UNIONIZATION AND EMPLOYMENT BEHAVIOR

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ABSTRACT

Although there exists a large literature on the effects of trade

unions upon wages, there is no published work that uses

microeconomic data to examine the employment consequences of

unionization. The paper addresses this issue with a new British

data set and shows that, even after the addition of a

substantial set of control variables, there is a strong

association between poor employment performance and the presence

of trade unions. The union employment growth differential is

estimated at approximately -3% per annum.

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1. Introduction

For many decades the study of the effects of trade unions upon wage rates has been a central part of labour economics. Such analyses number in their hundreds. For the US alone, Lewis (1986) surveys almost two hundred econometric studies[1].

As Hamermesh and Rees (1988), Hirsch and Addison (1986) and Freeman and Medoff (1984) all note[2], however, there is no equivalent literature on the consequences of trade union activity for the level and growth of employment[3]. Pencavel and Hartsog (1984) have recently argued that this is "surely an issue that deserves to be the subject of much more research" (p.217). In their study the authors perform one of the first statistical examinations of the problem. They use US time-series data from 1920 to 1980, and conclude that there is some evidence of a negative effect of unionism upon relative man-hours worked, but that the estimated standard errors are too large to allow confident conclusions to be drawn. In a related vein, the review by Stafford (1986) has identified a gap in the availability of plant and firm microeconomic data. Stafford ends his paper by arguing that knowledge would be "greatly improved by additional, micro-level demand side work" (p.420) as a complement to the existing research on individual wage and labour supply determination. These sentiments are echoed in Hamermesh (1988).

It seems probable that it is the absence of microeconomic data for representative samples of employers that has prevented

the exploration of the employment effects of trade unions. A particular difficulty for US research is that a comparatively small proportion of employees are unionized, so that large gross samples are required. The only work on US microeconomic data is an apparently little known study by Leonard (1985), which uses a sample of Californian manufacturing plants, and finds evidence of a negative effect of unionization on employment growth.

This paper uses a newly collected microeconomic data set on two thousand British establishments. The data cover a nationally representative random sample in 1984. This sample is divided approximately six to four between unionized and non-unionized establishments (in 1984 roughly 55% of Britain's employees were members of trade unions) and thus allows a comparison of their performance and behaviour. A detailed description of the sampling method used, and of the data themselves, can be found in Millward and Stevens (1986).

The paper also has a theoretical component. It breaks with static tradition by constructing a model of the dynamic consequences of union activity. Adapted from a class of optimization models suggested by Phelps and Winter (1970), the analysis shows how a once-and-for-all effect on labour costs makes the firm alter its chosen growth rate and thus produces continuing repercussions upon the number of jobs. This approach - based upon the assumption that employers optimally exploit temporary product market power - contrasts with conventional trade union analysis. The data are consistent with this dynamic model's predictions.

The paper has five further sections. Section 2 constructs a model in which the rate of change of employment depends upon whether or not the firm is unionized. Section 3 introduces the 1984 Workplace Industrial Relations Survey and presents cross-tabulations on the simple correlation between unionism and the rate of growth of employment. A strong negative correlation is found. Sections 4 and 5 attempt to answer the obvious questions suggested by this correlation: they allow for industry, regional and establishment characteristics. Even with up to two hundred control variables - most of them highly disaggregated industry dummy variables - there continues to be evidence of a statistically significant negative effect of unionization upon employment growth. Section 6 summarises the results.

2. Theoretical Issues

Conventional neoclassical analysis predicts that, by raising labour costs, unionization reduces employment. This assumes that employment is determined along a labour demand curve defined by the equality of the value of marginal product with the wage. The conventional framework - as in Freeman and Medoff (1982) - is static. It assumes that any adjustments are made instantaneously. Yet there is much evidence (Nickell (1986)) that employment functions are highly autoregressive, and that static models are therefore unlikely to be adequate.

Consider the less restrictive possibility that an increase in the cost of labour shows through only gradually. Assume that, as in Phelps and Winter (1970), a firm's customers take

time, after a price rise, to switch to other suppliers. It can
then be proved that the effects of unionization may be upon the
rate of employment growth of the firm.

