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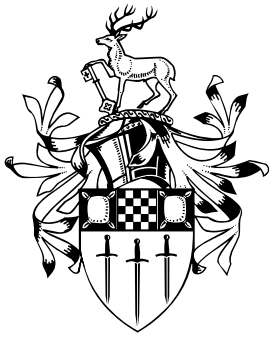

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EVERYONE'S A WINNER? UNION EFFECTS ON PERSISTENCE IN PRIVATE SECTOR WAGE SETTLEMENTS: LONGITUDINAL EVIDENCE FROM BRITAIN

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Everyone's A Winner? Union Effects on Persistence in Private Sector Wage Settlements: Longitudinal Evidence from Britain

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Abstract

Against a background of increased decentralisation in the structure of wage decision making, we analyse the effects of unions on the dispersion and persistence of pay settlements over the medium term using a longitudinal data set covering British private sector establishments over the period 1987-2001. It seems that the union effect of a reduction in wage dispersion in pay levels observed in earlier studies is repeated when we follow wage changes (settlements) over the medium term. Declining union presence seems therefore to account for some of the increase in longer-term wage dispersion over the sample period. The increase in aggregate wage settlement dispersion seems to have been accompanied by an increase in the permanent rather than transitory components of the variance and this stems mostly from the non-union sector.

Key words: Pay, Wage Change, Unions, Persistence, Inequality

JEL: J3, J5, J6

Everyone's A Winner? Union Effects on Persistence in Private Sector Wage Settlements: Longitudinal Evidence from Britain

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1. Introduction

Since 1979, movements toward greater decentralisation of the structure of wage decision making in Britain, both in unionised and non-union establishments, has placed the determination of wage settlements increasingly at the level of individual firms rather than multi-employer agreements[1]. Economic theory, (Calmfors and Driffill 1988, Layard, Nickell and Jackman 1991), indicates that greater decentralisation will be accompanied by greater dispersion in pay levels, as wage negotiators focus their attentions on the individual performance of the firm with less regard for the external consequences of their actions. Pay levels in Britain have indeed become more dispersed, though there is little evidence on whether the distribution of the annual wage settlement, the principal source of pay change for most employees in Britain, has changed over this period.

There is a large literature, which documents the presence of lower dispersion in wage-levels among unionised individuals than among those who do not belong to a trade union, (summarised in Freeman 1980, and Blau and Kahn 1999 for example). It is also well known that union presence is in decline in Britain and in the U.S.A. Gosling and Machin (1995) estimate that the cross-sectional distribution of individual pay in Britain in the 1990 would have been some 15 per cent narrower had the union share remained at its 1980 level. DiNardo and Lemieux (1997) estimate that cross-sectional wage dispersion in the United States would have been some 10 per cent

1. See Brown and Walsh (1991), Metcalf, Hansen and Charlwood, (2001) for more details on decentralisation and union pay dispersion. It remains true, however, that many firms still appear to take account of the actions of others when determining the pay settlement, (Brown, Ingram and Wadsworth (1999)).

lower at the end of the 1980s had the union share remained at its 1981 level [2]. Card (1991) finds that workers in the lower earnings quantiles are most affected by the decline in density.

Relatively little is still known, however, about the successive outcome of individual company level wage setting through time, (see Gregory, Lobban and Thomson (1987) and Leonard (1989), for earlier attempts in Britain and the U.S. respectively). Just as the inequality in pay levels at a point in time may be exacerbated or reduced over a longer period of reference[3], so the cumulative pattern of annual wage changes may reinforce or reduce settlement variation over time. Furthermore, and for the focus of this paper, we still know little about the effect of union presence on the pattern of cumulative settlement variation.

In the standard competitive model it would be impossible in the long run for firms to pay wages and, by implication, settlement rates that were consistently higher or lower than the average of firms employing similar types of labour. If there are economic rents to be shared in certain sectors however, then continuous good, or bad, performance could generate consistent winners and losers in the pay round and with it the possibility of a wider distribution of settlements over the medium term compared to the short run. Equally, if rents are transient – a one off shock to profits for example – then this would be consistent with a lack of persistence in settlement outcomes. In this context any changes, as in Britain, that focus the determinants of the pay settlement on workplace or establishment performance may generate greater or lower transience in settlement rankings over time compared to what has gone before.

Non-competitive rent-sharing models say little explicitly about the pattern of relative settlements over time. Union wage models typically focus on the

2. See Freeman (1980).

3 For evidence on short and long run inequality using individual pay *level* data, see Gottschalk and Moffitt (1995) for the U.S. or Dickens (2000) for Great Britain.

determination of wage levels and on any differential in levels with the non-union sector and their maintenance, or not, over time. However if the mean union-wage gap is changing over time, (Blanchflower and Bryson (2004) suggest as much for the UK), then one of the principal mechanisms through which this change will occur is through differences in the annual settlement. Our focus in this paper is on whether union coverage reduces dispersion in pay over the medium run compared to the non-union sector. Union presence is thought to reduce wage-level dispersion by a combination of within and between-firm influences that include a reduction of pay differentials among different groups within the firm, fixing a going rate for the job and discouraging individual merit pay schemes. If unions reduce dispersion in pay levels and seek to maintain the going rate for the job or to maintain differentials then this compression effect will also be present in the annual wage settlement, the principal channel of wage adjustment for most employees in Britain. In a unionised setting the existence of leapfrogging or pattern bargaining, as settlement groups seek to restore differentials with reference to a target outside wage, (see Budd 1992 , Erickson (1996), Marshall and Merlo (2004) for example), may also be sufficient to generate the rapid movement of groups across the settlement distribution over time. Without such rent-sharing mechanisms, movement through the non-union sector settlement distribution may be less rapid. How long these relative positions in the settlement distribution persist will depend on the individual rent extraction abilities of the individual unions and firms.

In order to inform the debate on movement across the settlement distribution researchers need access to panel data.[4] Our main objective is to use longitudinal data to address the influence of unionisation on the cumulative outcome of private sector wage settlements over a period in which the unionised sector has shrunk and wage inequality

4 Lemieux (1998) for the U.S. and Andrews, Bell and Upward (1998) for Britain use panel data on individuals to address selection effects on the union/non-union differential in wage levels. Neither study examines the issue of the persistence of any union effects.

grown. Let the non-union wage level for group i is $_{Wi}^{N} = w + \varepsilon_i^N$, where w is the average wage in the non-union sector and ε_i is a group specific random component with $\varepsilon_i^N \sim N(0, \sigma^2_N)$. Similarly, let the union wage level for group i be $_{Wi}^{U} = w + k + \varepsilon_i^U$, where k is the union mark-up, k>0 and $\varepsilon_i^U \sim N(0, \sigma^2_U)$. Union dispersion effects suggest that $\sigma^2_N > \sigma^2_U$. Over time, it is obvious that if both groups receive the same percentage *settlement*, r, each year then the non-union wage level grows by $w(1+r)^t$ and the union wage level grows by $(w+k)(1+r)^t$. Hence the absolute gap in levels between the two sectors increases but the relative wage gap remains the same. The relative union wage mark-up in levels will fall if the mean non-union settlement is larger than the mean union settlement.

Similarly, if there is lower wage dispersion around the mean union wage level then the same percentage increase in the annual settlement across the two sectors will increase the absolute dispersion in levels between the two sectors but maintain the relative dispersion in levels.[5] If in addition, unions pursue policies that reduce dispersion in *settlements* across groups, then both absolute and relative dispersion in pay levels between the two sectors will rise over time.[6]

To see what evidence there is at the level of the settlement group for wage persistence, we examine whether high paying, or correspondingly low paying, groups remain high paying - or low paying - over time and whether there appear to be differences in behaviour between unionised and non-union groups. The paper is organised as follows. Section 2 describes the wage settlement data we use in this investigation. Section 3 describes the headline properties of the dispersion and variance characteristics of our data and addresses the extent of persistence in wage changes through time. The evidence suggests that less than 1% of settlement groups

5. This follows from the identity $Var(rW) = r^2Var(W)$ for any constant r

6. Gosling and Lemieux (2003) provide evidence on changes in dispersion of pay levels in Britain which suggest that both absolute and relative dispersion in levels between union and non-union has indeed risen over the period.

appear continuously in either the top or bottom quintile of the settlement distribution over a five year period. Yet this large variation in settlement rankings is sufficient to generate inequalities in pay levels consistent with those observed in Britain over the past 15 years. Section 4 concludes that the absence of wage change persistence in our data suggest that we may be able to discount unobserved firm/settlement group effects as a potential explanation for rising inequality in Britain.

