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HOW DOES FINANCIAL PRESSURE AFFECT FIRMS?

Stephen Nickell and Daphne Nicolitsas

ABSTRACT

How does monetary policy work? While one aspect of the investigation has focused on the behaviour of consumers, another has concentrated on the behaviour of companies faced with the kind of financial pressure associated with tight monetary policy. The general focus in this area is on the impact of financial constraints on investment expenditures including fixed capital and inventories. Our purpose is to shift this focus somewhat and to concentrate on the impact of financial pressure on other aspects of company behaviour. We first discuss briefly the theoretical background and the empirical formulation. Then, using panel data on a large number of UK companies, we derive a number of results.

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HOW DOES FINANCIAL PRESSURE AFFECT FIRMS?

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Introduction

How does monetary policy work? There has been renewed interest in this question in recent years, sparked by the apparently important role played by monetary policy in the severe fluctuations in many OECD economies in the last decade. While one aspect of the investigation has focused on the behaviour of consumers (see King, 1994, for example), another has concentrated on the behaviour of companies faced with the kind of financial pressure associated with tight monetary policy.

A pithy summary of the issues involved is provided in Gertler and Gilchrist (1993). The general focus in this area is on the impact of financial constraints on investment expenditures including fixed capital and inventories. We now possess a large body of microeconometric evidence that liquidity constraints of various kinds influence investment spending, controlling - at least in part, for current and expected shifts in product demand.[1]

Our purpose here is to change this focus somewhat and to concentrate on the impact of financial pressure on other aspects of company behaviour. We shall investigate a number of issues. First, do liquidity constraints directly affect employment as well as investment, again controlling for direct demand shifts?[2] Second, in addition to "cutting back", how else do firms respond to financial pressure? Do they, for example, attempt to negotiate lower wage increases with their employees? Or do they try and get them to increase productivity by one means or another? These latter responses will, in fact, offset the potential adverse impact of financial pressure on employment and investment, by making both activities more profitable.

In order to address these questions, we first discuss briefly the theoretical background and the empirical formulation. Then, using panel data on a large number of UK companies, we derive a number of results. These indicate that the impact of financial pressure on company employment is large and the offsetting effects on wages and productivity, while detectable, tend to be small.

1. Theoretical Background

In their very useful survey, Gertler and Gilchrist (1993) set out what they describe as two more or less indisputable facts. First, information asymmetries (between borrowers and lenders) induce a wedge between the cost of "uncollateralized" external funds and the price of funds generated by a company internally. Second, the cost of external funds is increasing not only in the general level of interest rates but also in the ratio of the size of the loan to "collateralizeable" net worth.

Looking at the first of these, it is clear that even securely collateralized external funds are likely to be more expensive than internal funds, because of the real costs involved in evaluating the collateral and monitoring the position of the loan. The second indisputable fact arises essentially because the probability of bankruptcy rises when debt rises relative to net worth, and this raises the cost of borrowing because of the increased risk. Indeed borrowing or credit may even be rationed at some point but the existence of credit rationing is not necessary to the general argument. Since a large part of the net worth of a company consists of the present value of future profits, we can now see how a rise in the general level of interest rates has two effects on the costs of borrowing for a firm. There is a direct effect because the (safe) rate of interest has risen and an indirect effect because, as interest rates rise, net worth falls and so the ratio of debt to net worth rises. The indirect effect, of course, reinforces the direct effect and is more important the higher is the initial level of debt (relative to net worth). (See, for example, the discussion in Greenwald and Stiglitz, 1988.)

How will this impact on firms? There are two sorts of impact to consider. First, there is the direct consequence of the cost of borrowing. Any kind of investment activity is adversely affected by a rise in borrowing costs, and since these will be more significant when the initial debt position is more adverse, this immediately implies that the debt position of the company will influence its investment behaviour. This is confirmed by the results in Bond and Meghir (1994) for fixed capital investment. The second possible impact relies on the fact that managers' interests are not the same as shareholders', and that because of informational asymmetries, managers have some freedom to pursue their interests. These ideas underlie many conjectures about the behaviour of companies, a good example being the "free cash flow" theory due to Jensen (1986). In the present context, an important aspect of this type of analysis is the notion that managers are more concerned by bankruptcy than are shareholders, basically because the managers have more to lose. So when the debt position worsens and the threat of bankruptcy looms, managers may not only cut back on investment of various kinds but may also increase their efforts to cut costs, raise efficiency, reduce wages and so on. Of course, the very existence of the "organizational slack" that allows this as a possibility depends on their being a degree of managerial autonomy in the first place.[3]

Our investigation here is concerned with a number of these possibilities, beginning with employment. When borrowing costs rise, investments of all kinds may be reduced, including the hiring of new employees. Credit restrictions may also induce a direct contraction of employment by reducing working capital and, furthermore, the prospective costs of bankruptcy may be reduced if the labour force is lower.[4] Our main concern here is to investigate the <u>direct</u> impact of financial factors on employment <u>controlling for</u> the effect of actual or expected changes in product demand. This investigation is related to, but is distinct from, that presented in Sharpe (1994). There, the focus is on how high leverage firms exhibit more employment responsiveness over the business cycle. Here, we shall be concerned with actually tracing the consequences of a <u>ceteris paribus increase</u> in financial pressure on the subsequent behaviour of companies.

Then, as we have already argued, when financial pressure increases, managers will be very concerned to minimise bankruptcy risks. Workers will also be concerned if they see their jobs under threat, and this leads naturally to the possibility that workers and managers will agree both on smaller annual pay increases and on efforts to improve productivity. Both of these will, of course, offset the adverse impact of financial pressure on investment and employment.

