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Abstract

In this paper, we compile a unique historical dataset that records strike activity in the British engineering industry from 1920 to 1970. These data have the advantage of containing a fairly homogenous set of companies and workers, covering a long period with varying labour market conditions, including information that enables the addition of union and company fixed effects, and providing geographical detail that allows a district-level analysis that controls for year and seasonal effects. We study the cyclicality of strike durations, strike incidence, and strike outcomes and distinguish between pay and non-pay strikes. Like the previous literature, we find evidence that strikes over pay have countercyclical durations. However, in the post-war period, the magnitude of this effect is much reduced when union and firm fixed effects are included. These findings suggest that it is important when studying strike durations to take account of differences in the composition of companies and unions that are involved in strikes at different points of the business cycle. We also find that strike outcomes tend to be more favourable to unions when the national unemployment rate is lower.

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1. Introduction

Economists have long been interested in how strike duration and strike incidence change with labour market conditions. Evidence from the U.S. (Kennan 1985) and Canada (Harrison and Stewart 1989) suggests that strike durations are countercyclical. The North American evidence lends more qualified support to the view that strike incidence is procyclical (Kennan, 1986; Harrison and Stewart, 1994). However, the findings are by no means uniform across the strikes' literature. In this paper, we use a new data set that we have put together from the strikes records of the Engineering Employers Federation (EEF) in Great Britain. Statistics cover 10,870 company-level strike incidents over the period 1920 to 1970. These unique data allow us to study strike durations in a relatively homogenous industry and so differ from the cross-industry studies that dominate earlier research work.[1]

Our data add to earlier studies in several other ways. First, they cover a long period that straddles two colossal events, the Great Depression and the Second World War (WW2). As such, there is tremendous variation in cyclical conditions over the sample period. Second, they allow use of other comparable data collected for this period, especially district-level unemployment rates. These rates, matched to districts in which strikes took place, enable us to exploit cross-sectional variation in labour market conditions in addition to time-series variation. Third, we make use of company and union identifiers to investigate the robustness of our estimates to the presence of company and union fixed effects. Including these extra controls increases the likelihood that we are

[1] Also, the engineering industry was particularly strike-prone. Durcan et al. (1983) report that 57% of major stoppages (defined as involving the loss of 5000 working days or more) in all British industry (excluding Mining) between 1946 and 1973 were accounted for by just five industries; these were, in descending order, motor vehicles, non-electrical engineering, electrical engineering, iron and steel, and shipbuilding.

capturing true cyclical effects rather than selection effects. Finally, we add to the literature by examining how labour market conditions impact strike outcomes. In particular we examine whether unions are more likely to obtain successful outcomes if the unemployment rate is low.

2. Is there a Good Time to Stay Out?

Would we expect strike activity to link systematically to changes in the macroeconomic climate? The dominant approaches to understanding strikes incidence and duration (see, especially, Kennan 1986) appear to give, at best, equivocal answers.

One view effectively rules out significant correlations between strike incidence/duration and the business cycle. Hicks (1932) holds that strikes occur more or less randomly, resulting from irrational bargaining behaviour. If the company and its workforce are fully and symmetrically informed about internal and external product and labour markets, then they can rationally achieve an optimal contractual relationship without recourse to costly and inefficient disputes and work stoppages.

For strikes to occur under conditions of full rationality requires an assumption of private information, the principal motivation behind the dominant approach to explaining strike activity. In a company-union context, for example, strikes can be seen as a means of one (or both) party's willingness to incur costs in order to elicit more information from the other side of the dispute. Generally, the assumption is that the company has private information about profitability and the union about its members' appetite and capacity for strike action. In screening models, the union makes take-it-or-leave-it wage offers to the company and strikes if an offer is rejected. The company balances the cost of a strike of a

given expected length followed by settlement at a low wage against the cost of accepting the union's initial high wage offer and not facing a strike. Signalling models have the opposite structure in that the informed party, the company, makes the wage offers. There are also models in the literature that allow for private information on both sides and/or both screening and signalling elements (Kennan and Wilson 1993, Cramton and Tracy 2003). However, it is difficult to envisage product and labour market conditions playing a prominent role in models that stress the motivating role of variables that are asymmetrically understood by the parties.[2]

In the literature, there is limited evidence of procyclical strike incidence and somewhat broader support for countercyclical strike duration. These are plausible outcomes from a union perspective. When sales are high and inventories are low and when productive workers are faced with abundant job opportunities, the company may perceive particularly high costs of work stoppages. This would seem to provide a good time for the union to solve a grievance through strike action since there is pressure on the company to expedite matters. When unemployment is high, the union may perceive high costs to strike action (Farber, 1978). Alternative sources of employment income for strikers (part-time jobs, the black economy) will be relatively scarce and the situation may be exacerbated if wider family members are also experiencing adverse job conditions. Moreover, when strikes do occur during economic downturns, high

[2] Booth and Cressy (1990) establish a possible connection between private information regarding company profit and the business cycle. Companies with high capacity utilisation, *ceteris paribus,* may be perceived to enjoy high profits and so be more strike-prone. This line of reasoning suggests procyclical strike incidence. In their regression analysis, however, the two measures used by these authors to proxy utilisation (rising/stable sales and establishments operating at full capacity) produce contradictory results.

inventories and thin order books may provide conditions in which employers can afford to be more robust in their resolve, resisting demands for relatively protracted periods.[3]

Kennan (1986) and Cramton and Tracy (2003) argue that it is a challenge for bargaining models to underpin theoretically findings of procyclical incidence and countercyclical duration. But, there is considerable room to be cautious over treating these outcomes as if they represented a consensus among researchers. Strong counter evidence exists. Analysing 6,000 negotiations in British manufacturing in the 1980s, Ingram et al. (1993) find significant countercyclical strike incidence. Based on a U.S. data set covering over 6,000 union contracts for the period 1970 to 1981, McConnell (1990) finds no evidence of cyclical variation in strike duration.

3. Data and Descriptive Analysis

The strike records we use come from a set of volumes on engineering strikes within the Engineering Employers' Federation (EEF)[4] that are stored at the University of Warwick's Modern Records Centre. These provide company-level annual strike information for all the Federation's members over an unbroken period from 1920 to 1970. The data are very comprehensive: for each strike, they report the name of the company involved, the union(s) involved, the geographical engineering district (e.g.

[3] There is an obvious counter argument (Vanderkamp, 1970). If product market demand is generally weak then employers may be wary of jeopardising their relationship with existing customers given a relative abundance of alternative supply sources.

[4] The Employers' Federation of Engineering Associations was established in 1896 and by 1899 had become known as the Engineering Employers' Federation. It later merged in 1918 with the National Employers' Federation and become known as the Engineering and Allied Employers' National Federation. In 1961 it changed its name back to the Engineering Employers' Federation (EEF). The EEF is the largest sector employers' organisation in the United Kingdom with a current membership of nearly 6000 companies throughout the country.

Coventry), the cause of the strike, the outcome or resolution, the strike duration in days[5] (with precise start and end dates), the numbers involved (by men, women and boys), the classes of workers involved (e.g. toolroom fitters, machinemen), and numbers of workers incidentally laid off as a result of the strike. The level of detail is consistent for each and every year over the half century covered. We have transcribed these data on to spreadsheets in a systematic fashion so that they are useful for statistical analysis. There are no censored durations because all reported strikes had ended at the end of the data.

By far the highest strike incidence in our data occurred during the 1960s (see Figure 2b and Table 3 below). We are able to undertake an especially detailed investigation of this important strikes period as monthly district-level unemployment rates are available for the period 1960-1970 for 54 engineering districts. (Districts are listed in Appendix Table 1). We match these exactly to the start month of the strike and to the EEF district in which each strike occurred.

Because we are using a new dataset, we now describe some of the characteristics of the included strikes and describe how these relate to information in the literature from other sources.

Determinants of Working Days Lost

The number of working days lost as a result of strikes depends on three factors – the number of strikes, the average strike duration, and the average number of workers per strike. Following Forchheimer (1948) and Knowles (1952), Figure 1 shows the annual decomposition of total days lost due to EEF strikes sub-divided into these three factors.

