PROFIT DETERMINATION IN U.K. MANUFACTURING

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ABSTRACT

This paper examines the determinants of profitability in 90 U.K. manufacturing industries over the period 1983-86. It considers the importance of labour market characteristics in determining profits and how their inclusion in a profitability equation affects the concentration-margins relationship. The empirical work also pays detailed attention to the endogenous nature of variables derived from structural Industrial Organisation models and we report instrumental variables estimates of profitability equations in which there is a significant role for labour market characteristics. Indeed, both unionisation and unemployment are found to depress profit margins. The impact of concentration on profitability is seen to be biased downwards when these variables are not considered.

Keywords : Profitability, Labour Market, Instrumental Variables.

JEL Classifications : 610, 820, 830.

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1. Introduction

One popular view, held by many industrial economists and confirmed by a number of empirical studies over the years, is that the structure of an industry plays a fundamental role in the determination of profits.[1] In addition to this, it has been suggested that labour market characteristics can also play an important role and, indeed, some recent empirical work has supported this contention.[2] Much of this work, however, has utilised U.S. data and, of the British work that has used industrial data, the focus has very much been on the concentration-margins relationship using a single cross section in which little attention has been paid to the endogenous nature of the relevant explanatory variables.

This paper considers the determination of profits at the industry-level and is unique in a number of important ways. Firstly, we utilise a panel of U.K. industry-level data in the early 1980's. The fact that we have a time series element to our analysis means that we can confront the issue that a number of the key variables in Industrial Organisation models of profit determination are endogenous. A second important issue concerns the theoretical underpinning of the empirical model and, in particular, how it relates to the often used assumption that marginal and average costs are equal. Thirdly, and perhaps most important, we feel that there is a potential role for labour market variables to enter into profitability equations. This follows from theoretical considerations such as the idea that labour market models like bargaining models of union behaviour or efficiency wage models of wage determination suggest that workers should be able to obtain a share of

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1 See, *inter alia*, the reviews of Scherer(1980) and, more recently, Geroski(1988) and Schmalensee(1988).

2 At the industry-level, most of this work is based on U.S. data : see, among others, Freeman(1983), Karier(1985,1988) and Voos and Mishel(1986). Some British work does exist on this issue, but typically uses more disaggregated data sources (see Blanchflower and Oswald(1988), Machin(1989) and Machin and Stewart(1988)).

the firm or industry's rents. It also emerges from the empirical observation that union power appears to be an important determinant of profit margins. Hence, we consider the interaction between product and labour market imperfections to be of some importance in determining industrial profitability.

To briefly anticipate our results, we find an important role for labour market factors such as unionisation and unemployment, both of which impact negatively on our preferred measure of industrial profitability. Indeed, the evidence reported here suggests that the gains from monopoly power (working through higher industry concentration) are strongly biased downwards when these labour market variables are not considered.

The paper proceeds as follows. In Section 2 we outline some theoretical considerations and the econometric modelling strategy to be adopted. Section 3 presents the results and Section 4 offers some concluding remarks.

2. Profitability, Market Structure and the Role of the Labour Market

The Impact of Structure on Profitability

Theoretical models developed on the basis of Cournot quantity setting oligopoly imply a positive relation between the excess of price over unit costs and a more highly concentrated market structure. In particular, Cowling and Waterson(1976) demonstrated this relationship for the range of values of the Herfindahl index in oligopolistic equilibrium. This is easily illustrated by considering the following maximand for a price taking firm i in a homogeneous product Cournot oligopoly j

$$(1) \qquad \Pi_{ij} = [P_j(Q_j) - MC_{ij}(q_{ij})]q_{ij}$$

where Π_{ij} is profits, $P_j(.)$ is industry price which is a negative function of market output Q_j ($= \Sigma q_{ij}$) and MC_{ij} is marginal costs which are a function of own output q_{ij}. Because costs vary across firms in the market, equation (1) generates an asymmetric oligopoly situation. The first order condition for (1) (where firms choose q_{ij} to maximise Π_{ij}) can be re-arranged to give the following expression for the degree of oligopoly power, say μ_{ij}, as

$$(2) \qquad \mu_{ij} = (P_j - MC_{ij}) / P_j = (S_{ij}/\varepsilon_j)\ (\partial Q_j/\partial q_{ij}) + (\partial MC_{ij}/\partial q_{ij})\ (q_{ij}/P_j)$$

