specifications were: member of an employers' association; single site; skilled and semi-skilled proportions; various non-linearities in workforce composition variables.

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establishment comparisons. The rest of this chapter looks at whether this finding is robust to controlling for the non random selection of establishments into the union sector.

Appendix: robustness checks

The censored nature of the dependent variables in the results presented in table 8.2 was the reason for using a tobit in estimation. Tobit estimates are only consistent if the latent dependent variable is normally distributed conditional on the explanatory variables (X). The more censoring there is, the more this distributional assumption is needed for identification of the parameters. As there is no a priori reason why one should expect conditional normality in this case, there is obviously a potential worry about the robustness of the above results. The underlying conditional relationship between union status and within establishment earnings inequality was the same, however, when it was estimated using OLS regression (The coefficient on union status in the proportion below 50% equation was -0.031 with a standard error of 0.010, and the coefficient on union status in the proportion above 200% equation was -0.021 with a standard error of 0.005) or by a probit on whether there are any workers in that category (The coefficient on union status in the below 50% equation was -0.180 with a standard error of 0.099), and the coefficient on union status in the proportion above 200% equation was -0.181 with a standard error of 0.116). It thus seems as if the above results are robust.
Chapter 9

The Joint Determination of Wages and Union Status

9.1 Introduction

There are strong reasons to suggest that the results described in the previous chapter are misleading estimates of the actual union effect on the wage distribution. If unions affect skill differentials then we should expect not only different workers to select themselves into the union sector but firms to respond to the different relative price structure by altering the composition of employment. Added to this is the problem in the UK\(^1\) that managers are under no legal compulsion to negotiate with unions and it is thus likely that recognition agreements will not occur in a random selection of workplaces.

In this section possible ways in which a consistent estimator of the true union effect on the determination of wages could be achieved are discussed. In order to discover this wages need to be related to a variable which only effects wages to the extent that it makes union coverage more or less likely. It is demonstrated that such exclusion restrictions in individual level data are hard to justify given the underlying theory of union membership and wages. It is then argued that modelling the union effect on the establishment level wage policies is more tractable. This is because the time dated

\(^1\)There is nothing equivalent to the NLRB elections in the UK.
nature of the recognition decision shown earlier in the thesis allows us conceptually and empirically to separate out the determination of wages from the determination of union presence.

9.2 The selection of workers into the union sector

The best way to see the potential biases arising from the non random allocation of workers into the union sector is to describe a model in which all the underlying parameters are known. Equations 9.1 and 9.2 show the determination of (log) wages in the union and non union sectors respectively. The increase in wages for an individual switching from the union to the non union sector is dependent on her characteristics \(X\) and is given by \(X_i[\beta_u - \beta_n]\)

\[
W^u = X_i\beta^u + \epsilon^u_i 
\]  \hspace{1cm} (9.1)

\[
W^n = X_i\beta^n + \epsilon^n_i 
\]  \hspace{1cm} (9.2)

Individuals also have different tastes for other services that unions offer and these are given by \(Z_i\). Thus if \(V(.)\) is as a utility function, equation 9.3 defines the expected utility gain from moving from the non union to the union sector

\[
V(\text{Union}) - V(\text{Non Union}) = V(X_i\beta^u, Z_i^u) - V(X_i\beta^n, Z_i^n) 
\]  \hspace{1cm} (9.3)

Thus if the wage and non wage aspects of a job are separable in an individual’s utility function and marginal utilities are constant, the probability that
individual $i$ will queue for a union job can be written as:

$$\Pr(Q_i = 1) = \Phi \left( X_i [\beta^n - \beta^n] + Z_i \right) \quad (9.4)$$

where $\Phi(.)$ is a cumulative distribution function. As the $X$s determine wages through their effect on the relative productivity of different workers, the estimated mark-up $X_i[\beta^n - \beta^n]$ will also affect what sort of workers are hired in each sector. Profit maximising firms in the union sector, taking wages as given will hire labour of a certain type up to the point at which the value of the marginal product of an extra worker $(f(X_i))$ is equal to the wage $(X_i\beta^n)^2$. The probability that each worker is offered a job in the union sector is thus given in equation 9.5

$$\Pr(A_i = 1) = \Phi (f(X_i) - X_i\beta^n) \quad (9.5)$$

The probability therefore that we observe a worker in the union sector must depend on both the relationships expressed in equation (9.4) and (9.5). More formally:

$$\Pr(U = 1) = \Pr(Q = 1) \times \Pr(A = 1) \quad (9.6)$$

$$= \Phi \left( X_i [\beta^n - \beta^n] + Z_i \right) \Phi (f^u(X_i) - X_i\beta^n)$$

The partial derivatives of equation 9.6, will show how the probability of

---

2 For ease of exposition I have assumed that production in both sectors takes place on the demand curve. The underlying intuition is the same, however, in any model where wages are correlated even weakly with productivity.
observing someone in the union sector will vary with their characteristics. Unfortunately as equation 9.6 demonstrates, any prediction depends on the relative importance of non-wage preferences \((Z_i)\) in determining occupational choice, the relative size of the \(\beta\)s and the slope and position of the demand curve for each different type of worker \((f^u(X_i))\).

All that can be deduced from equation (9.6) is that if \(\beta^u - \beta^n\) is non zero, then the composition of \(X\)'s (some of which will be typically unobserved) to will differ systematically between the union and the non union sectors. Thus although we can have no priors on the direction of the bias in raw union effects on wages, we do know that the non random allocation of workers depends on whether unions actually affect the distribution of wages. In order to control for the fact that union workers may have different unobserved characteristics than non union workers, wages have to be related to some component of \(Z^3\) which by construction will only affect wages through its effect on union status. However, as this next section shows, models such as these are almost impossible to estimate, in a consistent way, in practice.

### 9.3 Identification of the union effect on wages

In a meta-analysis of existing simultaneous equation estimates of the union effect on wages in 1986, Gregg-Lewis found estimates of the OLS bias ranging from -0.66 to 0.63. He concluded:

"The selectivity bias problem in OLS wage gap estimates is one of omitted variables, a lack of information......Yet in the present context the techniques are not working. I know little more about the magnitude of the selectivity bias in OLS wage gap estimates after completing the survey of this chapter than if I had ignored the SE results reported here" Gregg-Lewis (1986) p 59

\(^3\)see equation 9.3 above
This is not surprising as the following discussion makes clear.

There are two main ways in which empirical researchers have obtained consistent estimates of the relative size of the $\beta$'s and the $\beta''$'s when all the $X$s are not observed.

### 9.3.1 Structural cross sectional models

The basic idea here (see Robinson (1993)) is that union status and interactions between union status and the determinants of wages are either instrumented by (exogenous) components of $Z$, or, if a sufficient number of these are not available, joint normality of the error terms in the wage and union status equations is exploited as an additional identification restriction and an estimated residual from the union status equation is included as an additional regressor in the wage equation to correct for sample selection bias$^4$. There are the following problems with these approaches in individual level studies. First, most components of $Z$ are typically not observed in micro-data. Second there is always the strong possibility of significant sample correlation between $Z$ and unobserved components of $X$, (political affiliation for example). Third, for someone to work in the union sector, 2 conditions have to hold. First the utility of a union job has got be greater than the utility of a non union job and second they have to receive a job offer in the union sector. Thus as Abowd and Farber (1982) show there may well be queues for union jobs in many industries. The fact that there is dis-equilibrium in the demand and supply for union jobs means that shifts in $Z$ will only result in shifts in union status for certain types of workers. This is one explanation for the range of biases found by Gregg-Lewis in his literature review.

$^4$There have been a few papers (for example Lanot and Walker (1995)) which have attempted to measure the union effect on wages using non-parametric sample selection techniques. The problem here is that these models need a continuous (rather than discrete) instrument for union status and they are not able in general to identify the constant term.
9.3.2 Estimates from panel data

The assumption here (see Card 1996 or Jackubson 1991) is that if the unobserved $X$s and their prices are fixed over time then a comparison of the wages of the same person in a union and a non union job should give consistent estimates of the effect of unions on wages. This will only be the case, however, if switching from the union to the non union sector is random. If movements in and out of the union sector are correlated with unobserved shocks affecting wages then this comparison will give inconsistent estimates.

Movements in and out of the union sector arise either through changes in jobs, or through changes in the union status of existing jobs. It is easy to see that the sample of people who change jobs, in particular those who move from a high paid union job to a low paid non union job, are more likely to have suffered adverse productivity shocks, especially in times of structural change effecting the relative productivity of unskilled and semi-skilled jobs. Part 1 of the thesis argued that changes in the union status of workplaces were rare suggesting that many observed changes not arising from job moves are a result of measurement error.(Freeman (1984) makes this case for the US labour market)

9.3.3 Union wage determination at the workplace

These models are much more tractable, one can split up the question about whether unions affect the wages structure into two:

1. Do unions change the way wages are set in firms, at least in the short run?

2. Do the wage policies of firms have any effect on the overall wage structure?

The lack of a legal duty on the part of employers in the UK to negotiate with unions makes (1) not necessarily obvious. And, as unions can only affect
the wage structure to the extent that they effect what wage firms pay, this question is an important starting block to the whole issue. Of course the answer to (2) is dependent on the presence of significant labour and product market frictions (see Manning 1995) which create a range bounded below by some reservation wage and above by individual marginal productivity in which firms can chose to set wages.

Moreover, the analysis of part 1 of this thesis lends itself to a consistent exclusion restriction. The union status of establishments is determined in the past and wages are determined in the present. Thus, providing there has been significant changes in the degree in the threat of unionisation across industries (our model controls for industry characteristics) one should be able to model the union effect on wages.

9.4 Estimation procedure

The models estimated in the preceding chapters of this thesis are essentially reduced form, the aim being to look at the determinants of recognition. The model is now extended and explicitly related to the union effects on pay

Consider the following model:

\[ W^u_i = X_i \beta^u + \theta_i \gamma^u + \epsilon^u_i \]  \hspace{1cm} (9.7)

\[ W^n_i = X_i \beta^n + \theta_i \gamma^n + \epsilon^n_i \]  \hspace{1cm} (9.8)

\[ U^*_i = X_i (\beta^n - \beta^u) + \theta_i (\gamma^n - \gamma^u) + Z_i \alpha + \nu_i \]  \hspace{1cm} (9.9)

\[ U = U^* > 0 \]
\[
\text{and} \\
\Pr(U = 1) = \Phi(X_i(\beta^u - \beta^n) + \theta_i(\gamma^n - \gamma^u) + Z_i\alpha)
\]

where equations 9.7 and 9.8 show how wages are determined in the union and the non union sectors respectively and equation 9.9 shows how union status is determined by the expected difference in wages \((X_i(\beta^n - \beta^u) + \theta_i(\gamma^n - \gamma^u))\) and other costs to the manager of recognition \((Z_i\alpha)\). The \(X_i\)s are observed and the \(\theta_i\)s unobserved. Thus the variables in \(X_i, \theta_i\) can be seen as determining the costs of recognition and those in \(Z\) as determining the costs that workers can impose on management if it does not recognise a union. What we want to estimate is whether these latter costs are sufficiently high so that recognition will take place even if \(X_i(\beta^n - \beta^u) + \theta_i(\gamma^n - \gamma^u) < 0\).

Given that there is selection into the union sector on the unobservables \(\theta_i\), they should be expected to be systematically different across the two sectors. Thus if the \(\gamma_i\)s are non zero or not equal across the two sectors, not controlling for selection will mean that we are unable to decompose the difference between union and non union pay into that driven by differences in pay setting (i.e. the \(\beta\)s and \(\gamma\)s) and that driven by unobserved differences in the characteristics of establishments (i.e. the \(\theta\)s).

In \(\theta\) will be any characteristics of the establishment which will affect pay differently in the two sectors and can not be observed in our data. For example, if some of the jobs in the establishment are unpleasant and unions can negotiate a higher premium for this, then recognition will be less likely.

### 9.4.1 Model specification

As mentioned earlier in this part of the thesis the wage data from the WIRS 90 is grouped meaning that OLS on mid points of the bands will give inconsistent estimates. Moreover, the inclusion of a generalised residual is not valid

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5This could be the wage for a certain skill group, but it might also be their policy towards differentials across different parts of their workforce

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in models such as these where censoring introduces non linearity. Estimation has to be thus done using full information maximum likelihood (FIML).

The latent (uncensored) structural equations can be written as follows:

\[ U_i^* = z_i \gamma + \epsilon_i \]  
\[ (9.10) \]

\[ y_i^{u*} = x_i \beta^u + \epsilon_i^u \]  
\[ (9.11) \]

\[ y_i^{n*} = x_i \beta^n + \epsilon_i^n \]  
\[ (9.12) \]

censoring is such that

\[ U_i = 1 \times (z_i \gamma > -\epsilon_i) \]

\[ A_i^{up} = \sum_{k=2}^{k} A_k \times (A_{k-1} < y_i < A_k) \]

\[ A_i^{down} = \sum_{k=1}^{k-1} A_k \times (A_k < y_i < A_{k+1}) \]

where \( A_i^{up} \) is the upper limit of the range of possible wages of establishment (i), (ranging from \( A_{k=1} \) to \( \infty \) ) and \( A_i^{down} \) is the lower limit. (ranging from \(-\infty \) to \( A_{k=k} \) ) Providing the error terms in equations (9.10) to (9.12) are normally distributed with covariance matrices

\[
\begin{bmatrix}
1 & -\\
\sigma_1 \rho_1 & \sigma_1
\end{bmatrix}
\begin{bmatrix}
\text{cov}(\epsilon, \epsilon^u)
\end{bmatrix}
\]

\[
\begin{bmatrix}
1 & -\\
\sigma_2 \rho_2 & \sigma_2
\end{bmatrix}
\begin{bmatrix}
\text{cov}(\epsilon, \epsilon^n)
\end{bmatrix}
\]

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$(\sigma_1, \sigma_2)$ is the conditional standard deviation of wages in the union (non union) sector. The contributions to the sample likelihoods can be defined as follows:

\[
L_i = \Phi_2 \left( \frac{A_{up} - x_i \beta^u}{\sigma_1}, z_i \gamma, \rho_1 \right) - \Phi_2 \left( \frac{A_{down} - x_i \beta^u}{\sigma_1}, z_i \gamma, \rho_1 \right) A_{up, \sigma < \infty, A_{down} > \infty, U=1}^{
}\times 
\Phi_2 \left( \frac{A_{up} - x_i \beta^u}{\sigma_2}, -z_i \gamma, \rho_2 \right) - \Phi_2 \left( \frac{A_{down} - x_i \beta^u}{\sigma_2}, -z_i \gamma, \rho_2 \right) A_{up, \sigma < \infty, A_{down} > \infty, U=0}^{
}\times 
\Phi_2 \left( \frac{A_{up} - x_i \beta^u}{\sigma_1}, z_i \gamma, \rho_1 \right) A_{up, \sigma < \infty, A_{down} < \infty, U=1}^{
}\times 
\Phi_2 \left( \frac{A_{up} - x_i \beta^u}{\sigma_2}, -z_i \gamma, \rho_2 \right) A_{up, \sigma < \infty, A_{down} < \infty, U=0}^{
}\times 
\left[ 1 - \Phi_2 \left( \frac{A_{down} - x_i \beta^u}{\sigma_1}, z_i \gamma, \rho_1 \right) \right] A_{up, \sigma > \infty, A_{down} > \infty, U=1}^{
}\times 
\left[ 1 - \Phi_2 \left( \frac{A_{down} - x_i \beta^u}{\sigma_2}, -z_i \gamma, \rho_2 \right) \right] A_{up, \sigma > \infty, A_{down} > \infty, U=0}^{(9.14)}
\]

where $\Phi_2(.)$ is the bivariate normal cumulative distribution function.