2. The Empirical Formulation

Here we consider the specification of equations which will elucidate the impact of financial factors on employment, wages and productivity.

Employment

Consider a firm, index i, with a production function

$$Y_i = A_i F(N_i, K_i) \qquad (1)$$

where Y = output, N = employment, K = capital, A = efficiency. Then if it sets prices in an imperfectly competitive environment, the equilibrium level of employment (ignoring financial factors) is given by

$$A_i F_N(N_i, K_i) = W_i(1+t_1)/P_i \kappa_i \qquad (2)$$

where W_i is the wage, t_1 is the payroll tax rate, P_i is the price of output and $\kappa_i = 1 -$ (demand elasticity)$^{-1}$. This latter term may systematically vary with current or future expected demand.[5] So if we add in financial factors and dynamics (because of adjustment costs), this leads us to investigate a log-linear equation of the form

$$n_{it} = \alpha_i + \alpha_t + \lambda_1 n_{it-1} + \lambda_2 n_{it-2} + \alpha_1 k_{it} - \alpha_2 (w_{it} - p_{it}) + \alpha_3 d_{it} + \alpha_4 f_{it} + \epsilon_{it}\ . \qquad (3)$$

i refers to company, t to time and α_i = company effect, α_t = time effect, n_{it} = log employment, k_{it} = log capital, w_{it} = log wage, p_{it} = log output price, d_{it} = demand terms, f_{it} = financial factors. The company effect, α_i, refers to all those factors (e.g. efficiency) which are company specific but fixed over time. The time effect, α_t, captures factors common to all firms such as the payroll tax rate, the safe rate of interest and so on. Implicit in (3) is an assumption of static expectations.

Under non-static expectations, we must also include expected future levels of real wages and demand. These will be thoroughly investigated in the empirical analysis.

The financial factors which we consider in this and later models are set to capture the premium on borrowing costs or the probability of credit being rationed completely. The key variable here is the ratio of debt to "collateralizeable" net worth. An obvious variable which comes close to capturing this is the ratio of debt to equity. A typical practical problem here is the fact that while it is easy to obtain the book value ratio, the market value ratio is much harder to measure correctly.[6] This suggests that we consider a flow equivalent, and the most obvious is the ratio of total interest payments to profits (before tax and interest) plus depreciation.[7] A justification for the use of this kind of measure is that if we consider the key variable to be the ratio of debt to net worth, we could write this as

$$\text{Debt/PV profits} = \frac{D}{\pi/(r+\rho-\dot{p}^e-g^e}$$

where D is current debt, π is current profit (including interest payments), r is the safe interest rate, ρ is the risk premium, $\dot{p}^e$ is the expected rate of inflation and g^e is the expected growth of profits. This ratio can then be written as

$$(r+\rho-g^e)\,\frac{D}{\pi} - \dot{p}^e\,\frac{D}{\pi}\;.$$

Now the first term can arguably be approximated by the ratio of total interest payments to profits because the average interest payments per unit of debt will depend on the safe rate and the degree of risk, including a negative element corresponding to expected growth prospects. The problem with this measure is that it ignores the second element, namely the fact that part of the interest rate which corresponds to inflation is effectively being used to pay back the principal.[8] Nevertheless this flow measure of financial pressure may well be closer to what is required than the book value debt-equity ratios, not least because it captures elements of the current cash flow position so beloved of bankers. Indeed, we shall also briefly consider a third variable precisely because it is one of the bankers' favourite measures of credit worthiness, namely the "current ratio" which is the ratio of current assets to current liabilities.[9]

Returning to the employment equation (3), a couple of final points are worth noting. First, note that under constant returns to scale, $\alpha_1 = 1 - \lambda_1 - \lambda_2$. Second, we shall lag a number of the independent variables such as wages and the financial factors on the grounds that they are unlikely to have an instantaneous impact.

Wages

The modelling of wages here corresponds closely to that used in Nickell and Nicolitsas (1994). The idea here is to focus on the difference between the wage increases in a firm and the average level of wage increases. This difference will depend on the relative shifts in the product market position of firms as well as their financial position, the former being based on the notion that some of the product market rents may be captured by workers in the form of higher pay rises. Thus we have a wage equation of the form

$$\Delta(w_{it}-w_t) = \beta_0 + \beta_t + \beta_1 \Delta c_{it} + \beta_2 \Delta f_{it} + \eta_{it} \qquad (4)$$

where β_t = time effect, c_{it} = product market competition, f_{it} = financial factors. Note that the time effect captures the aggregate or average levels of product market competition and financial pressure. The terms in c and f can thus be viewed as deviations from the aggregate average.

Productivity

Here we simply use a standard production function approach, so our basic equation has the form

$$\begin{aligned} y_{it} - k_{it} = \gamma_i + \gamma_t + \lambda(y_{it-1} - k_{it}) + \gamma_1 (n_{it} - k_{it}) \\ + \gamma_2 h_{it} + \gamma_3 c_{it} + \gamma_4 f_{it} + \gamma_{5i}\, t + \omega_{it} \end{aligned} \qquad (5)$$

γ_i is a firm effect, γ_t is a time effect, y_{it} = real output, h_{it} = cyclical factor based on working hours.