[5] For strikes lasting less than a day, durations are reported in hours.

Let DAYSLOST = total working days lost (per-period), STRIKES = number of strikes, MEANDUR = average strike duration, and MEANW = average number of workers involved in strikes; then ln(DAYSLOST) = ln(STRIKES) + ln(MEANDUR) + ln(MEANW). The latter expression is graphed in Figure 1. It is clear that all three components play an important role in determining the total number of working days lost. Note the large fall in the number of strikes in the mid 1920s to early 1930s. This is not special to our EEF data but is true in general for engineering and related metal industries, as illustrated in Appendix Table 2.

Numbers of Strikes

Figures 2a and 2b show the annual number of strikes taking place within the EEF from 1920 to 1970. They also show the number of strikes within British Industry as a whole. Clearly, EEF and national patterns match closely. Figure 2a covers the period from 1920 to the end of WW2. The two marked features are (a) the relatively low level of strike activity between 1922 and 1934 and (b) a growth in the number of strikes in the run up to and during WW2. For the first of these sub-periods, Knowles (1952, p.145-150) finds little evidence of national level relationships between the number of strikes on the one hand and the cost of living, weekly wage rates and union membership on the other. Low levels of strikes do tend to correspond more closely with high national unemployment rates, but even these associations are not altogether very persuasive.[6] In the second sub-period, there were large numbers of official and unofficial engineering

[6] For example, unemployment rates peaked in 1931 and 1932, at the height of the Great Depression, with about one-quarter of the workforce unemployment on average in EEF engineering districts (Hart and MacKay, 1975). But strike activity was at its lowest in 1927 when, at 10%, unemployment was well below its peak.

strikes resulting, in particular, from pressures of war demands on the industry. A very noticeable feature of Figure 2b, covering post-war strike numbers, is that strike activity increases considerably during the 1960s. This is in line with other sources that have demonstrated an upsurge in strikes at this time. Galambos and Evans (1977) show that, during the period 1965 – 1970, "the Vehicles, Aircraft, Metal Manufacture and Engineering groups, already isolated as 'strike prone', continue to deteriorate during this period". Between 1965 and 1970, these authors show that between 20 and 25 percent of all U.K. industrial disputes (excluding Mining) occurred in engineering and electrical goods.

Pay Versus Non-Pay Strikes

The data include reported reasons for striking and, in common with a number of papers in the literature, we have used these to classify strikes as pay-related or non-pay-related. Respective issues and frequencies are shown in Tables 1a and 1b, in terms of the whole period as well as pre-war and post-war years.[7] For all three periods in Table 1a, the predominant pay disputes involved wages, bonuses and piece rates.[8] Non-pay strikes occur for many different reasons, although disputes involving perceived wrongful dismissal and union-related grievances are clearly generally important.[9]

[7] The complete data set, published in the UK Data Archive (see Acknowledgements for full reference), contains more detail about the reason behind each strike.

[8] Knowles and Hill (1954) provide an excellent discussion of these payment methods within the context of the EEF payroll data.

[9] Galambos and Evans (1977) show that in Metals and Engineering Industries the two main reasons for non-pay stoppages from 1965 to 1969 were (a) disputes concerning the employment and discharge of workers (between 9 and 22 percent of all stoppages during this period), and (b) other working arrangements, rules and discipline (between 5 and 16 percent). The first of these matches 'wrongful dismissal', the most important cause of non-wage disputes in our data (see Table 1b). The second, almost certainly is included in 'treatment of workers', the third in importance.

Figure 4 plots the proportion of non-pay to total strikes from 1920 to 1970. To the extent that we can verify, this is quite strongly representative of the reported incidence of non-pay disputes in other sources. For the period 1965 – 1970, Galambos and Evans (1977) report proportions of non-pay strikes of (respectively) 49.7, 44.4, 51.3, 21.0, 37.1 and 27.6 for the Metals and Engineering industries. For the period 1945 – 1957, McCarthy (1977) shows that 54.8% of all U.K. strikes involved non-pay issues. For all British industry over the entire period 1946 to 1973, Durcan et al. (1983) show that non-pay strikes constituted about 51% of all strikes.

Strike Duration

Table 2 presents information on strike durations by pay and non-pay issues. It shows that durations are longer for strikes in which pay is a factor. Also, strikes tend to last longer in northern districts (North of England and Scotland) presumably reflecting greater militancy among workers and their unions in the older, more traditional engineering areas. Durations in general were considerably longer in the pre-war compared to the post-war era. Wartime strike durations were lowest, with much unofficial strike action.

Table 3 shows the mean, median and survival rates of strike durations (in days) for each year in the sample. Figure 5 plots the mean duration data. It is clear that there is wide variation in durations across years with durations being particularly long during the first halves of the 1920s and 1930s. These patterns in the data are consistent with other sources. Knowles (1952, pp. 152-157) examines British industrial strike durations (all industries) during the period 1911 to 1936. Over this period, 27.1% of striking workers were involved in strikes lasting for 10 weeks and over, while 23.3% of strikers took part

in strikes lasting for between 4 and 10 weeks. 1926 appears to have been a watershed year. Up to that year, 31.5% of strikes lasted for at least 10 weeks, a percentage that fell to 20.2% between 1927 and 1936. Knowles also shows that strikes involving 5000 workers or more were prevalent during the period 1911 - 1926 (85.5% of all working days lost) but far less so between 1927 and 1947 (55.7%). [10]

When mean strike durations are juxtaposed against national unemployment rates, as in Figure 5, the contrast between pre- and post-war eras is even more starkly illustrated. Pre-war unemployment is generally on a different scale from post-war experience, around the towering peak of the early 1930s Great Depression. At their lowest points – in the late 1920s and middle-to-late 1930s - average pre-war durations are comparable to post-war figures. But in the early-to-mid 1920s and at the height of the Depression, mean durations displayed extraordinary increases.

Number of Unions per Strike

In line with British unionism in general, engineering unions did not represent companies but, rather, trades and skills. Therefore, a given industrial dispute could involve more than one union. Table 4 shows the percentage of total strikes in the complete data set covered by one, two (and so on up to ten) unions. While two-thirds of strikes in the data involve a single union, clearly there are significant numbers with two or more unions participating.

[10] One well known long term engineering strike in which the EEF featured prominently was the apprenticeship strike of 1937. It involved 32,500 apprentices, lasted for 94 days and resulted in 406,000 working days lost (see Ryan, 2004).

4. Strike Incidence and Unemployment Rates

Strike Incidence

Given data limitations, we cannot undertake a detailed analysis of the relationship between strike incidence and the business cycle. Data are recorded as and when company strikes take place and therefore do not report on companies for which no strikes occur. However, since we know the total numbers of EEF companies each year from a secondary source (Wigham 1973, Appendix J), we can construct a simple annual average index of strike incidence:

$$cratio_t = \ln\left(\frac{CSTRIKE_t}{C_t}\right) \qquad (1)$$

where $CSTRIKE_t$ is the total number of EEF companies that experienced a strike in year t and C_t is the total number of EEF companies in year t.

Figure 3 shows the (unlogged) graph of this index. The incidence of strikes is quite low in the pre-war period (usually less than 2% per year) but rises and exceeds 10% in the late 1960s. Unsurprisingly, the patterns in Figure 3 are broadly similar to those of the strikes frequencies shown in Figure 2.

We regress this index on the national annual unemployment rate, U_t, and a quadratic time trend for the periods 1920 to 1970, 1920 to 1938 and 1946 to 1970. Thus, we have

$$cratio_t = \alpha_0 + \alpha_1 U_t + \alpha_2 t + \alpha_3 t^2 + \varepsilon_t \qquad (2)$$

where $cratio_t$ is defined in expression (1) and ε_t is an error term. As in all subsequent regressions, we split strikes by whether they were primarily about pay or non-pay issues (see Tables 1a and 1b for details of the distinctions).

The estimates are presented in Table 5. Consistent with most of the prior literature, the evidence suggests that strike incidence is procyclical. Like that literature, the results are by no means overwhelmingly supportive.[11] Standard errors are relatively large and in only one instance – pay disputes over the entire period – do we obtain statistical significance.