Separate identification of the $p_s$ and the $\sigma_s$ in this model may be problematic, particularly with discrete regressors and in small samples. The results presented in this next section are therefore to be treated with some caution.

### 9.4.2 Empirical implementation

The control vector used to estimate the model was very different to that in the earlier chapter. Here union status is related to a set of 8 industry
dummy variables and the dated instrument (industry union density at the
time of set up) and a shift variable indicating whether the establishment was
created after 1979. Wages are related to these same industry dummies and
another shift variable indicating whether the wage question refers to men or
to women. This is because it is important to control for industry effects on
wages and union status which do not change over time and which will by
definition be correlated with the dated instrument when industry effects are
excluded from the regression.

There are many other covariates of wages which should possibly be in­
cluded in estimation such as workplace size, workforce composition and so
on. These were excluded on two grounds. First the exclusion of workplace
size terms makes it unclear whether it is an employment or a wage equation
that is being estimated and it might seem inappropriate to include these
when estimating what is essentially a structural model. The second reason
was purely pragmatic, there was simply not enough variation in the sample
to identify both the industry and the workforce composition effects. The
1980s shift dummy although considered to be an important correlate of the
threat of unionisation may also effect wages. However, preliminary analysis
suggested that this variable was not only insignificant in the structural wage
equations (P value > 0.2 for both union and non union workplaces) but the
point value of the coefficient was the same across the two sectors. It was thus
excluded from the final estimation procedure.®

9.4.3 Identification

The identification restriction used to estimate the union effect on wages is
that industry level union density at the time the establishment was set up
only affects current wages to the degree that it determines union status. The

® Stewart (1995) finds that the union mark-up in workplaces established in the 1980s is
significantly lower than older workplaces. The finding here is not contradictory to this, it
merely suggests that it is the changing industrial composition of new workplaces which is
generating the fall in the mark-up.
inclusion of the full set of industry dummies means that industry effects on unions and wages that are correlated over time are controlled for. The fact that the time path of rises and falls in union density differs across industries means that it is possible to control for establishment level age/cohort effects on wages so long as they do not differ across industries. The crucial assumption here, therefore is that unions do not affect the birth and death rates of workplaces, this sample selection process would then introduce spurious correlation between union status and factors that determine wages. This assumption has not been tested in the empirical work but. I believe that this is plausible given Machin's (1995) finding that closure rates are not related to union status.

9.5 Results

The wage data used is on semi-skilled wages from the 1990 WIRS as described above. The dated variables were constructed as described in the last part of Chapter3. Table 9.3 presents two sets of maximum likelihood estimates of the determination of semi-skilled wages and union status. Columns (1), (3) and (5) presents estimates obtained from a specification restricting the covariance between observed factors affecting wages and union status to be zero. This is just a probit on union status and a Grouped Dependent Variable (GDV) estimator on wages. Column (2), (4) and (6) on the other hand present the full information maximum likelihood (FIML) estimates where function 9.13 is maximised. A comparison of the log likelihoods, shown in table 9.3 suggests clearly that the null of no correlation is rejected.

The first encouraging thing to note is the similarity between columns (1) and (2), the only coefficients with large changes are the one which are not

\[ \text{OLS regressions were ran for comparison but, as expected the estimated } \sigma \text{ were different to the GDV ones.} \]

\[ \text{Under the null the difference between the absolute value of the two log likelihood multiplied by 2 is distributed } \chi^2(2) \text{ The 5% critical value for this is 5.99. This is well below the value suggested by the two log likelihoods.} \]
statistically significant. Second the $\chi^2$ tests that the two variables (dated industry level union density, and the 1980s shift variable) which appear in the union but not in the wage equations are jointly significant are very large. This suggests that these variables are an important determinant of union presence even when industry effects are controlled for.

Table 9.1 presents the evidence on the question of whether the determination of wages is different amongst union as opposed to non union workplaces. The first line shows how the implied "mark-up" computed at sample means (weighted) differs across estimation procedures. The GDV results suggest a positive but insignificant relationship between union status and wages while the FIML results show that much of this positive effect is driven by the fact that higher wage workplaces are more likely to be unionised. The other results were obtained using minimum distance. The next row is just a joint test of parameter equality (including the constant but not the $\sigma$ and $\rho$ terms) between union and non union workplaces. Here the GDV results would suggest quite strongly that union wage setting is significantly different from non union wage setting. The FIML results, on the other hand, suggest that much of these differences may arise from selection effects. Indeed the test statistic is only significant at the 7% level. The next rows of table 9.1 presents a slightly weaker test that the industry effects on wages are the same in the two sectors. A similar picture emerges, while the GDV results seem quite conclusive, the FIML results are less clear cut again indicating that selection biases may be important.

Another look at table 9.3, however, suggests that what changes between columns (3) and (4) and between columns (5) and (6) is not the size of the coefficients but the precision with which they are estimated. In fact, as the

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9 This procedure tests restrictions on a general model using the unrestricted parameters and their covariance matrix. The basic premise is that $(\beta^{unrestricted} - \hat{\beta}^{unrestricted}) V^{-1} (\beta^{unrestricted} - \hat{\beta}^{unrestricted})$ should be distributed $\chi^2(K)$ under the null where $V^{-1}$ is the inverse of the variance covariance matrix of the unrestricted model and $K$ is the number of restrictions.
Table 9.1: Estimates of parameter equality between the union and the non union sectors

<table>
<thead>
<tr>
<th></th>
<th>GDV</th>
<th>FIML</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2(\beta_{\text{union}} - \beta_{\text{non union}})$</td>
<td>0.0815</td>
<td>-0.052</td>
</tr>
<tr>
<td>standard error</td>
<td>0.080</td>
<td>0.092</td>
</tr>
<tr>
<td>$\chi^2(9)$ test that $\beta_{\text{union}} = \beta_{\text{non union}}$</td>
<td>38.802</td>
<td>16.315</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.061</td>
</tr>
<tr>
<td>$\chi^2(8)$ test that $\beta_{\text{union}} = c + \beta_{\text{non union}}$</td>
<td>16.304</td>
<td>14.645</td>
</tr>
<tr>
<td></td>
<td>0.038</td>
<td>0.066</td>
</tr>
</tbody>
</table>

Notes: Probability values under the null given in italics

The first rows of Table 9.2, shows the magnitude of the industry and gender effects on wages seem to increase in the non union sector and decrease in the union sector once you control for the non random allocation of workplaces. (These results were obtained from predicting the standard deviation of wages using the whole sample with union and non union $\beta$s.). It is likely therefore, that the failure to reject absolutely the null of parameter equality is a problem arising from the small size of the sample.

A similar picture is suggested by the next panel of Table 9.2 which shows the conditional standard deviation of wages. Again the absolute value of the differences between the $\sigma$s in the union and non union sectors is larger in the FIML model, and the associated t statistic is similar. This suggests that even when one controls for the possible correlation between the determinants of union status and wages, there is still evidence that unions compress the conditional distribution of wages.

In equations 9.7 and 9.8, the unobserved component of wage determination are seen to be related to $\theta$ (a set of unobserved workplace characteristics which influence wages in a way foreseen by managers when they make the decision to recognise a trade union) as well as to a idiosyncratic component ($\epsilon$) which can be interpreted as a productivity or demand shock. The impli-
Table 9.2: Predicted union effects on wage dispersion

<table>
<thead>
<tr>
<th></th>
<th>Union Workplace</th>
<th>Non Union Workplace</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$sd(x\beta)$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDV stage</td>
<td>0.176</td>
<td>0.218</td>
<td>0.032</td>
</tr>
<tr>
<td>FIML stage</td>
<td>0.168</td>
<td>0.240</td>
<td>0.072</td>
</tr>
<tr>
<td>$\hat{\sigma}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDV stage</td>
<td>0.240</td>
<td>0.285</td>
<td>0.045</td>
</tr>
<tr>
<td>FIML stage</td>
<td>0.230</td>
<td>0.328</td>
<td>0.098</td>
</tr>
<tr>
<td>$\hat{\rho}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.316</td>
<td>0.734</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.616</td>
<td>12.677</td>
<td></td>
</tr>
<tr>
<td>$\sqrt{\hat{\sigma}^2(1-\hat{\rho})}$</td>
<td>0.218</td>
<td>0.223</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Notes: T tests that the number above is zero given in italics
cation from equations 9.7 and 9.8 is that the correlation between the error
terms in the union status and the wage equation will depend on the size of
the \( \gamma_s \) (the "returns" to these unobserved characteristics). The next row
of table 9.2 shows this estimated correlation to be much larger between the
unobserved determination of union status and wages in the non union sector,
than between wages in the union sector. The "economic" interpretation of
this is that the \( \gamma_s \) are bigger (though of the same sign) in the non union and
the union sector.

The next line presents the conditional standard deviation of wages con-
trolling for the different composition and return to unobservables. This is an
estimate of the standard deviation of the \( \epsilon \) in equations 9.7 and 9.8. This
suggests that such shocks to wages are distributed more or less identically
between the union and the non union sectors. The fact this rise in the esti-
mated variance of unconditional distribution in the union sector is explained
by the selection process does beg the question of whether the \( \rho_s \) and the
\( \sigma_s \) are separately identified in this sample. A smaller \( \sigma \) and \( \rho \) may be thus
likely to give a similar fit of the data. Further work using simulations may
be needed to test the robustness of this estimation method. The implication
from these results is, however, that both very high paying and very low
paying firms in each industry do not tend to become unionised and that this
explains much of the union effect on the structure of wages. However, there is
still, albeit weak, evidence that inter-industry wage differentials are smaller
under unionisation.

9.6 Conclusions

The results presented in this chapter suggest that unions affect the way
pay is determined in establishments and that this is not purely a feature of
the different characteristics of union firms. To go from this finding to say
that unions actually affect the wage structure is not easy. Moreover, the
Table 9.3: The Joint Determination of Semi-Skilled Wages and Union Status

<table>
<thead>
<tr>
<th>Probit on Union Status</th>
<th>Union Workplaces</th>
<th>Non Union Workplaces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Probit FIML GDV FIML</td>
<td>Probit FIML GDV FIML</td>
</tr>
<tr>
<td>Metals</td>
<td>0.544 0.480 4.984 5.023</td>
<td>4.897 5.263</td>
</tr>
<tr>
<td></td>
<td>0.283 0.292 0.050 0.049</td>
<td>0.148 0.161</td>
</tr>
<tr>
<td>Engineering</td>
<td>0.033 -0.064 4.907 4.952</td>
<td>4.844 5.115</td>
</tr>
<tr>
<td></td>
<td>0.326 0.333 0.035 0.041</td>
<td>0.062 0.090</td>
</tr>
<tr>
<td>Other Manufacturing (and utilities)</td>
<td>0.192 0.155 4.867 4.905</td>
<td>4.866 5.095</td>
</tr>
<tr>
<td></td>
<td>0.256 0.253 0.033 0.040</td>
<td>0.060 0.090</td>
</tr>
<tr>
<td>Construction</td>
<td>-0.110 -0.220 4.801 4.882</td>
<td>4.741 4.960</td>
</tr>
<tr>
<td></td>
<td>0.314 0.307 0.057 0.070</td>
<td>0.086 0.104</td>
</tr>
<tr>
<td>Distribution</td>
<td>-0.358 -0.523 4.825 4.870</td>
<td>4.622 4.763</td>
</tr>
<tr>
<td></td>
<td>0.137 0.134 0.038 0.078</td>
<td>0.037 0.052</td>
</tr>
<tr>
<td>Transport</td>
<td>0.776 0.392 4.891 4.905</td>
<td>4.974 5.331</td>
</tr>
<tr>
<td></td>
<td>0.616 0.582 0.058 0.060</td>
<td>0.281 0.228</td>
</tr>
<tr>
<td>Finance</td>
<td>-0.694 -0.734 4.957 5.066</td>
<td>4.938 5.067</td>
</tr>
<tr>
<td></td>
<td>0.349 0.356 0.129 0.131</td>
<td>0.109 0.107</td>
</tr>
<tr>
<td>Other Services</td>
<td>-0.824 -1.133 4.880 4.884</td>
<td>4.605 4.785</td>
</tr>
<tr>
<td></td>
<td>0.514 0.528 0.059 0.079</td>
<td>0.095 0.108</td>
</tr>
<tr>
<td>Established in the 1980s</td>
<td>-0.883 -0.801 - -</td>
<td>- -</td>
</tr>
<tr>
<td>Dated Union</td>
<td>0.129 0.128 - -</td>
<td>- -</td>
</tr>
<tr>
<td>Density</td>
<td>0.622 0.678 - -</td>
<td>- -</td>
</tr>
<tr>
<td>Majority Union Density</td>
<td>0.248 0.254 - -</td>
<td>- -</td>
</tr>
<tr>
<td>Majority Sex</td>
<td>- - 0.363 0.338</td>
<td>0.338 0.319</td>
</tr>
<tr>
<td>Male</td>
<td>- - 0.033 0.031</td>
<td>0.046 0.046</td>
</tr>
<tr>
<td>log(σ)</td>
<td>-1.428 -1.470 -1.255 -1.114</td>
<td></td>
</tr>
<tr>
<td>arctan(ρ × π/2)</td>
<td>0.035 0.049 0.041 0.090</td>
<td></td>
</tr>
<tr>
<td>Log Likelihood of Restricted Model</td>
<td>-2530.13</td>
<td></td>
</tr>
<tr>
<td>Log Likelihood of Unrestricted Model</td>
<td>-2516.3</td>
<td></td>
</tr>
<tr>
<td>Number of Observations</td>
<td></td>
<td>671</td>
</tr>
</tbody>
</table>

Notes
1. Standard Errors in italics
2. χ²(2) tests of excluded instruments:
   1st stage probit 47.2
   2nd Stage FIML 39.5 (5% critical value = 5.99)
3. log(σ) and arctan(ρ × π/2) are estimated rather than σ and ρ to ensure that these parameters remain within the permitted range.
estimation procedure chosen in the final part of the chapter is not robust, particularly in small samples.
Part III

The Changing Structure of Wages
Chapter 10

Introduction

10.1 Introduction

The aim of this last part of the thesis is to describe and explain the recent explosion in the structure of wages in the UK. The changing distribution over time, the lifecycle, across generations and education groups will be modelled in order to see how much these changes can be attributed to changes in the structure of demand. I then look at the importance of labour market institutions in the wage structure in two ways. First I assess the degree to which changes in the structure of earnings can be explained by a decline in union presence. Second I compare the changing distribution of wages in the UK with that of West Germany in order to see how a country with very different institutional features responded to the same global technological and product market shocks.