So in equation (5) we have a standard constant returns Cobb-Douglas with a dynamic element to take account of the fact that if new workers join the firm, for example, it takes some considerable time before they are as proficient and productive as their more experienced counterparts. The role of product market competition (c) is to allow for the possibility that competition tends to improve efficiency (see Nickell, 1993). The financial factors (f) we have already discussed and we also allow productivity growth to vary systematically across firms via the γ_{5i} coefficient. This we allow to depend on industry (via 2 digit industry dummies) plus various 3 digit industry characteristics as well as average firm size.

Data and estimation

The basic data source is the published accounts of around 670 UK manufacturing companies over the period 1973-86, taken from the EXSTAT data tape. We augment this with information on a subset of 66 companies from the Confederation of British Industries (CBI) Wage Settlements survey over the period 1979-86. These data include information on pay increases for well specified groups of employees and also whether or not the pay settlement involves the elimination of restrictive labour practices. The main panel is unbalanced. The number of firms in each year is available in the Appendix. It peaks in 1980 and then declines rapidly because of changes in the legal requirements for reporting employment. Detailed definitions of all the variables may be found in the Appendix.

The employment and productivity models (3), and (5) are specified in levels but estimated in first differences in order to eliminate the unobserved firm effects. The wage equation is already in first differences. Generally speaking most current firm specific variables in these models will have some elements of endogeneity since they are likely to be influenced by employment, wage and productivity shocks. This endogeneity extends to the first lag in the first difference context because of the presence of the lagged error in the equation. The lagged dependent variable is then automatically endogenous. However, for our present purpose, the most important endogeneity problems arise with the financial variables. Recall that our key measure of financial pressure is the ratio of interest payments to cash flow which we shall refer to as the (flow) borrowing ratio. Despite lagging it one period, the danger is that a lagged shock to employment, caused say by an adverse productivity shock, will force the firm to increase its borrowings and will subsequently also influence it directly to change employment. This will generate a spurious correlation between the lagged borrowing ratio and employment. What we require is a set of instruments which will impact on the borrowing ratio but have no direct effect on employment. The instruments we select refer to the performance of the company three years prior to the employment decision. This will impact on the future borrowing ratio by influencing its current and hence future debt position but will not influence employment directly because it is too distant in the past. Recall here that we use a fixed effects framework so we focus on the time series variation in the data (i.e. correlating changes with changes) and that we already control for the basic non-financial factors influencing employment. Furthermore, we are assuming no serial correlation in the random (non-fixed effect) part of the error, a testable assertion (see below).

The estimation programme we use was developed by Arrelano and Bond (1991), and is an efficient extension of the first difference instrumental variables method suggested for dynamic fixed effects models by Anderson and Hsiao (1981). The validity of the method depends on the absence of serial correlation in the error (absence of second order serial correlation in the first difference error) which is investigated using a robust statistic developed by Arellano and Bond.

3. Results

We begin by looking at some employment regressions which are reported in Table 1. The reason for reporting a regression using the CBI sample is that the wage is more accurately measured than in the large sample. In the former case we have the basic pay for a given number of hours applying to a specific skill group.[10] In the large sample, we simply have information on the total wage bill divided by the number of employees. This measure of pay is corrupted by changes in both hours of work and the skill composition of the workforce as well as measurement error in employment.

In the first equation reported in Table 1, we have a standard employment equation with the change in industry output serving as the demand proxy and a flow measure of leverage, the borrowing ratio (BR). This is the ratio of interest payments to pre-tax profits with interest payments and depreciation added back in (i.e. cash flow). We also looked at the debt ratio (DER), that is the ratio of debt to debt plus equity, both being book value measures. This turns out not to be significant but as equation 1 reveals, there is some evidence that the borrowing ratio has an independent effect on employment. In addition, we investigated the impact of the current ratio (current assets/current liabilities) but it has no important impact either here or elsewhere, tending to be dominated by the other two variables.

The next five equations in Table 1 are based on a much bigger sample and hence have more precisely estimated coefficients. The idea of these five equations is to examine the robustness of the borrowing ratio effect in response to different attempts to control for current and expected future wages and demand. In equation 3 we include future wages and industry output, instrumenting these with industry level forecasts of demand, prices and costs based on the regular surveys published by the Confederation of British Industry. In equation 4, we treat the future values as exogenous. Then in equation 5, we include lagged, current and future (real) sales at the company level treated as endogenous and finally we treat them as exogenous in equation 6. We recognise that the last three equations are, strictly speaking, misspecified but we report them simply to see if they reveal any shift in the borrowing ratio effect. In fact, as Table 1 indicates, the coefficient on the borrowing ratio remains strongly significant and of the same order of magnitude throughout.

Turning now to Table 2, we investigate some interactions. In columns 1 and 2 we see a slight tendency for the impact of the borrowing ratio to be bigger in firms with higher levels of debt (relative to equity) and in firms which are relatively smaller. We also investigated non-linearities, in particular to see whether or not increases in the borrowing ratio had a bigger impact once the ratio had passed some threshold. For example, it is said that banks consider that it is prudent for firms to keep interest payments below a given fraction of profits (e.g. one-quarter). We tried a variety of splines but there was no indication of this effect. Finally, in equation 3, we see that while the coefficient on the inflation offset to interest payments ($\dot{p}D/\pi$) is positively signed, as we might expect, it is both small and insignificant. This suggests that banks take little or no account of the fact that some of the interest is actually being used to pay off the debt and should not, therefore, be "counted" as part of the flow borrowing ratio.