5. Strike Duration and Unemployment Rates

In contrast to strike incidence, we can make use of our company-level data to study relationships between strike duration and the cycle. We use both national and district-level unemployment rates.

The first specification is a log-linear model of strike duration which we estimate over the entire period (1920 – 1970) as well as the pre-war (1920 – 1938) and post-war (1946 – 1970) periods using the national rate of unemployment as our measure of the cycle.

$$\log(duration_{it}) = \beta_0 + \beta_1 U_t + \beta_2 (Unions_{it}) + \beta_3 t + \beta_4 t^2 + \varepsilon_{it} \qquad (3)$$

Here, the log duration of strike *i* in year *t* is expressed as a function of the national unemployment rate in year *t* (U_t), the number of unions involved in the strike ($Unions_{it}$) [12]

[11] Harrison and Stewart (1994) provide one of the best known studies. Using Canadian data on strikes and contracts they find evidence of procyclical strike incidence, particularly in manufacturing industry, but only with respect to nonwage issues.

[12] There is a potential endogeneity issue with the *Unions* variable. As a given strike progresses through time, more workers may become affected which in turn may require more unions to become involved. Unfortunately, our strike union data does not allow us to observe such sequences. On the basis of simple regressions in which the mean annual average number of unions per strike was regressed on the unemployment rate and a quadratic time trend, there is no evidence of cyclicality. In any event, all

and a quadratic in time (measured in years). The quadratic is included to take account of secular trends that impact strike duration. Because the national unemployment rate does not vary across strikes that occur in the same year, there is a clustering problem that will cause OLS variance estimates to understate the true uncertainty about the estimate (Moulton 1986). To counter this problem, we report robust standard errors that allow for observations within any year to be correlated.[13]

At a far more disaggregate level, the second regression model makes use of 11 years of monthly unemployment rates (1960 – 1970) for 54 districts (see Appendix Table 1 for a list of districts).[14] For strike i in district d at time t, it takes the form

$$\log(duration_{idt}) = \beta_0 + \beta_1 U_{dt} + \beta_2 (Unions_{idt}) + \beta_3 Year\ Dummies + \beta_4 District\ Dummies + \beta_5 Month\ Dummies + \varepsilon_{idt}. \quad (4)$$

Here U_{dt} is the district level unemployment rate at time t (where t is defined in months).[15]

There are four potential advantages of the specification in (4) compared to its more aggregate equivalent in (3). First, district-level analysis captures the likelihood that,

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subsequent regressions were estimated with and without number of unions per strike as a control variable and the estimates of strike duration cyclicality were not impacted by its inclusion or exclusion.

[13] We also tried an alternative 2-step estimation procedure, often used in the wage cyclicality literature, to overcome the clustering problem (Solon, Barsky and Parker 1994; Devereux 2001). In the present example, the first step involves regressing strike duration on number of unions involved in the strike and a set of time dummies. In the second step, the estimated time dummies are regressed on the national unemployment rate and the quadratic time trend. The second stage regressions are weighted by the numbers of strikes occurring each year. In the event, the two methods produced very similar results.

[14] Unfortunately, we do not have equivalent data for the pre-1960 period. However, the 1960s are an especially interesting period to study. From Figures 2a and 2b it is clear that the 1960s marked a period of exceptional strike incidence both within the group of EEF companies and British industry as a whole. In fact, it marked the start of an era of union militancy.

[15] We cluster the standard errors at the year/month/district level in these regressions. As before, we have verified that the analogous 2-step approach gives very similar results for coefficients and standard errors.

in many instances, it is local labour market conditions that matter most to unions and workers. Second, introducing cross-sectional variation allows us to include both year fixed effects and district fixed effects, while still identifying the effects of the unemployment rate. Thus, we can be sure that some unknown year-specific factor that impacts strike durations is not confounding our estimates. Third, from Table 2 we note that the average strike in the post-war period lasted for about 6 days. In many instances, the decision over the best time to stay out may well have been quite finely tuned to the perceived state of the cycle within a relatively short interval of time. This may not be captured by a rate of unemployment averaged over a complete year. Fourth, embracing seasonality may well be an important consideration. In their analysis of the seasonal patterns of UK strikes between 1946 and 1973, Durcan et al. (1983) show that spring and autumn are the two periods in the year when major stoppages are likely to begin.

There is a particular value of employing district rates in the post-war period because, as shown in Figure 5, during that period the national rate of unemployment goes no higher than 2% and so is suggestive of a period of very gentle business cycles.[16] However, there is a great deal of district variation around this aggregate trend. Using our 1960-1970 monthly unemployment data for 54 districts we regressed the district unemployment rate on district, monthly and annual dummies and plotted the residuals. Four representative examples – from Scotland, Northern Ireland, the North of England (N.E. Coast) and the Midlands (Coventry) - are shown in Figure 6. Recall from Figure 2b that strike activity was especially prevalent at this time as was trade union militancy. One of the centres of militancy was in the Midlands, dominated by the automotive

[16] This is not an issue for the pre-war estimates as there are enormous cyclical variations during that period.

industry. In Figure 6, Coventry represents this region and it is quite clear that this city experienced several marked unemployment cycles over these 11 years. The other districts shown – which were not the most volatile of the remaining districts – also display systematic movements with high points in late 1962/early 1963 and towards the end of the period as well as a fairly pronounced trough in 1966.

We can classify strikes by both company and by union involvement. Therefore, in regression equations (3) and (4) above, we can add company and union fixed effects in the estimating equations. As we saw in Table 5, strike incidence appears to be procyclical, suggesting that, to some limited degree, unions and companies may have been more willing to engage in brinkmanship when labour market conditions are good. However, it has the further implication that the types of companies and unions that are engaged in strikes may differ systematically over the business cycle. This is the rationale for inclusion of company and union fixed effects in estimation. With company effects, we are essentially comparing strike durations across strikes that occur in the same company but at different points in the business cycle. With union effects, we are controlling for the aggressiveness of the union.

There are 1909 different companies in our data set of which 49% experienced only 1 strike within the full data coverage. Of the remainder, 16% percent featured twice, 8% 3-times, 6% 4-times, 4% 5-times, 3% 6-times, 2% 7-times, and about 1% featured 8-times or more. At the extreme right of the distribution there are 12 examples of companies featuring 100 times or more. On the union side, our data include 94 different single unions involved in strikes while additional strike actions featured 2 or more unions. Where more than one union was involved, the data identify the leading union.

Therefore, we decided to code unions from 1 to 94 for single union involvement and then 95 to 147 where one of these single unions is identified as leading one or more additional unions in a given strike. Appendix Table 3 shows the strike frequency distribution pertaining to these 147 distinct union cells. In 29% of cases there was only one strike incident, while 16% involved 2 incidents, 4% 3 incidents and so on.

The estimates from regression model (3) – that incorporates annual national unemployment rates – are shown in Table 6.[17] Results for the whole period and for the pre-war period reveal only one instance of significant countercyclicality in strike durations. This is obtained in relation to pay-related disputes and after controlling for union fixed effects. Somewhat more comprehensively, pay-related disputes also exhibit countercyclical durations in the post-war era. While the standard errors are large, there is an indication that non-pay disputes are also countercyclical during the later period.[18]

For the period 1960 to 1970, we repeated the durations regressions using the extended specification shown in equation (4). These estimates for the district unemployment rate are in Table 7. We present results with year fixed effects in addition to estimates with a quadratic in year and we obtain strong evidence that non-pay strike durations are countercyclical. Recall that about 50% of strikes at this time involved non-

[17] We do not report coefficient values for the Unions variable in the table as this variable is likely endogenously determined and so subject to bias. However, the coefficient on it is generally negative, indicating that strike durations are shorter when more unions are involved. This supports the notion that a single union leading a dispute can more efficiently muster the solidarity and cohesion required to 'stay the course' in order to meet its members' objectives. However, given the number of unions involved may be correlated with many other factors, caution is warranted in interpretation.