10.2 What has happened to the Distribution of Wages in the UK.

Figure 10.1 plots the 10th, 50th and 90th percentiles of the male real hourly earnings distribution (indexed 1966=100) and shows:
Figure 10.1: Indexed real male hourly wages by percentile in the FES
1. a period (1966-72) when there was real wage growth throughout the distribution coupled with no change in the wage structure,

2. a short period (1972-75) when relative differentials were falling and all wages were growing in real terms. For example in 1974, the 10th percentile wage was 40% higher than it was in 1966 and the 90th percentile wage was only 25% higher;

3. the period following this when the social contract was at its toughest and where all wages were falling;

4. a long sustained period from 1978 to 1992 when growth rates diverged across the distribution. Over these 15 years, the 10th percentile wage did not change, never recovering the wages received in 1975, while the median grew by 35 percent and the 90th percentile by over 50 percent.

To draw out the relative differences in the growth rates of wages across the distribution, Figure 10.2 plots the ratios of the 90th percentile to the median and the median to the 10th percentile between 1966 and 1992. Looking first at the top line, the 90/50 ratio, a bowl-shaped relationship emerges, with differentials falling until the mid-1970s and then rising dramatically and overtaking the 1966 level by 1984. Apart from the period 1970-76 when pay differentials between the top and the bottom were compressed, there was no real change in the 50/10 ratio until after the incomes policy period of the mid-to-late 1970s, after which the ratio rose steadily. Over the whole period, median wages increased from being 47 percent more than the 10th percentile in 1966 to being over 80 percent more by 1992. Thus, since the mid-1970s, the real wages of low paid workers have fallen successively further and further behind the rest. This appears to be the most dominant trend in the distribution of wages over this time period.
Figure 10.2: The changing distribution of male wages 1966 to 1992
10.3 Why should Wage Inequality have Risen in the 1980s?

This increase in wage inequality has prompted a large body of research both in the US and the UK\(^1\). Changes in the structure of wages have been related to several factors, including changes in the structure of the demand for labour, changes in the composition of skills among the workforce and in the influence of pay setting institutions. These are now discussed in more detail.

The increased integration of international product and capital markets (globalisation) has been suggested as a reason why the demand for unskilled workers in developed economies such as the UK and the US should have fallen (Murphy and Welch 1992). Investment is now more mobile and thus more likely to move in response to cross-country differences in unit wage costs. Similarly, in order to maintain their competitive position, firms who face international competition are under more pressure to keep their unit wage costs down. Skilled workers are thus at more of a premium than before and there are fewer unskilled jobs at any given wage.

It has also been suggested (see Bound and Johnson 1992 and Van Reenen 1992 or Machin 1994 for the UK) that technological change has increased the relative productivity of skilled versus unskilled workers. Examples of this are the rapid influx of computers into many workplaces and the introduction of machines to do assembly tasks previously done by unskilled or semi-skilled workers in sectors like the automobile industry. This seems to have created an increase in the demand for skilled workers to run these machines and an increase in the proportion of workers needed for administrative and supervisory roles.

There is also considerable evidence that important compositional changes

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have occurred in the UK labour market. In 1969, for example, 39 percent of the total workforce worked in manufacturing, whilst by 1990 this had fallen to 23 percent. In 1969 the private service sector employed 49 per cent of the workforce, whilst by 1990 it employed 70 percent. It is likely that the return to skill is higher in these new types of employment where jobs are more heterogeneous. It may also be likely that the increase in female participation, itself perhaps a consequence of the decline in the relative earning power of unskilled married or cohabiting men (Machin and Waldfogel 1994) has increased the numbers competing for unskilled jobs, although what evidence there is suggests that the increase in participation has come from educated women (see, for example, Gregg and Wadsworth 1995). With the above in mind, Chapter 11 uses microeconomic data to look at how the distribution of wages evolves over the lifecycle, across time and skill groups.

Other authors (e.g. Freeman and Katz 1994) have stressed the importance of labour market institutions, particularly trade unions and minimum wage setting mechanisms, in shaping the way that labour markets have responded to these changes in the structure of supply and demand. In this light, Freeman and Katz (1994) and Gregg and Machin (1994) cite evidence showing that the UK and the US are alone in experiencing such a widening of wage differentials in the 1980s (with the US still having a much higher level). While earnings differentials in most countries became more compressed in the 1970s, and the 1980s saw rises in a number of countries, the increases in dispersion of the 1980s are much smaller elsewhere than in the US or the UK. Chapter 12 looks at the role of trade unions in the wage structure and Chapter 13 looks at this question explicitly by comparing the distribution of wages between the UK and West Germany.

The first point to make is that the fall in demand for unskilled labour may result in both falls in employment and declines in the relative wages of the less

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skilled. In this light, one important difference between the experience of the US and that of Europe over recent years is that the US has not experienced such large and persistent levels of unemployment. In the UK inactivity rates of men of working age doubled from 7 to 14 percent from 1973 to 1991. Moreover, real wages at or below the median have been falling steadily in the US over the last 20 years. By contrast, in the UK real wages at the 10th percentile have been flat since the late 1970s. In many states in America, there is no universal benefit available to able-bodied unemployed men without children and benefit is instead restricted to those who have worked if only for a few weeks over the past year. The collapse in demand for unskilled workers then seems more likely to affect their wages rather than their employment.

Secondly, the ability of the workforce to respond to the increasing demand for skilled labour by upgrading their skills is likely to depend on their educational background and their opportunities for training. The education and training systems then become very important. It has been argued that not only are UK workers less skilled on average than those in some other European countries, but that they also lack the general skills obtained from basic education that are necessary for further training (see the discussion in Chapter 13 below).

There have been significant changes in public policy toward education in the last century. The minimum school leaving age was raised from 14 to 15 in 1948 and again to 16 in 1973. The 1960s and 1970s saw the expansion of further and higher education after the Robbins report. It is evident that the level of wages among particular age groups is likely to be affected by the returns to and the distribution of education (Becker 1975). How the variance of wages is then affected by education policies will depend on what is happening to the structure of demand. In the face of increasing relative demand for educated workers, we should expect policies such as those described above to mitigate the increased educational premia. Chapter 11 looks at this question in more by comparing the wage distributions across generations.
Even if there had been no changes in the structure of demand in the UK, we should expect the dispersion of wages to rise given the recent moves away from national and industry level wage setting and from the overall decline in union presence. There have been important changes in government policy towards pay over the last three decades. Up until 1978, there were explicit controls over wage increases through incomes' policies. These will compress pay differentials if they contain a flat rate element as in the 1975-1977 period of the social contract, a maximum level of pay increase as in the 250 limit imposed during 1972 to 1973, or any preferential arrangement for lower paid workers. Moreover, they constrained the growth of relative pay differentials even when all workers received the same rate of pay increase. For the last 15 years, there has been no such centrally imposed restraint.

Since 1980, two institutional arrangements that held up the wages of low paid workers have been removed or weakened. Although Wages Councils (committees made up of employers and worker representatives to set industry level minimum wages) were not abolished until 1993, the number of inspectors were reduced and young workers were taken out of the net in 1986 (see Machin and Manning 1994). The "fair wages resolution" was abolished in 1980. This not only protected the wages of public sector workers in low paid occupations but also workers in any organisation contracted to do work for central or local government. The effect of the abolition on low wages is thus magnified given the recent trend towards subcontracting of many local government tasks such as cleaning.

The actual mechanism by which pay is set are also important. There is evidence that the variance of wages is smaller when pay is set at an industry or national level and/or between unions and firms than when it is set unilaterally by the employer. Freeman (1980, 1982) and Card (1991) using US data show that trade unions are associated with lower levels of wage dispersion. Between 1980 and 1990, there was a large drop in union presence in the UK: the percentage of the work-force belonging to a trade union fell from 58 percent
to 42 percent over this time period (see Waddington 1992); the proportion of workplaces with recognised unions fell from 64 percent in 1980 to 53 percent by 1990 (see Millward et al. 1992; Disney et al. 1995). Moreover, even in the union sector, national or industry level pay agreements have all but disappeared over the 1980s and pay is now more likely to be set within the firm or the workplace. Chapter 12 looks specifically the relationship between the decline in trade union power and the rise in wage inequality.

10.4 Within and Between Skill Group Wage Differentials

The demand side explanations for the changes we have observed in the wage structure suggest that we should be able to explain much of the increase in wage dispersion by changes in skill differentials. Thus we now look at changes in wage differentials within and between education and age groups.

Data Two datasets were used for this preliminary analysis, first the Family Expenditure Surveys (FES) from 1966 to 1992 and second the General Household Surveys (GHS) from 1978 to 1991. From both datasets all men aged between 23 and 59 (inclusive) who worked at least one hour in the past week were included in the analysis. For the FES individual hourly wages were constructed by dividing usual weekly pre-tax earnings by usual weekly hours of work (both measures including overtime). A consistent series of hourly wages in the GHS is not available and so the usual weekly earnings of full time men were modelled. This excludes about 2% of working men. The education measure used in the FES is age left full time education and for the GHS, highest formal educational qualification.

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3 We excluded all men who reported themselves to be self employed
4 The earnings measure in the GHS includes payment for bonuses and overtime but the hours measure excludes overtime which varies across individuals and over the business cycle.
Figure 10.3: Cumulative changes in log wage differentials by education group (FES data)
Figure 10.4: Cumulative changes in log wage differentials by education group (GHS data)
Figure 10.5: Difference in median log wages between older and younger men: (older= 35+)
In order to look at the role of education in the wage structure, a subsample of the FES from 1978 was used. and workers were allocated into three education groups: those who left full time education at or before 16, those who left at 17 or 18 and those who left after 18. The latter includes college graduates. The analysis was repeated on GHS data from 1978 to 1991 which will indicate the importance of the measure of education used. The four education groups used in the GHS data were as follows: 1) no formal educational qualifications 2) “O” level, CSE or equivalent qualification (usually obtained at 16+), 3) “A” Level or equivalent (needed to get into university) 4) Degree or Teaching qualification.

**Preliminary Results** Figures 10.3 and 10.4 use FES and GHS data respectively to plot movements in education differentials measured as the difference in median log wages from the base category. This is the group of workers who left school at or before 16 for the FES sample and the group of workers with no qualification for the GHS sample. In both datasets, there is strong evidence for an upward trend in the unconditional returns to education, with growth in median wages being positively correlated with the level of education. For example the raw wage differential between workers with a degree and those with no qualifications has risen from 0.320 in 1978 to 0.460 in 1991.

Figure 10.5 shows how the growth rates in median wages differ across workers of different ages in both datasets. In the GHS the difference between the median wages of men 35 and over to those under 35 has risen from 0.02 in 1978 to 0.14 in 1991, while in the FES this difference reached a maximum of 0.14 in 1988 and has since declined slightly. This increasing gap between the wages of older versus younger workers could mean that the returns to experience have increased and/or that there are significant cohort effects on

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5The education measure in the FES is only available after 1977. We use the FES here because we want to focus on hourly wages rather than weekly earnings.
wages. Chapter 11 demonstrates that once you control for cohort effects, there is no evidence of increasing returns to experience.

Finally figures 10.6 and 10.7 show how the distribution of wages has evolved within education groups. As can be seen these have widened considerably over time. The next chapter thus explicitly model the shape as well as the location of the wage distribution of age and education groups.

![Figure 10.6: 90/10 Differential within education groups (FES)](image)

The structure of these next chapters is as follows. Chapter 11 looks at how the distribution of wages evolves over the life-cycle, across generations and education groups Chapter 13 compares changes in the UK distribution between 1984 and 1992 with that of West Germany over the same period. Finally 12 looks at the changing influence of trade unions on the wage struct-
Figure 10.7: 90/10 Differential within education groups (GHS)
ture.
Chapter 11

The Changing Distribution of Wages in the UK

11.1 Introduction

Chapter 10 described the large changes that have taken place in the distribution of wages. This chapter now describes the evolution of the distribution of wages in more detail by estimating life-cycle, cohort, and macro effects on the level and distribution of wages across and within skill groups.

11.2 Estimating the Wage Distribution over Time

One can think of the wage that you receive as being a function of:

1. The skills that you have acquired or have before entering into the labour market. These will be determined by how much and what sort of education you received, perhaps the income and attitudes of your parents and your intelligence and willingness to learn. These will also be affected by policy changes such as the minimum school leaving age, the move away from grammar schools the 1960s, expansion of higher education and so on. Workers from different generations will thus have systematically different amounts of these skills. It will be also the case that
education policy will affect the distribution of these initial skills across labour market entrants. It is thus likely that there will be important "cohort effects" on wages.

2. The skills that you have acquired since entry into the labour market. The number of workers obtaining on the job training can be shown to be determined, at least in part, by the distribution of initial skills across workers and other institutional factors determining the costs of training. These skills will affect wage growth over the life-cycle. It is interesting to note the degree to which some workers find it easy to up-grade their skills will both affect the change in the distribution of wages over the lifecycle within a cohort but also how labour markets respond to technological shocks.

3. The wage premia that higher skilled workers can command for their skill. This will be a function of technology and competition which will effect employers relative demand for skilled versus unskilled labour, wage-setting institutions and the degree to which other workers are able to acquire new skills.

4. The extent to which workers, even with the same skills, are rewarded differently. Cohort size effects on wages are one example of this, here workers do not compete with the entire workforce for the best jobs but just with those who entered into the labour market at the same time. Large macro shocks such as the 1979-81 recession in the UK may also have the effect of reducing the wages of labour market entrants than incumbents. This is another reason why it is likely that there will be cohort effects on wages.

As the shape as well as the location of the distribution of wages is of interest, quantiles of the distribution of wages as functions of age and education, cyclical time effects and a cohort effect are modelled. This last is
determined by general productivity growth, which may differ across the wage distribution, as well as the difference in productive characteristics across generations. If all quantiles are the same apart from an intercept shift, then the change in dispersion of pay can be explained by the changing returns to and composition of observed skill. Using quantiles is an easy and intuitive way of characterising the distribution of wages. The median defines the location of the distribution while the quantiles around it can be used to describe changes in dispersion or other aspects of its shape. This difference across quantiles is thus an estimate of the changing importance of the unobserved component in wages within the predefined groups.