In order to see the orders of magnitude involved in our results, suppose the safe rate of interest rises from 5 percent to 8 percent (i.e. by 60 percent). Assuming this implies a 60 percent rise in interest payments,[11] then since the mean value of BR is 0.2, the effect on BR is an increase of 0.12. Given that the coefficient on BR in Table 1, column 2 is 0.24 this yields a short-run reduction in employment of 2.9 percent. In the long run this expands to a reduction of around 11 percent. While the rise in interest rates from 5 to 8 is quite significant, it is by no means exceptional in the process of tightening monetary policy.[12] So we see that the government can have a substantial direct effect on employment by raising interest rates although it takes a considerable time for the major portion of the effect to come through (e.g two thirds of the effect takes 5 years). Furthermore, insofar as the firm can enforce a moderation of wage demands, this will attenuate the employment effect.

Turning now to the impact of financial factors on wage increases, the results based on equation (4) are reported in Table 3. Both regressions indicate that the flow borrowing ratio (BR) has some impact on wages. But the effect is not very big. As we have already noted, a 3 percentage point increase in interest rates from 5 percent to 8 percent leads to a rise of 0.12 in BR which leads to a short-run reduction in wages of between 0.2 and 1 percent. The corresponding long-run reduction is around 0.8 percent in equation 1 or 1.6 percent in equation 2. Given that estimated long-run employment wage elasticities rarely exceed 2.0 (the long-run elasticity in Table 1, equation 1 is 1.4), this wage reduction is not going to have much of an impact on the employment effect discussed above, even in the long term (i.e. at most a 3 percent increase in employment compared to the 11 percent reduction discussed above).

As well as trying to moderate wage bargains, firms under financial pressure may also attempt to improve efficiency. To capture this effect, in Table 4 we present a production function estimate based on equation (5). The key result is that the flow borrowing ratio (BR) exhibits a consistent positive effect on (total factor) productivity, but as with wages, the effect is small. To get some idea of the scale of the effect, again consider a rise in the interest rate from 5 to 8 percent. This generates an increase of in total factor productivity of a mere ½ percent in the long run.

Making use of the CBI data set we might be able to gather some information as to the source of this efficiency improvement. One of the variables reported indicates whether or not the employees agreed to eliminate restrictive work practices in their last pay bargain. Since such an event is more or less bound to generate a productivity improvement, it is worth investigating whether or not the chances of restrictive practices being eliminated are enhanced if the firm is under financial pressure. The results are reported in Table 5 and indicate that there may be some effect from the borrowing ratio in the correct direction (significant at the 10 percent level) but it is again very small. The usual increase in interest rates from 5 to 8 percent raises the chances of a reduction in restrictive practices by around 1½ percent. This is, of course, consistent with the small productivity effect. It is worth noting, however, that there is also an effect from profits per employee which tends to reinforce the borrowing ratio effect (i.e. a fall in profits raises the chances that restrictive practices will be removed).

Summary

We have undertaken an investigation of the impact on company behaviour of increases in financial pressure. Using a flow measure of leverage, interest payments relative to cash flow, we find that an increase in this variable has a large negative effect on employment, a fairly small negative effect on pay increases and a small positive effect on productivity. It also increases the probability that a pay increase will be associated with the elimination of restrictive labour practices.

The employment coefficients indicate that a rise in interest rates from 5 percent to 8 percent will generate a short-run employment reduction of nearly 3 percent which rises to around 11 percent in the long run. The other effects are relatively small by comparison, although the long-run offset due to lower wages could be as much as 3 percent.

ENDNOTES

1. See, for example, Bond and Meghir (1994); Fazzari et al. (1988); Devereux and Schiantarelli (1990); Gertler and Gilchrist (1994); Hoshi et al. (1991); and Kashyap et al. (1994) whose results basically confirm those obtained in the classic study of Meyer and Glauber (1964). However, the discussion in Chirinko (1994) indicates that some of this microeconometric evidence is less supportive of finance constraints than is commonly believed.

2. Earlier results reported in Wadhwani (1987) and Nickell and Wadhwani (1991) suggest that there may be something in this hypothesis. More recently Sharpe (1994) finds that high leverage firms have higher employment sales elasticities over the business cycle (i.e. engage in less labour hoarding). This is obviously consistent with "liquidity constraints" influencing employment.

3. In the standard, black-box neoclassical model of the firm, costs are minimised by assumption.

4. Because, for example, employees may be entitled to various forms of compensation for job loss.

5. The inverse of κ_i is the mark-up of price on marginal cost and there is a large and inconclusive literature on its cyclical behaviour. See, for example, Bils (1987); Rotemberg and Saloner (1986); and Layard et al. (1991), Ch. 7.

6. However, it can also be argued that the book value is more exogenous than the market value so its subsequent impact on employment, say, is easier to interpret.

7. Note this is the inverse of a standard measure of leverage known as the "interest cover".

8. We shall pursue this issue in the empirical analysis by including an additional variable in the equation which represents the inflation term ($\dot{p}^e D/\pi$).

9. Current assets include cash, marketable securities, receivables and stocks of finished goods. If we remove the last, the ratio becomes the "quick" or "acid-test" ratio.

10. In fact, we have data on the percentage pay increase, but because we estimate the equation in first differences, this is all we require.

11. Obviously some of a firm's debt has a fixed interest rate but this applies only to a small proportion.

12. For example, in the final stages of the late 1980s boom, bank base rates rose from 8.5 percent in 1988 Q1 to 13.0 percent in 1988 Q4.