2. The Data

The results in this paper are drawn from a longitudinal data set collected at the level of the individual settlement unit within establishments by the Confederation of British Industry's (CBI) Pay Databank survey. The CBI began the systematic monitoring of private sector wage settlements among CBI members and non-members alike, from the start of the 1979/80 pay round in August 1979. The series is used by many commentators as a guide to pay pressures in the UK economy. It is one of the longest continuous sources of disaggregated firm-level wage data available in Britain, providing information on settlement outcomes and pay-setting influences.

The data are collected in annual "pay rounds" running from 1 August to 31 July the following year. Each round of data contains around 1,500 observations, union and non-union, covering around 1.5 million employees, some 8% of all private sector employees in Britain. There are, currently, 23 consecutive years of data spanning the period August 1979 to July 2002. When the firm is first included in the sample it is asked to give information, where applicable, on its three largest occupational groups whose wages are determined, in part, at a local (plant) level[7], along with information on other details of the settlement and some (limited) information on the characteristics

7. Establishments are randomly sampled from the Census of Production. Groups are only included in the survey if at least part of the settlement is determined at local level.

of the group itself, though not the occupation or skill level[8]. The firm is subsequently contacted regarding these same groups. The mean number of responses is two groups for each establishment.

Whilst most studies look at the effects of union coverage, Bell and Pitt (1998) show that the drop in union coverage has more influence on dispersion than the fall in membership. Our data are closer to the idea of union coverage rather than membership. Beginning in the sixth wave of the survey, information was gathered on whether the settlement group had submitted a pay claim. A positive response to this question is used to establish union status in what follows. Around one-third of the union responses and one fifth of the non-union responses come from "mixed" establishments, in the sense that there are union and non-union settlement groups in the same establishment. The union only and mixed observations in the sample have declined at around the same rate over the sample period. Around 60% of groups were unionised in 1987/88, and 23% in 2001/02. One half of all union groups were in "union only" establishments in 1987/88 and in 2001/02. We do not pursue the issue of within-firm spillover effects across settlement groups in the same firm and the possible effect on dispersion over the medium-run here, leaving this issue to further work, but note that the average cross-sectional variance of non-union settlements over the sample period is significantly smaller for non-union groups if they are observed in "mixed" establishments[9].

The CBI survey was initially confined to the manufacturing sector, but in 1987 the survey was extended to cover the entire private sector. We focus mostly on the period beginning in 1987 in what follows, though our methodology has also been applied to the longer time period covered by manufacturing data[10].

8. Information on the occupation of the groups has been collected sporadically, but not sufficiently to allow us to examine the issue of union impact across skill groups.
9. The average non-union (union) variance of real settlements over the sample period is 3.6 (3.6) in mixed establishments and 4.7 (4.0) elsewhere.
10. Results available from the authors on request.

Our analysis focuses on the dispersion in, and persistence of, pay settlements over time. The settlement figure used in this paper is in response to the question "*Please indicate how much the settlement will increase the earnings of a typical employee in this group over the next 12 months. Please include the effect of bonus payments, merit awards etc, if made as part of the settlement*"[11]. The wage variable therefore includes indirect benefits from shorter hours, longer holidays or changes in working arrangements. The mean difference between this measure and the actual base settlement increase, available for a shorter period, is quite small at around a third of one per cent. The inclusion of drift, however, may mean that we are more likely to overstate the degree of transience in our settlement calculations than if increases in basic rates were used.

The real wage variable used is the nominal settlement increase minus the inflation rate in the month of the settlement. The annual sample mean of this real variable is often close to zero and there are also many negative real settlement increases. Both these factors render many of the conventional relative measures of inequality unstable or invalid. We therefore employ measures of dispersion like the variance and absolute measures of inequality, namely the absolute Gini and the Kolm index, to summarise the real settlement distribution since they can be computed for negative values. Unlike relative inequality measures, absolute inequality measures are invariant to equal changes in all values, which is appropriate when the mean of the real settlement distribution is changing but dispersion around the mean may not be. The variance is the only absolute dispersion measure that can be decomposed by sub-groups, Chakravarty (2000). This property is needed to assess the contribution of

11. The question remains the same in nature to the detail sought in '*Notification of Pay Settlements*' as required under the Government's counter inflation policy as set out in the White Paper, The Attack on Inflation (Cmnd 6151), (see CBI (1975)) and is intended to capture earnings drift. This question is identical to the one used by all previous academic analysis of the CBI data set, and is the only one recorded over the duration of the sample .

changing union presence to changes in short and medium-run settlement dispersion [12].

To address the issue of persistence in settlement behaviour we follow the same group over time. We construct a series of balanced panels of settlement groups who remain in the sample for five consecutive years[13]. The sample frame is restricted to those groups party to an annual settlement, around 95% of all groups in each year. The time dimension is limited by the attrition rate over the sample. The attrition rate between consecutive surveys is rather high at around 30% rising to around 50% if a five-year window is used[14]. Using five-year periods ensures that the sample size does not fall below 200 observations in each panel. Table A1 in the appendix provides more details. If groups are lost to the survey, efforts are made to retain the sample stratification by region and industry. The issue of attrition is important if it affects the outcome variables of concern, see Fitzgerald, Gottschalk and Moffitt (1998). We return to this issue when we discuss our principal findings below.

3. Changes in Pay Dispersion and Settlement Persistence Over Time

Our first step is to check whether the dispersion in individual pay levels that has emerged over the last twenty-five years in Britain is mirrored in a widening dispersion of company pay settlements. Table 1, together with Figure 1 and Table A2 in the appendix, provide summary statistics for the real settlement distributions since 1979. While widening dispersion in pay levels in Britain began around this time, (see for example Machin 2003), the aggregate pattern of real settlement dispersion is

12. If we use the nominal settlement distribution, this amounts to a lateral shift in the real wage distribution so that dispersion measures, but not relative inequality measures will be the same.

12. Ingram (1995) finds little evidence of widespread differences between settlement averages in the panels and the corresponding whole sample figures in the relevant years.

13. As a result only 2% of settlement groups remain in the sample for the entire period and only 25% remain for any consecutive eight observations.

cyclical and does not appear to be trended strongly.

However, Table 1 and Figure 1 demonstrate that dispersion in wage settlements of unionised groups becomes significantly lower than settlement dispersion among and those of non-union groups at the onset of the economic recovery in 1993/94 and remains lower throughout the rest of the sample period. While the mean settlement appears to be similar across union and non-union groups over the sample period, dispersion among union groups starts to fall from 1993, while settlement dispersion for non-union groups remains broadly constant after this point. Since the sample proportion of unionised settlement groups falls from 0.62 to 0.23 between 1987 and 2001, this finding is consistent with the idea that declining union presence may account for a wider overall settlement distribution than if union presence had remained steady.

Settlement Persistence

Our results indicate that there is increased dispersion between union and non-union groups, so we turn now to dispersion within groups. The implications for inequality in the cross-sectional settlement distribution depend on how much movement within the distribution there is over time. Our next step is to investigate the evidence for relative wage settlement persistence within the distribution of settlements and to determine whether unionised and non-union groups differ in the degree of settlement persistence. There are several ways of capturing persistence. Table 2 reports the results of simple regressions of the real value of the settlement on a lagged value for each of the five-year panels:

$$\Delta W_{it+j} = \alpha + \beta \Delta W_{it} + u_{it} \qquad i = 1, .. N \text{ groups} \quad t = 1, ..4 \text{ time periods} \qquad (1)$$

In this case, complete mobility and lack of any persistence in the real level of the settlement would imply that the coefficient β would equal zero. Complete immobility in the settlement pattern over time, so that the settlement distribution at time t is the

same as that in time t+i, would imply that β=1. We estimate (1) for the full sample and then the union and non-union sub-samples in each panel.

The results suggest that mobility across the pay distribution is quite rapid. The aggregate one-period ahead β coefficients that are significant, are in the range of 0.3 but the four-period ahead β coefficients estimates are more volatile. It is apparent from the β coefficients in the Table that persistence in settlements during the recession period 1989-1993 was much lower than at other times. So not only do recessions increase settlement dispersion, they appear to generate a rapid re-ordering of groups within the settlement distribution.

There appear to be no systematic differences in the pattern of settlement movements within the union and non-union sub-samples. Settlement persistence in both unionised and non-unionised groups is lower during the recession. In other periods, wage settlement persistence in unionised groups is either higher, lower or the same as in non-unionised groups depending on which panel is chosen.

These simple regressions do not take account of any changes in the set of all possible correlations afforded by the panel data. One way to begin to address this issue is to produce summary statistics using the set of autocorrelations in the data and in so doing try to determine whether the differential changes in settlement dispersion across union and non-union groups have been driven by permanent or transitory changes, or both. Permanent changes to the pattern of settlement dispersion require different explanations to transitory changes. The relatively limited length of our panels, required by the need to keep sample sizes from becoming too small, restricts us from undertaking a comprehensive modelling of the permanent and transitory components of the settlement, as demonstrated by Gottschalk and Moffitt (1995) for the U.S. or Dickens (2000) for Great Britain using individual pay level data.