[18] One concern is that our results may be model-dependent and there are many more sophisticated duration models that we could have used. The loglinear model we have used is exactly equivalent to an accelerated failure time hazard model in which the error is assumed to be normally distributed. We have experimented with many other hazard specifications including weibull, exponential, log-normal, log-logistic, gamma, and gompertz and found similar estimates. The derivatives were generally similar to the estimates we report in the tables.

pay issues (see Figure 4). Generally, we obtain similar results with respect to OLS and union fixed effects regressions. Interestingly, the addition of company and union fixed effects eliminates any evidence that pay-related strike durations are countercyclical. This suggests that there were changes in the composition of unions and firms involved in pay strikes over the business cycle and that the inability of previous studies to include union and company fixed effects may have led to bias.

6. Union Strike Success and Unemployment Rates

In order to improve the probability of gaining from a strike, is it better for the union to strike towards the peak of a cycle (when company profit and demand pressures are relatively high) while resisting action during troughs (when strikers and their families face less favourable alternative labour market options)? The EEF data record the outcomes of strikes, although in somewhat less detail than the causes. The outcomes were allocated under the various headings shown in Appendix Table 4. Some of these allocations are, of necessity, somewhat tentative. In other words, it was difficult in some instances to decide whether or not a given strike was unequivocally successful or unsuccessful. For the categories labelled 'successful', however, it was reasonably clear that most strikes achieved a partial gain or a completely successful resolution for the union.

Let OS_{it} be the outcome of strike i at time t such that OS_{it} =1 if a strike is 'successful' (all the OS_i's listed in Table 8) and OS_{it} = 0 otherwise. We then specify a linear probability regression model

$$OS_{it} = \gamma_0 + \gamma_1 U_t + \gamma_2 (Unions) + \gamma_3 t + \gamma_4 t^2 + \varepsilon_{it} \quad (5)$$

that we estimate by OLS in the same way as in the duration regressions. As can be seen in Table 8, our evidence points to procyclical successful outcomes, both in the pre-war and the post-war period. The pre-war finding of procyclicality is robust to company and union fixed effects in the case of pay strikes but not for non-pay strikes. In the post-war period, the procyclical finding is statistically significant for non-pay strikes when union and company fixed effects are included. The magnitude of the effect for pay strikes is similar but the standard error is higher so it is not statistically significant. The magnitudes are quite big – in the pre-war period a one unit increase in the unemployment rate reduces the probability that a pay strike has a successful outcome by .03 (from a baseline of 0.40). The equivalent effect of a one point increase in unemployment in the post-war period is about .06 for both types of strikes (from a baseline of 0.75).[19]