The model is set up as follows. A wage-taking firm is
assumed. The unit cost of labour, w, is defined as the sum of
wages and fringe benefits per employee. Product price, p, is
chosen by the firm. Assume that high prices induce customers to
drift away and that lower prices encourage a movement of
customers toward the firm[4]. The rate of change of the stock of
customers, c, is assumed to be

$$\dot{c} = a + s(p)c,$$

where a is a constant and $s(p)$ is a function, defined on the
product price, measuring customers' speed of response. It is
assumed that $s(.)$ is a decreasing concave function - so that, at
the margin, the effectiveness of price-cutting diminishes - and
is twice differentiable. A high price implies a negative value
of $s(p)$. When multiplied by the stock of customers, c, this
measures the loss of customers per unit of time. Parameter a,
assumed to be positive, captures the innate rate of increase in
customers as the whole economy grows.

For the sake of tractability it is assumed that the unit
cost of labour is independent of output. Under this form of
constant returns the level of employment can be normalised
to equal the number of customers, c. The proportional rate
of growth of the firm's employment is then $\dot{c} / c$.

The firm is assumed to maximise discounted profits over an infinite time horizon. Where r is the discount rate, therefore, its maximand is

$$\pi = \int_0^\infty (p-w)\, c e^{-rt} dt.$$

It is convenient to assume that both feasible prices and the number of customers are bounded above by large finite numbers. It is also assumed that p - w > 0 for some time periods. A loss-making firm would leave the market. To maximise its returns the firm must choose an optimal time path for the price of output. To do so, it has to weigh up the temporary benefits of a high price (large profits in the short run) with the long run disadvantages of such a policy (an erosion of its customer base). It is this optimisation which generates the key result.

The existence of a trade union is assumed to raise unit labour costs, w. There is much empirical support for such an assumption - as in Lewis (1986) and Freeman and Medoff (1984) for the US, and in Stewart (1983), Blanchflower (1984) and Blanchflower, Oswald and Garrett (1990)[5] for the UK. Unions may have other effects. Freeman and Medoff (1984) argue that US unions raise productivity, whilst Metcalf (1988) suggests that British unions reduce productivity. However, there is as yet no agreement on how such mechanisms work, nor how they can be introduced into orthodox theory. Our model is restricted to be conventionally neoclassical[6].

The model's solution and properties are derived in the Appendix. The principal results are summarised in the following two propositions.

Proposition 1   The firm's rate of employment growth declines with size.

Proposition 2   A unionized firm has a slower rate of employment growth than a non-unionized firm.

The proofs are given at the end of the paper.

These results conform to intuition. Proposition 2 is the dynamic counterpart of the static notion that, by driving up the marginal product of labour, a union reduces the number of jobs. In the model presented here the effects of unionization emerge less abruptly: a unionized employer sets a higher price than if non-unionized and thus gradually loses customers. After unionization, it is optimal for the firm to set a lower growth target.

Proposition 1, which is less crucial for our purposes, stems from the assumption that the exogenous flow of new customers is a constant determined by the rate of expansion in the economy. Its proportional impact therefore declines as the firm increases in size. Intuitively, one hundred new customers might double the size of a small firm, but have only a negligible impact on a giant corporation.

The model predicts that unionized firms gradually shrink relative to non-union employers. In principle, this process may take years or decades, and the long run or steady-state

implications of unionization could be explored only by using a data source with many years of observations. The model suggests that the contractionary impact of union activity will show up on rates of (employment) growth.

Although the analysis is highly simplified, its key results are likely to be robust. It is a time-invariant optimal price path which helps to generate both propositions (see the Appendix) and this will be a characteristic of all versions of the model in which profits and the flow of customers are linear in the number of customers. More complex demand functions can, for example, be introduced in place of the present implicit restriction that each customer always buys one unit of output: the outcome is unchanged. The model is also consistent with a wide range of assumptions about trade union preferences, because all that has been assumed here is that the existence of a union has some positive effect upon unit labour costs[7].

3. The Raw Data

The British Workplace Industrial Relations Survey of 1984 (WIRS2), which is the data source used in this paper, was sponsored by the Department of Employment, the Policy Studies Institute, the Economic and Social Research Council, and the Advisory, Conciliation and Arbitration Service. The sampling frame used was the 1981 Census of Employment. To be included in the survey an establishment had to have at least 25 employees (full or part-time) both in 1981 and 1984. The survey covered England, Scotland and Wales, and its industrial coverage was all

manufacturing and services in both the public and private sectors.