Instead, in order to help corroborate whether the auto-covariance patterns in the

data have changed over time and whether they differ by union status, we follow Gottschalk and Moffitt (1995) in assuming that the settlement value at time t can be modelled simply as the sum of a group-specific, permanent component, μ_i and a serially uncorrelated transitory component, v_{it}, then:

$$\Delta W_{it} = \mu_i + v_{it} \qquad (2)$$

In this case, if the variance of the permanent component is σ^2_μ and that of the transitory component is σ^2_v, then it is easy to show that the variance of settlements is constant within each panel and given by $\sigma^2_\mu + \sigma^2_v$, so the diagonal elements of the covariance matrix all take this value. The autocovariances are also constant and given by σ^2_μ. [15] Hence a simple OLS regression of the t*(t+1)/2 unique autocovariances, C_{jt}, from any panel j consisting of t time periods on a dummy variable which takes the value 1 if the observation is a settlement variance and 0 if it is an autocovariance between settlement values at times t and s, s≠t:

$$C_{jt} = b_0 + b_1 D + e_{jt} \qquad (3)$$

will give an estimate of σ^2_μ as the constant, b_0, and an estimate of σ^2_v for the slope, b_1.

To see whether these components have changed over time, we pool the variance/covariance data from all 11 five-year panels and allow the estimates of the permanent and transitory variances to change over time in the following way:

$$C_{jt} = b_0 + b_1 D + b_2 \text{Time} + b_3 D*\text{Time} + e_{jt} \qquad (4)$$

The coefficient b_2 gives the annual change in the permanent component of the settlement variance and the coefficient b_3 gives the annual change in the transitory component of the settlement variance. To see whether these effects differ by union status we estimate (3) and (4) separately for unionised and non-union settlement groups. Table A3 gives the set of autocovariances and autocorrelation values for the union and non-union groups. The autocovariances/autocorrelations are positive and do

15. This is not true if there is autocorrelation in the transitory error component.

not decline significantly with lag length until t+4, which lends some support to the simple transitory/permanent model of settlements outlined above.[16] In passing, we note that our data suggest then that earnings *levels* in Britain may not be characterised by a simple unit root process, in which this year's pay equals last year's level plus a random, residual adjustment[17].

Column 1 of Table 3 suggests that around one quarter of the average aggregate private sector settlement variance is accounted for by a permanent component. The average variance, the sum of the coefficients on the constant and the slope, is indeed lower for unionised groups, (column 4), than non union groups, (column 7), but the average share of the permanent component is similar for the two groups, (21% in the union sample, 23% in the non-union sample).[18] Column 2 suggests that, for the private sector as a whole, there has been an upward trend in the permanent variance over time and a downward trend in the transitory variance. Columns 5 and 8 suggest that the increase in the permanent component of dispersion stems primarily from the non-union sector, while the trend decline in transitory variance appears to be greater in the union sector. So, the decline in settlement dispersion among union groups observed in Figure 1 is driven by transitory components.

To check whether these observations are driven by the increased settlement dispersion that we observe during the 1990-93 recession, we add a cyclical variable - the annual percentage change in real g.d.p. at time t - and its interaction with the dummy variable D. This allows both the permanent and transitory component to vary across the economic cycle as well as over a longer period, proxied by the linear time

16. This contrasts somewhat with the findings of Leonard (1989) and Abowd and Card (1994) or Baker (1997) who find negative 1st order autocovariance and insignificant effects thereafter, using individual wage change data from the United States.

16. Since differencing a unit root in levels leads to a negative first order autocovariance and negative covariance at higher orders.

18. If this simple model holds then the share of the variance accounted for by the permanent component is $\sigma^2_\mu / (\sigma^2_\mu + \sigma^2_v)$ which is also equal to the autocorrelation coefficient at any two points in time.

trend. In column 3 the interaction of the time trend with the diagonal component is no longer significant, but the interaction of D with the gdp term is, suggesting that cyclical variation can account for much of the apparent downward trend in the transitory variance. This suggests that the impact of a recession affects pay in different firms at different points in time. Some firms are able to pay high wages during certain recessionary years and others are not, depending on when the negative shock falls. However, this pattern is only temporary. In contrast, the coefficient on the time trend, the indicator of the growth in permanent variance, is not reduced when the cyclical variable is added. If anything, the estimated trend growth in permanent variance is now larger[19].

The different persistence patterns across the unionised and non-union settlement groups also remain. The addition of the cyclical variables does not change the impression that the transitory variance fell among unionised groups over time with little change in the permanent component, (column 6). For the non-union groups, controlling for the cycle, the permanent component of the variance appears to have grown over time, (column 9). When the two groups are combined, non-union group effects dominate and so behavioural changes across this sector underlie the increase in the permanent component of dispersion for the whole sample, (column 3). The decline in the transitory variance among unionised groups is still not large enough to influence the aggregate dispersion pattern significantly.

While falling transitory variance is consistent with the idea of a decline in leapfrogging behaviour among unionised groups, even by the end of the sample period, the permanent share of settlement variance is still smaller than the transitory variance. This suggests that, firms either find it difficult to, or choose not to, pursue distinctive

19. The covariances in the data are largest when gdp growth is at its lowest. If we use the unemployment rate as an alternative cyclical variable to the growth in gdp, which lags gdp growth by around 2 years, then in both the union and non-union samples the significance of the cyclical and trend components are reduced and the R^2 falls.

wage policies over long periods of time. This pattern is also consistent with the sharing of transient rents in wage outcomes.

Another way to capture mobility in the settlement distribution is to examine cumulative settlement outcomes over the medium term. The extent of mobility across the settlement distribution over the medium run is made apparent in Table 4, which summarises the number of times a settlement group appears in the top or bottom quartile of the pay distribution in each five-year panel.[20] In the first half of the sample period there is little difference in mobility across the respective settlement distributions of union and non-union groups. Around 1% of all groups are consistently in the top or bottom quartiles during the first half of the sample period and two thirds of groups appear in the top and bottom quartiles at least once. In the later years of the sample differences between the union and non-union samples begin to emerge. Some non-union groups begin to appear more regularly in the top quartile of the non-union settlement distribution, which is consistent with the increased persistence among these groups observed in Table 3. The shares of non-union groups who appear at least once in the top and bottom quartiles do not, however, change.

To examine the implications of this pattern of settlements for pay levels we create a set of counterfactual level outcomes. The cumulative effect of annual pay settlements on implied wage levels over time is outlined in Table 5 which gives counterfactual and actual indices of the implied pay *levels* at the 10th, 50th and 90th percentiles of the cumulative real wage distribution for the five year cohorts. Using a base year index of 100, if the settlement group had received the median settlement increase in each of the five years beginning 1987/88, then Table 5 shows that real earnings would have been some 3 percentage points higher by the end of the pay-round

20. The indices of mobility as an equaliser of longer-term incomes outlined in Fields (2002) are difficult to apply in this context because of negative real settlement values in the cross-sectional distribution. Also the lack of pay level data precludes definitive analysis as to whether inequality has risen or fallen.

1991/92. The real pay of those receiving settlements in the lowest decile in each year would be some 3 percentage points lower and that of the top decile 13 points higher over the period.

These counterfactuals are of course an upper bound on the extent of earnings dispersion assuming as they do no mobility between pay quantiles. The actual out-turns indicate that the lack of persistence in settlements reduces the change in the 90-10 differential by around 9 points to 16.6 points over the five years, with corresponding reductions of 4 to 5 points in the 90, 50th and 10th percentile implied levels. Again the divergence between the union and non-union samples becomes apparent over time. In the early panels there is little difference between the union and non-union groups. At the end of the period, cumulative dispersion – as given by the 90/10 differential - among non-union groups is much larger and driven by larger sustained increases at the top of the private sector wage distribution. It appears that certain non-union groups in the late 1990s were able to achieve a series of pay awards that kept them consistently toward the top of the pay distribution despite not being at the top of the settlement distribution in every year.

Table 6 and Figure 3 summarise the difference between cross-section real settlement variance and the cumulative five-year distributions by union status. Both short and medium-term dispersion in settlements is significantly lower in the unionised sector than in the non-union sector by the end of the sample period. The absolute Gini measures in both the one year and the cumulative five year settlement distributions fall steadily over the sample period for the unionised sample. No such fall is observed among non-union groups.