The qth quantile of the wage distribution, conditional on cohort, age and education is defined as:

\[ q = \text{Prob}[w_{it} < w^q(\text{cohort}_i, \text{age}_i, \text{education}_i)] \]  

(11.1)

where \( w_{it} \) refers to the log of the real hourly wage rate of individual \( i \) in time period \( t \). In equation 11.1, \( \text{cohort} \) is the year of birth of a particular worker, \( \text{age} \) his age in years at the time his wage is observed and \( \text{education} \) (abbreviated to \( \text{ed} \) below) is a measure of education.

Following MaCurdy and Mroz (1996), equation (11.1) is restricted to have the following additive structure:

\[ w^q = A^q(\text{age}, \text{ed}) + C^q(\text{cohort}, \text{ed}) + T^q(\text{time}, \text{ed}) \]  

(11.2)

where \( T^q(\text{time}, \text{ed}) \) is constructed so that it is orthogonal to the cohort and age functions and hence includes no trends. All trends in the data will be included in the functions \( A^q \) and \( C^q \). This assumption is examined in more detail below. A comparison of the fit of equation 11.2 to that of the unrestricted quantile estimates is a test of this restriction.
The set of functions $C^q(cohort, ed)$ for each quantile will measure the cross generational differences in wages caused by the different characteristics of cohorts, including their size, interacted with the changing labour markets in which they work and the overall growth in productivity. The differences of these functions between the top and the bottom of the distribution is thus the effect of these factors on the dispersion of wages within a particular cohort. Similarly the differences across education groups will measure the changes to the returns to education across generations.

The functions $A^q(age, ed)$ will measure how the wage distribution changes as a cohort ages for each education group. This is important for the following reasons. First and foremost, age minus years of education is the level of potential experience for an individual, so if experience is important we should observe wages growing with age. Second, age reflects learning about individual ability both by workers and their employers. As such we may also observe an increase in the variance of wages with age, as unobserved productivity is gradually revealed and translated into pay. Indeed it may be as the workforce ages, we should expect an increase in aggregate variance (Deaton and Paxson, 1993, make a similar argument in the case of consumption). No such ageing of the workforce has taken place in Britain over our sample period. Third, $A^q$ will reflect changes in wages over the life-cycle for reasons other than accumulated experience, most importantly general productivity growth.

Common shocks to the wage distribution $T^q(time, ed)$ are defined as those changes in wages which are the same within all education groups regardless of age and which are orthogonal to the other functions in equation 11.2. This functional form specification defines macroeconomic effects as relative changes within the sample which are common to all individuals in the same education group at any point in time, regardless of age. This is the only way that growth rates with age will differ across generations if the functional form restrictions are not rejected.
Since, by construction, the time effects $T^q(time, ed)$ do not contain any trends, wage growth will be reflected in the evolution of the other two functions, that of age and that of cohort. Thus the rate of growth of entry level wages for the $q$th quantile is given by $\frac{\partial \hat{c}^q}{\partial \text{age}}$. Given entry, wages at the $q$th quantile grow at a rate $\frac{\partial \hat{a}^q}{\partial \text{age}}$. Both these growth rates contain a constant term which is independent of both age and cohort and can be thought of as the effect of a constant growth rate in labour demand, which may differ across skill groups (for example productivity growth). If it differs across quantiles, conditional on education, this indicates the existence of a trend within our time period towards increasing within group dispersion.

The estimation procedure is particularly simple to implement. It is based on regressing the chosen order statistics of cohort/year/education groups (for example the median) on the chosen functional form described above, using weighted least squares where the weights are the inverse of the variances of the order statistics. Using these estimated quantiles counterfactual distributions of wages can be then constructed in order to consider the within and between group contributions to changes in dispersion. The econometric justification for this estimation procedure as well as the technical details of constructing the counterfactual distributions are given in the appendix.

11.3 Results

11.3.1 The returns to experience and the fit of the model

The first hypothesis tested is that life-cycle profiles for wages have not changed. This implies that changes in the wage differentials between young and old workers can be attributed to cohort effects. The $\chi^2$ goodness of fit measures of a model estimated on FES data for a number of quantiles of each education

\footnote{This is similar to the minimum distance procedure in the context of quantile regressions suggested by Chamberlain (1993)}
The subsamples are presented in Table 12.3. For the median and the two quartiles around it the restriction that the life-cycle profiles are the same across generations (except for cyclical effects) can not be rejected. Even though the restrictions are rejected at the top decile and for the two higher education groups at the bottom decile, there is practically no loss of fit. Figure 11.1 shows how the interdecile range actually evolved for each of these education groups and how the restricted model implies it would evolve. There is no substantive difference in the slope of the fitted and actual interdecile range of log wages (the 90/10 differential) in any of the three education groups. The interpretation of this chapter is that changing returns to experience, conditional on cohort effects do not explain any of the change in dispersion of wages within education groups.

At first glance, these results seem to be in conflict with some of the US literature which places a lot of emphasis on the growing difference between the pay of older versus younger workers over time as a major cause of the rise in dispersion (see, for example, Bushinsky, 1994, Katz and Murphy, 1992, and Juhn, Murphy and Pierce, 1993). In the UK, this rise can be represented as a cohort effect and a general linear macro trend which differs across quantiles. Life-cycle growth of wages can be taken as constant across cohorts, apart from common cyclical effects whose role is examined later. In other words this increasing gap between the wages of old and young workers does not imply that the returns to experience have increased.

To estimate the quantiles of the wage distribution the empirical investigation began by specifying the functions \( A^q \) and \( C^q \) as a set of age and cohort dummies respectively. These could be both restricted to cubic polynomials without any loss of fit.

This measure of dispersion is constructed by combining the information from 15 estimated quantiles: The max and min, the nine deciles and the top and bottom percentiles and quintiles. The estimation appendix explains how we combine the conditional quantiles to obtain the unconditional ones. To show how the fitted model predicts the change in dispersion, the fitted level of dispersion was set to equal the actual one in 1978.
Figure 11.1: Actual and predicted 90/10 differentials by education group
Table 11.1: χ² Tests for Changes in the Return to Experience

<table>
<thead>
<tr>
<th>Left School at or Before 16</th>
<th>Percentile</th>
<th>10th</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>90th</th>
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<td></td>
<td>608.59</td>
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<td>457</td>
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<tr>
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<td>(0.99)</td>
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<tr>
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<td>Sample Size = 33526</td>
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</table>

<table>
<thead>
<tr>
<th>Left School at 17 or 18</th>
<th>Percentile</th>
<th>10th</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>90th</th>
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<td></td>
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<td>75th</td>
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</tr>
<tr>
<td></td>
<td>703.361</td>
<td>473.139</td>
<td>355.250</td>
<td>397.903</td>
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<tr>
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<td>(0.972)</td>
<td>(0.630)</td>
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<table>
<thead>
<tr>
<th>Left School after 18</th>
<th>Percentile</th>
<th>10th</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>90th</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>25th</td>
<td>50th</td>
<td>75th</td>
<td>90th</td>
<td></td>
</tr>
<tr>
<td></td>
<td>725.627</td>
<td>473.00</td>
<td>356.833</td>
<td>396.833</td>
<td>669.313</td>
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<td>(0)</td>
<td>(0.006)</td>
<td>(0.933)</td>
<td>(0.507)</td>
<td>(0.000)</td>
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<td>Sample Size= 6696</td>
<td></td>
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</tr>
</tbody>
</table>

Notes:
Estimates are on FES data from 1978 to 1992, comparable GHS estimates available on request
P values given in brackets
11.3.2 Cohort Effects and the Changing Returns to Education

As shown above, the driving forces underlying the observed increase in wage dispersion are a combination of cohort effects and changing returns to education across generations. The cyclical time effects are insignificant for the post 1977 period except for the higher education group where they only play a minor quantitative role. The coefficient estimates for the cohort effect are reported in Table 11.2 below while Table 11.3 presents a set of test statistics for the null hypothesis that the cohort effects are the same across quantiles. For those workers with 11 years of schooling or fewer the differences in the coefficient estimates across quantiles are large and statistically significant. Thus the unobserved component of wages appears to have become much more important amongst the lower education group. The evidence is less clear cut for workers with some form of post compulsory education. The hypothesis of parameter equality for percentiles between 75th and the 25th cannot be rejected although the differences are significant when the top and bottom decile are included (see the $\chi^2$ statistics in Table 11.3). The quantitative importance of the cohort effects on dispersion by education group are shown in Figure 11.2.\(^1\) The dispersion of wages has increased for workers of younger cohorts with low levels of education. In contrast, there has been practically no increase in dispersion among workers of different cohorts for the highest education group.

The returns to education have increased across cohorts and over time. This can be seen in Figure 11.3 which plots the differences between the predicted median wages at forty across education groups against year of birth. The returns to post 16 education have been increasing for all cohorts in the sample although not always at the same rate. The returns to post 18

\(^1\)The quantiles shown form components of the estimated quantiles of wages; there is no reason why they should not cross, so long as the sum of all components (age, cohort and time effects) defining the conditional quantile do not cross.
education (mainly but not exclusively university) actually declined for the cohorts born between 1920 and 1940 but rose rapidly thereafter: The returns to the highest education for workers entering the labour market after 1960 have been increasing at a very fast rate.

To summarise: Returns to education have increased and the dispersion of wages has increased within the lower education groups: The changing returns to unobserved factors determining wages is correlated inversely with observed skills in our data. These unobserved factors reflect among other things the increasing heterogeneity of the lower education group in terms of the qualifications obtained by 16 and the quality of education; we illustrate this below. A recent study (Ginther, 1994) of the changing of wages within and across skill groups in the US also finds larger increases in inequality within the lower skill groups. As we illustrate below the increasing returns to education and the effect of education on within group dispersion are the key to understanding the events in the UK.

11.3.3 The Effects of Education on Wage Dispersion

The results above suggest that education has had interesting and complex effects on the distribution of wages. To fully understand these a number of counterfactual experiments are constructed which illustrate the effects of education on between and within group dispersion. A group is defined by date of birth cohort and education unless otherwise specified.  

5To construct the between group measures of dispersion we predict wages for each group using the estimated conditional median. In each year we use these predicted values to compute the interdecile range of this distribution weighting each prediction by the cell sizes. To obtain a similar scale for comparisons across graphs we subtract from the series the 90/10 dispersion in 1978. The within group measure of dispersion is obtained by setting the medians for each group equal to each other and constant over time. The quantiles around the median are then used to predict the dispersion around the constant median for each group. Using the techniques described in the appendix the data from each group are combined to construct the implied unconditional interdecile range. Again we set the first period dispersion to zero by subtracting the first period dispersion from the entire series.
Figure 11.2: Predicted log wages across cohorts by percentile and education
Figure 11.3: The wage returns to education across generations
Table 11.2: The Cohort Effects

<table>
<thead>
<tr>
<th></th>
<th>90th</th>
<th>75th</th>
<th>50th</th>
<th>25th</th>
<th>10th</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Left School at or before 16</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohort</td>
<td>.066</td>
<td>.081</td>
<td>-.081</td>
<td>-.026</td>
<td>-.114</td>
</tr>
<tr>
<td></td>
<td>(.137)</td>
<td>(.118)</td>
<td>(.108)</td>
<td>(.111)</td>
<td>(.107)</td>
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<td>.046</td>
<td>.060</td>
<td>.021</td>
<td>.055</td>
</tr>
<tr>
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<td>(.028)</td>
<td>(.026)</td>
<td>(.026)</td>
<td>(.025)</td>
</tr>
<tr>
<td>Cohort cubed</td>
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<td>-.004</td>
<td>-.005</td>
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<td>-.005</td>
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<tr>
<td></td>
<td>(.002)</td>
<td>(.002)</td>
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<table>
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<th></th>
<th>90th</th>
<th>75th</th>
<th>50th</th>
<th>25th</th>
<th>10th</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Left school at 17 or 18</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohort</td>
<td>1.487</td>
<td>.510</td>
<td>.378</td>
<td>.329</td>
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<tr>
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<td>(.420)</td>
<td>(.441)</td>
<td>(.438)</td>
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<td>.052</td>
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<tr>
<td></td>
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<td>(.089)</td>
<td>(.089)</td>
<td>(.093)</td>
<td>(.094)</td>
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<tr>
<td>Cohort cubed</td>
<td>.017</td>
<td>.003</td>
<td>.001</td>
<td>.001</td>
<td>-.006</td>
</tr>
<tr>
<td></td>
<td>(.006)</td>
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<td>(.007)</td>
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<table>
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<th>90th</th>
<th>75th</th>
<th>50th</th>
<th>25th</th>
<th>10th</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Left school after 18</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohort</td>
<td>-.749</td>
<td>-.315</td>
<td>-.186</td>
<td>-.371</td>
<td>.574</td>
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<tr>
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<td>.058</td>
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<td>(.082)</td>
<td>(.090)</td>
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<td>Cohort cubed</td>
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<td>-.003</td>
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<td>.008</td>
</tr>
<tr>
<td></td>
<td>(.005)</td>
<td>(.005)</td>
<td>(.006)</td>
<td>(.006)</td>
<td>(.006)</td>
</tr>
</tbody>
</table>

Standard errors in brackets

Cohort = (Year of Birth - 1900)/10

162
Table 11.3: \( \chi^2 \) Tests of Parameter Equality of the Cohort Effects Across Quantiles

<table>
<thead>
<tr>
<th>Education group</th>
<th>90th, 75th, 50th &amp; 25th, 10th</th>
<th>75th, 50th &amp; 25th</th>
</tr>
</thead>
<tbody>
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<td>Left school at or before 16</td>
<td>89</td>
<td>39</td>
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<td>(0)</td>
<td>(0)</td>
<td></td>
</tr>
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<td>Left school at 17 or 18</td>
<td>68</td>
<td>13</td>
</tr>
<tr>
<td>(0)</td>
<td>(0.04)</td>
<td></td>
</tr>
<tr>
<td>Left school after 18</td>
<td>54</td>
<td>18</td>
</tr>
<tr>
<td>of schooling</td>
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<td>(0.01)</td>
</tr>
<tr>
<td>Degrees of Freedom</td>
<td>12</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 11.4 shows the relative changes in between and within group dispersion from 1978. Up to 1986 both components contribute equally to the overall increase in dispersion. From that point on the within group dispersion no longer increases and all subsequent changes can be attributed to between group movements.