A sample of 2019 establishments (defined as 'places of employment at a single address or site') was achieved. Establishments were selected differentially across establishment size bands, with large establishments over-sampled. The data are weighted to compensate for these inequalities of selection. The survey incorporated interviews with the senior manager responsible for dealing with employee relations, industrial relations or personnel matters, plus interviews with worker representatives and, where appropriate, with works managers. This paper uses only data obtained from the senior manager's interview. For details of the weighting scheme, and the design and selection of the sample, see Millward and Stevens (1986, Technical Appendix).

Table 1 sets out descriptive statistics for the employment growth rates of British establishments. The elements in the tables add horizontally to 100 per cent. Thus, for example, 17% of establishments declined by one fifth or more between 1980 and 1984; 20% grew by one fifth or more. There is clear evidence that the rate of change of employment is correlated with size. Only 4% of establishments with more than 2000 employees increased by one fifth or more, compared with 20% for all sizes of establishment. As might be expected, small establishments grow proportionately most quickly.

Table 2 gives the equivalent statistics for establishments

Table 1.

Change in Employment, 1980-1984.

	Decrease of 20% or more	Decrease of 5% to 20%	Stable	Increase of 5% to 20%	Increase of 20% or more	Weighted numbers
All Establishments	17	27	20	16	20	1624
No. of employees at establishment						
25-49	15	29	21	18	18	824
50-99	16	26	19	14	26	436
100-199	21	25	19	20	16	200
200-499	23	23	22	13	19	112
500-999	26	25	18	13	18	32
1000-1999	21	45	22	9	4	13
2000 or more	27	26	28	14	4	5
Private Sector	22	23	15	16	25	1044
Private Manufacturing	33	21	10	11	25	378
Private Services	15	24	17	19	24	666

Base: those establishments where the 1980 employment size was reported.
Source: 1984 Workplace Industrial Relations Survey.

Table 2.

Change in Employment, 1980-1984

Row percentages

	Decrease of 20% or more	Decrease of 5% to 20%	Stable	Increase of 5% to 20%	Increase of 20% or more	Weighted numbers
All Establishments	17	27	20	16	20	1624
Non-union	14	19	16	17	33	560
Open shop	15	23	21	17	14	794
Closed shop	27	29	25	13	8	269
Union membership						
0%	15	19	14	18	34	448
> 0% to 25%	20	26	19	13	22	184
> 25% to 50%	19	35	14	18	13	160
> 50% to 75%	15	33	21	20	12	335
> 75%	19	30	27	12	11	364
Private sector	22	23	15	16	25	1044
Non-union	15	19	16	17	33	550
Open shop	27	25	14	17	18	352
Closed shop	37	30	13	12	9	142
Union membership						
0%	15	19	14	18	34	447
> 0% to 25%	20	23	21	14	23	146
> 25% to 50%	32	22	12	18	16	95
> 50% to 75%	25	31	14	17	14	155
> 75%	36	28	12	9	9	150

Base: those establishments where the 1980 employment size was reported.

Source: 1984 Workplace Industrial Relations Survey.

Notes: 'Open shop', defined as where unions were recognised by management for bargaining over pay and conditions but no compulsory union membership.
'Closed shop', defined as where at least one group of workers had to be members of a trade union to obtain or keep their jobs.

with different degrees of unionization. Union strength is measured in two ways:

(1) as the three categories 'non-union', 'open-shop' and 'closed-shop'.

(2) as the percentage of workers in the establishment who are union members.

With either of these measures, a strong inverse correlation between union strength and employment growth is apparent. For example, one third of all establishments in the non-union sector increased in size by more than one fifth. The figure for closed-shop union establishments, however, was less than one in ten. A similar result holds among the fastest declining establishments. A much larger proportion of the unionized establishments experienced more than a twenty per cent reduction in employment. This tendency is especially marked in the private sector. Of all plants with zero union membership, 52% grew by more than 5% between 1980 and 1984. By contrast, of plants with union density of more than 75%, only 23% grew by this amount over the same period.