7. Conclusions

In this paper, we have compiled a unique historical dataset that records strike activity in the British engineering industry from 1920 to 1970. A strength of these data is that they include a homogenous set of companies and workers, covering a long period with varying labour market conditions. We show that the incidence and causes of strikes in engineering over these years follow patterns that are quite reflective of strike behaviour in British industry as a whole. However, unlike earlier broadly based cross-industry studies, the engineering data allow us to study the cyclicality of strike durations and outcomes after controlling for company, union, time (month and year), and local labour market effects.

[19] We have also carried out this estimation using the 1960-1970 district level unemployment rates sample. We found negative estimates that were never statistically significant.

We use unemployment rates as our measure of the cycle primarily because they allow two levels of aggregation in the regression analyses – i.e. annual national and monthly district. The great advantage of the latter is that the district unemployment rate data are matched to coincide with the location and timing of the EEF company strikes. We are forced to examine strike incidence at a quite aggregate level and find, in line with other studies, fairly weak support for procyclicality. Like the previous literature, we find evidence for countercyclical strike durations, both for pay and non-pay related strikes. However, in the post-war period, the magnitude of this effect is much reduced for pay strikes when union and firm fixed effects are included. These findings suggest that it is important when studying strike durations to take account of differences in the composition of companies and unions that are involved in strikes at different points of the business cycle.

We also find that strike outcomes tend to be more favourable to unions when the national unemployment rate is lower. The evidence for this is particularly strong for pay-strikes in the pre-war period. This is perhaps unsurprising given the extremely adverse economic conditions during the Great Depression years. The evidence on strike success rates and the business cycle is weaker post-war but does indicate greater union success when the national unemployment rate is lower.

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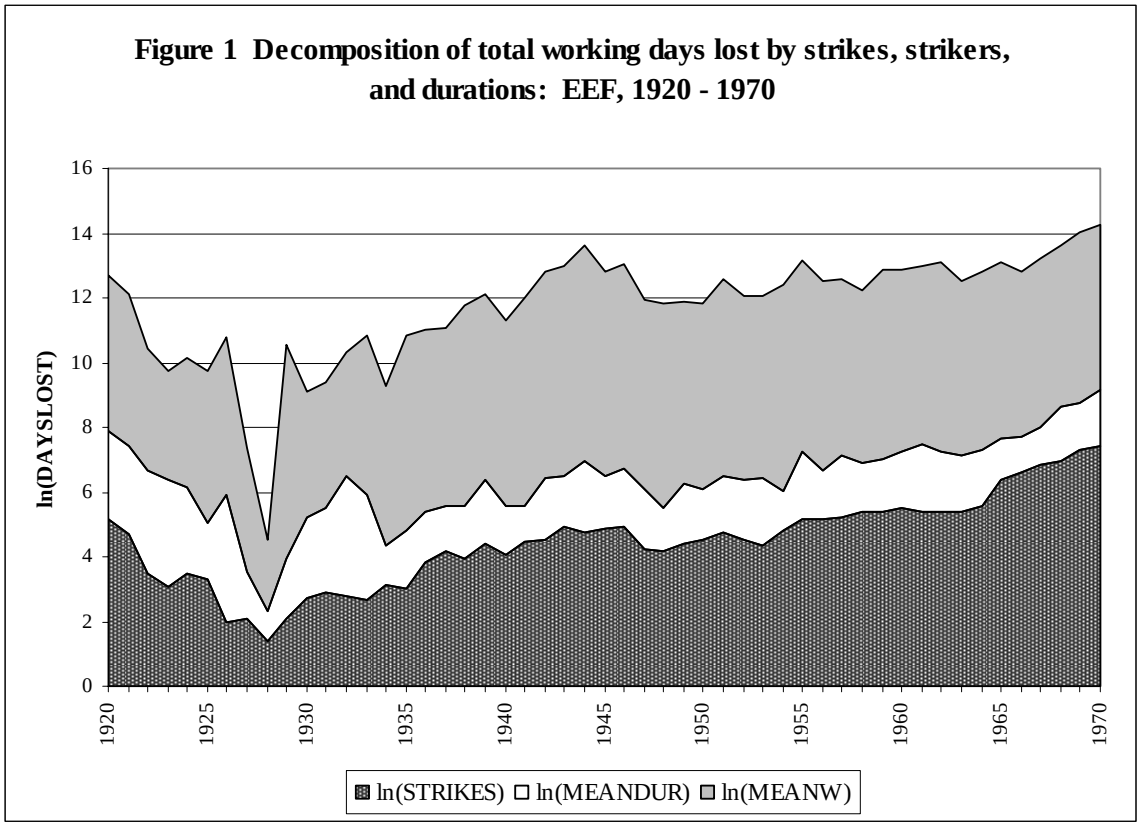
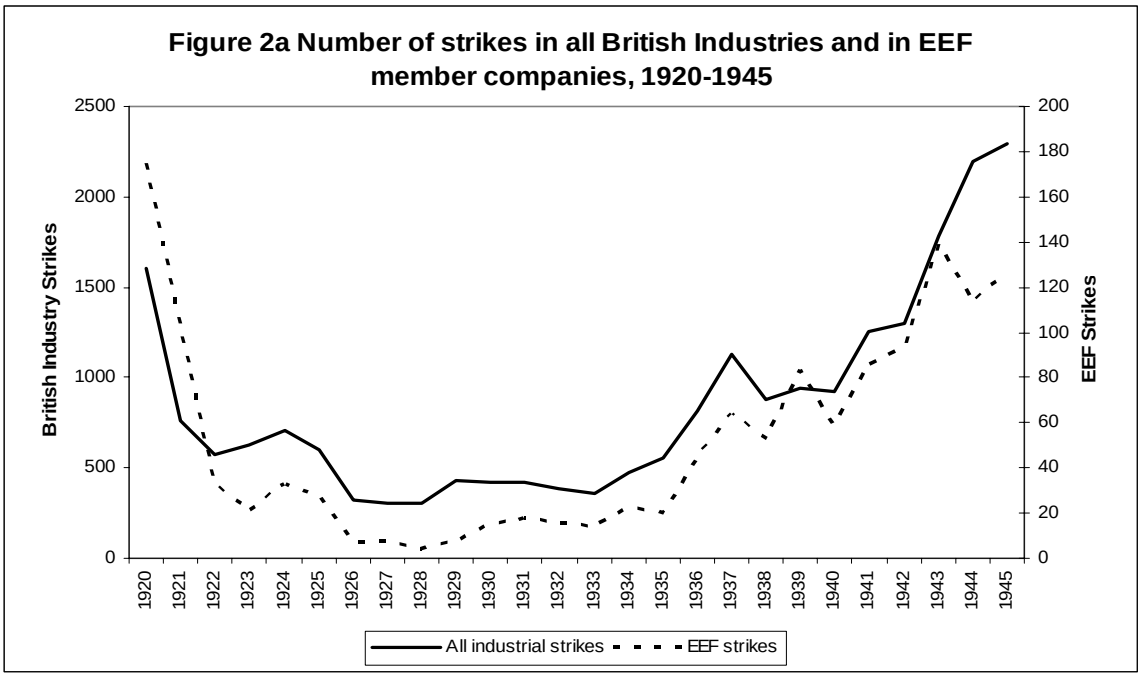
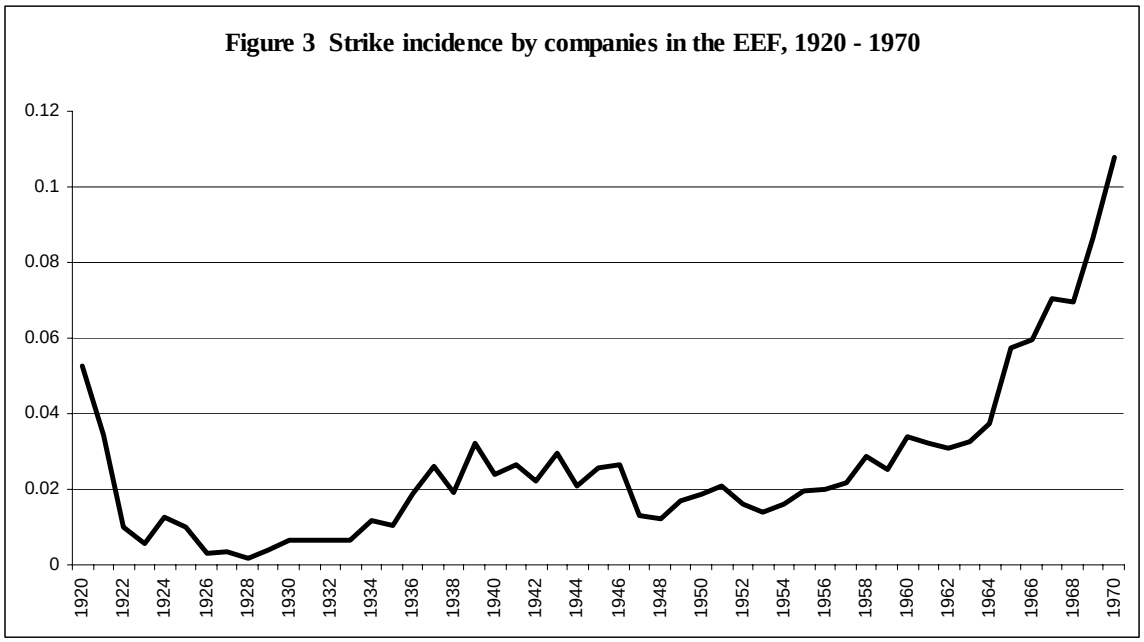