Table 1

Employment Regressions Controlling for Demand

Dependent variable: n_{it}

Independent Variables	CBI sample '81-'86 Basic		Large sample ('75-'86) Basic		Include future variables endogenous		Include future variables exogenous		Include firm output endogenous		Include firm output exogenous	
	1		2		3		4		5		6	
$*n_{it-1}$	0.40	(4.0)	0.89	(11.8)	0.82	(9.9)	0.82	(10.4)	0.85	(11.6)	0.84	(12.7)
$*n_{it-2}$	0.04	(0.5)	-0.15	(2.0)	-0.08	(1.0)	-0.08	(1.2)	-0.06	(0.8)	-0.06	(1.1)
$*k_{it}$	0.56		0.26		0.26		0.26		0.21		0.22	
$*w_{it+1}$					-0.02	(0.2)	-0.02	(0.5)	0.003	(0.02)	0.027	(0.7)
$*\Delta w_{it}$			-0.21	(1.7)	-0.26	(2.0)	-0.23	(1.9)	-0.27	(2.0)	-0.24	(2.3)
$*w_{it-1}$	-0.80	(3.1)	-0.01	(0.1)	-0.25	(1.7)	-0.20	(1.5)	-0.20	(1.5)	-0.15	(1.3)
$*y_{jt+1}$					0.22	(1.4)	0.027	(0.4)	0.23	(1.6)	-0.039	(0.6)
y_{jt}	-0.06	(0.9)	0.20	(2.8)	0.27	(3.4)	0.24	(3.1)	0.14	(1.6)	0.096	(1.5)
y_{jt-1}	0.06	(0.9)	-0.16	(2.2)	-0.04	(0.5)	-0.06	(0.9)	0.02	(0.3)	0.02	(0.4)
$*y_{it+1}$									-0.03	(0.5)	0.005	(0.3)
$*y_{it}$									0.29	(3.9)	0.31	(10.1)
$*y_{it-1}$									-0.21	(3.3)	-0.26	(7.6)
$*Br_{it-1}$	-0.044	(2.5)	-0.24	(3.5)	-0.31	(4.1)	-0.30	(4.3)	-0.26	(3.6)	-0.24	(3.7)
$*DER_{it-1}$			-0.22	(1.2)	-0.08	(0.4)	-0.09	(0.5)	-0.08	(0.5)	-0.087	(0.5)
se	0.078		0.091		0.088		0.088		0.078		0.077	
Serial correlation (N(0,1))	1.25		-0.048		-0.67		-0.55		-1.03		-0.98	
Instrument validity	$\chi^2(23)=20.4$		$\chi^2(87)=136.5$		$\chi^2(80)=115.0$		$\chi^2(82)=116.8$		$\chi^2(77)=120.6$		$\chi^2(82)=136.3$	
Time dummies	√		√		√		√		√		√	
Industry specific trends	√		√		√		√		√		√	
Firm dummies	√		√		√		√		√		√	
NT	231		4407		3732		3732		3732		3732	
N	66		675		675		675		675		675	

Table 1
Employment Regressions Controlling for Demand

Notes:

(i) These equations are estimated in first differences to eliminate the firm dummies. The basic technique is due to Arrelano and Bond (1991), and uses an IV (GMM) method. The validity of the instruments depends on the absence of serial correlation in the level errors, i.e. absence of second order serial correlation in the first difference errors. This is investigated via the serial correlation test. The t ratios in brackets are robust against heteroskedasticity.

(ii) Starred variables are treated as endogenous except in equations 4, 6 where output variables and future wages are treated as exogenous. Instruments include n_{it-4}, n_{it-5}, y_{it-3}, y_{it-4}, w_{it-3}, w_{it-4}, k_{it-2}, k_{it-3}, $(\Pi/Y)_{it-3}$, $(ER)_{it-3}$, Δy^e_{jt}, Δp^e_{jt}, Δc^e_{jt}.

(iii) n_i = employment, k_i = capital stock, w_i = real wage normalised on industry (3 digit), output price, y_j = real industry output, y_i = real firm output, Π/Y = profits/sales, ER = return on firm's equity, BR = flow borrowing ratio (interest payments/cash flow), DER = debt ratio (debt/debt+equity), Δy^e_{jt} = balance of firms in the industry who expect output to rise (i.e. difference between percent who expect output to rise and percent who expect it to fall), Δp^e_{jt} = balance of firms in the industry who expect output prices to rise, Δc^e_{jt} = balance of firms in the industry who expect (unit) costs to rise.

(iv) In equation 1, we use instruments dated t - 2 because the sample is so short.

Table 2
Employment Regressions with Borrowing Ratio Interactions

Dependent variable: n_{it}

Independent Variables	BR interaction with Debt 1		BR interaction with Size 2		Include inflation effect 3	
$*n_{it-1}$	0.82	(9.9)	0.82	(10.1)	0.82	(9.6)
$*n_{it-2}$	-0.08	(1.0)	-0.08	(1.0)	-0.07	(0.9)
$*k_{it}$	0.26	(0.5)	0.26		0.25	
$*w_{it+1}$	-0.02	(0.2)	-0.03	(0.2)	-0.02	(0.1)
$*\Delta w_{it}$	-0.26	(1.9)	-0.26	(2.0)	-0.25	(1.9)
$*w_{it-1}$	-0.25	(1.7)	-0.25	(1.7)	-0.25	(1.7)
$*y_{jt+1}$	0.22	(1.4)	0.22	(1.4)	0.23	(1.5)
y_{jt}	0.28	(3.4)	0.28	(3.4)	0.27	(3.4)
y_{jt-1}	-0.04	(0.5)	-0.04	(0.6)	-0.04	(0.5)
$*BR_{it-1}$					-0.32	(3.3)
$*(\dot{p}D/\pi)_{it-1}$					0.03	(0.6)
$*BR1D_{it-1}$	-0.32	(3.4)				
$*BR2D_{it-1}$	-0.29	(2.6)				
$*BR1S_{it-1}$			-0.27	(2.7)		
$*BR2S_{it-1}$			-0.32	(4.0)		
$*DER_{it-1}$	-0.08	(0.4)	-0.09	(0.5)	-0.12	(0.7)
se	0.088		0.087		0.087	
Serial correlation (N(0.1))	-0.68		-0.73		-0.56	
Instrument validity	$\chi^2(79)=114.7$		$\chi^2(79)=114.1$		$\chi^2(79)=114.9$	
Time dummies	√		√		√	
Industry specific trends	√		√		√	
Firm dummies	√		√		√	
NT	3732		3732		3711	
N	675		675		670	