There are of course a number of factors that could help explain why settlement dispersion is lower for the unionised sector in the medium term as well as the short term. The data allow us to control for group size effects, industry (15 sectors), and

region (10 regions). As measures of dispersion we calculate the real value of the settlement relative to the median given firstly, a one year window; and secondly, a five year window, see Table 7. We then regress this variable on a union status dummy with and without the size, region and sector controls. The coefficient can be read as the estimated percentage point deviation from the median of unionised groups relative to non-union groups. The union presence dummy is negative and significant in the latter part of the sample period in the one year regressions, even allowing for variations across groups by employment size, sector and region and for random unobserved group effects, (column 3). The union dummy is also significant for the same periods when using a five year window, conditional on size, region and sector. This again suggests that unionised groups lower pay dispersion over the medium as well as the short term.

Attrition in the panel is a problem if it leads to bias in the outcome variables of interest, in this case the dispersion of settlements. As one means of addressing this issue, Table A4 in the appendix reports the marginal effects from a set of probit regressions of the probability that a settlement group is present in each year that comprises a given five year panel. The covariates of interest are the average distance from the median of the settlement group, union status and an interaction term of the two. The Table shows that presence in the panel during the first half of the sample period was positively related to union status. However the settlement dispersion generally has no effect on attrition. Groups who drop out do not appear to be at different points in the settlement distribution over time compared to those groups who remain in the sample. The exception to this pattern occurs during the recession period of 1989-91. Unionised groups in particular who settled closer to the median were more likely to drop out during this period. If anything then, this suggests we may underestimate any union effects on dispersion at this time.

Declining Union Presence and Settlement Dispersion

To assess the importance of the decline in union coverage over the sample period on the overall change in settlement dispersion over both the short and medium terms, we next present counterfactual estimates of what the 1997 short and medium term settlement dispersion would be holding everything else constant but using the 1987 union share.

We estimate a counterfactual real settlement variance based on the variance decomposition first used by Freeman (1980) and more recently by Card, Lemieux and Riddell, (2003):

$$Var(\Delta W) = u*Var(\Delta W^{union}) + (1-u)*Var(\Delta W^{non-union}) + u*(1-u)*(\Delta \bar{W}^{union} - \Delta \bar{W}^{non-union})^2$$

$$= Var(\Delta W^{non-union}) + u[Var(\Delta W^{union}) - Var(\Delta W^{non-union}] + u*(1-u)*(\Delta \bar{W}^{union} - \Delta \bar{W}^{non-union})^2 \quad (5)$$

where u is the union share in each year. The second term is the within-group dispersion effect of unions and the third is the between-group dispersion effect on the variance. Card et al. (2003) argue that the counterfactual effect of unions on settlement dispersion – the difference between the observed variance and that which would prevail if all groups were non-union - can, under certain assumptions, be given by Var(ΔW)-Var($\Delta W^{non\text{-}union}$). We estimate (5) for the annual settlement variance in each of the five years of the final panel and then take the average. We also calculate (5) for the cumulative distribution over the same five year period.[21]

Table 8 confirms that the union effect is to reduce dispersion in the medium term. The variance decomposition based on (5) suggests that the union effect on dispersion is somewhat cyclical, being weaker in recessionary periods. Based on annual variances averaged over five years, the union compression effect is around 16%

21. Wooden's (2001) exploration of the effects of decentralisation on Australian wage levels finds that the dampening union effect is greater across rather than within establishments.

in both the first and the final five year periods, despite the large fall in unionisation over the period. This is because the difference in dispersion between union and non-union sectors has grown at the same time as unionisation has fallen. The majority of the union effect on settlement variance comes from the within sector effect. So unions, as expected, influence the dispersion of settlements rather than the mean settlement level. Over the medium term the cumulative difference in dispersion between the unionised and non-union sectors is such that the union effect rises. Between the first and last panels the medium-run union effect on cumulative settlement variance rises from 9 to 15%, the latter being close to the annual average effect.

We use union shares from different years to construct the counterfactuals, all else constant, for both the short run and medium run real settlement variances for the five years beginning in 1997. Settlement variances would have been some 40% lower had the union share remained at its 1987 level. Based on these estimates the union effect on dispersion in the medium term is close to that over a one year period.

4. Conclusion

During a period when unions have been in numerical decline and wage inequality has increased, our evidence suggests that there is less dispersion in the distribution of wage settlements in the unionised sector. Since the last recession, settlement dispersion has fallen significantly among the (shrinking) union sector. Indeed the growing difference between union and non-union settlement dispersion explains why the union dampening effect on inequality in the settlement distribution remains, and may even have risen over the medium term compared to fifteen years ago, despite the declining union presence.

By using the panel element of our data set we are able to follow movements across the settlement distribution over the medium term. This suggests that much of

the fall in union settlement dispersion is driven by transitory rather than permanent falls in the variance. For non-union groups, controlling for the cycle, the permanent component of the variance appears to have grown over time, offset by a fall in the transitory variance. What this suggests is that while we show that many groups do not appear to receive wage increases above or below the going rate over a sustained period of time, there has been more stability in recent years. It seems then that there may be more permanent winners and more permanent losers in the settlement rankings than in the past. Since this feature is common to both the union and non-union sectors, it seems an explanation that can encompass behaviour in both sectors may be required.

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Figure 1. Real Settlement Dispersion 1979/80-2001/02