Figure 1 shows the annual decomposition of total days lost due to EEF strikes sub-divided into three factors. Let DAYSLOST = total working days lost (per-period), STRIKES = number of strikes, MEANDUR = average strike duration, and MEANW = average number of workers involved in strikes; then ln(DAYSLOST) = ln(STRIKES) + ln(MEANDUR) + ln(MEANW). The latter expression is graphed in Figure 1.
Source: Authors' calculations

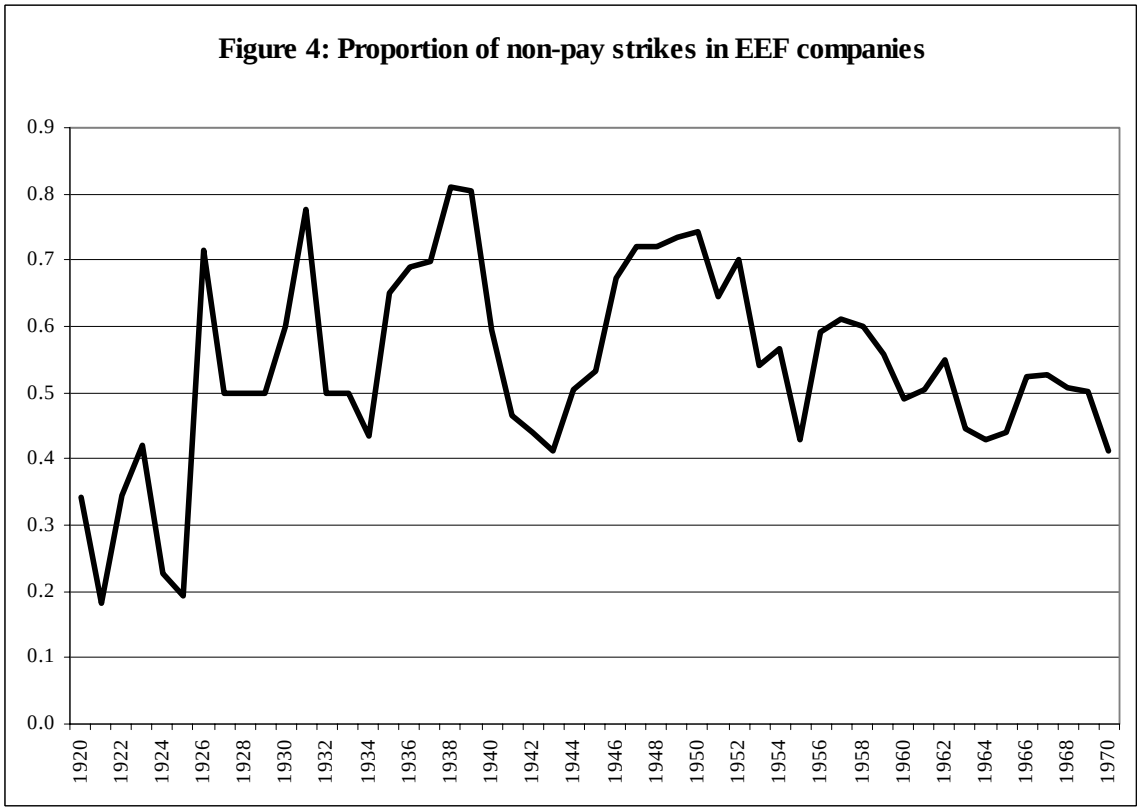


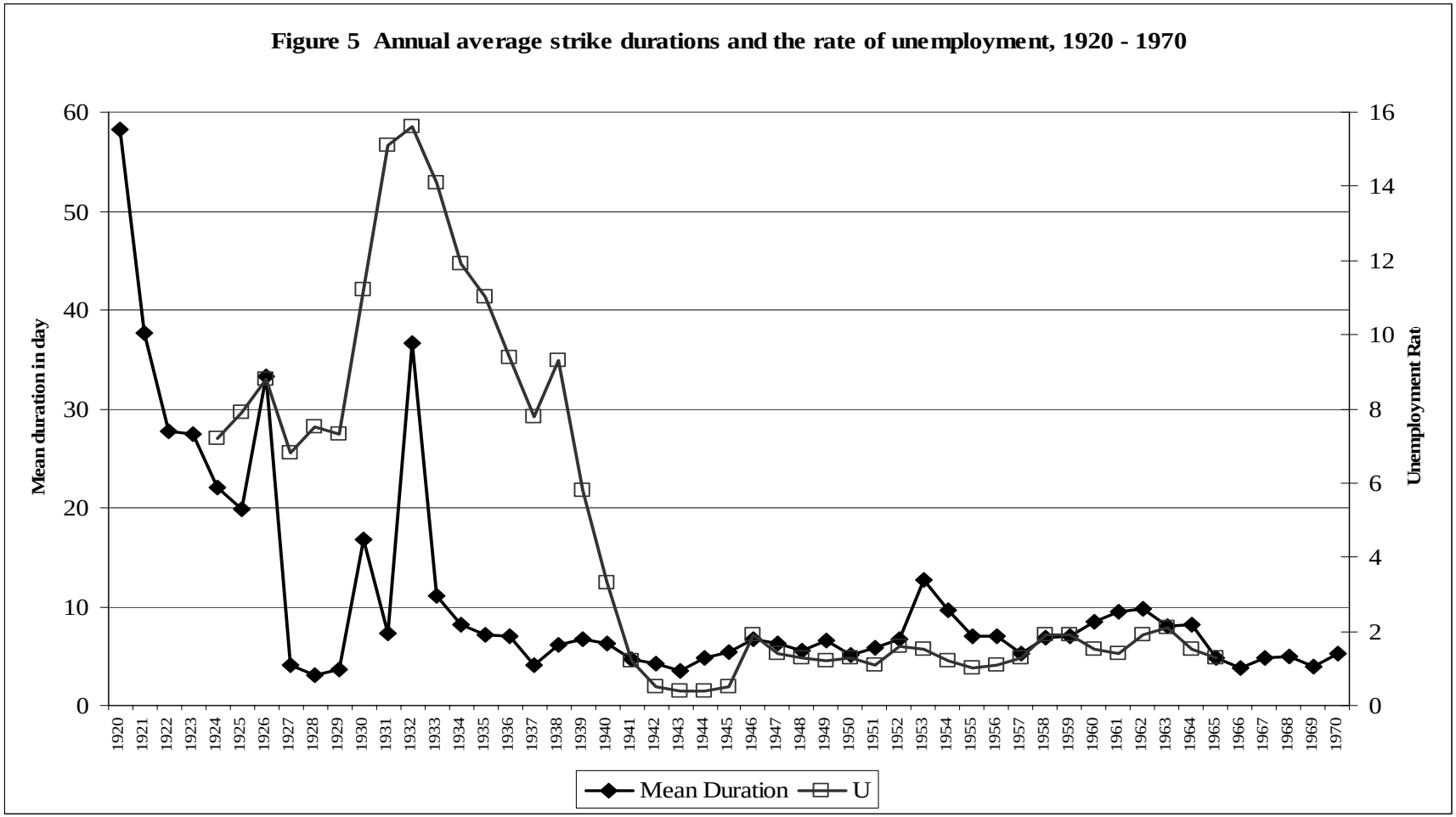
Source: Data for all-industries graph taken from Knowles (1952, Statistical Appendix Table 1, p.310). (For 1926, all industries data exclude the General Strike. It lasted from 3-12 May and, while initiated through an employers' lock out of coal miners, involved a wide cross-section of industry including building, printing, dock, iron, steel, metal, heavy chemical, transport and railway workers.)

Source: Data for all-industries graph from Durcan et al. (1983, Table 6.1, p.174)



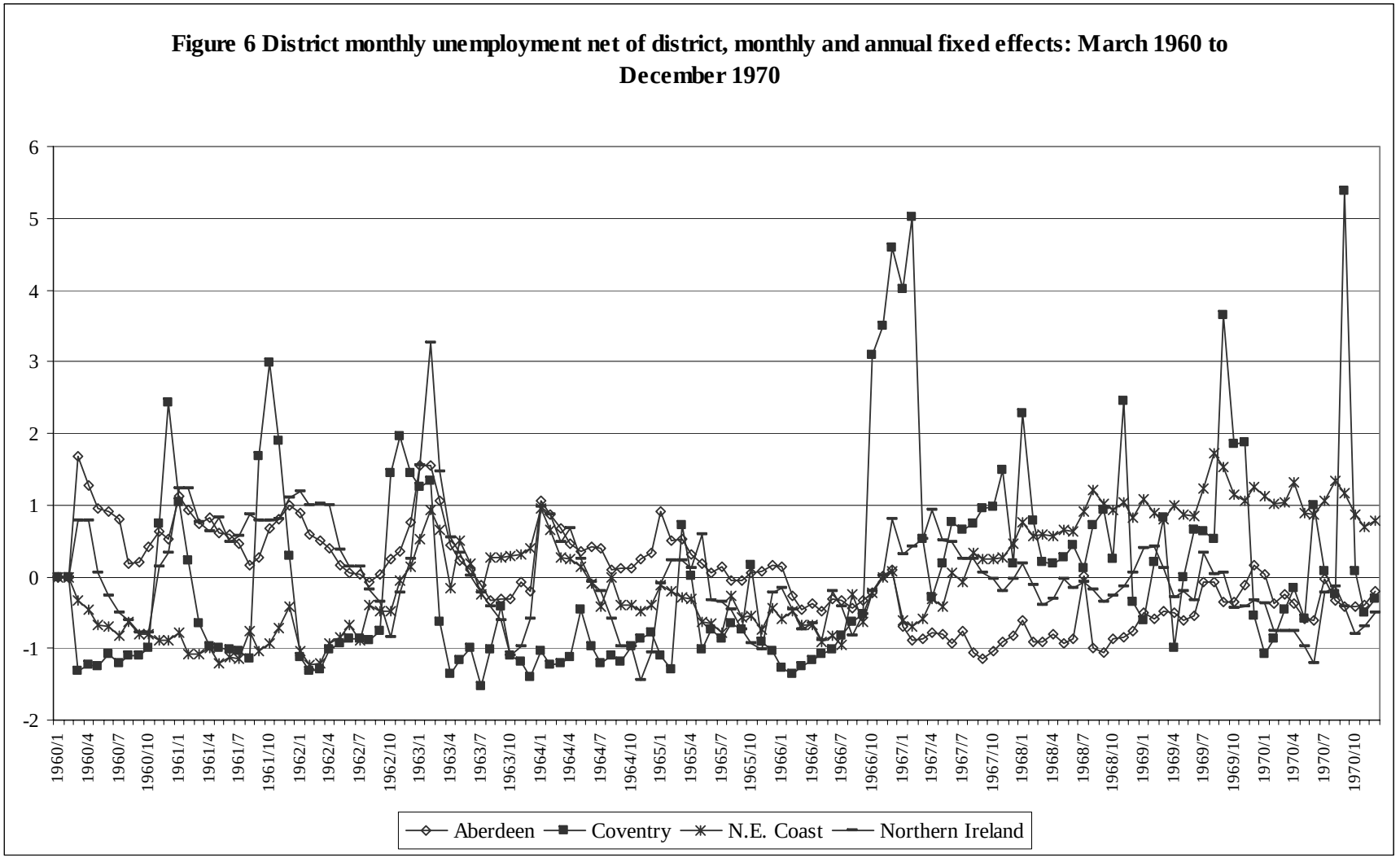
Strike incidence is calculated as the total number of EEF companies that experienced a strike in year *t* divided by the total number of EEF companies in year *t*.





Source of Unemployment Rates: Denham and McDonald (1996)

Figure 6 District monthly unemployment net of district, monthly and annual fixed effects: March 1960 to December 1970



This figure is constructed by regressing the district unemployment rate on district, monthly and annual dummies and plotting the residuals.