Interestingly education has had opposing effects on these two aspects of dispersion. Figure 11.5 plots the evolution of the within group dispersion setting the effects of education to zero and this is compared to the total within group dispersion. Over the entire post 1978 period and particularly between 1981 to 1984 and 1986 to 1992 the effect of education, conditional on cohort, was to reduce within group dispersion which is the reason that the overall within group dispersion does not increase after 1986. In contrast changing returns to education explain over half of the changes in between group dispersion as is illustrated in Figure 11.6. This compares the changes in between group dispersion predicted by our model to that which would occur if the returns to education were set to zero over the whole period.

These results can be interpreted in the following way: Even though there
has been an increase in the supply of educated workers, the demand for skills has increased faster pushing up the education premium to unprecedented levels. This is responsible for the much of observed increase in the between group dispersion. At the bottom of the skill ladder two phenomena are increasing the within group distribution, particularly for new cohorts: First, the population of workers who stop school at 16 have become less homogeneous in terms of qualifications obtained. Thus, even before carrying out their own screening, employers know much more about the individuals’ capabilities. Second, given the increasing premia paid to workers with higher education, one might expect employers to devote more resources into choosing the most productive of the lower educated workers to work with the new technologies.6

11.3.4 The Role of Educational Qualifications

The results have shown that most of the increase in the within group dispersion has taken place for the lower education individuals. The interpretation we presented, based on the increased heterogeneity of qualifications among that group, implies that some of the effects of education on within group dispersion should be explained away if we re-classify individuals by the qualification obtained. Although the FES contains no information on qualifications (as opposed to years of schooling), an alternative data source, the General Household Survey (GHS) does. The model is now replicated on GHS data using weekly earnings as the dependent variable and classifying individuals on the basis of their highest educational qualifications as explained in the data section.

The restricted specification, which attributes the changing differentials between younger and older workers to cohort effects, fits as well as it does

---

6Perhaps the proliferation of agencies whose primary role is to "screen" workers for both temporary and permanent contracts in some low waged labour markets might be a result of this.
Figure 11.4: Cumulative changes in 90/10 differentials within and between groups
Figure 11.5: Cumulative changes in within group 90/10 differential s-the role of education
Figure 11.6: Cumulative changes in 90/10 differentials between groups - the role of education
Figure 11.7: Cumulative changes in 90/10 differentials (GHS)
in the FES: All the change in dispersion is explained by the restricted model implied by equation (11.2.)

As with the FES the between group dispersion and the within group dispersion can account for about equal amounts of the overall change as shown in panel 1 of Figure 11.7 Similarly, as the second panel shows education can explain over half of the increase in the between group inter decile range. An important difference emerges on the effect of education on within group inequality across the two datasets. Results on the FES imply that education defined by years of schooling has a negative effect on within group dispersion (conditional on cohort), while the GHS data shows that education defined by highest formal qualification has no effect for most of the period apart from 1990 and 1991 (Figure 11.7) This is compatible with the interpretation of the FES results, namely that the increased dispersion in the lower education group is partly due to the increased heterogeneity of qualifications received by them. In fact the GHS shows that the proportion entering the labour market with qualifications and who left school at 16 has increased from 40% in 1981 to 50% in 1990.7

11.3.5 A Comparison with the 1970s

It has been shown that the increase in the dispersion of earnings after 1978 can be attributed to the changing returns to education and to cohort effects on the level and dispersion of wages. From 1972 to 1976 wage differentials fell. During this period the oil shock took place, unemployment increased and the Labour government implemented a number of incomes policies specifically designed to compress wage differentials. It is now considered whether an interpretation of this, consistent with our analysis of the subsequent years can be provided.

Educational qualifications are not observed for the pre 1978 period in

7GHS data does not contain years of schooling before 1981; hence the comparison based on 1981.
the FES and the GHS does not provide a consistent earnings series before that. Table 11.4 shows the $\chi^2$ goodness of fit statistics for 5 quantiles while in Figure 11.8 we show that all the change in dispersion is explained by the fitted model - here the effects of the changing returns to education are captured by the cohort effects. The results corroborate the validity of previous estimates and imply (albeit indirectly) that the changing education composition does not play an important role in explaining these changes.

![Figure 11.8: Actual and predicted 90/10 differentials 1966-1992](image)

Figures 11.9 and 11.10, illustrates the role of the estimated cyclical time effects on median wages and the 90-10 differential. These show that the wage compression of the mid 70s can be attributed to common shocks across all individuals. The model suggests the presence of an upward trend in inequal-

170
ity throughout the period which is consistent with the steadily increasing returns to education across generations found by the post 1978 estimation. What prevented inequality rising in the 1970s as well as the 1980s was these shocks to the wage distribution which affected all education and age groups in the same way. This allows a major puzzle in the explanations of increases in the earnings dispersion in the UK to be resolved, namely that most of the underlying causes of increases in the demand for skilled labour (technical change which increased the demand for skills, globalisation etc.) were occurring in the 1970s when earnings dispersion fell.

Table 11.4: $\chi^2$ Tests for Changes in the Return to Experience

<table>
<thead>
<tr>
<th>Percentile</th>
<th>10th</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>90th</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1030.34</td>
<td>793.45</td>
<td>854.53</td>
<td>1044.96</td>
<td>1298.71</td>
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<td></td>
<td>(0.07)</td>
<td>(1)</td>
<td>(1)</td>
<td>(0.04)</td>
<td>(0)</td>
</tr>
</tbody>
</table>

*Degrees of Freedom = 965*
*Sample Size = 81627*
*P values given in brackets*

Table 11.5: $\chi^2$ Tests of Parameter Equality of the Year Effects across Quantiles

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>90th, 75th, 50th &amp; 25th, 10th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>818</td>
</tr>
<tr>
<td>P-value</td>
<td>(0)</td>
</tr>
<tr>
<td>Degrees of</td>
<td></td>
</tr>
<tr>
<td>Freedom</td>
<td>108</td>
</tr>
</tbody>
</table>

*The returns to post 16 education has been increasing for all cohorts. The returns to post 18 education have been increasing for all those born after 1940 and hence entering the labour market after 1962.*
Prediction without time effects

Figure 11.9: Common shocks to median log wages
Figure 11.10: Common shocks to 90/10 differentials
11.3.6 The Distribution of Real Wages Over the Life-cycle

The estimated age profiles of wages have remained stable over the sample period and differences in wage growth across cohorts at the same age can be attributed to common cyclical effects.

Table 11.6 presents the coefficients on age for each quantile by education group while Table 11.7 presents test statistics for the null hypothesis that the age coefficients are the same across quantiles. These imply that dispersion of wages increases over the life-cycle particularly for the lower education group. This is consistent with a model where information about individuals is revealed on the job.\(^9\) One explanation for this is as follows. Initial pay, at labour market entry is quite homogeneous for individuals with similar observable characteristics. As individuals' ability or the productivity of job specific matches gets revealed, the variance of productivity is transmitted into the dispersion of wages. It is likely that this is most important for the lower education group where firms have less information on which to base their hiring decisions. Since the increase of dispersion seems to persist over the lifecycle, irrespective of whether individuals are followed within one firm or across jobs it is likely that the information revealed about individual productivity may be relevant across jobs and not only to the current match. Moreover, Chapter 13 of this thesis shows that in West Germany where firms have more information in which to base their hiring decisions this increase in inequality over the life-cycle does not occur. Of course there are many other possible reasons for this difference.

The implied life-cycle distribution of wages is presented in Figure 11.11 and the return to education over age is shown in Figure 11.12. The within-education group dispersion, displayed in Figure 11.11, is much higher and increases much more among the lower education group. At the bottom of\(^9\) See Jovanovic (1979), Farber and Gibbons (1994) and Baker, Gibbs and Holmstrom (1994).
that distribution wages remain constant over the life-cycle. In contrast, the
top decile experiences 100 percent growth from the age of 23 to 59. The
picture is less dramatic for the 17/18 group although even for them the
growth of wages is very low at the bottom. For the highest education group
there is substantial growth at all parts of the distribution, at least up to the
age of 50. Although dispersion rises a lot even here, the differential between
the top and the bottom of the distribution is 60 percent which compares to
160 percent for the lowest education group. An obvious extension of this
work would be to analyse the mobility of individuals across this widening
distribution. This can only be done with panel data.

Figure 11.11 shows how the returns to education, at the median, change
over the life cycle. This shows quite clearly that the education “mark up” is
higher for older than for younger workers. For example, at age 59 the wage
difference is 0.65 between those who left full time education at or before 16
and those leaving full time education after 18 while at age 23 it is zero. Hence,
it seems that returns to education increase with the level of experience.

The results are consistent with the basic human capital model: Workers
with some post 18 education have much less experience at the age 22 (when
we start observing). At that point they have no advantage over those who
left school at 18 and a negative differential from those who stayed on at
school between 17 and 18. The returns to age (a proxy for experience) are
then much higher for those in the highest education group and keep rising
for the entire working life. Some decline with age is observed after the age
of 50 for those with intermediate levels of education.

11.4 Concluding Remarks

There has been a considerable increase in the dispersion of both hourly wages
and weekly earnings in the UK and, in contrast to the US, considerable
growth in median wages in all our sample periods (except between 1975

175
Table 11.6: Quantile Regression Estimates of the Age Effects

<table>
<thead>
<tr>
<th></th>
<th>Left school at or before 16</th>
<th></th>
<th>Left school at 17 or 18</th>
<th></th>
<th>Left school after 18</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentile</td>
<td></td>
<td>Percentile</td>
<td></td>
<td>Percentile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>90th</td>
<td>75th</td>
<td>50th</td>
<td>25th</td>
<td>10th</td>
<td>90th</td>
</tr>
<tr>
<td></td>
<td>(.199)</td>
<td>(.173)</td>
<td>(.161)</td>
<td>(.167)</td>
<td>(.159)</td>
<td>(.390)</td>
</tr>
<tr>
<td>Age squared</td>
<td>-.024</td>
<td>-.039</td>
<td>-.061</td>
<td>-.058</td>
<td>-.042</td>
<td>-.875</td>
</tr>
<tr>
<td></td>
<td>(.052)</td>
<td>(.044)</td>
<td>(.041)</td>
<td>(.043)</td>
<td>(.041)</td>
<td>(.107)</td>
</tr>
<tr>
<td>Age cubed</td>
<td>-.004</td>
<td>-.001</td>
<td>.001</td>
<td>.003</td>
<td>.001</td>
<td>.052</td>
</tr>
<tr>
<td></td>
<td>(.004)</td>
<td>(.004)</td>
<td>(.003)</td>
<td>(.004)</td>
<td>(.003)</td>
<td>(.009)</td>
</tr>
</tbody>
</table>

Standard Errors given in brackets
Age = (Age in years/10)
Table 11.7: $\chi^2$ Tests Of Parameter Equality of the Age Effects

<table>
<thead>
<tr>
<th>Model</th>
<th>90th, 75th, 50th</th>
<th>75th, 50th &amp; 25th</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 or less years</td>
<td>486</td>
<td>162</td>
</tr>
<tr>
<td>of schooling</td>
<td>(0)</td>
<td>(0)</td>
</tr>
<tr>
<td>12 or 13 years</td>
<td>123</td>
<td>15</td>
</tr>
<tr>
<td>of schooling</td>
<td>(0)</td>
<td>(0.02)</td>
</tr>
<tr>
<td>over 13 years</td>
<td>80</td>
<td>15</td>
</tr>
<tr>
<td>of schooling</td>
<td>(0)</td>
<td>(0.02)</td>
</tr>
<tr>
<td>Degrees of Freedom</td>
<td>12</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 11.11: Predicted log wages over the lifecycle by percentile and education

177
Figure 11.12: The wage returns to education over the life cycle
and 1977). To analyse the causes of this increase two datasets are used: The Family Expenditure Survey and the General Household Survey. The role that observable educational attainment and cohort effects may have had in shaping the changes in the wage structure are focused on in particular. Cohort effects are likely to be a very important factor in the UK because of the succession of educational reforms that have occurred, as well as other changes that affect the quality and type of education that children receive. Using a simple model we show that the growing age differentials can be fully explained as permanent differences across cohorts, keeping the returns to age constant for different cohorts. Thus cohort effects explain an important part of the increased dispersion.

In line with the findings of related work, returns to education are shown to have increased. Based on the FES data, where the age at which the individual left full time education is recorded, it is shown that education is responsible for half the increase in dispersion between cohort and education groups. Interestingly, we find that dispersion has increased mainly within the lower education group. In fact, conditional on cohort, the level of education is inversely related to within group dispersion. It was argued that this was driven by the increasing heterogeneity of educational qualifications and other characteristics of the lower education groups. The GHS data records the highest educational qualification obtained. Using this, the result that the age differentials within education groups can be modelled as cohort effects was corroborated. Moreover as with the FES the education differentials explain about half the between groups growth in dispersion. In line with our predictions, however, reclassifying individuals by qualifications obtained explains away part of the effect of education on within group dispersion.

A measure of education in the same data set as a consistent wage series is not available for the period before 1978. However, by applying the model over the entire 1966-1992 time period and pooling over all education groups it is demonstrated that the effects of the changing returns to education can
be fully captured by the cohort effects. The compression of the 1970's is explained as a common time effect across all age and education groups. Having controlled for such time effects we show that the underlying causes of increasing dispersion must have existed since the start of our data. This accords well with the view that the changing structure of labour demand is driven by long term structural factors. Chapter 13 below compares the UK and the West German experience to see how the same structural changes effected a country with very different social and labour market institutions.