where S_{ij} ($= q_{ij} / Q_j$) is firm i's market share and ε_j is the absolute value of the price elasticity of demand. If one ignores the second right-hand side expression this is simply the usual first order condition derived from basic Cournot oligopoly models. The presence of this extra term is however due to a possible divergence between average and marginal costs (as in Harris(1988)). To see this, define φ_{ij} as the ratio of average total costs to marginal costs $(q_{ij}/C_{ij}(q_{ij}))(\partial C_{ij}/\partial q_{ij})$ so that (2) can be written as:

$$(3) \qquad (P_j - MC_{ij}) / P_j = (S_{ij}/\varepsilon_j)\ (1 + \alpha_{ij}) + (1/\varphi_{ij} - 1)\ (MC_{ij}/P_j)$$

where α_{ij} is the reaction coefficient capturing the change in rivals output to a change in the output of firm i.

To establish the relationship between industrial concentration and performance we simply sum across firms, and re-arrange to get the condition

$$(4)\ (P_j\Sigma q_{ij}-\Sigma q_{ij}(\partial C_{ij}/\partial q_{ij})/P_jQ_j = (H_j/\varepsilon_j)(1 + \alpha_j) + \Sigma(1/\varphi_{ij} - 1)S_{ij}(MC_{ij}/P_j)$$

where the left hand side is the profit margin, H_j $(= \Sigma S_{ij}^2)$ is the Herfindahl index of concentration and α_j $(= \Sigma \alpha_{ij})$ is the industry-wide conjecture term.

Ignoring for a moment the second term on the right hand side then under

Cournot assumptions ($\alpha_j = 0$) a positive relationship is established between the Herfindahl and the optimal profit margin for industry j. This is the Cowling-Waterson(1976) result. Additionally, even if the reaction coefficient is not Cournot but it lies between -1 and +1 there still exists a positive relation between margins and concentration.

An important point we need to make is that the presence of the extra term on the right hand side implies that industry margins can differ due to the effect of scale economies within the industry. If marginal equal average costs ($\varphi = 1$) then price-cost margins are fully determined by the market share distribution in the industry, the conjectural variation term and the price elasticity of demand. This is the Cowling-Waterson(1976) extension of the Lerner condition. However, if there are increasing returns to scale (where $\varphi > 1$) margins will fall and if there are decreasing returns ($\varphi < 1$) margins will rise. Clearly, if one adopts the assumption that marginal and average costs are equal and this proves incorrect then the price-cost margin is overstated (if $\varphi > 1$) or understated (if $\varphi < 1$). Hence, to conclude that concentration impacts positively on margins it is necessary to net out the effect of within-industry efficiency as captured in a measure of returns to scale. We feel that this has potentially important implications for the empirical work, and unlike previous work on this issue, we control for this potential bias by including an industry-specific estimate of scale economies in our profitability equation.

Assuming products to be homogeneous and that incumbent oligopolists can credibly deter entry (or equivalently that the number of firms in the industry is fixed) we may characterise the non-linear equation in (4) as a general function of the form

$$(5) \qquad PROF_j = \phi\,[H_j\,,\ \alpha_j\,,\ \varepsilon_j\,,\ \varphi_j\,] = \mu_j^*$$

where $PROF_j$ is the average profitability of the firms in industry j. So, industrial profit margins are a positive function of concentration H (conditional on α) and to isolate this one needs to appropriately control for conjectures, the elasticity of demand and scale economies. Hence, we may term the optimal industry degree of monopoly derived from profit maximisation by firms in industry j as μ_j^*.

The model presented here is subject to the objection of Clarke and Davies(1982) that the optimal profit margin exhibits a relationship with concentration but is not caused by it. This is effectively the point that variables entering the profit determination process are fundamentally endogenous. Hence, the estimation of a reduced form profit equation in which concentration is treated as exogenous will lead to erroneous inference. We take up this point in the empirical work where we allow for the endogeneity of concentration in our estimating framework.