4. Employment Equations

The cross-tabulations of the previous section reveal that on average Britain's unionized plants grew more slowly, and declined more quickly, than did non-unionized plants. There are three obvious objections to the hypothesis that this correlation reflects a causal mechanism from unionism to the number of jobs.

First, the data show that small establishments expanded faster than large establishments, and it is known that there is a

positive relationship between workplace size and the proportion
of employees who belong to trade unions. Second, British private
sector trade unions are most heavily represented in traditional
(so called 'declining') industries, especially in certain forms
of manufacturing. If, as is often claimed, these sectors are
dwindling for exogenous technological reasons, the link between
unionism and declining employment is the result of industrial
structure and part of a historical process. Third, rates of
unionization are highest in regions such as Scotland and the
north of England, namely, the higher unemployment and lower
income areas of Great Britain (see Millward and Stevens, (1988)).
Again this may produce a spurious correlation between low speed
of job growth and the existence of trade unions.

A related line of argument focuses on demand conditions
across establishments. The cross-tabulations allow no adjustment
for the fact that some plants between 1980 and 1984 enjoyed
increased product demand. To control properly for this, however,
is intrinsically difficult. If the existence of a union leads -
through pressure on labour costs and thus selling prices - to
reduced sales, the level of demand for the product is not an
exogenous variable.

Various other establishment characteristics may affect the
rate of employment change. Multi-product plants may suffer less
in the downswing of the trade cycle, because they switch away
from less profitable projects. Older plants may expand more
slowly than newer ones. Administrative centres within
organisations - workplaces which are themselves head offices -

may have different growth characteristics from the plants they oversee.

Although the 1984 Workplace Industrial Relations Survey is not a panel, it records the numbers of workers employed in 1980, 1983 and 1984. It also gives information about each establishment in 1984, including its industrial and regional classification, the form and extent of unionization, and many details of its type. Various questions were also asked about sales and financial performance. To reduce the question non-response, however, on these issues the survey required only qualitative information.

In our analysis we estimate various forms of unrestricted employment equations. This preserves symmetry with the methodology used in the cross-section literature on union wage differentials.

The theoretical analysis of section 2 forms the back-drop to the empirical work, because it turns attention towards the dynamic effects of union activity, and because it suggests a mechanism by which size and labour costs together shape the speed of employment growth. Although data restrictions make impossible a structural test of the model, empirical knowledge in the area is sufficiently limited to warrant a less restricted examination of the data.

Although it would be desirable to study the effects of unionization on the probability of plant closure, that is not possible with the data set available. The Workplace Industrial Relations Survey provides details on plants that closed between

the time the sample was drawn (1981) and the date of the survey
(1984). However, there is no record of the union status of any
of these plants. If closures are more likely under a union, our
estimate understates the total effect of unionization upon jobs.
If unions reduce the likelihood of closure, our estimate
overstates the aggregate effect. The results in this paper
should be seen strictly as an analysis of employment movements
inside establishments.

Two kinds of union variable are used in the estimation. The
first is a dummy variable for the existence of a trade union at
the workplace. More precisely, it covers establishments where
there was in 1984 a trade union which was 'recognised' by
management for the purpose of bargaining. Two thirds of
establishments had a recognised union. A second variable used,
containing more information, is the density of union membership
at the workplace.

The following variables are also included in the regressions
explaining employment in 1984:

(i)   the log of employment in both t-1 and t-4 (that is,
       the years 1983 and 1980)

(ii)   10 regional dummy variables

(iii) 183 industry dummy variables

(iv)   the county unemployment rate (across 58 British
       counties)

(v)   a set of establishment characteristics, especially
demand, capacity and financial performance variables.

The form of the microeconomic variables is explained in the
Statistical Appendix. Much experimentation was also done with
variables not reported in the paper. Various establishment
characteristics (age, proportion of females, of part-timers, of
white collar workers, etc.) familiar from work on wage equations
had little or no explanatory power, once industry dummies were
included, and are therefore omitted.

5. Results

The principal results are given in Tables 3 and 4. The
sample for these tables, using data only on the private sector,
is approximately one thousand establishments. The dependent
variable is the log of employment, but the equation can be
interpreted as an employment growth regression, because the first
lagged dependent variable enters with a coefficient of
approximately unity.