11.5 The Estimation Procedure

To estimate the conditional quantiles of the wage distribution least absolute deviations estimator (LAD) was used (the asymptotic properties of which are described in Koenker and Bassett, 1988). The nature of the problem lends itself to a simple two-step estimation procedure based on minimum distance (see Ferguson, 1958, and Rothenberg, 1971). The data were split into three subsamples by education group and then further grouped into cells by date of birth and time.\(^{10}\) and estimate the required quantiles. These order statistics are exactly equivalent to the parameters from an LAD regression with the complete set of cohort-year-education interactions on the right hand side. (i.e. model 11.1.) Following Koenker and Bassett(1988), each of these order statistics are asymptotically normal and their covariance matrix within each group consists of the elements

\[
\sigma_{ij}^\alpha = \frac{q_i (1 - q_j)}{N_t h_i^\alpha h_j^\alpha} \text{ for } i \leq j
\]  

(11.3)

where \(\sigma_{ij}^\alpha\) is the covariance of quantile \(i\) \((q_i)\) with quantile \(j\) \((q_j)\) of cohort \(\alpha\) at time \(t\), \(h_i^\alpha\) is the density of the distribution at the \(i^{th}\) percentile and \(N_t\) is

\(^{10}\)In the empirical section we follow two approaches. In one we use the data from 1966-1992 and estimate the wage distribution without conditioning on education. We then repeat the analysis for the 1978-1992 period during which education is observed, including it as one of the grouping variables.
the number of observations in cohort c at time t. To obtain this the density function within each cell was estimated using non-parametric techniques.\footnote{In particular for each cell we use a Gaussian Kernel with fixed window length set at half the standard deviation of the residuals.}

For each education group the model implied by eq (11.2) was fitted to the estimated quantiles. The cohort effects were specified as:

\[
C^q(\text{cohort}, \text{ed}) = g_{1}^{q, \text{ed}} \text{cohort} + g_{2}^{q, \text{ed}} \text{cohort}^2 + g_{3}^{q, \text{ed}} \text{cohort}^3
\]  (11.4)

where \(g_{i}^{q, \text{ed}}\) are the quantile-education specific parameters to be estimated.\footnote{We tested whether the data would best be described by a more flexible specification such as one with cubic splines or cohort dummies. It was only at the 90th percentile that these extra terms were significant at the 1 percent level and the magnitude of the changes in the prediction at the 90th percentile were minimal.}

and the age effects as:

\[
A^q(\text{age}, \text{ed}) = \eta_{1}^{q, \text{ed}} \text{age} + \eta_{2}^{q, \text{ed}} \text{age}^2 + \eta_{3}^{q, \text{ed}} \text{age}^3
\]  (11.5)

where \(\eta_{i}^{q, \text{ed}}\) are the unknown quantile-education specific parameters. The function \(T^q(\text{time}, \text{ed})\) is a set of time dummies, constructed to be orthogonal to both functions above. To fit 11.2 we apply minimum distance (see Ferguson, 1958 or Rothenberg, 1971). The estimated order statistics in each education subsample form the dependent variables and they are regressed on the age, cohort and time functions using GLS with weights the estimated variances of the quantiles. At the cost of some efficiency each quantile was estimated separately. This makes computation simpler and avoids specification error from one quantile affecting the estimation of others. The complete covariance matrix of all estimated coefficients is then constructed for the purposes of computing tests of equality of coefficients across quantiles.

The fit of the restricted quantiles can be assessed directly using the value of the criterion that is minimised by the procedure described above. Asymptotically this will be distributed as a \(\chi^2\) statistic with degrees of freedom equal to the number of cohort age cells minus the number of parameters in
the age, cohort and time functions under the null hypothesis that the fitted model is correct.

The estimated conditional quantiles and the unconditional ones are related in the following way

\[ q = \Pr(w < w^q) = \int_{R(z)} \Pr(w < w^q | z) dF(z) \]

where \( F(z) \) is the distribution of the observed vector of characteristics \( z \) (i.e. cohort, education and age) and \( w^q \) is the point corresponding to the \( q \)th quantile of the unconditional distribution. To characterise the distribution of wages up to 15 percentiles were estimated and a linear interpolation was made between these when required using the actual minima and maxima. This gives a consistent estimate of \( \Pr(w < w^q | z) \) for any fixed number \( w^q \) within the range of wages observed in the data. Another measure of the fit of the model (apart from the \( \chi^2 \) tests) will be how close this constructed unconditional distribution matches the actual one. Using the same idea counterfactual distribution of wages can be constructed which will allow the impact of specific variables on the observed changes to be assessed. For this purpose the weights \( F(z) \) can be altered in accordance with the counterfactual of interest. For example the observed skill composition can be held constant by setting the weights \( F(z) \) at their 1978 level.

\(^{13}\)These are the minimum, the maximum, the 1st, 5th, 95th, and 99th percentiles and the 9 deciles.
Chapter 12

Trade Unions and the Increase in Wage Dispersion

12.1 Introduction

As Part 1 of this PhD demonstrates, the 1980s also saw a marked decline in union presence. Part 2 of this PhD shows that trade unions compress wage differentials within and between skill groups and this effect that is not solely driven by the sorts of workplaces that are in the union sector. The aim of this chapter is to see how much of the increase in wage dispersion in the UK can be explained by the recent fall in union coverage. First, I present some evidence on the time series relationship between union density and wage inequality and evidence is found of a strong negative association between changes in wage dispersion and changes in the inequality of male hourly earnings. Second I use establishment level data on semi-skilled wages to look at how much of this association remains once one controls for the changing characteristics of workplaces.
12.2 Aggregate Evidence on Trade Unions and the Dispersion of Earnings

To illustrate the potential role unions may have in the wage structure, table 12.1 presents some time series evidence on the relationship between union density and the ln(90/10 percentile ratio) of the aggregate male hourly earnings distribution. The coefficient on union density is significant at all conventional levels and the explanatory power of the specification is large. In fact variations in union density alone can explain almost half of the variation in the 90-10 differential. It does appear that changes in union density are correlated strongly with changes in pay differentials.

Table 12.1: Time Series Correlation between Union density and Wage Dispersion 1966 to 1992

<table>
<thead>
<tr>
<th></th>
<th>$\beta$</th>
<th>se</th>
</tr>
</thead>
<tbody>
<tr>
<td>Union density</td>
<td>-0.015</td>
<td>0.002</td>
</tr>
<tr>
<td>Social Contract Dummies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1974</td>
<td>-0.059</td>
<td>0.035</td>
</tr>
<tr>
<td>1975</td>
<td>-0.046</td>
<td>0.035</td>
</tr>
<tr>
<td>1976</td>
<td>-0.074</td>
<td>0.035</td>
</tr>
<tr>
<td>1977</td>
<td>-0.073</td>
<td>0.035</td>
</tr>
<tr>
<td>Trend</td>
<td>0.009</td>
<td>0.001</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.005</td>
<td>0.129</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.947</td>
<td></td>
</tr>
<tr>
<td>LM test for auto-correlation ($P$ value)</td>
<td>3.053 (0.17)</td>
<td></td>
</tr>
<tr>
<td>RESET specification test ($P$ value)</td>
<td>3.27 (0.007)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Density figures obtained from the Bain and Price series and the Employment Gazette.
90-10 figures on male hourly earnings from the Family Expenditure Surveys.
Year dummies included to abstract from the effects of dispersion of the social contract period 1974-1977, where union density was also rising fast.
12.3 Evidence from the three Workplace Industrial Relations Surveys.

This section uses the three Workplace Industrial Relations Surveys (of 1980, 1984 and 1990) to examine changes in the relationship between unions and across-establishment inequality between 1980 and 1990. The focus is on one group of workers for whom data is available in all three years, the semi-skilled, and union/non-union comparisons of dispersion over time are reported.\(^1\)

Panel 1 of Table 12.2 reports unconditional standard deviations of \(\ln(\text{earnings})\) for semi-skilled workers in union and non-union plants for the three available years. In 1980 the gap between union and non-union dispersion (in terms of unconditional standard deviations) was -0.028; in 1984 the gap widened to -0.063 and by 1990 it became -0.066. All gaps are significantly different from zero, though only at the 10\% level in 1980. Whilst dispersion grew among both union and non-union plants, it appears that the non-union distribution opened up by more over the 1980s.

Panel 2 reports regression-corrected conditional standard deviations, together with union/non-union differences. The pattern is robust to the inclusion of controls: in all cases, union dispersion is lower than non-union dispersion (though only just in 1980 and it is not different from zero in terms of statistical significance). The gap widens through the 1980s and the rise is significant in conventional statistical terms: The difference in the change in the standard deviation of \(\ln(\text{earnings})\) between the union and the non union sector between 1980 and 1990 is -0.045 with an associated standard error of 0.021. Furthermore, in the union sector the regression controls are able to explain the majority of the observed rise in dispersion that is depicted by the unconditional standard deviations in Panel 1. Finally, to put it another way, the importance of unionisation is clearly illustrated when one views that, in

\(^1\)More details on the surveys are the questions used are given in Parts 1 and 2 of this PhD
Table 12.2: Wage Dispersion of Semi-Skilled Workers by Union Status 1980 to 1990

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>1984</th>
<th>1990</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Union</td>
<td>Non</td>
<td>Union</td>
</tr>
<tr>
<td>Standard Deviation for all Establishments</td>
<td>0.245</td>
<td>0.274</td>
<td>0.277</td>
</tr>
<tr>
<td>Union-Non Union Difference (standard error)</td>
<td>-0.028 (0.016)</td>
<td>-0.063 (0.018)</td>
<td>-0.066 (0.021)</td>
</tr>
<tr>
<td>Standard Deviation for all Establishments with 5 or more semi-skilled workers</td>
<td>0.243</td>
<td>0.274</td>
<td>0.266</td>
</tr>
<tr>
<td>Union-Non Union Difference (standard error)</td>
<td>-0.031 (0.017)</td>
<td>-0.055 (0.021)</td>
<td>-0.066 (0.021)</td>
</tr>
</tbody>
</table>

2. Maximum Likelihood Estimates of conditional standard deviation from semi-skilled ln(real earnings) regression

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>1984</th>
<th>1990</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Union</td>
<td>Non</td>
<td>Union</td>
</tr>
<tr>
<td>Standard Deviation for all Establishments</td>
<td>0.188</td>
<td>0.201</td>
<td>0.206</td>
</tr>
<tr>
<td>Union-Non Union Difference (standard error)</td>
<td>-0.013 (0.012)</td>
<td>-0.035 (0.018)</td>
<td>-0.058 (0.021)</td>
</tr>
<tr>
<td>Standard Deviation for all Establishments with 5 or more semi-skilled workers</td>
<td>0.185</td>
<td>0.195</td>
<td>0.191</td>
</tr>
<tr>
<td>Union-Non Union Difference (standard error)</td>
<td>-0.010 (0.012)</td>
<td>-0.028 (0.015)</td>
<td>-0.058 (0.021)</td>
</tr>
</tbody>
</table>

3. Percentage of Establishments with recognised unions

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>1984</th>
<th>1990</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>unweighted / weighted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Establishments</td>
<td>74 / 51</td>
<td>69 / 50</td>
<td>64 / 41</td>
</tr>
<tr>
<td>Establishments with 5 or more semi-skilled workers</td>
<td>75 / 51</td>
<td>74 / 54</td>
<td>64 / 41</td>
</tr>
</tbody>
</table>

Notes:
1. Union status is defined as any union recognised for collective bargaining purposes for manual workers.
2. The regressions are Maximum Likelihood estimates for union and non-union sectors. (see Stewart 1991) Controls included are: 5 plant size dummies, manual, part-time, skilled, semi-skilled and female proportions, dummy variables for majority sex male, manufacturing, single site, shift work, payment-by-results, UK owned, employer’s association and (in the union sector) existence of pre- or post-entry closed shop arrangements.
Table 12.3: The Effect of the Decline of Unions on Wage Inequality

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1980-1990 Changes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V(w) in 1980</td>
<td>0.0375</td>
<td>0.0389</td>
<td>0.0360</td>
<td>0.0372</td>
</tr>
<tr>
<td>V(w) in 1990</td>
<td>0.0556</td>
<td>0.0622</td>
<td>0.0556</td>
<td>0.0622</td>
</tr>
<tr>
<td>V(w) in 1990 replacing 1990 values of U with 1980 value</td>
<td>0.0526</td>
<td>0.0593</td>
<td>0.0523</td>
<td>0.0594</td>
</tr>
<tr>
<td>Percentage contribution of 1980-90 fall in U to 1980-90 rise in V(w)</td>
<td>17</td>
<td>12</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1980-1984 Changes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V(w) in 1980</td>
<td>0.0375</td>
<td>0.0389</td>
<td>0.0360</td>
<td>0.0372</td>
</tr>
<tr>
<td>V(w) in 1984</td>
<td>0.0488</td>
<td>0.0520</td>
<td>0.0408</td>
<td>0.0435</td>
</tr>
<tr>
<td>V(w) in 1984 replacing 1984 values of U with 1980 value</td>
<td>0.0479</td>
<td>0.0519</td>
<td>0.0407</td>
<td>0.0438</td>
</tr>
<tr>
<td>Percentage contribution of 1980-84 fall in U to 1980-84 rise in V(w)</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1984-1990 Changes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V(w) in 1984</td>
<td>0.0488</td>
<td>0.0520</td>
<td>0.0408</td>
<td>0.0435</td>
</tr>
<tr>
<td>V(w) in 1990</td>
<td>0.0556</td>
<td>0.0622</td>
<td>0.0556</td>
<td>0.0622</td>
</tr>
<tr>
<td>V(w) in 1990 replacing 1990 values of U with 1984 value</td>
<td>0.0541</td>
<td>0.0597</td>
<td>0.0526</td>
<td>0.0585</td>
</tr>
<tr>
<td>Percentage contribution of 1984-90 fall in U to 1984-90 rise in V(w)</td>
<td>22</td>
<td>25</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Notes
1. \( V(w) = U.V(w_u) + (1 - U).V(w_n) + U.(1 - U).(\bar{w}_u - \bar{w}_n)^2 \) where \( U \) is the proportion of establishments with recognised unions, \( V(w_k) \) is the variance of log earnings for group \( k (k = u, n \text{ where } u \text{ denotes union recognised and } n \text{ denotes no union recognised}) \) and \( \bar{w}_k \) is average \( \ln(\text{earnings}) \) in group \( k \).

2. The values used to compute \( V(w) \) are taken from panel 2 of Table 12.2 together with Stewart's (1991, 1992) ceteris paribus estimates of \( \bar{w}_u - \bar{w}_n \) of 0.066 in 1980, 0.084 in 1984 and 0.062 in 1990.

3: Column Samples
(1)=All establishments: unweighted \( U \)
(2)=All establishments: weighted \( U \)
(3)=Establishments with 5 or more semi-skilled workers: unweighted \( U \)
(4)=Establishments with 5 or more semi-skilled workers: weighted \( U \)
the union sector between 1980 and 1990, the conditional standard deviation rises by 0.023 (or 12% of the 1980 standard deviation) as compared to a 0.069 (34%) rise in the non-union sector.

There is, however, an important issue of comparability of the earnings data across years. First, the earnings question in 1980 was different from the question asked in the later years. Second, the question in 1990 (whilst having the same format as the 1984 question) was only asked for plants which had 5 or more of the skill group in question (here the semi-skilled). More specifically, the 1980 question asked managers to give the weekly earnings of the typical employee in the appropriate skill group. In 1984 and 1990 managers were first asked to state whether there were more men or women in a particular skill group (in 1990 only if there were 5 or more workers in the skill group) and then to report the typical pay of this majority sex worker.

Some further checks on this are now described. Table 12.2 also reports union/non-union earnings dispersion gaps when one restricts the 1980 and 1984 data to cover only workplaces with 5 or more semi-skilled employees. A similar pattern emerges, with the gap if anything becoming wider through the 1980s. Based on consistent sample definitions, the union/non-union dispersion gap in the conditional standard deviation widens from -0.010 in 1980 to -0.058 in 1990.