To date we have dealt with the importance of structure, in particular concentration and scale economies, on a measure of performance. A further issue arises due to the fact that (2) assumes an equilibrium relationship holds. Now, a popular research area in the recent Industrial Organisation literature has argued that, for example, the presence of adjustment costs in input demands, stock accumulation and thwarted expectations mean that, for the model to hold, it is necessary to impose some dynamic structure. To capture this in our empirical work we also estimate a dynamic model by exploiting the panel nature of our data and estimating a simple partial adjustment model.[3]

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[3] The rationale for this is further explored theoretically, *inter alia*, by Geroski and Masson(1987) and empirically by Levy(1987).

The Role for Labour Market Variables

We introduce the role of labour into the model in a heuristic fashion. In the labour economics literature a robust result is that unionism reduces profits (see the references in footnote 2). This is hardly a surprising result and accords with expectations from both common sense and economic theory. Over and above this, it seems likely that unions may act to offset capitalist control and as such curtail the product market power enjoyed by firms and industries. However, the model of profit determination given above essentially corresponds to a situation where either unions are not present, or if they are, they do not impinge on the profit maximising process. Evidently this may not prove reasonable for unionised economies. We therefore see a potential role for unionisation in the profit determination process.[4]

So, our fundamental argument is that the strategic price/output decisions of firms are likely to be influenced by the behaviour of the labour force. By this, we mean not only internal factors like the degree of unionisation in the firm, but also other related external variables: for instance, in industries facing de-industrialisation (the likes of, say, shipbuilding) structural demand variables are likely to be of potential importance. To model structural shifts in employment relations we picture a potentially important role for labour market variables in addition to unionisation. In particular, we consider a role for industry-wide differences

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4 It is reasonably straight-forward to write down a formal model which illustrates that unions will dampen down profit margins. Machin(1988) presents a model, based on strongly efficient wage-employment bargaining (see e.g. Brown and Ashenfelter(1986)), in which unions and firms bargain over a share of the firms potential surplus (in our notation μ^*). In this model, the profit margin of a unionised firm (= $(1 - \Theta) \mu^*$) is lower than the non-union margin μ^*, where Θ (< 1) is the bargaining strength of the union relative to the firm. Of course, in this Nash framework the "size of the pie" is unchanged by unionisation : if μ^* is, however, altered by the presence of unions, as we argue above, the solution is less clear-cut. Nevertheless, the prediction that unions may matter for profit determination remains. For an exposition based on intra-firm conflict between capital and labour see Kalecki(1971).

in unemployment rates in affecting the profit determination process.

Modelling Strategy

Following the theoretical discussion, industrial profitability is treated as a function of the form

$$(6) \qquad PROF_{jt} = X_{jt}'\gamma + Z_{jt}'\theta + \varepsilon_{jt}$$

where $PROF_{jt}$ is a performance measure for industry j in time period t, X is a vector of Industrial Organisation determinants of the profit process, Z are appropriate labour market characteristics, ε_{jt} an error term and (γ, θ) are population parameters to be estimated.

The choice of the profit measure is of some importance. We define profits as gross value added minus the operative wage bill and our margin as profits divided by value added. This has the advantage that it can be construed as either a measure of profitability, or alternatively as profit share. On the latter point, note that we use this measure since it also allows us to derive inferences concerning the distributional element of profit determination.

Our model is estimated for the period 1983 to 1986 retaining data from 1980 onwards for use as instruments.[5] The choice of the sample period is not arbitrary and is chosen because published data on the key unionisation variable is only available for 1985. Given the large falls in the degree of unionisation in the early 1980's we are therefore reluctant to use 1985 data before 1983 and this dictates our sample selection. Some summary data on the key variables is reported in Table 1. The first point to note is that profit

[5] We are restricted in our time series component because of the change in definition of many of our 3-digit industries in the 1980 Standard Industrial Classification.

margins have risen slowly but steadily over this time period.

The industry characteristics included in X are variables typically considered in Industrial Organisation studies of the concentration-margins relationship.[6] Concentration is the proportion of sales accounted for by the largest five firms in the industry (i.e. not the Herfindahl index referred to in the model, which is unavailable for our data source). Note that the mean across manufacturing fell over the time period under study, as depicted by the variable CONC in Table 1. To control for the degree of potential international competition faced by given industries we use import and export intensity variables, both of which have risen between 1983 and 1986. Hence, the raw data in Table 1 generally confirm an increasing degree of competitiveness in U.K. manufacturing over the 1980's.