Notes:

(i) Starred variables are treated as endogenous. Instruments as in Table 1 (note (ii)).

(ii) Estimation method as in Table 1. Additional variables include $\dot{p}D/\pi$ = (absolute) falle in value of debt due to inflation as a proportion of cash flow; BR1D (BR2D) = BR for firms with above (below) median value of DER; BR1S (BR2S) = BR for firms above (below) median size (as measured by employment).

(iii) Estimation as in Table 1 (note (i)).

Table 3
Wage Regressions (Dependent variable: $\Delta(w_{it}-w_t)$)

Independent Variables	CBI sample ('81-'86) 1		Large sample ('75-'86) 2	
$*\Delta(w_{it-1}-w_t)$	0.72	(11.0)	0.39	(7.3)
$\Delta conc_{jt-2}$	-0.043	(1.5)	-0.093	(1.9)
$\Delta mksh_{it-2}$	0.44	(1.1)	0.62	(3.0)
$shock_{it}$	-0.0046	(0.9)	-0.016	(1.0)
$*\Delta BR_{it-1}$	-0.018	(2.1)	-0.089	(2.8)
se	0.012		0.062	
Serial correlation (N(0,1))	-0.056		-0.46	
Instrument validity	$\chi^2(13)=13.0$		$\chi^2(49)=76.4$	
Time dummies	√		√	
NT	231		4113	
N	66		618	

Notes:

(i) w_i = nominal wage, w = aggregate nominal wage, $conc_j$ = industry concentration ratio, $mksh_i$ = market share, $shock_i$ = proportional fall in employment from '79 to '81. The variable is set equal to this fall for the years 1982-4 and is set at zero otherwise. BR = flow borrowing ratio.

(ii) Starred variables are treated as endogenous. Additional instruments include n_{it-2}, n_{it-3}, w_{it-2}, w_{it-3}, y_{jt}, $(\pi/Y)_{it-3}$, ER_{it-3}. See also note (i), Table 1 although in this table, the results are presented in difference form.

Table 4

Productivity Regressions (Dependent Variable: y_{it}-k_{it})

Independent Variables	Large sample 1975-86	
*(y_{it-1}-k_{it})	0.38	(9.6)
*(n_{it}-k_{it})	0.62	(11.4)
H_{ojt} / H_{njt}	1.32	(3.9)
$10^{-3}(H_{ojt} / H_{njt})^{-1}$	-0.13	(0.5)
($conc_j$)t	-0.038	(2.6)
(imp_j)t	-0.011	(0.7)
10^{-2}($size_i$)t	0.34	(3.9)
Br_{it-2}	0.030	(1.9)
$mksh_{it-2}$	-1.45	(2.5)
se	0.10	
Serial correlation (N(0,1))	-0.14	
Instrument validity	$\chi^2(71)=149.1$	
Firm dummies	√	
Time dummies	√	
Industry specific trends	√	
NT	4407	
N	675	

Notes:

(i) y_i = output, k_i = capital, H_{oj} = industry overtime hours, H_{nj} = industry standard hours, imp_j = average industry import penetration, average size = average log employment, $conc_j$ = average concentration ratio, BR_i = flow borrowing ratio, DER_i = debt ratio, $mksh_i$ = market share.

(ii) Starred variables are treated as endogenous. Additional instruments include y_{it-2}, y_{it-3}, n_{it-2}, n_{it-3}, k_{it-2}, k_{it-3}, $(\pi / Y)_{it-3}$ $(ER)_{it-3}$. See also note (i), Table 1.

Table 5
Eliminating Restrictive Practices (Dependent variable, ΔRP)

Independent Variables	CBI sample (1981-86)	
$\Delta mksh_{it-2}$	-6.71	(2.2)
$\Delta(\pi / N)_{it-2}$	-0.023	(1.9)
$shock_{it}$	0.27	(1.8)
ΔBR_{it-1}	0.12	(1.6)
imp_j	0.56	(1.9)
$size_i$	-0.036	(2.7)
se	0.28	
Serial correlation 1st order(N(0,1))	0.76	
2nd order(N(0,1))	-0.017	
Time dummies	√	
Industry dummies	√	
NT	231	
N	66	

Notes:

(i) ΔRP_i = dummy which takes the value 1 when restrictive practices are reduced in the pay round, zero otherwise, $mksh_i$ = market share, $(\pi / N)_i$ = real profit per employee, $shock_i$ = proportional fall in employment from '79 to '81. The variable is set equal to this fall in the years 1982-4 and is zero otherwise. BR_i = flow borrowing ratio, imp_j = average industry import penetration, $size_i$ = average log employment.

(ii) The equation is estimated by OLS but the t ratios are robust to general heteroskedasticity.