Table 1a Causes of Pay-Related Strikes, 1920 – 1970

PAY ISSUES	**1920-1970** Percentage	**1920-1938** Percentage	**1946-1970** Percentage
Wages	49.82	61.94	49.97
Bonuses	17.09	7.96	17.62
Piece Rates	14.14	12.19	14.01
Systems of pay (e.g. rate fixing, abolition of piecework system)	6.78	5.72	5.79
Payment for Time Lost (mainly waiting time payments due to downtime)	5.07	1.49	5.61
Relative Pay (mainly disputes over pay differentials among skill groups	3.32	4.48	3.26
Holiday Pay	1.97	-	2.27
Shift/Night Rates	0.11	0.5	0.06
Overtime	0.09		0.09
Misc. Pay-related	1.6	5.72	1.32

Table 1b Causes of Non-Pay Strikes, 1920 – 1970

NON-PAY ISSUES	**1920-1970** Percentage	**1920-1938** Percentage	**1946-1970** Percentage
Wrongful dismissal	14.13	14.1	13.79
Union-related issues (e.g. employment of non-union workers, inter-union disputes)	10.46	20.51	9.46
Treatment of worker(s)	9.63	2.24	9.75
Work Environment (e.g. work conditions too cold or too hot)	8.27	0.96	8.89
Work flexibility (e.g. switching labour to alternative tasks, cover for absenteeism, work reorganisation)	7.41	0.64	8.29
Job demarcation	7.06	21.79	6.17
Working hours	5.87	3.85	6.19
Redundancy	5.61	1.28	6.01
Timing of job tasks (e.g. timing of piecework; objections to work time investigations)	4.95	6.41	4.92
Sympathy with others (largely sympathy with workers directly involved in strikes/disputes)	4.75	9.62	4.48
Supervision (e.g. objection to attitude of foreman)	4.38	3.21	4.16
Delay in/ refusal of management to open negotiations	3.56	-	4
Production constraints (e.g. shortage of work, partial plant shutdown, manning problems)	3.47	2.56	3.56
Attendance at union meeting (e.g. attendance at an unofficial meeting during working hours)	2.46	-	2.8
Use of outside labour	0.81	2.24	0.75
Apprentices (e.g. ratios of apprentices to skilled journeymen)	0.42	4.17	0.15
Miscellaneous	6.73	6.41	6.61

Table 2: Mean and median strike durations (days) by period and north/south

		Issue			
		Wages Only	All Pay	Non-Pay	All Issues
Pre-war	Mean	60.03	43.51	9.33	28.41
	Median	23	13	4	6
	No. of strikes	237	383	303	686
War	Mean	6.36	5.02	4.86	4.94
	Median	2.5	2.5	2	2
	No. of strikes	110	333	360	693
Post-war	Mean	8.23	6.71	4.49	5.58
	Median	3	2	1.5	2
	No. of strikes	2311	4626	4776	9402

		Issue			
		Wage Only	Wages Plus	Nonwage	All Issues
North	Mean	20.83	15.12	7.63	11.58
	Median	5	4	3	3.5
	No. of strikes	1,095	2,080	1,869	3,949
South	Mean	7.13	5.50	3.30	4.35
	Median	2	2	1	1
	No. of strikes	1,563	3,262	3,570	6,832

Table 3: Description of Strike Activity (1920 – 1970)

	No. of strikes	Mean Duration	Median Duration	Survival rates				
				Day5	Day25	Day50	Day75	Day100
1920	175	58.3	10	0.7	0.33	0.27	0.26	0.23
1921	103	37.61	11	0.68	0.41	0.34	0.21	0.12
1922	33	27.7	20	0.79	0.42	0.21	0.12	0
1923	21	27.48	19	0.71	0.33	0.24	0.05	0.05
1924	33	22.09	8	0.64	0.27	0.09	0.09	0
1925	27	19.81	16	0.78	0.48	0.07	0	0
1926	7	33.29	2	0.29	0.29	0.29	0.14	0.14
1927	8	4.13	4	0.25	0	0	0	0
1928	4	3	2.5	0.25	0	0	0	0
1929	8	3.69	2.5	0.25	0	0	0	0
1930	15	16.73	6	0.6	0.13	0.07	0.07	0.07
1931	18	7.28	3	0.33	0.11	0	0	0
1932	16	36.69	29	0.81	0.56	0.38	0.19	0
1933	14	11.03	6.25	0.64	0.07	0.07	0	0
1934	23	8.18	3	0.35	0.09	0.04	0	0
1935	20	7.18	4	0.45	0.05	0	0	0
1936	45	6.96	3	0.36	0.09	0	0	0
1937	64	4.07	3	0.28	0.02	0	0	0
1938	53	6.14	2	0.3	0.04	0.02	0	0
1939	83	6.78	3	0.39	0.06	0.01	0	0
1940	59	6.33	3	0.34	0.05	0	0	0
1941	86	4.74	2	0.27	0.02	0.01	0.01	0
1942	94	4.18	2	0.23	0.02	0	0	0
1943	139	3.48	2	0.19	0.02	0	0	0
1944	113	4.77	2	0.28	0.03	0	0	0
1945	127	5.46	3	0.39	0.02	0	0	0
1946	135	6.73	3	0.36	0.07	0.01	0	0
1947	67	6.24	2	0.37	0.04	0	0	0
1948	66	5.52	2.25	0.32	0.02	0	0	0
1949	80	6.64	3.5	0.39	0.05	0	0	0
1950	93	5.08	2	0.27	0.04	0	0	0
1951	115	5.91	2	0.36	0.07	0	0	0
1952	94	6.65	2	0.3	0.11	0	0	0
1953	77	12.76	2.5	0.39	0.13	0.05	0.05	0.04
1954	120	9.4	1.5	0.33	0.14	0.05	0.01	0
1955	172	4.7	1	0.26	0.03	0	0	0
1956	179	6.94	1.5	0.25	0.07	0.02	0.02	0

1957	189	5.31	1	0.22	0.04	0.02	0.01	0.01
1958	225	6.85	2	0.3	0.06	0.02	0.01	0.01
1959	219	7.04	2.5	0.33	0.07	0.03	0	0
1960	240	8.31	4	0.45	0.11	0.01	0.01	0
1961	222	9.55	5	0.55	0.09	0.02	0.01	0
1962	225	9.83	4	0.49	0.1	0.03	0.01	0
1963	220	8.06	3.25	0.41	0.1	0.02	0.01	0
1964	251	8.26	4	0.44	0.09	0.03	0	0
1965	585	4.82	2	0.26	0.04	0.01	0	0
1966	744	3.83	1.5	0.18	0.02	0.01	0.01	0
1967	942	4.86	1.5	0.21	0.04	0.01	0.01	0
1968	1054	5.01	1.5	0.26	0.03	0.01	0	0
1969	1452	4.01	1	0.2	0.03	0.01	0	0
1970	1678	5.26	1.5	0.26	0.05	0.01	0	0

Table 4 Number of unions participating in strikes, 1920 – 1970

Number of Unions per Strike	Total Number	Percentage of Total
1	7102	66.9
2	1823	17.2
3	1169	11.0
4	288	2.7
5	119	1.1
6	51	0.5
7 or more	56	0.5
Mean number of unions per strike = 1.58		

Table 5: Strike incidence and the business cycle: annual national unemployment rates, 1920 – 1970						
	1920 – 1970		1920 – 1938		1946 – 1970	
	P	N-P	P	N-P	P	N-P
Companies (see equation (1))	-0.051* (0.023)	-0.024 (0.019)	-0.028 (0.019)	-0.017 (0.025)	-0.094 (0.126)	-0.047 (0.105)

Note: * indicates significant at 5% on two-tail-test. Standard errors in parentheses.