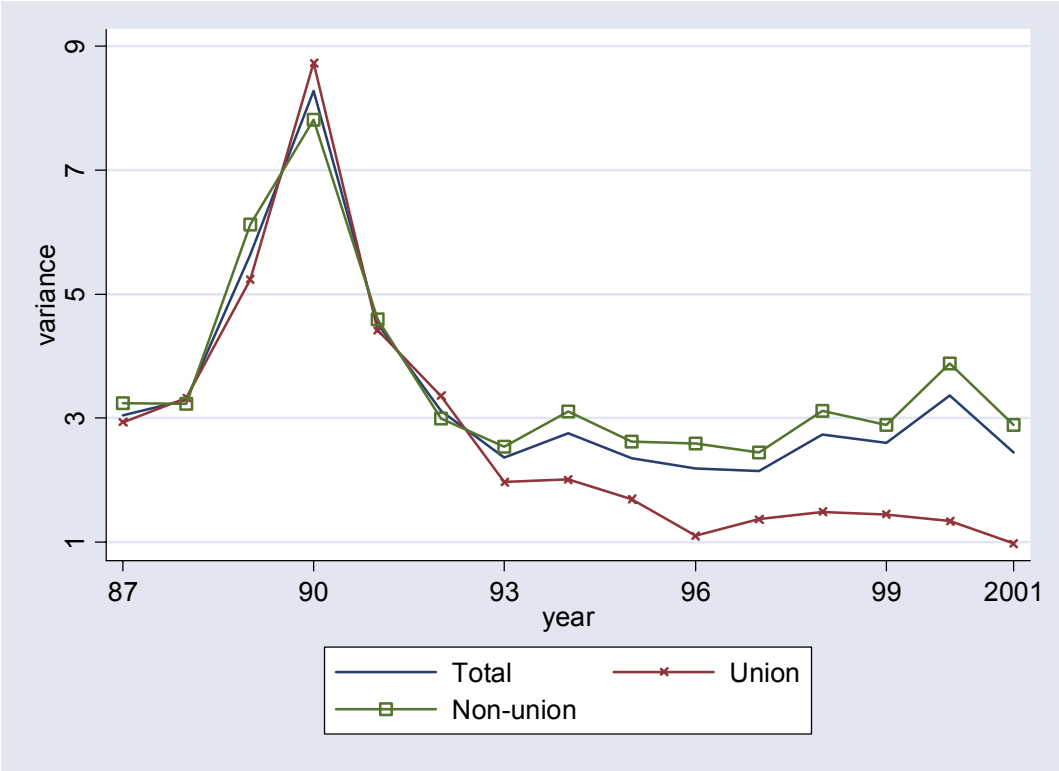


Figure 2. Autocorrelation in Settlement Levels by Union Status

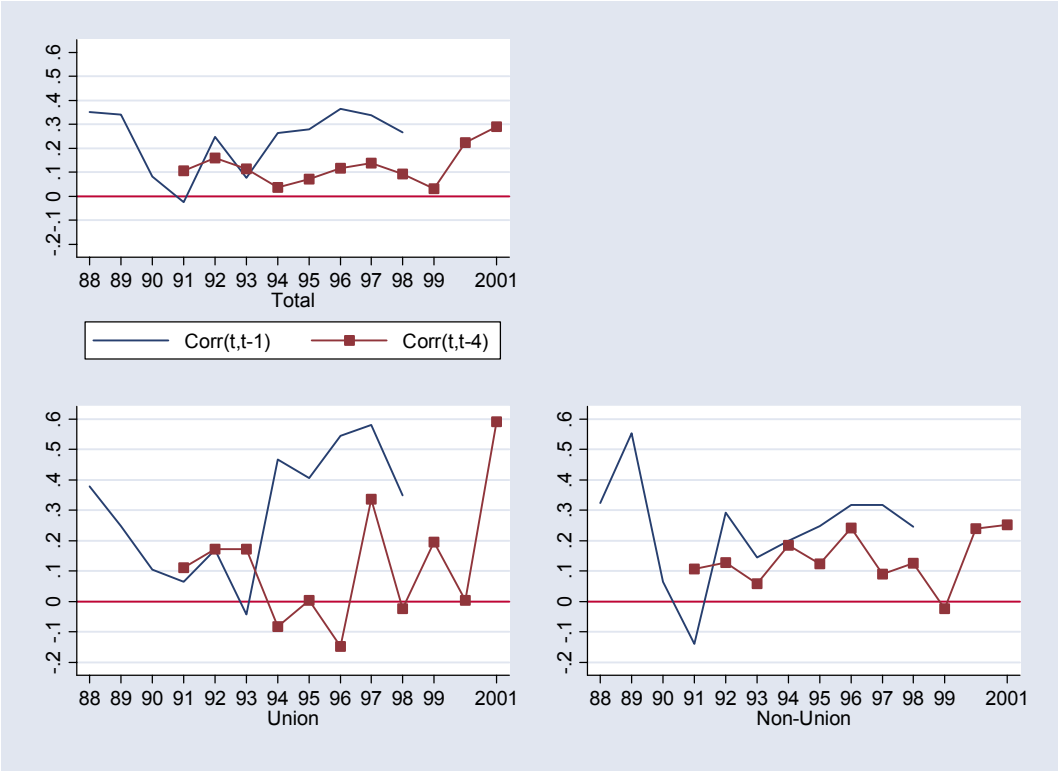
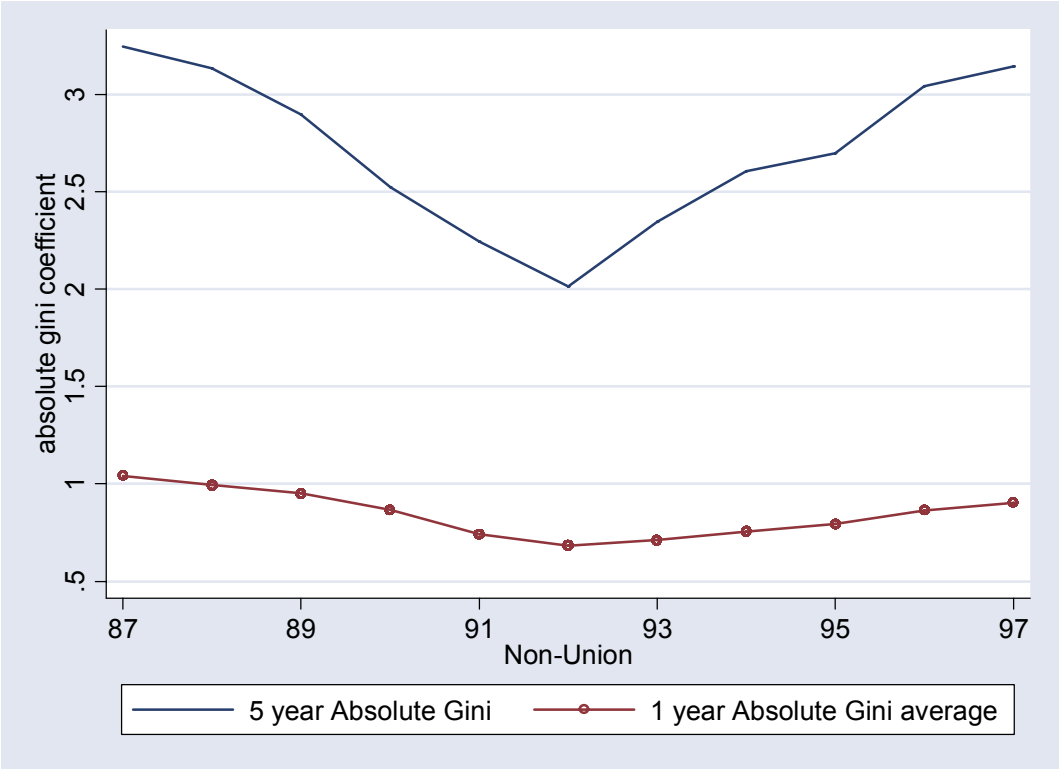


Figure 3. Changing Inequality in the Union and Non-Union Settlement Distributions: one year and five year windows

a) Non-Union



b) Union

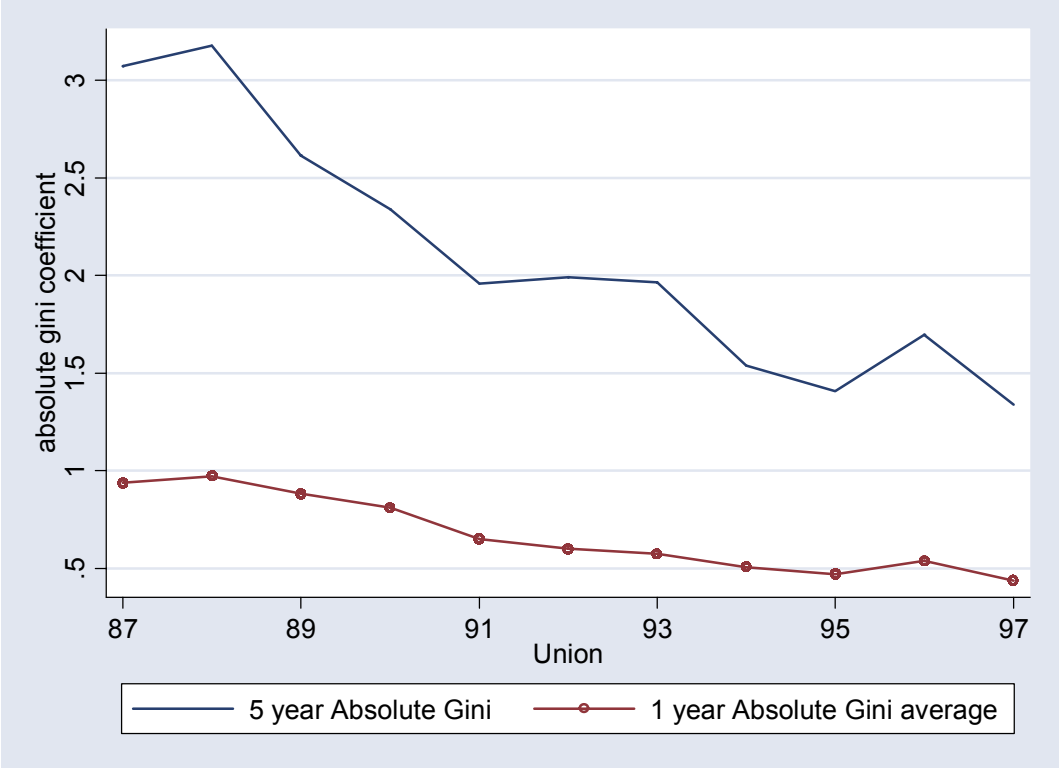


Table 1. Real Settlement Dispersion by Union Status, 1987/88-2001/02

Pay Round	Mean	Variance	90-10	Absolute Gini	Kolm Index
Union					
1987/88	2.1	4.0	3.5	0.986	2.153
1988/89	0.0	4.5	4.6	1.024	2.189
1989/90	0.1	5.7	4.5	1.199	5.125
1990/91	-0.4	8.9	7.3	1.616	4.806
1991/92	0.2	4.4	6.5	1.110	2.285
1992/93	0.9	3.9	4.9	1.025	1.689
1993/94	0.5	2.0	2.6	0.659	0.686
1994/95	0.1	2.3	3.0	0.715	1.011
1995/96	0.9	1.7	1.9	0.631	1.125
1996/97	0.6	1.1	1.5	0.489	0.537
1997/98	0.1	1.4	2.0	0.570	0.752
1998/99	1.1	1.9	2.5	0.668	0.919
1999/2000	0.3	1.4	2.2	0.652	0.861
2000/01	0.8	1.3	2.0	0.621	0.744
2001/02	1.4	0.9	2.0	0.509	0.549
Non-Union					
1987/88	2.1	3.2	3.5	0.951	1.665
1988/89	0	3.5	4.9	0.958	2.876
1989/90	0	7.1	4.8	1.276	5.145
1990/91	-0.6	7.8	7.0	1.497	4.479
1991/92	0.3	5.3	7.0	1.187	2.391
1992/93	0.9	3.3	4.8	0.974	1.513
1993/94	0.5	2.7	3.9	0.847	1.056
1994/95	0.2	4.5	3.5	0.994	1.405
1995/96	0.8	3.3	3.0	0.850	1.435
1996/97	0.7	2.9	3.0	0.827	1.238
1997/98	0.1	3.3	2.3	0.808	1.296
1998/99	1.1	3.8	5.0	0.952	1.458
1999/2000	0.7	3.2	4.0	0.911	1.209
2000/01	0.9	3.7	5.0	1.066	1.745
2001/02	1.4	2.9	4.2	1.002	1.423

Note: the Kolm index is based on choice parameter set to 1. Bootstrapped standard errors for absolute Gini (Kolm) coefficients are in range 0.035 to 0.046 (0.074 to 0.245) for the union sample and 0.044 to 0.048 (0.093 to 0.253) for the non-union sample based on 1000 replications. The sample proportion of unionised groups is 0.62 in 1987, 0.31 in 1995 and 0.23 in 2001.