All the equations in the Tables could be estimated with the
change in employment as the dependent variable. It is important
to make clear that this has no effect on the model's estimated
coefficients (it converts a coefficient of, for example, 0.97 on
E_{t-1} into one of -0.03). <u>Whether the equations are estimated
with the dependent variable as the employment level or the one
year change in employment is a matter only of presentation</u>. The
employment change specification would be equivalent to deducting
E_{t-1} from both sides of the equations presented in Tables 3-5.

The six equations in Table 3 gradually add explanatory
variables, building up to the full specification in column 6.

Table 3: Employment Equations with a Union Dummy Variable.

	(1)	(2)	(3)	(4)	(5)	(6)
E_{t-1}	.9681	1.0156	1.0118	1.0150	1.0082	.9805
	(210.3)	(69.50)	(69.33)	(69.29)	(48.83)	(69.34)
E_{t-4}	*	-.0475	-.0443	-.0354	-.0256	-.0064
		(2.29)	(1.81)	(1.88)	(1.49)	(0.34)
Union recognition	*	*	-.0379	-.0436	-.0369	-.0258
			(2.59)	(2.89)	(2.34)	(1.70)
Regional dummies	No	No	No	Yes	Yes	Yes
Industry dummies	No	No	No	No	Yes	Yes
Demand up	*	*	*	*	*	.0578
Demand down	*	*	*	*	*	-.0306
						(4.47)
Capacity high	*	*	*	*	*	.0300
						(1.50)
Capacity low	*	*	*	*	*	-.0885
						(2.34)
Financial performance	*	*	*	*	*	.0176
						(4.03)
County unemployment	*	*	*	*	*	-.0295
						(2.81)
Single product	*	*	*	*	*	-.0214
						(0.81)
Head office	*	*	*	*	*	-.0074
						(0.45)
Constant	.1537	.1374	.1346	.1344	.1413	.1456
	(6.21)	(5.40)	(5.30)	(4.73)	(3.66)	(1.62)
Adjusted R^2	.9759	.9775	.9776	.9778	.9834	.9852
F	44237.4	21449.4	14384.6	3350.7	338.14	361.36
N	1094	989	989	989	989	989

Notes: Dependent variable: natural logarithm of employment, E_t.
Union status defined as the existence of a trade union recognised by
management for negotiating pay and conditions at the workplace.
t-statistics in parentheses.

Table 4: Employment Equations with a Union Density Variable

	(1)	(2)	(3)	(4)	(5)
E_{t-1}	.9790	1.0059	1.0083	1.0060	.9789
	(199.93)	(53.89)	(53.94)	(47.49)	(48.33)
E_{t-4}	*	-.0237	-.0240	-.0238	-.0032
		(1.32)	(1.34)	(1.16)	(0.16)
Union density x 10^3	-.6411	-.6538	-.7646	-.7881	-.5571
	(3.69)	(3.62)	(3.96)	(3.34)	(2.42)
Regional dummies	No	No	Yes	Yes	Yes
Industry dummies	No	No	No	Yes	Yes
Demand up	*	*	*	*	.0612
					(4.53)
Demand down	*	*	*	*	-.0331
					(1.57)
Capacity high	*	*	*	*	.0326
					(2.44)
Capacity low	*	*	*	*	-.0977
					(4.32)
Financial performance	*	*	*	*	.0160
					(2.46)
County unemployment	*	*	*	*	-.0208
					(0.55)
Single product	*	*	*	*	-.0263
					(1.96)
Head office	*	*	*	*	-.0042
					(0.24)
Constant	.1299	.1122	.1197	.1071	.1076
	(5.49)	(4.69)	(4.45)	(2.29)	(1.09)
Adjusted R^2	.9797	.9818	.9821	.9830	.9849
F	24774.2	16670.2	3912.4	310.59	335.89
N	1027	928	928	928	928

Equation (3) provides an example. It shows the effects of the addition of a union dummy to the employment equation (which may again be read as an employment growth equation). This union variable enters with a coefficient of approximately -0.04 and a t-statistic of 2.6. The correlation between employment change and unionism remains even when the regression controls for establishment size.