To analyse the importance of falling union activity through the 1980s for the overall rise in inequality, note that the variance of ln(real earnings), say $V(w)$, can be written as:

$$V(w) = U.V(u) + (1 - U).V(n) + U.(1 - U).\left(\bar{w}_u - \bar{w}_n\right)^2$$

where $U$ is the proportion of establishments with recognised unions, $V(w_k)$ is the variance of log earnings for group $k$ ($k = u, n$ where $u$ denotes union recognised and $n$ denotes no union recognised) and $\bar{w}_k$ is average ln(earnings) in group $k$). The variance of earnings can thus be decomposed into a weighted combination of the union and non-union sector variances plus an interaction
term based on the union earnings gap. One can think of the first two terms as picking up within-sector changes in the structure of earnings, and the third term as capturing between-sector changes due to trade union related wage differences. Using this decomposition, it is possible to compute the predicted variation of \( \ln(\text{earnings}) \) in 1990 had the 1980 union structure prevailed and compare it to the actual 1990 variance. The gap between these two gives an indication to the importance of the decline in unionism for the rise in the inequality of earnings.

The upper panel of Table 12.3 reports the 1980 and 1990 computations of \( V(w) \), together with the simulated value in 1990 had the 1980 union structure prevailed. We report four experiments which differ in whether they utilise weighted or unweighted union proportions and on whether they use the full sample of establishments or restrict to those which have at least five semi-skilled workers. We use the conditional standard deviations from the regression models of semi-skilled earnings reported in Table 12.2, together with Stewart's (1991, 1995) estimates of the ceteris paribus semi-skilled union/non-union \( \ln(\text{earnings}) \) gap of 0.066 in 1980 and 0.062 in 1990.

For all four cases, the first two rows of the upper panel of Table 12.3 adequately illustrate the sharp rise in the variance of earnings between 1980 and 1990. In the third row we report the value of \( V(w) \) that our models predict would have been present in 1990 had the union structure of 1980 still been in place (i.e. using the 1980 value of \( U \)). As one would expect, this is lower in all cases. Finally, the fourth row of Table 12.3 computes the percentage contribution of the 1980 to 1990 fall in unionisation. Depending on the experiment considered, this ranges between 11 and 17%.

The lower two panels of the Table perform the same analysis for the two sub-periods 1980-84 and 1984-90. The latter period is where the majority of the 1980-90 decline in unionisation occurred. Not surprisingly, then, the impact of falling unionisation is more marked in the second sub-period. Effects are small, and can explain less than 10% of the inequality rise, between 1980
and 1984; on the other hand, between 1984 and 1990 the observed decline in union activity is an important contributor to the rise in the inequality of the earnings of semi-skilled manual workers and can account for between one-fifth and one-quarter of the observed increase.

Hence, on average, the decline in unionisation accounts for somewhere around 15% of the rise in the variance of semi-skilled earnings between 1980 and 1990. This is similar to the US findings of Card (1991) and Freeman and Needles (1993), who report that the US decline accounts for about 20% of the US rise in the variance of male earnings between the 1970s and 1980s. Given the very large changes in the UK wage structure that occurred during the eighties, the decline in union activity thus appears to be an important factor. Nevertheless, the majority of the rise in across-establishment semi-skilled earnings dispersion between 1980 and 1990 is due to increased inequality in the non-union sector.

12.4 Interpretation of the Results.

The results presented above do not control for the fact that workers and workplaces covered by unions may be systematically different in unobservable ways from those that are not. Part 2 of this PhD estimates a model where wages and union status are allowed to be jointly determined and suggests that the association between union status and the shape of the distribution of pay may not be solely driven by the fact the unions can only organise certain types of workplaces.

I think the following interpretations can be drawn from these results. First technical change and increased competition may have increased management's willingness to resist unionisation. This suggests that these economic trends will have effected wages directly through the productivity advantage of skilled versus unskilled workers and also indirectly through the removal of wage setting institutions which may have compressed the pay
structure. Second, part of the decline in unionisation may have been driven by legislative changes reducing the bargaining power of workers vis-à-vis management. If this is so, it may be the case that these changes have widened the wage structure. It is likely that a mix of both factors is at work.
Chapter 13

The Distribution of Wages in the UK and West Germany 1984-1992

13.1 Introduction

The aim of this chapter is to describe and explain the determination of wages in West Germany and the UK. As figures 13.1 to 13.3 illustrate, there have been important differences in the experiences of the UK and West Germany between 1984 and 1992. These have been shown elsewhere to be the driving force behind the large increase in income inequality in the UK and the apparent stability of the gap between the rich and poor in Germany.¹ These differences are discussed in more detail and some possible economic explanations for this divergence of experience are suggested.

Figure 13.1 shows the change in two measures of dispersion in wages from 1984 to 1992. The sample used in this graph in the hourly earning distribution of all prime aged workers (23 to 59) and the data used is the Family Expenditure Survey. The top line gives the 90/50th percentile ratio from 1984 to 1992. This suggests that the growth in wages at the top of the distribution has not been that different from the growth in wages at the

¹see Goodman and Webb 1994 for the UK and Giles et al 1996 for the UK and for West Germany
middle. The lower line shows that 50/10 percentile ratio over the same period has risen almost continuously meaning that the wages of the lowest paid have failed to keep up with average wages. The late 1980s and early 1990s in the UK can be characterised, therefore, more as a period where the lowest paid were falling behind, than one in which the highest paid were racing ahead.²

In contrast, figure 13.2 shows no evidence of an increase in wage differentials over time in West Germany. The data used in this graph is on all adult (23 to 59) wages from the German SOEP which has been described

²This is not to say that wage differentials between the highest paid and the middle did not change over the 1980s. However, the big changes to these differentials occurred during the early 1980s. (see Chapter 11) Of course the 90/10 has been rising continuously from the mid 1970s.
above. In fact the 90/50 ratio rises sharply between 1984 and 1985\(^3\) and falls steadily after that. The 50/10 ratio shows no systematic trend.\(^4\)

Another big change that has occurred in the UK and the US over the 1980s is the fast relative growth in female wages. (see Blau and Kahn 1993 for a cross country comparison, Fortin and Lemieux 1995 for the US or Harkness 1996 for the UK). One possible explanation for this is that the driving force behind the changes in structure of wages has been the large fall

\(^3\)The estimations results we present later suggest that this sharp rise can be explained by the changing composition of the German Panel

\(^4\)Care must be taken when interpreting figure 13.2 as the data used have not been weighted and it may be the case that the composition of the sample is changing in a different way that the composition of the German workforce as a whole. However, the results in section 13.4 below which have controlled for changes in the composition of the workforce give a very similar picture
in demand for unskilled manual labour. This would have the effect of both reducing the comparative advantage of unskilled men in the labour market and increasing the differentials between the skilled and the unskilled. Figure 13.3 suggests that these changes in the gender wage gap have not occurred in West Germany, although female relative wages are much higher in West Germany than the UK.®

The structure of this chapter is as follows. Section 13.2 discusses possible reasons why the different labour market institutions in the UK and West Germany should mean that both countries will have different responses to

®The fact that female labour market participation is lower in West Germany than the UK means that this does not necessarily imply a difference in discrimination between the two countries.
changes in technology and product market structure. Section 13.3 describes how the distribution of wages can be estimated. Section 13.4 discusses the results of this estimation procedure. Finally some concluding remarks are offered in section 13.5

13.2 Why Should Institutions Matter?

13.2.1 Labour Market Institutions and the Cost of Training

The Context

![Diagram of relative demand and supply for skills]

Figure 13.4: The relative demand and supply for skills

Figure 13.4 shows that the consequence of a change in demand for skill differentials and relative employment shares will be dependent on the elasticity of supply of skills. Both countries have the same technology and same market structure and will face the same relative demand for skilled versus unskilled
workers, given in the first time period by $D_{t=0}$ and in the second by $D_{t=1}$. The relative supply curve in country 1 is given by $S_{uk}$ and in country 2 by $S_{wg}$. As can be seen in $t = 0$, relative wages are higher in country 1 ($W_{uk0}$ versus $W_{wg0}$) and relative employment shares are lower ($N_{uk0}$ versus $N_{wg0}$). A shift in demand from $D_{t=0}$ to $D_{t=1}$ is also shown to effect relative wages more in country 1 and relative employment shares in country 2. This is an intuitive reason why the same technology or product market shock will not necessarily affect all countries in the same way and suggests that changes in the structure of demand must be only part of any explanation of changes in the overall structure of wages. We next discuss why the relative slope of the supply curve for skilled workers should differ between the UK and West Germany.

In a world of individuals who differ only by the level of human capital investment and perfect capital markets, skill differentials will tend towards the present value of the cost of training. However, if individuals differ in terms of access to capital markets or in terms of levels of basic ability then the costs of training will vary across individuals. The effect of this on the slope of the supply curve, i.e. the change in the proportion of the workforce who receive positive benefits from training can be seen by comparing two possible extremes. If all workers have the same costs of training and the same discount rates then all workers will want to train if the present value of the returns to training exceed the costs. The supply curve will then be a horizontal line. On the other hand if the costs of training for one worker are zero and infinite for all the others then the supply curve will be vertical. Whatever the benefits to training, only one person will be trained. These two extremes can be generalised so that the more different workers are in the costs of training that they face, the steeper the relative supply curve for trained workers.

The bigger the variance of costs of training or acquiring skills across individuals, therefore, the more likely it will be that an increase in demand for
skills will result in changes in relative prices rather than in relative quantities. Different labour market institutions will determine how easy it is for workers to up-grade their skills and more importantly the degree to which untrained workers face higher costs of training than trained workers. We next discuss some possible reasons why the average cost of training faced by unskilled workers should be higher in the UK than in West Germany.

The Education System

Think of training as a particular increase in skills, then the cost of training will depend on the ability and motivation of the workers and their initial skills. This will be even more important if skills acquired before labour market entry are complementary to more vocational skills. The emphasis of the education system will thus have a fundamental impact on the distribution as well as the level of wages.

Children in West German schools are not allowed to progress up another year until they have achieved a minimum standard, which ever route, vocational or academic they chose. This is in contrast to the UK where very few children are allowed to retake a year. This means that lower achieving German children get more education than higher achieving ones which must have the effect of reducing the difference in initial skills across groups of workers.

Employer Provided or On The Job Training

In both the UK and West Germany, many skills are acquired whilst attached to a job, either through “learning by doing” or through formal training on site and at college. In many (indeed most cases) it is the employer that “writes the cheque” for the training of its workers. This does not necessarily mean that the employer pays for training for it is likely that employees themselves pay for at least part of training through lower wages. However, the degree to which employers respond to a change in the relative productivity of skilled versus unskilled workers by increasing the number of workers that they train
or by trying to “poach” trained workers from other firms will determine the
costs of training of individuals.

There have been many discussions in the literature (see Lynch (1994),
Soskice (1994) Harhoff and Kane (1995) of the possible reasons why German
institutions should deliver a more flexible (in the sense that a change in
relative productivities leads more easily to a change in quantities rather than
prices) labour market. There are the following reasons suggested in the
literature:

1. Under centralised wage setting, such as operates in West Germany
   firms will find it harder to bid trained workers away from other firms
   by offering higher wages. Thus the relative cost of training workers
   become lower; first because of the lower risk of skilled workers quitting
   and second because it is more costly to hire workers already trained.(see
   Soskice (1994))

2. Centralised wage setting also implies that wages become associated
   with a particular job, rather than a particular match between a worker
   and a job. Hiring a “bad” worker is more costly when reducing his or
   her relative wage is more difficult and thus employers facing centrally
determined wages will want to make sure than new hires have at least
   a minimum level of ability/initial skill. It may be the case that such
   characteristics are only observed inside the firm. The combination of
   centralised wage setting plus strict employment protection legislation
   may make apprenticeships very attractive for firms, therefore, because
   they provide a period during which the aptitude of the worker can be
   tested. Trainees in Germany who fail to reach the required standard
   are not taken on as full employees. (see Harhoff and Kane 1995)

3. Acemoglu and Pischke (1995) formulate a model in which apprentice-
   ship training gives employers monopsony power over their trainees as

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other employers will know less about their productivity. This may explain why firms invest in general training but does not in and of itself explain why West German firms are more likely to train than UK firms. Indeed one might think that such processes would be more important in the UK where labour market entrants are more diverse (see above) and there is less accreditation of on the job training. Employment protection legislation and centralised wages will however, make employers more risk averse and reduce the possibility of a “good” worker accepting a low wage while demonstrating his or her true ability.

4. Unions and works councils may reduce labour turnover through the provision of collective voice. This means that firms will be more able to recoup the costs of training over a long time period. This will also make workers more willing to accept lower wages during the period of training as the risk of losing the initial investment is lower.

5. Centralised wage setting will also reduce the uncertainty of any private return to training and thus, if workers are risk averse, make them more willing to pay for training themselves through lower wages.

6. Harhoff and Kane (1995 ibid.) also argue that unobserved differences in the cost of worker mobility will make it easy for firms to pass over the costs of training the apprenticeships who leave onto those who stay.

7. Finally, one can think of investing in general training as a classic example of a “prisoners dilemma”. This is the usual explanation given as to why economies might underinvest in training. The co-operative outcome, i.e. where all firms invest in training can be maintained through social institutions (an example being the strong employers federations) and may be self fulfilling if German firms operate a “tit for tat” strategy.
One indication of the importance of labour market institutions and the quality of education is the difference between the private returns to on the job training in the UK and West Germany. Pischke (1994) using the SOEP finds little evidence of individual private returns to on the job training, whereas Blundell et al. (1996) find large returns especially for those with little formal education. This is consistent with firms paying a greater share of the costs of on the job training in West Germany and with economic rents being paid to the few UK workers that are trained. The labour market institutions described above therefore suggest that it is more likely that unskilled workers face higher costs of training in the UK than in West Germany.

13.2.2 Other Labour market Institutions

The Social Security System

The level of income that is received by those out of work will determine, at least in part the minimum wage that an individual is prepared to accept. Thus the relative level of unemployment benefits and social assistance may be an important influence of wages at the bottom of the distribution. The German and UK social security systems are very different. In the UK the unemployed receive a mixture of unemployment benefits and income support, both of which are geared to the maintenance of a minimum absolute standard of living. In Germany on the other hand, most of the unemployed receive unemployment insurance which is tied to past earnings with a ceiling and the rest receive social assistance the level of which has been tied to average wage levels over the 1980s.

The evidence suggests, however, that this is not an important factor over the 1984-1992 period. The graphs below plot the proportions in the UK and Germany of adult (aged 23-59 inclusive) who are in work by skill group.

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4 Of course these studies are not directly comparable.

7 Skill definitions are as follows:
For the UK; left school at or before 16 = low, left school at 17 or 18 = medium and left
Employment rates for men are higher in West Germany than the UK and there is not so much of a systematic difference across education and skill groups. Moreover, the fall in employment rates in the UK during the last recession did not occur in West Germany. For women the position is slightly different, less women work in West Germany than the UK, but there has still been an increase in female participation over the period, though not among the high skill group. Thus the observed differences in the distribution of wages between the two countries can not be explained by the fact that low skilled people are less likely to work in Germany because of the benefit system.