Table 2. Persistence in Real Wage Settlements Over time (five year panels)

	Total		Non-Union		Union	
	t+1	t+4	t+1	t+4	t+1	t+4
1987-91	0.382**	0.105	0.462**	0.117	0.315**	0.107
	(0.059)	(0.057)	(0.095)	(0.095)	(0.069)	(0.165)
1988-92	0.332**	0.127**	0.333**	0.089	0.332**	0.175**
	(0.054)	(0.046)	(0.130)	(0.060)	(0.135)	(0.086)
1989-93	0.105	0.069**	0.066	0.067	0.170	0.071
	(0.070)	(0.033)	(0.114)	(0.049)	(0.139)	(0.055)
1990-94	-0.018	0.021	-0.031	0.009	0.007	0.047
	(0.038)	(0.032)	(0.045)	(0.033)	(0.064)	(0.070)
1991-95	0.209**	0.053	0.238**	0.080	0.111	-0.026
	(0.042)	(0.038)	(0.063)	(0.042)	(0.081)	(0.075)
1992-96	0.071	0.109**	0.057	0.073	0.120	0.221**
	(0.048)	(0.048)	(0.094)	(0.095)	(0.084)	(0.093)
1993-97	0.306**	0.153**	0.238**	0.099	0.531**	0.330**
	(0.057)	(0.056)	(0.080)	(0.072)	(0.185)	(0.133)
1994-98	0.292**	0.086	0.301**	0.133	0.246**	-0.102
	(0.054)	(0.051)	(0.116)	(0.116)	(0.155)	(0.077)
1995-99	0.390**	0.033	0.369**	0.031	0.513**	-0.052
	(0.055)	(0.058)	(0.105)	(0.095)	(0.204)	(0.084)
1996-2000	0.302**	0.257**	0.282**	0.253**	0.545**	0.147
	(0.050)	(0.066)	(0.063)	(0.120)	(0.199)	(0.089)
1997-2001	0.284**	0.341**	0.277**	0.320	0.218	0.265
.	(0.070)	(0.077)	(0.121)	(0.188)	(0.155)	(0.245)

Note: coefficients are slope estimates from regression of level of real settlement in year t+i , (i= 1 or 4), on real settlement in year t. Robust standard errors in brackets. ** denotes significance at 5% level.

Table 3. Summary Covariance Regressions for Real Annual Settlement (11 five year panels)

	Total			Union			Non-Union		
	1	2	3	4	5	6	7	8	9
Constant	0.628**	0.361**	0.468**	0.417**	0.683**	0.735**	0.677**	0.294*	0.384**
	(0.119)	(0.144)	(0.120)	(0.075)	(0.120)	(0.108)	(0.081)	(0.165)	(0.141)
Diagonal	2.182**	2.828**	3.215**	1.531**	2.940**	3.239**	2.248**	3.096**	3.544**
	(0.119)	(0.251)	(0.207)	(0.130)	(0.208)	(0.187)	(0.136)	(0.286)	(0.244)
Time Trend		0.045**	0.072**		-0.044*	-0.031		0.064**	0.087**
		(0.021)	(0.022)		(0.018)	(0.018)		(0.024)	(0.023)
Diagonal*Time Trend		-0.107**	-0.023		-0.235**	-0.168**		-0.103*	-0.004
		(0.037)	(0.033)		(0.031)	(0.029)		(0.042)	(0.039)
% Δ GDP			-0.114**			-0.056			-0.096**
			(0.042)			(0.037)			(0.048)
Diagonal* ΔGDP			-0.388**			-0.301**			-0.451**
			(0.066)			(0.060)			(0.078)
R^2	0.672	0.689	0.811	0.461	0.702	0.785	0.672	0.688	0.796

Note: standard errors in brackets. Sample size is 165 in each case

Identify why/how columns in each section vary

Table 4. Mobility in the Settlement Distribution

	% appearing in					
	Top Quartile at least once	Bottom Quartile at least once	Top Quartile at least 3 times	Bottom Quartile at least 3 times	Top Quartile each time	Bottom Quartile each time
1987-91						
All	67.5	68.5	14.6	18.3	1.0	1.5
Union	*67.4*	*68.0*	*18.0*	*17.4*	*0.6*	*1.1*
Non-Union	*68.1*	*69.3*	*9.6**	*20.1*	*1.8*	*1.8*
1988-92						
All	64.0	67.8	16.1	15.8	2.4	1.7
Union	*65.0*	*66.1*	*18.9*	*13.9*	*1.7*	*0*
Non-Union	*62.5*	*70.5*	*11.6**	*18.8*	*3.6*	*4.6**
1989-93						
All	66.1	68.8	13.2	15.6	0.9	0.9
Union	*66.7*	*67.2*	*11.7*	*13.9*	*0.6*	*1.1*
Non-Union	*65.4*	*70.6*	*15.0*	*17.6*	*1.3*	*0.7*
1990-94						
All	63.4	69.6	12.8	18.5	0.9	0
Union	*63.0*	*68.8*	*12.7*	*20.8*	*1.2*	*0*
Non-Union	*63.8*	*70.6*	*12.9*	*16.0*	*0.6*	*0*
1991-95						
All	64.5	68.4	15	19.7	1.6	0.8
Union	*63.4*	*73.1*	*13.1*	*17.9*	*0.7*	*0.7*
Non-Union	*65.1*	*65.5**	*16.2*	*20.9*	*2.1*	*0.9*
1994-98						
All	56.8	73.5	19.4	20.9	1.8	0
Union	*58*	*73*	*16.0*	*15.0*	*2.0*	*0*
Non-Union	*56.3*	*73.8*	*20.8*	*23.3**	*1.7*	*0*
1995-99						
All	57.5	73.2	18.5	20	2.1	0.3
Union	*42.4*	*75*	*8.7*	*21.7*	*1.1*	*0*
Non-Union	*63.5**	*72.5*	*22.3**	*19.3*	*2.6*	*0.1*
1996-2000						
All	58.3	73.3	16.7	16	3.8	0.3
Union	*50*	*79.7*	*4.7*	*17.2*	*0*	*0*
Non-Union	*60.7*	*71.4*	*20.1**	*15.6*	*4.9**	*0.1*
1997-2001						
All	58.6	68.2	18.6	18.6	3.6	0.1
Union	*30.6*	*71.4*	*2.0*	*20.4*	*2.0*	*0*
Non-Union	*66.7**	*67.3*	*23.4**	*18.1*	*4.1*	*0.1*

Note: * indicates union and non-union proportions are significantly different from each other.