By equation (5) in Table 3, both regional dummies and industry dummies have also been included. Neither the coefficient on unionism nor its level of statistical significance is much altered. It is thus difficult to argue that the association between unionism and poor employment performance is because unions are predominantly in declining industries[8] and regions.

The addition of the (largely demand-related) establishment variables has only slightly more effect. Column 6 reveals that after their inclusion the t-statistic on the union recognition dummy variable falls to 1.7, and the coefficient drops to approximately -0.026 from -0.038. As the demand, capacity and financial performance variables must be functions of unionization, however, it is likely that the union coefficient in equation 6 is biased downwards.

Table 4 changes to a union density variable, which should contain more information, in the statistical sense, than a crude union dummy. For each of the six equations, the level of significance of the union variable is noticeably higher than in Table 3. Even in the full specification, in equation 6 of Table

4, union density enters with a t-statistic of 2.4. The size of
the coefficient is relatively stable across the six quite
different specifications.

Large numbers of experiments were performed around the
reported specifications. Regardless of specification the union
density variable was always significant at better than the five
percent level. The union dummy was marginally less strong -
occasionally its t-statistic fell to 1.5 - but only in the
presence of the potentially endogenous demand variables.

The results allow the calculation of a union employment
growth differential, which is analogous to the union wage
differential in the orthodox literature. In Table 3 the
coefficients on the union recognition dummy variable vary from
-0.026 to -0.044, and there is a presumption that the true
estimate is toward the bottom of this absolute range. Hence a
reasonable approximate estimate of the union employment growth
differential may be -0.03: unionized plants, thus, ceteris
paribus, contract three percent per annum more quickly than
equivalent non-unionized plants.

In conclusion, there is evidence, particularly in Table 4,
consistent with the view that there is some causal link between
trade union activity and employment behaviour. The strong
association between unionism and employment decline is robust to
the inclusion of control variables[9].

It is interesting to compare these findings with those of
Leonard (1985), which uses a sample of 587 Californian
manufacturing plants[10]. The author estimates an equation in

which the dependent variable is the proportional change in
employment over five years. He obtains a coefficient on the union
variable of -0.125 with a standard error of .04. The size of
this effect (2.4% per annum) is close to that found here.

Table 5 reports a series of further experiments. The first
column removes the lagged dependent variable E_{t-1}. The four year
effect of union recognition (recognition in 1984 is a good proxy
for recognition in 1980) is approximately 10 percentage points,
which is only slightly lower than that implied by compounding the
earlier numbers obtained for the one year effect. Column 2 shows
that the union recognition effect is a proxy for a membership
effect: the latter drives the former insignificant. In column 3
union membership is entered along with a variable that identifies
workplaces in which, for one or more groups of workers, union
membership is compulsory. Interestingly, the closed shop effect
is positive, <u>ceteris paribus</u>, so that this extreme form of
unionization appears to slow down the rate of employment decline.
To explore further the influence of the closed shop we restrict
our sample, in column 4, to workplaces without any closed shops.
As expected, the coefficient on membership (-.001262) is almost
double that in column 2 of Table 4 (-.0006538).

Columns 5-8 examine the effects of replacing union variables
by wage rate variables. Neither the own wage nor the outside
wage is significant on its own. Only in column 8, when
interacted with membership, is the outside wage significant.
Column 6 is inconsistent with the hypothesis that unions have
their influence only through this measure of the wage. In column

[9] a non-linear membership term is included, but this never reaches significance. Finally, a 'consultation' variable is entered. This identifies workplaces where at least one of the following is negotiated only at the establishment: 1) staffing levels, 2) recruitment, 3) redeployment. The object here is to isolate the mechanism through which unions have their effect on employment growth. Whilst consultation is significant without a membership variable, inclusion of the latter drives the t-statistic down to 1.32.

6. Conclusions

Although it is widely recognised that Economics needs statistically representative studies of the microeconomics of labour demand and employment, lack of data has prevented researchers from making progress on these topics. One example of this is the current asymmetry in research on trade unions: there is a huge literature on union effects upon wages and almost no research on their consequences for employment.

Our work is an attempt to fill this lacuna. It uses a newly available random sample of British workplaces in 1984. The Workplace Industrial Relations Survey is, to our knowledge, the world's only nationally representative survey of establishments.