The Wage Determination Process

Other labour market institutions which may have an effect on the overall wage structure are the formal mechanisms by which pay is set and it is clear that these mechanisms differ significantly between the UK and West Germany. Unions whether to prevent undercutting or out of a true altruistic wish to improve the lot of the lowest paid, generally tend to bid for “maximin” type agreements. Because of a wish to transfer the burden of risk away from workers towards employers, they also tend to push for payment systems based on the characteristics of the job, rather than the productivity of the worker in that job. Both these imply that pay setting under unions will be less dispersed than individually determined payment schemes. Centralised pay setting, either through a incomes policies or through industry level pay bargaining will also both dampen any growth in wage inequality but if these negotiations have specific clauses in them to protect pay at the bottom will also compress the distribution of pay.

school after 18 = high.. (FES data)
For West Germany, basic education = low, high school or apprenticeship = medium and degree = high (SOEP data)
8 see Part 2, and chapter 12 for a formal evaluation of the role of trade unions in the wage structure
Figure 13.5: Employment proportions of men by skill group
Figure 13.6: Employment proportions of women by skill group

**Low Skilled**
- 204

**Medium Skilled**
- 204

**High Skilled**
- 204

- United Kingdom
- West Germany
UK workers are much less likely than their West German counterparts to be covered by a collective agreement (see above). Moreover, the UK has seen large falls in union presence driven by first a failure to organise in the service sector and second a sharp decline in the manufacturing sector where unions have typically been strong (see above). In West Germany, not only are workers more likely to be unionised than in the UK, but these unions typically negotiate on an regional/industry level rather than in the workplace or enterprise. It has also been argued (see Carruth and Schnabel (1993) and Neuman et al. (1990)) that these agreements tend to follow each other so that the system is in fact even more centralised than even the formal institutions would show.

13.3 Estimation of the UK and West German Wage Structure

The section above suggests that there are important institutional differences between the UK and the West German labour markets. Their importance is now assessed by replicating the procedure described in Chapter 11 on comparable UK and West German datasets. This allows one to isolate how the level and distribution of wages changes over time and over the life cycle within and between skill groups in the two countries.

The data is grouped into year of birth (cohort), age and education cells⁹. To draw out the comparisons more clearly between the two counties the mean wage of each cell is modelled. The results here will tell us about the (changing) average returns to education over the life-cycle and over time. The model of the standard deviation of wages in the same way which indicates how much within group inequality is changing over time.

⁹These education groups are defined below
13.3.1 Data Description and Selection Procedure

Because of the nature of this analysis it was important to obtain datasets that were exactly comparable. Unfortunately this was not possible. The only, generally available, West German dataset was the Social Economic Panel (SOEP). For the UK, the two possible micro level data sources were the General Household Surveys (GHS) which has good information on education, but only a consistent series of weekly earnings rather than hourly wage rates and the Family Expenditure Surveys (FES) which has a consistent series of hourly wages but less good information on education. The FES education variable is age left full time education which may correspond quite well to actual educational attainment in the UK but not in West Germany were, as described above, children obtain the same standard of schooling at very different ages. Two sets of comparisons are conducted. The first compared the General Household Surveys versus the Social Economic Panel and we compare earnings of full time tax payers (similar definitions of skill). The second compared the Family Expenditure Surveys versus Social Economic Panel which allows to look at all workers but with slightly different definitions of skill.

In both countries there are kinks in the tax schedule at the lower earnings limit for National Insurance (UK) and Social Security (West Germany) contributions. As expected the overall weekly earnings distribution in both countries shows significant bunching at this points. In order to abstract from this problem when modelling weekly earnings for the UK and monthly earnings for the SOEP, a selection was made on those full time workers whose earnings were enough to bring them over this tax threshold.

The skill groups used in the analysis were as described in table 13.1 below.
Sample Selection

The focus of the analysis is primarily on men as we believe it is difficult to make meaningful comparisons between the UK and West Germany for women. The problem is that there have been many changes in the labour market participation rate of women over time in the UK, and this has been primarily driven by an increase in participation rate of married women in the middle of the life cycle, many of whom work part time. Thus it will be hard to establish how much of the difference between the wages of women in the two countries is attributable to the fact that different sorts of women work in West Germany than the UK and how much to the different structure of demand. Thus because the wages of women, even very low paid women have risen much faster than the wages of men, we may be overstating the differences in the change in structure of wages between the UK and West Germany.

If attrition rates out of a panel are non random, then it will tend to get less and less representative over time. One particular worry for the German data source was that the highest and lowest paid workers may be more likely to leave the sample. To get some idea of the importance of this, the proportion of new entrant workers in each earnings decile for each year was taken away from the proportion of workers in each earnings decile that left in the previous year. The degree to which this difference varies across earnings

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deciles over time will say some thing about how the fall in general representativeness of the German Panel over time. Of course the UK datasets, being series of representative cross sections will not suffer from this problem. The results can be seen in Figure 13.7. As can be seen apart from the 1984-1985 there is no systematic variation across deciles. The analysis was repeated, omitting the first year of data, but this had no effect on the results, suggesting that this attrition 1984-1985 is random, once one controls for the observed characteristics of workers.\textsuperscript{10}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure13_7.png}
\caption{Entry and exit into the German panel}
\end{figure}

One other problem with the German Panel is that entry and exit is determined by some family relationship to incumbent households. This means

\textsuperscript{10}Results available on request

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that it will not capture any immigrants that entered West Germany after 1984. The results can only be interpreted, therefore, as relating to the labour market faced by those that were present in Germany in 1984.

The top and bottom 0.1% were trimmed from the data to remove the outliers and anyone with very high or very low reported hours was discarded. Because the labour market participation rate of younger and older workers varies between countries due to the different educational system and retirement institutions, the focus was on “prime age” workers, that is between the ages of 23 and 59 inclusive.

13.4 Results

Tables 13.2 and 13.4 show the coefficient estimates obtained from regressing the mean wage in each education, age and year cell for the three datasets on a trend and a cubic in age. Also given for each column are \( \chi^2 \) tests of omitted interactions between age and time. The difference in the coefficients across the columns in tables 13.2 and 13.4 can be interpreted as the changing effect of education over the life cycle and over time for each education group in each country. In contrast tables 13.3 and 13.5 show how the dispersion of wages within narrowly defined education and age groups has changed.

13.4.1 Life Cycle Effects

The implied life cycle profile of wages from tables 13.2 and 13.4 are plotted in figures 13.8 to 13.11. The return to education for each age group can be seen by comparing the vertical distance between the curves. The following findings emerge from these graphs. First, the return to education increases over the life cycle in both countries. Second this effect is much more pronounced for the UK than West Germany. Third wage growth over the life cycle is much more pronounced in West Germany than the UK for the lowest skilled group. While, some of these differences may be driven by the fact that these implied
Figure 13.8: The implied life cycle profile of wages in the UK (FES data, all male workers, scale is ln(£ per hour))
Figure 13.9: The implied life cycle profile of wages in West Germany (SOEP data, all male workers, scale is ln(DM per hour))
Figure 13.10: The implied life cycle profile of wages in the UK (FES data, all full time male workers, scale is ln(£ per week))
Figure 13.11: The implied life cycle profile of wages in West Germany (SOEP data, all full time male workers, scale is ln(DM per month))
life cycle profiles also include the trend\textsuperscript{11}, it is clear that there are important differences in evolution of wages over the life cycle between the two economies.

Tables 13.3 and 13.5 show how the distribution of wages \textit{within} each skill group changes over the life cycle. Looking at the hourly wage distribution of all workers first (Table 13.3), we see that these age effects on within group inequality vary both between countries and between skill groups. Thus in the UK, there is evidence that wage inequality rises over the life cycle for those who left full time education at or before 16. For those with at least some post compulsory schooling, no such evidence exists. For West Germany, the situation is very different, the dispersion of wages in fact narrows over the life cycle for all skill groups. There are some differences, however, between the evolution of the within group hourly wage distribution with that of the weekly earnings distribution. Thus, as table 13.5 shows there is no evidence that wages have become more compressed over the life cycle for Germany, for the UK wage inequality rises over the life cycle for both the lower skill groups. As the sampling differences between the two comparisons are small (very few men, who work, work part time) it must be the case that in both countries, there must be an increase in the association between hourly pay and hours of work over the life cycle.

Wage inequality might increase over the life cycle within education groups for two main reasons. First wage growth over time may result from the productivity enhancing effects of on the job training and experience. If training is rationed, either because of the non-excludability of the benefits of training or because some workers do not have the requisite basic educational skills, then we will observe increasing wage differentials over the life cycle picking up the fact that some workers have more training than others. Second, the distribution of wages offered to labour market entrants may be narrower than the distribution of underlying productivities, over time firms and employers

\textsuperscript{11}There is no way of exactly quantifying this as Chapter 11 demonstrates
are able to use past performance to measure the underlying productivity of workers, some workers will thus receive greater wage increases than others and the dispersion of wages will rise. The argument discussed above suggested that, not only were firms more likely to provide training in West Germany and the UK because of the difference in the structure of the labour and product markets in the two countries but also that the education system meant that workers had more similar skills in West Germany. Both these imply that the effects described above will be less important in West Germany

13.4.2 The Differing Trends in Within Group Wage Inequality

Table 13.2 shows that wage growth for those who left school after 18 between 1984 and 1992 was almost double that of those with less formal schooling. In West Germany, although there is a small growth in the difference between the wages of the low education group and the others, this difference is not significant at any conventional level. For the UK table 13.4 shows a similar picture for the UK, but slight evidence that skill differentials have been compressed. This suggest that differentials between skill groups have increased in the UK and not really changed in West Germany

Tables 13.3 and 13.2 show how wage inequality within education groups has changed. Table 13.3 shows evidence of declining within group dispersion over our period in West Germany for hourly wages of all skill groups but increasing within group dispersion in the UK for the lowest skilled. Table 13.5 shows this compression in West Germany is mitigated by changes in the distribution of hours.
Table 13.2: The Determination of Wages (all male workers)

<table>
<thead>
<tr>
<th></th>
<th>United Kingdom</th>
<th>West Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Skilled</td>
<td>Skilled</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.343, .222</td>
<td>-.841, .704</td>
</tr>
<tr>
<td>Age x 10</td>
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<td>.874, .556</td>
</tr>
<tr>
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<td>-.066, .155</td>
</tr>
<tr>
<td>Age^3 x 1000</td>
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<td>-0.001, 0.014</td>
</tr>
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<td>.141, .028</td>
</tr>
<tr>
<td>Year Dummies yes</td>
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<td>.017, .028</td>
</tr>
</tbody>
</table>

\[ \chi^2 \text{ Test of Restrictions} = 326.468, 214.523, 220.702, 270.534, 295.326, 257.001 \]

Prob Test > 0 = 0.467, 0.107, 0.109, 0.394, 0.88, 0.257

Notes
1. UK data is from the FES
2. West German from the SOEP
3. The Test Statistic in simply the weighted sum of interactions between cohort and time. If these are jointly insignificant, they will follow a $\chi^2$ distribution
Table 13.3: The Determination of Within Group Wage Inequality (all male workers)

<table>
<thead>
<tr>
<th></th>
<th>United Kingdom</th>
<th>West Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Skilled</td>
<td>Medium Skilled</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.23</td>
<td>.254</td>
</tr>
<tr>
<td></td>
<td>.615</td>
<td>.592</td>
</tr>
<tr>
<td>Age x 10</td>
<td>.084</td>
<td>.088</td>
</tr>
<tr>
<td></td>
<td>.03</td>
<td>.073</td>
</tr>
<tr>
<td>Trend x 10</td>
<td>.061</td>
<td>.053</td>
</tr>
<tr>
<td></td>
<td>.029</td>
<td>.07</td>
</tr>
</tbody>
</table>

Table 13.4: The Determination of Wages (all full time workers)

<table>
<thead>
<tr>
<th></th>
<th>United Kingdom</th>
<th>West Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Skilled</td>
<td>Medium Skilled</td>
</tr>
<tr>
<td>Intercept</td>
<td>2.362</td>
<td>2.24</td>
</tr>
<tr>
<td></td>
<td>.773</td>
<td>.999</td>
</tr>
<tr>
<td>Age x 10</td>
<td>.155</td>
<td>.219</td>
</tr>
<tr>
<td>Age^2 x 100</td>
<td>-.087</td>
<td>-.14</td>
</tr>
<tr>
<td>Age^3 x 100</td>
<td>.039</td>
<td>.058</td>
</tr>
<tr>
<td>Trend x 10</td>
<td>.003</td>
<td>.005</td>
</tr>
<tr>
<td>Year Dummies</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Prob β(year) &gt; 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>χ^2 Test of Restrictions</td>
<td>320.05</td>
<td>330.69</td>
</tr>
<tr>
<td>Prob Test &gt; 0</td>
<td>.567</td>
<td>.046</td>
</tr>
</tbody>
</table>

See notes to table 13.2 above
Table 13.5: The Determination of Within Group Wage Inequality (all full time workers)

<table>
<thead>
<tr>
<th></th>
<th>United Kingdom</th>
<th>West Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Skilled</td>
<td>Medium Skilled</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.246</td>
<td>-.314</td>
</tr>
<tr>
<td></td>
<td>.307</td>
<td>.37</td>
</tr>
<tr>
<td>Age x 10</td>
<td>.069</td>
<td>.087</td>
</tr>
<tr>
<td></td>
<td>.036</td>
<td>.043</td>
</tr>
<tr>
<td>Trend x 10</td>
<td>.066</td>
<td>.068</td>
</tr>
<tr>
<td></td>
<td>.035</td>
<td>.042</td>
</tr>
</tbody>
</table>

13.5 Conclusions

The results that have been presented in this paper indicate quite clearly the important differences between labour markets in the UK and West Germany. The dramatic changes that have been seen in the UK and the US labour markets which increased the gap between skilled and unskilled workers and inequality within skill groups has not occurred in Germany. A discussion of possible reasons why West Germany should have responded differently to the changes in technology and international competition which may have increased the relative demand for skill was also made. The tentative, (see below) conclusion from this work is that the structure of German institutions have allowed it to respond more flexibly to changes in demand, changing quantities more than prices. The crucial test will be the degree to which these institutions can be maintained in the face of unification and increased competition from the Far East.

There are two main caveats to this conclusion which relate to the quality of the data used. First the short time period in which the data is available may not have allowed cohort and life-cycle effects on wages to be accurately identified. Second, the SOEP is not structured to be representative of the workforce over time and it is certainly likely to be the case that those who
stay in the panel come from a more homogenous distribution than those who leave or who are not sampled.
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