Table 6 Strike durations and the business cycle, 1920 – 1970 (Annual national unemployment rates)

Estimation Method	**All years (1920 – 1970)**		**Pre-war (1920 – 1938)**		**Post-war (1946 – 1970)**	
	(1)	(2)	(3)	(4)	(5)	(6)
	P	**N-P**	**P**	**N-P**	**P**	**N-P**
Ordinary Least Squares	-0.016 (0.019)	-0.0001 (0.022)	-0.034 (0.021)	0.051 (0.028)	0.329* (0.159)	0.197 (0.160)
Union Fixed Effects	0.043** (0.016)	0.014 (0.018)	0.087** (0.014)	0.029 (0.028)	0.287 (0.165)	0.191 (0.140)
Company Fixed Effects	-0.034 (0.019)	-0.008 (0.012)	-0.057 (0.038)	-0.013 (0.037)	0.299* (0.125)	0.182 (0.123)
Union and Company Fixed Effects	0.035 (0.023)	-0.0006 (0.014)	0.087 (0.049)	-0.078 (0.041)	0.234** (0.088)	0.067 (0.136)
Sample sizes (number of clusters)	5274 (51)	5334 (51)	360 (19)	296 (19)	4583 (25)	4678 (25)
Union groups (company groups)	119 (1297)	107 (1241)	56 (274)	55 (182)	83 (1023)	77 (1053)
Mean duration (days)	9.2	4.8	46.3	9.5	6.6	4.5

Notes: Annual unemployment rates taken from Denham and McDonald (1996).All regressions include a quadratic time trend. Robust standard errors allow for clustering by year. ** (*) denotes two-tail significance at 0.01 (0.05) level.

Table 7 Strike durations and the business cycle, 1960-1970
(Monthly district unemployment rates)

Unemployment coefficients [Dependent Variable: log duration]		
	P	**N-P**
ORDINARY LEAST SQUARES		
(a) (year dummies)	0.046 (0.048)	0.065* (0.032)
(b) (quadratic time trend)	0.089* (0.045)	0.089** (0.027)
UNION FIXED EFFECTS		
(a) (year dummies)	0.044 (0.047)	0.068* (0.030)
(b) (quadratic time trend)	0.082* (0.040)	0.090** (0.026)
COMPANY FIXED EFFECTS		
(a) (year dummies)	0.033 (0.048)	0.047 (0.027)
(b) (quadratic time trend)	0.047 (0.039)	0.055* (0.023)
UNION and COMPANY FIXED EFFECTS		
(a) (year dummies)	0.014 (0.054)	0.073** (0.027)
(b) (quadratic time trend)	0.020 (0.042)	0.063** (0.024)
Sample sizes (number of clusters)	3673 (987)	3461 (942)
Union groups (company groups)	69 (864)	61 (763)
Mean duration (days)	6.6	4

Notes: The data cover 11 years by 12 months by 54 districts. All regressions include district and month dummies. Robust standard errors allow for clustering at the year/month/district level. ** (*) denotes two-tail significance at 0.01 (0.05) level.

Table 8 Successful strike outcomes (from the union standpoint) and the business cycle: pre- and post-war periods (National annual unemployment rates)

Estimation Method	Pre-war (1920 – 1938)		Post-war (1946 – 1970)	
	(1)	(2)	(3)	(4)
	P	**N-P**	**P**	**N-P**
Ordinary Least Squares	-0.032** (0.004)	-0.020* (0.009)	-0.019 (0.049)	-0.080 (0.050)
Union Fixed Effects	-0.026** (0.007)	-0.006 (0.007)	-0.035 (0.051)	-0.067 (0.044)
Company Fixed Effects	-0.042** (0.009)	-0.008 (0.006)	-0.029 (0.041)	-0.051* (0.026)
Union & Company Fixed Effects	-0.028* (0.013)	0.011 (0.012)	-0.061 (0.037)	-0.062* (0.029)
Sample sizes (number of clusters)	360 (19)	296 (19)	4583 (25)	4678 (25)
Union groups (company groups)	56 (274)	55 (182)	83 (1023)	77 (1053)
Mean duration (days)	46.3	9.5	6.6	4.5

Notes: Annual unemployment rates taken from Denham and McDonald (1996).All regressions include a quadratic time trend. Robust standard errors allow for clustering by year. ** (*) denotes two-tail significance at 0.01 (0.05) level.
Appendix Table 4 gives the breakdown between successful strike outcomes and unsuccessful ones.

Appendix Table 1: Local Unemployment Districts used in 1960-1970 regressions

1	Aberdeen	28	Leicester
2	Barrow	29	Lincoln
3	Bedfordshire	30	Liverpool
4	Belfast Marine	31	London
5	Birkenhead	32	Manchester
6	Birmingham	33	Mid Anglian
7	Blackburn	34	North East Coast
8	Bolton	35	Northern Ireland
9	Border Counties	36	North Staffordshire
10	Bradford	37	North West Scotland
11	Burnley	38	Northern Counties
12	Burton	39	Nottinghm
13	Chester	40	Oldham
14	Coventry	41	Outer London
15	Derby	42	Peterborough
16	Dundee	43	Preston
17	East Anglia	44	Rochdale
18	East Midlands	45	South Wales
19	East Scotland	46	Scottish
20	Grimsby	47	Sheffield
21	Halifax	48	Shropshire
22	Huddersfield	49	South Eastern
23	Hull	50	St Helens
24	Keighley	51	West of England
25	Kilmarnock	52	Wakefield
26	Lancashire	53	West Midlands
27	Leeds	54	Wigan

Source: Ministry of Labour Gazette (various issues), 'Numbers Unemployed in Principal Towns and Development Areas', London (HMSO).

Appendix Table 2 Stoppages of work in the Metal, Engineering and Shipbuilding Industries, 1914-1945

Year	Number of strikes*	Number of workers directly and indirectly involved* (000)	Number of working days lost** (000)
1914	232	51	1308
1915	189	46	357
1916	105	75	305
1917	225	429	3063
1918	420	242	1499
1919	335	403	12284
1920	340	183	3414
1921	151	63	4420
1922	115	369	17484
1923	103	61	5997
1924	136	71	1400
1925	94	24	184
1926	62	14	221
1927	69	16	81
1928	51	8	60
1929	80	39	768
1930	70	10	92
1931	61	12	99
1932	46	4	48
1933	68	15	112
1934	81	15	160
1935	73	17	93
1936	148	47	206
1937	220	107	778
1938	138	44	243
1939	181	56	332
1940	229	40	163
1941	472	154	556
1942	476	141	526
1943	612	170	635
1944	610	194	1048
1945	591	123	528

Source: Knowles (1952, p. 308).

* Relates to strikes beginning in year

** Relates to strikes in progress during year

Appendix Table 3 Strike frequency by union

No. of Strikes	Freq.	Percent	Cum.%	No. of Strikes	Freq.	Percent	Cum.%
1	43	29.25	29.25	40	1	0.68	81.63
2	23	15.65	44.90	42	1	0.68	82.31
3	6	4.08	48.98	51	1	0.68	82.99
4	4	2.72	51.70	56	1	0.68	83.67
5	5	3.40	55.10	59	1	0.68	84.35
6	3	2.04	57.14	71	1	0.68	85.03
7	1	0.68	57.82	80	1	0.68	85.71
8	2	1.36	59.18	84	2	1.36	87.07
9	3	2.04	61.22	85	1	0.68	87.76
10	3	2.04	63.27	96	1	0.68	88.44
11	5	3.40	66.67	97	1	0.68	89.12
12	1	0.68	67.35	104	2	1.36	90.48
13	2	1.36	68.71	132	1	0.68	91.16
14	2	1.36	70.07	209	1	0.68	91.84
16	1	0.68	70.75	213	1	0.68	92.52
17	2	1.36	72.11	235	1	0.68	93.20
19	1	0.68	72.79	243	1	0.68	93.88
20	2	1.36	74.15	252	1	0.68	94.56
23	2	1.36	75.51	313	1	0.68	95.24
24	2	1.36	76.87	390	1	0.68	95.92
25	1	0.68	77.55	416	1	0.68	96.60
28	1	0.68	78.23	824	1	0.68	97.28
30	1	0.68	78.91	1107	1	0.68	97.96
31	1	0.68	79.59	1198	1	0.68	98.64
33	1	0.68	80.27	1482	1	0.68	99.32
39	1	0.68	80.95	1785	1	0.68	100.00
				Total	147		

Appendix Table 4

Classification of strike outcomes

Unsuccessful	**Successful**
Work resumed unconditionally	Discussions/Investigations opened
Work resumed. Discussions resumed.	Matter resolved pending discussions
Strike continued into following year	Partial concessions made
Workers dismissed	Full demands met
Workers voluntarily left company	Work resumed
Miscellaneous	Miscellaneous