The results in this paper suggest that trade unions depress the rate of employment growth and increase the extent of employment decline. We estimate the union employment growth differential at approximately -3¾ per annum. This is comparable to the only other estimate, namely, that obtained by Leonard (1985) using Californian data on manufacturing plants.

Neoclassical labour market theory predicts that, if firms operate along labour demand curves, the well-established support for a union wage differential implies that there must also be detrimental effects on the number of jobs. Our conclusions are in accordance with a dynamic version of this hypothesis. The theoretical model set out in the paper is related to that in Phelps and Winter (1970) and suggests why a high wage level is likely be associated with a low employment growth rate. The paper's empirical findings are consistent with this prediction.

Footnotes

1. Further reviews are available in Freeman and Medoff (1984), Farber (1986) and Hirsch and Addison (1986). Addison and Hirsch (1989) is a recent survey which calls for further research on the dynamic effects of trade unions.

2. See, for example, the discussion on p.309 of Hamermesh and Rees (1988).

3. The closest work appears to be that in a small symposium reported in the European Economic Review (see, for example, Oswald (1988), Freeman (1988) and Blanchflower and Millward (1988)). Few unambiguous conclusions emerge. Clark (1984) finds weak union effects on the rate of change of output, but does not examine the employment consequences of unionization. Dunne, Roberts and Samuelson (1989) study employment change in the US, although they do not focus on the impact of unions. Montgomery (1989) uses CPS individual data, and finds small effects from the proportion unionised in the SMSA on the probability of being unemployed, but cannot examine the behaviour of the employing unit.

4. The model is thus related to those in papers such as Phelps and Winter (1970) and Gaskins (1971).

5. Estimated union wage differentials for both countries are typically ten to twenty percent. The British union wage differential appears to have changed little over the last decade (see Blanchflower (1989)). The model in this paper does not rest on the assumption of a changing differential, because it predicts a link between the level of wages and the rate of change of employment.

6. However, the model is compatible with a small positive effect of unions on productivity, as long as the net unit cost of labour rises after unionization.

7. Efficient bargaining (Leontief, 1946) is not necessarily compatible with the approach.

8. Our own prior belief had been that the addition of such a large number of industry dummy variables would drive the union effect insignificant.

9. Although simultaneity bias is theoretically possible, it appears unlikely to be a practical problem, because unionism in Britain generally predates employment decline. Evidence in Millward and Stevens (1986, Table 3.6) suggests that less than one in ten plants changed union status between 1980 and 1984. Therefore, it does not seem credible to argue that employment decline (growth) in 1983-1984 caused an increase (decrease) in unionization.

10. Our attention was drawn to Leonard's work by Larry Katz
    after a Harvard seminar presentation of an earlier version
    of this paper.

Appendix

This appendix derives the proofs of Propositions 1 and 2.

The maximization problem for the firm may be written

$$\text{Maximize} \quad \int_0^\infty (p-w)ce^{-rt}dt \tag{1}$$

subject to $\dot{c} = \alpha + s(p)c$, $\tag{2}$

where, to recapitulate, p is the product price, w is unit labour costs, c is the number of customers who buy from the firm, r is the discount rate, and s(p) is a function which describes the speed at which customers switch to or from the firm.

Define ϕ as a multiplier, and assume that it may be written as a differentiable function of time. The Hamiltonian for the maximization may be formulated as

$$H = (p-w)ce^{-rt} + \phi[\alpha + s(p)c] \tag{3}$$

An optimal price path must satisfy the following conditions

$$\frac{\delta H}{\delta p} = e^{-rt} + \phi s'(p) = 0 \tag{4}$$
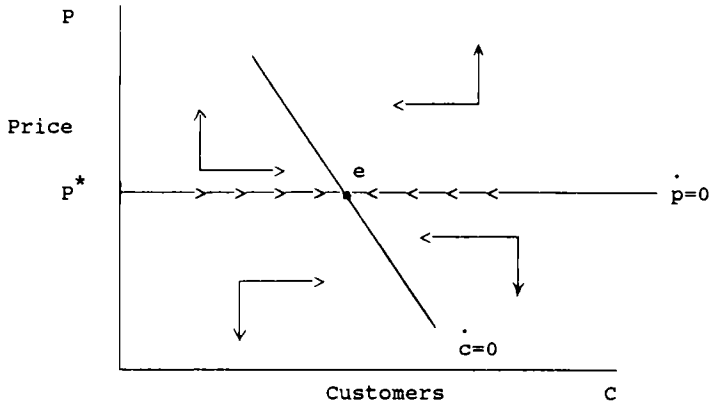
$$\dot{\phi} = -\frac{\delta H}{\delta c} = -(p-w)e^{-rt} - s(p)\phi \tag{5}$$