DATA APPENDIX

The following datasets are used:

1. The `CBI Sample' consists of longitudinal data on 66 companies over the period 1979-86 for which we can merge information from the EXSTAT company database and the Confederation of British Industry (CBI) Pay Databank. The panel is unbalanced; 10 firms are present for 5 consecutive years, 7 for 6 years, 8 for 7 and 41 for 8. The first column in Table A2, at the end of this document, presents the distribution of firms by years.

2. The `Large Sample' consists of longitudinal data on 675 companies for the period 1972-86 from the EXSTAT company database. The panel is unbalanced and the distribution of the number of firms by the number of consecutive years for which they are present is the following:

Years	Firms	Years	Firms
6	112	11	153
7	65	12	15
8	28	13	12
9	51	14	2
10	196	15	41

The second column in Table A2, at the end of this appendix, presents the distribution of firms across years in this sample. Note that in the wage regression the sample is reduced to 618 firms since firms for which the $Shock_i$ variable cannot be calculated (i.e. firms which are not present in both 1979 and 1981) have been dropped. It is important to recognise that the reduction in the sample size after 1981 is not because the relevant firms ceased to exist, merely that they ceased reporting a consistent measure of employment since they no longer had any legal requirement to do so.

1. Firm-level data

The basic source of the firm-level data are the published company accounts accessed through the EXSTAT Company Data Service. The definitions of all variables used and their sources are presented next. Acronyms are presented in brackets next to the variable descriptions. In general, lower case `versions' of these acronyms, within the text, refer to the variable in logs.

1. Employment (N_{it})

   Domestic employment (EXSTAT item C15). The firms included in the sample are fairly large; in 1982 the average employment is 4574 employees and the median is 961 employees.[1]

2. Size ($Size_i$)

   This is defined as the average of log employment:

$$\frac{\sum_{i=1}^{T} n_{it}}{T} \qquad \text{(A1)}$$

3. Wages (W_{it})

   Two sources for wage information are used:

   (a) The published accounts provide information on total domestic remuneration (EXSTAT item C16). By dividing this by the appropriate employment figure we get the average total remuneration per employee. This amount is then converted into real terms by deflating with the Producer Price Index of the 3-digit industry (see Section 2) to which the firm belongs.

[1] For the 66 firms in the CBI sample average employment in 1982 is 7413 and median employment is 1764.

(b) The CBI Pay Databank provides information for a subsample, of 66 out of the 675 firms, on the pay rise granted for up to 3 bargaining groups. The pay rise for a manual bargaining group is used here. For this bargaining group the Databank contains information on:

(i) The month of the pay settlement.

(ii) A manager's estimate of the impact of the settlement on the gross average earnings in the coming calendar year and,

(iii) The agreed pay increase.

The last item is not always available. Given, however, that when available this is nearly always the same as the manager's estimated increase we use the latter. Information on the month of the settlement is used to allocate the pay rise over the two calendar years to which it typically refers (nearly all settlements last for 12 months).

4. Capital Stock (K_{it})

This is based on transforming net tangible assets at historic cost into the same variable at current replacement cost and then normalising on the price index for plant and machinery. Details of the method are provided in Wadhwani and Wall (1986).

5. Output (Y_{it})

Firm sales (EXSTAT item C31) deflated by the producer price index of the 3-digit industry into which the firm belongs.

6. Profits (π_{it})

Profits before tax (EXSTAT item C34).

7. Effort (RP_{it})

The existence or otherwise of restrictive practices is used here as a measure of effort. The CBI Pay Databank provides managers' replies for a subsample, of

66 out of the 675 firms, on the removal or otherwise of restrictive practices. The variable is a dummy which takes the value 1 if the reply is affirmative. The settlement date is used to allocate this variable across the relevant two calendar years since the removal of restrictive practices is a process lasting for at least the length of the settlement. In the period 1980-86 around 38 percent of firms in the sample removed restrictive practices.

8. Market Share ($mksh_{it}$) ($\overline{mksh_{it}}$ = 0.011).
This is defined as the ratio of firm sales (EXSTAT item C31) over a measure of industry total sales. Industry total sales ($TSALS_j$) is defined as the product of the average number of firms in industry j in a chosen base year (1980) (N_j) with the average sales of a firm in industry j in year t ($AVSALS_{jt}$).

$$MKSH_{it} = \frac{SAL_{i\,t}}{N_{j80} \times AVSALS_{jt}} \qquad (A2)$$

The sample of firms used to get the average sales and the number of firms in each industry contains about 1200 firms including all the major quoted companies in the industry. The number of firms, N_j, is held constant to correct for the changing composition of the sample.

9. Shock ($Shock_i$)
$Shock_i$ is defined as the proportional fall in employment from 1979-1981, that is $-(n_{1981}-n_{1979})$ ($\overline{Shock_i}$ = 0.14).

10. Borrowing ratio (BR_{it}) ($\overline{BR_{it}}$ = 0.19).

This is defined as:

$$\frac{\text{Interest payments}}{\text{Profits before tax} + \text{Depreciation} + \text{Interest payments}} \qquad \text{(A3)}$$

$$\text{EXSTAT ITEMS} \qquad \frac{C57}{C34 + C52 + C57}$$

For those firms for which the denominator in (A3) above takes on a negative value, that is for firms facing losses prior to the payment of interest rates and the deduction of depreciation, BR is set equal to 1. Thus BR varies between 0 and 1, its mean value is 0.19 and its median is equal to 0.11. Table A1 presents the average value of BR in each year in the period 1972-1986. The Borrowing Ratio deteriorated dramatically in 1980 and 1981, consistent with the decline in profits over the same period, and shows an improvement since then.