Table 5. Real and Counterfactual Evolution of Implied Pay Levels based on Real Settlement Distribution

a. 1986-91

	Counterfactual Level			Actual					
				Non-Union			Union		
Year	10	50	90	10	50	90	10	50	90
1986	100	100	100	100	100	100	100	100	100
1987	100.7	101.9	104.1	100.8	101.9	104.4	100.4	101.8	104.2
1988	98.9	101.5	106.3	99.1	102.0	105.1	99.2	101.5	106.0
1989	97.2	101.7	108.8	97.6	101.9	107.9	97.6	101.8	108.2
1990	94.4	101.8	111.2	97.4	102.1	108.0	95.6	101.6	109.1
1991	92.7	102.0	113.2	95.8	101.6	108.9	95.1	102.0	109.9

b. 1990-95

	Counterfactual Level			Actual					
				Non-Union			Union		
Year	10	50	90	10	50	90	10	50	90
1990	100	100	100	100	100	100	100	100	100
1991	98.9	100.7	102.3	98.9	100.6	102.4	98.9	100.7	102.3
1992	98.3	101.9	105.1	98.7	101.8	105.1	98.4	101.6	104.4
1993	97.8	102.4	106.9	98.7	102.2	105.8	98.4	102.2	105.9
1994	97.0	102.4	108.3	98.1	102.2	107.4	97.8	102.2	106.7
1995	97.0	103.3	110.6	98.5	103.2	108.6	98.3	103.2	108.1

c. 1995-2000

	Counterfactual Level			Actual					
				Non-Union			Union		
Year	10	50	90	10	50	90	10	50	90
1995	100	100	100	100	100	100	100	100	100
1996	99.7	100.6	102.6	99.3	100.6	102.9	99.9	100.6	101.5
1997	98.9	100.6	104.3	99.1	100.9	104.0	99.9	100.6	101.2
1998	98.7	101.6	107.0	99.2	101.9	107.4	100.2	101.7	102.9
1999	97.7	102.2	109.7	99.3	102.4	109.9	99.6	102.0	104.1
2000	96.9	103.0	113.3	99.2	103.1	112.9	99.2	103.1	106.1

Table 6. Cumulative Real Settlement Dispersion by Union Status, (five year panels)

Pay Round	Mean of cumulative distribution	Variance	90-10	five year absolute Gini	1 year absolute Gini (average)
Union					
1987-91	2.3	31.0	14.0	3.07 (0.19)	.867
1988-92	1.6	33.4	13.3	3.18 (0.22)	.882
1989-93	2.3	22.5	10.7	2.61 (0.18)	.838
1990-94	2.4	18.1	10.5	2.34 (0.17)	.771
1991-95	3.2	14.4	8.3	1.96 (0.18)	.651
1992-96	3.2	17.7	7.9	1.99 (0.24)	.601
1993-97	2.7	21.6	6.6	1.97 (0.33)	.575
1994-98	2.9	12.7	5.1	1.54 (0.26)	.508
1995-99	3.1	8.7	5.2	1.41 (0.20)	.471
1996-2000	2.5	11.3	6.6	1.70 (0.23)	.539
1997-2001	2.7	7.5	5.0	1.34 (0.23)	.439
Non-Union					
1987-91	2.5	35.7	14.4	3.25 (0.27)	1.04
1988-92	1.6	32.6	13.7	3.14 (0.22)	.994
1989-93	1.9	28.9	12.3	2.90 (0.19)	.952
1990-94	2.5	20.7	12.3	2.52 (0.14)	.866
1991-95	3.4	16.8	10.5	2.25 (0.12)	.742
1992-96	3.6	15.0	8.4	2.02 (0.15)	.683
1993-97	2.7	23.3	8.5	2.35 (0.19)	.712
1994-98	4.1	26.6	10.6	2.61 (0.19)	.757
1995-99	4.5	29.6	11.0	2.70 (0.21)	.794
1996-2000	4.6	40.3	12.8	3.10 (0.26)	.875
1997-2001	6.0	45.8	10.9	3.14 (0.35)	.904

Note: bootstrapped standard errors in brackets based on 1000 replications

Table 7. OLS Estimates of Union Effect on Cumulative Pay Distribution

	one year window		one year window: pooled, random effects	five year window	
Payround					
1987/88	-0.094	-0.122	-0.146	-0.259	-0.383
	(0.160)	(0.151)	(0.087)	(0.458)	(0.476)
1988/89	-0.001	0.048	0.012	0.179	0.236
	(0.161)	(0.164)	(0.086)	(0.428)	(0.450)
1989/90	0.007	0.103	-0.027	-0.248	-0.086
	(0.153)	(0.151)	(0.077)	(0.362)	(0.377)
1990/91	0.027	0.054	-0.055	-0.146	-0.229
	(0.175)	(0.187)	(0.075)	(0.313)	(0.310)
1991/92	-0.291*	-0.178	-0.070	-0.424	-0.420
	(0.125)	(0.157)	(0.073)	(0.291)	(0.330)
1992/93	-0.144	-0.118	-0.110	-0.147	-0.256
	(0.104)	(0.102)	(0.078)	(0.349)	(0.336)
1993/94	-0.171	-0.173	-0.091	-0.612	-0.281
	(0.106)	(0.108)	(0.091)	(0.447)	(0.398)
1994/95	-0.161	0.058	-0.236**	-1.570**	-1.100**
	(0.140)	(0.142)	(0.100)	(0.395)	(0.384)
1995/96	-0.411**	-0.274**	-0.286**	-1.730**	-1.230*
	(0.119)	(0.119)	(0.093)	(0.368)	(0.372)
1996/97	-0.558**	-0.550**	-0.298**	-1.910**	-1.320**
	(0.151)	(0.153)	(0.131)	(0.459)	(0.508)
1997/98	-0.536*	-0.226	-0.495*	-2.370**	-2.100**
	(0.144)	(0.133)	(0.194)	(0.542)	(0.704)
Employment controls	No	Yes	Yes	No	Yes
Industry controls	No	Yes	Yes	No	Yes
Region controls	No	Yes	Yes	No	Yes

Note: dependent variable is absolute deviation from median (measured in percentage points). Coefficient is union status dummy variable from OLS regression. Robust standard errors in brackets. * indicates significance at 5% level

Table 8. The Effect of Declining Union Presence on Short and Medium-Run Settlement Dispersion

		Annual (five year average)				five year cumulative distribution			
Initial Year	Union Share	Variance	Within-Group Effect	Between-Group Effect	Union Effect	Variance	Within-Group Effect	Between-Group Effect	Union Effect
1987	0.62	3.7	-0.630	0.012	-0.618	32.7	-2.919	0.009	-2.910
1992	0.33	1.8	-0.109	0.004	-0.105	16.0	0.889	0.027	0.862
1997	0.20	3.3	-0.610	0.075	-0.535	39.9	-7.702	1.775	-5.927
Counterfactual 1997 with 1987 union share		2.1				25.7			
1997 with 1992 union share		3. 1				37.1			

Note: The within-group effect is given by $u[Var(\Delta W^{u}) - Var(\Delta W^{N})$ and the between-group effect is given by $u*(1-u)*(\Delta \bar{W}^{union} - \Delta \bar{W}^{non-union}$ in equation (5)

Appendix 1: CBI Pay Database

Pay round	Number of bargaining groups	One year attrition rate	Five year attrition rate	End of sample attrition rate	No. of times group appears in dataset	(% of total)
1979	927	0.388	0.498	0.947	1	3.9
1980	1357	0.279	0.498	0.92	2	5.3
1981	1430	0.278	0.481	0.903	3	5.7
1982	1307	0.243	0.49	0.888	4	6.9
1983	1361	0.284	0.526	0.886	5	6.6
1984	1246	0.298	0.498	0.861	6	7.0
1985	1156	0.338	0.484	0.863	7	7.6
1986	1174	0.379	0.506	0.855	8	6.8
1987*	1264	0.333	0.453	0.845	9	6.5
1988	1181	0.302	0.447	0.826	10	5.9
1989	1467	0.334	0.479	0.817	11	5.4
1990	1424	0.253	0.484	0.801	12	4.7
1991	1602	0.285	0.436	0.78	13	4.1
1992	1662	0.297	0.545	0.768	14	4.0
1993	1673	0.305	0.493	0.747	15	3.4
1994	1575	0.232	0.518	0.714	16	3.2
1995	1739	0.365	0.531	0.692	17	2.8
1996	1357	0.289	0.458	0.638	18	2.9
1997	1502	0.346	0.622	0.622	19	3.0
1998	1340	0.387		0.592	20	1.9
1999	1277	0.366		0.555	21	1.2
2000	1336	0.485		0.485	22	1.4