Sufficiency relies upon Proposition 9 in Arrow (1969), the concavity of s(.) and the positivity of ϕ. Differentiate (4) with respect to time to give

$$- re^{-rt} + \dot{\phi}s'(p) + \phi s''(p)\dot{p} = 0 \tag{6}$$

Substitute out $\dot{\phi}$ and ϕ, using (5) and (4) respectively, to give

$$\dot{p}\,\frac{s''(p)}{s'(p)} = - r - s'(p)[p-w] + s(p) \cdot \tag{7}$$

Figure 1

The Optimal Price Path.

This equation governs the dynamic behaviour of the firm's price. The model thus reduces to two differential equations, (2) and

(7). In steady-state equilibrium

$$0 = \alpha + s(p)c \tag{8}$$

$$0 = -s - r - s'(p)(p-w) + s(p) \cdot \tag{9}$$

Figure 1 plots these as loci in p,c space. The latter locus is independent of c, the number of customers. The former defines a negatively sloped curve, because along the locus,

$$\frac{dc}{dp} = \frac{s'(p)}{s(p)^2} < 0 \ . \tag{10}$$

The second derivative is ambiguous in sign.

The only feasible price path, marked as the arrowed line, is the one in which price p* is set immediately. All others diverge from e, as the phase diagram shows. This relies on the fact that, by (2), c is positive when p is sufficiently low and, by (7), p is positive (negative) above (below) p*.

To prove Proposition 1, that the optimum growth rate declines as the firm's size increases, write equation (2) evaluated at the solution price p* as

$$\dot{c} = \alpha + s(p*)\cdot c. \tag{11}$$

Hence

$$\frac{\dot{c}}{c} = \frac{\bar{c}}{c} + \text{constant},$$

so that the chosen growth rate falls as the firm becomes larger.

To establish Proposition 2, that the growth rate of unionized firms is lower than that of non-unionized firms, it is convenient to use Figure 1. If unionization raises the horizontal steady state price locus, c / c falls. Under the

assumption that a union sets w above its non-union value, it is sufficient to prove that the optimal price is increasing in w, unit labour costs. Differentiating implicitly in (9),

$$\frac{dp}{dw} = s'(p) \ / \ [p-w]s''(p) > 0 \tag{12}$$

Thus a unionized firm sets a higher price and chooses a lower rate of growth.

Statistical Appendix

The definitions of the establishment-level variables are given below.

Demand up   A dummy variable for establishments reporting that 'the value of sales of the main products or services' had been rising over the previous 12 months.

Demand down   An equivalent dummy variable for sales falling over the previous 12 months.

Capacity high   A dummy variable for establishments reporting that they were working 'at full capacity'

Capacity low   An equivalent dummy variable for establishments working 'considerably below full capacity'.

Financial performance   A variable created from the question 'How would you assess the financial performance of this establishment compared with other establishments/firms in the same industry?', where answers were by a fivefold ordering from 'a lot better than average' down to 'a lot below average'. The single variable Financial Performance used the cardinality restriction $+2$, $+1$, 0, -1, -2 for the five answers.

Single product   A dummy variable for establishments reporting that their output was 'concentrated on one product or service'.

Head office   A dummy variable for establishments reporting that their establishment was 'the head office of (the) organization or a similar administrative office that does not itself engage in making or selling goods or providing services'.

Union recognition   A dummy variable for establishments reporting that there were trade unions 'recognized by management for negotiating pay and conditions for any sections of the workforce'.

Union density   The value, at the establishment, of the ratio of union members to employees.

Wage   The natural logarithm of the gross annual earnings of a typical unskilled manual employee. Estimates obtained from grouped earnings data using midpoints.

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