11. Debt-Equity ratio (DER_{it}) ($\overline{DER_{it}}$ = 0.52)

This is defined as:

$$\frac{\text{Total liabilities} - \text{Shareholders' funds}}{\text{Total liabilities}} \qquad \text{(A4)}$$

$$\text{EXSTAT ITEMS} \qquad \frac{(C158 - C132)}{C158}$$

As Table A1 indicates, this improved in the 1980s.

12. Current Ratio ($CURR_{it}$)

This is defined as:

$$\frac{\text{Current assets}}{\text{Current liabilities}}$$

$$\text{EXSTAT ITEMS} \quad \frac{C114}{C157}$$

13. Profits over sales (π / Y)

This is the ratio of Profits before tax (EXSTAT item C34) over firm sales (EXSTAT item C31).

14. Stock Market Returns (ER)

Stock Market returnsare defined as the sum of the dividend received in this period and the change in the share price as a proportion of the share price in the last period. That is

$$\text{Returns} = \frac{D_t + (P_t - P_{t-1})}{P_{t-1}} \simeq \ln\left(\frac{P_t + D_t}{P_{t-1}}\right)$$

where P_t
is the share price in month t and D_t is the dividend yield at time t.

The source for this information is the London Business School "London Share Price Database" (LSPD) and the item is labelled `Log Returns'. The LSPD contains all companies listed in the London Stock Exchange or in the Unlisted Securities Market since 1975. Prior to 1975 only a sample of these firms is reported. LSPD Returns refer to monthly Returns.

Use of Stock Market Returns assumes that the firm is listed in some market. For firms which are not quoted in either `market' the returns corresponding to the average of the industry into which they belong have been used.

The average value of returns over the period 1972-1986 is 18 percent.

2. Industry-level variables

1. Producer Price Index (P_{jt})

   Source: British Business and its predecessors and unpublished data from the Business Statistics Office.

2. Overtime Hours (H_{0jt})

   Weekly overtime hours per operative on overtime times the fraction of operatives on overtime.

   Source: Employment Gazette.

3. Standard Hours (H_{njt})

   Normal weekly hours.

   (mean $\frac{H_{0jt}}{H_{njt}}$ = 0.07).

   Source: Employment Gazette.

4. Concentration Ratio ($conc_{jt}$)

   Five-firm concentration ratio in terms of sales ($\overline{conc_{jt}}$ = 0.41).

   Source: Annual Report on the Census of Production, Summary Tables, Table 13.

5. Import Penetration ratio (imp_{jt})

   Ratio of imports over home demand (sales+imports-exports) ($\overline{imp_{jt}}$ = 0.21).

   Source: Business Monitor MQ12 (collected by S. Machin).

6. Industrial Output (Y_{jt})

   Deflated by Producer Price Index (P_{jt}) (see above).

   Source: Monthly Digest of Statistics.

The next 3 variables are forecast variables collected by the CBI in their Quarterly Industrial Trends Survey. The responses to these questions are qualitative; only the direction of the expected change has to be reported. The variable we use is the difference in the proportion of managers expecting a rise from those expecting a decrease. Data are available at quarterly intervals and we use the annual average of these. The industry classification adopted by the CBI is not the same as the Standard Industrial Classification used by official government statistics. During the period 1972-86 the classification has become progressively more detailed improving the match between these data and the firm level data. More specifically the classification has changed twice during this period; in 1978 and in 1984. The correspondence between the `CBI Industries' and the Stock Exchange Classification for the periods 1972-77, 1978-83 and 1984-86 are presented in Table 2 below. Note that for the 66 firms for which we have information from the CBI Pay Databank for the period 1979-1986 the match has been based on the SIC68 information available in the CBI Pay Databank.

7. Expected change in the volume of output in next 4 months (Δy^e_{jt}).

8. Expected change in average costs per unit of output (Δc^e_{jt}).

9. Expected change in the average prices at which domestic orders are booked (ΔP^e_{jt}).

3. Aggregate Variables

1. Wage (W_t)

   Aggregate wage taken from S. Savouri, `Regional Data 1967-87', Centre for Economic Performance, London School of Economics, WP No. 133, 1991.

Table A1

Financial measures and treasury bill yield in

1972-1986

Year	BR	Treasury bill yield (%)	DER
1972(422)	0.11	8.48	0.49
1973(435)	0.12	12.82	0.52
1974(450)	0.17	11.30	0.55
1975(494)	0.18	10.93	0.55
1976(649)	0.16	13.98	0.57
1977(669)	0.13	6.39	0.55
1978(664)	0.13	11.91	0.53
1979(664)	0.19	16.49	0.52
1980(660)	0.31	13.58	0.50
1981(620)	0.31	15.39	0.50
1982(307)	0.28	9.96	0.48
1983(125)	0.20	9.04	0.46
1984(102)	0.20	9.33	0.47
1985(88)	0.14	11.49	0.45
1986(83)	0.13	10.94	0.44

Notes:

The numbers in brackets next to the years represent the number of observations from which the averages have been calculated.

Sources:

1. EXSTAT dataset.
2. Treasury bill yield is from Economic Trends Annual Supplement, 1992 Edition, Table 47, p.224.

Table A2

Number of observations by year

Years	`CBI Sample'	`Large Sample'
1972	-	422
1973	-	435
1974	-	450
1975	-	494
1976	-	649
1977	-	669
1978	-	664
1979	52	664
1980	55	660
1981	60	620
1982	66	307
1983	65	125
1984	61	102
1985	55	88
1986	39	83

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