Note: * manufacturing only before this date

Table A2. Real Settlement Dispersion, 1979-2001

Pay Round	Mean	Variance	90-10	Absolute Gini	Kolm
Manufacturing					
1979/80	-2.7	20.2	8.6	2.186	4.179
1980/81	-4.1	8.9	7.5	1.460	2.483
1981/82	-3.6	7.8	5.1	1.448	2.698
1982/83	0.8	5.7	4.6	1.284	3.424
1983/84	1.0	2.0	3.6	0.955	2.199
1984/85	0.6	3.8	3	1.038	2.333
1985/86	1.9	4.7	3.6	1.187	3.162
1986/87	1.3	2.6	3.1	0.845	1.822
1987/88	2.0	3.5	3.6	0.936	1.989
1988/89	-0.1	4.0	4.4	0.965	2.263
1989/90	0.1	5.0	4.5	1.158	4.715
1990/91	-0.6	7.9	7.1	1.521	4.549
1991/92	0.2	4.3	6.1	1.073	2.202
1992/93	0.8	3.1	4.5	0.933	1.502
1993/94	0.4	4.9	2.8	0.705	0.836
1994/95	0.1	2.7	3	0.787	1.151
1995/96	0.8	2.2	2.2	0.700	1.171
1996/97	0.5	1.8	2.2	0.642	1.000
1997/98	0	2.0	2.2	0.647	1.087
1998/99	0.7	2.4	4	0.772	1.189
1999/2000	0.3	1.8	4	0.737	1.019
2000/01	0.5	3.3	4	0.798	1.165
2001/02	1.2	2.0	3.6	0.714	0.900
Whole Economy					
1987/88	2.1	3.7	3.5	0.969	1.986
1988/89	0	4.2	4.7	0.999	2.515
1989/90	0	6.3	4.5	1.235	5.145
1990/91	-0.5	8.4	7	1.559	4.465
1991/92	0.2	4.9	6.5	1.156	2.348
1992/93	0.9	3.5	4.8	0.992	1.578
1993/94	0.5	2.5	3.25	0.792	0.956
1994/95	0.2	3.8	3	0.909	1.293
1995/96	0.8	1.7	2.8	0.789	1.360
1996/97	0.6	2.4	2.8	0.739	1.089
1997/98	0.1	2.7	2.2	0.744	1.172
1998/99	1.1	3.4	4	0.888	1.359
1999/2000	0.6	2.9	3.3	0.861	1.136
2000/01	0.9	5.0	3.5	0.981	1.591
2001/02	1.6	4.1	3.4	0.896	1.262

Note: the Kolm index is based on choice parameter set to 1. Bootstrapped standard errors for absolute Gini (Kolm) coefficients are in range 0.035 to 0.046 (0.074 to 0.245) for the union sample and 0.044 to 0.048 (0.093 to 0.253) for the non-union sample based on 1000 replications. The sample proportion of unionised groups is 0.62 in 1987, 0.31 in 1995 and 0.23 in 2001.

Table A3. Autocovariance and Autocorrelation Patterns in Settlements

Year	t	t+1	t+2	t+3	t+4	t+1	t+2	t+3	t+4
Union									
1987/88	2.72*	0.86*	1.13*	1.04*	0.29	0.30*	0.38*	0.27*	0.11
	(0.50)	(0.16)	(0.24)	(0.27)	(0.19)				
1988/89	2.90*	0.97*	1.52*	0.44*	0.51*	0.34*	0.36*	0.15	0.20*
	(0.37)	(0.37)	(0.41)	(0.21)	(0.24)				
1989/90	3.50*	0.60	0.46*	0.34	0.25	0.14	0.16	0.13	0.11
	(0.67)	(0.49)	(0.21)	(0.21)	(0.18)				
1990/91	5.40*	0.04	0.90*	0.22	0.25	0.01	0.31*	0.08	0.07
	(0.87)	(0.34)	(0.29)	(0.26)	(0.39)				
1991/92	2.12*	0.24	0.45*	0.07	-0.05	0.14	0.27*	0.03	-0.03
	(0.44)	(0.16)	(0.14)	(0.31)	(0.16)				
1992/93	1.50*	0.18	0.14	0.33*	0.33*	0.13	0.07	0.23*	0.24*
	(0.27)	(0.14)	(0.13)	(0.10)	(0.13)				
1993/94	1.49*	0.79*	0.40	0.50	0.49*	0.41*	0.28*	0.40*	0.35*
	(0.36)	(0.34)	(0.29)	(0.30)	(0.25)				
1994/95	1.91*	0.47	0.69*	0.49	-0.20	0.31*	0.56*	0.34*	-0.13
	(0.57)	(0.37)	(0.32)	(0.38)	(0.14)				
1995/96	0.96*	0.50	0.51	0.16*	-0.05	0.55*	0.57*	0.15	-0.04
	(0.44)	(0.39)	(0.35)	(0.07)	(0.09)				
1996/97	1.03*	0.56	0.12	0.04	0.15	0.55*	0.12	0.02	0.11
	(0.47)	(0.41)	(0.18)	(0.15)	(0.12)				
1997/98	0.47*	0.10	0.09	0.02	0.12	0.18	0.13	0.03	0.22
	(0.16)	(0.07)	(0.05)	(0.12)	(0.11)				
Non-Union									
1987/88	3.43*	1.58*	1.41*	1.10*	0.40	0.41*	0.36*	0.24*	0.12
	(0.79)	(0.46)	(0.42)	(0.44)	(0.35)				
1988/89	3.92*	1.31*	0.37	0.69*	0.35	0.35*	0.08	0.19*	0.12
	(1.08)	(0.36)	(0.60)	(0.30)	(0.25)				
1989/90	4.19*	0.28	0.91*	0.60*	0.28	0.05	0.25*	0.21*	0.12
	(0.80)	(0.48)	(0.30)	(0.25)	(0.20)				
1990/91	5.93*	-0.18	0.73*	-0.21	0.05	-0.04	0.19*	-0.07	0.02
	(0.94)	(0.32)	(0.33)	(0.22)	(0.19)				
1991/92	3.54*	0.84*	0.13	0.40*	0.28	0.28*	0.06	0.16*	0.12
	(0.42)	(0.23)	(0.18)	(0.13)	(0.15)				
1992/93	2.40*	0.14	-0.03	0.77	0.17	0.06	-0.02	0.29*	0.08
	(0.40)	(0.22)	(0.16)	(0.52)	(0.21)				
1993/94	1.96*	0.47	0.42*	0.57	0.20	0.21*	0.18*	0.26*	0.09
	(0.32)	(0.16)	(0.18)	(0.35)	(0.15)				
1994/95	2.57*	0.78*	0.83*	1.25*	0.34	0.27*	0.31*	0.46*	0.14
	(0.67)	(0.23)	(0.19)	(0.66)	(0.36)				
1995/96	2.48*	0.92*	0.62*	0.55*	0.08	0.34*	0.23*	0.22*	0.03
	(0.44)	(0.28)	(0.25)	(0.25)	(0.24)				
1996/97	4.09*	1.16*	0.59	1.12*	1.03*	0.32*	0.17*	0.34*	0.24*
	(1.05)	(0.31)	(0.42)	(0.28)	(0.42)				
1997/98	3.50*	0.97	1.24*	1.50*	1.12	0.28*	0.37*	0.38*	0.27*
	(1.00)	(0.55)	(0.42)	(0.73)	(0.65)				

Note: Standard errors in brackets calculated following Abowd & Card (1989) and Dickens (2000)
* significant at 5% level

Appendix Table A4. Probability of Presence in Five year Panel and Settlement Dispersion

	No Controls			With Controls		
Initial Payround	Distance from Median	Union* Distance from Median	Union	Distance from Median	Union* Distance from Median	Union
87	-0.009	-0.010	0.159**	-0.009	-0.004	0.146**
	(0.008)	(0.009)	(0.011)	(0.008)	(0.008)	(0.011)
88	-0.006	-0.009	0.149**	-0.002	-0.006	0.128**
	(0.006)	(0.007)	(0.012)	(0.006)	(0.006)	(0.011)
89	-0.003	-0.021**	0.169**	-0.001	-0.021**	0.160**
	(0.007)	(0.009)	(0.013)	(0.006)	(0.008)	(0.013)
90	0.023**	-0.054**	0.217**	0.023**	-0.049**	0.202**
	(0.004)	(0.008)	(0.014)	(0.004)	(0.007)	(0.014)
91	0.005	-0.047**	0.187**	0.007	-0.043**	0.171**
	(0.005)	(0.011)	(0.018)	(0.005)	(0.011)	(0.018)
92	-0.010	-0.016	0.121**	-0.009	-0.014	0.114**
	(0.006)	(0.012)	(0.019)	(0.006)	(0.012)	(0.020)
93	-0.009	-0.009	0.028	-0.009	-0.012	0.027
	(0.006)	(0.017)	(0.021)	(0.006)	(0.016)	(0.021)
94	-0.007	-0.015	0.034	-0.008	-0.017	0.035
	(0.006)	(0.019)	(0.022)	(0.006)	(0.019)	(0.022)
95	-0.002	-0.025	0.050**	-0.001	-0.027	0.063**
	(0.006)	(0.018)	(0.022)	(0.006)	(0.018)	(0.023)
96	0.007	-0.041**	0.038*	0.009	-0.044**	0.049**
	(0.008)	(0.019)	(0.023)	(0.006)	(0.018)	(0.024)
97	-0.006	-0.011	-0.011	-0.005	-0.013	0.002
	(0.006)	(0.022)	(0.023)	(0.006)	(0.021)	(0.023)

Note: The table shows the marginal effects from a set of probit regressions of the probability that a settlement group is present in each year that comprises a given five-year panel.