Our theoretical discussion also highlighted the importance of an appropriately defined returns to scale variable. Traditionally, the computation of such measures has proved problematic and various proxies such as average plant size in the industry have been used. We however propose a different approach and estimate returns to scale for all industries in the sample from a production function over the period 1980 to 1986. The production function we estimate is a Cobb-Douglas function of the form

$$(7) \qquad \ln Q_{jt} = \alpha + \beta \ln K_{jt} + \gamma \ln L_{jt} + \theta t + \nu_{jt}$$

where Q is deflated value added, K is the capital stock, L is employment, t a time trend and ν a random error. In this model returns to scale are given by the sum of the parameters on lnK and lnL, that is $\beta + \gamma$. We let each industry in the sample have a separate β and γ (i.e lnK and lnL are stratified by

6 We do not claim this to be a definitive Industrial Organisation formulation of the X-vector : it is very much a stylised version, although one that is sufficient for our purposes of highlighting the importance of labour market factors in shaping profitability.

industry dummies) to obtain industry specific estimates of returns to scale, given as $RTS_j = \hat{\beta}_j + \hat{\gamma}_j$ for industry j (j = 1,..90). The estimates of RTS seem reasonable, ranging from 0.119 to 1.985, with a mean of 1.050. Hence, we use this measure (which, by definition and due to degrees of freedom problems[7] is time-invariant) as our measure of scale economies in the estimating equation.

We use two labour market variables, namely union coverage and the industry wide unemployment rate. The first is only available for 1985 and is a fixed effect, although is treated as endogenous in the empirical work. The second, the industry unemployment rate, is included as a measure of industry-specific demand conditions reflecting compositional shifts in manufacturing employment in the 1980's.

As discussed in some detail above, we use instrumental variable estimation techniques to control for problems of the potential endogeneity of the key variables under study. Because of the panel element the presence of data from previous years means we have available to us a large number of instruments. We follow Arellano and Bond(1988a,b) in selecting an optimal choice of instruments : for example, if we view a variable X_t as being endogenous we have available values of X (plus any other variables in the model) before period t for use as instruments. Hence, in period t we can use data from t-1, t-2 etc. as valid instruments, in period t+1 we can use instruments dated t back and so on, so that as the panel becomes further advanced we can call on more instruments. We follow this procedure and are careful to choose our instrument set contingent on a test of instrument validity which is given in the results to follow. Note also that for

7 The equation is estimated from 630 observations (90 industries over 7 years) and, to derive a time-invariant returns to scale measure, includes 182 independent variables. To obtain time-varying measures is obviously infeasible.

parameter estimates to be consistent, it is important that there be no serial correlation. Appropriate tests are therefore presented in the empirical section of the paper. More details on the estimation procedure, and the reported diagnostics, are given in the Technical Appendix to the paper.

3. Estimated Models of the Profit Determination Process

Our estimated profitability equations are reported in Table 2. In columns (1) and (3) we report the basic models of profit determination, and in (2) and (4) these are augmented by the labour market variables of interest namely unemployment (UNEMP) and trade union presence (COVER). Given the non-linear nature of the model (see, for example, equation (4)) we present equations with all continuous variables defined in natural logarithms. All models are estimated using the generalised instrumental variables techniques described in the previous Section and in the Technical Appendix. A number of diagnostics are presented and are explained in the notes to the Table.

In column (1) we report a stylised Industrial Organisation equation.[8] The equation confirms that higher profits are earned by more highly concentrated industries and that facing increasing returns to scale mean that higher profits cannot be achieved. Industries with higher import penetration and/or less of an ability to export have lower profit margins.[9] These results are consistent with other empirical work and with the traditional models outlined in Section 2 of the text.

Column (2) augments column (1) with the union variable and the unemployment rate. We allow for the endogenous nature of union coverage by instrumenting it with lagged values of union density and the proportion of

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[8] Some other variables were considered but proved to be statistically insignificant. These included one year sales growth, capital intensity, and the log of total employment.

[9] The measure of imports and exports were found by grid search methods within the 0.05 interval.

manual employees in the industry (see the notes of Table 2 for more details). The negative impact of unionisation confirms what would be expected and is consistent with the U.S. evidence for this level of aggregation. All existing British work, with the exception of Cowling and Waterson's(1976) paper relating to 1960's data, also finds this result, but at a more disaggregated level. Hence, these are the first results to confirm a negative union effect for the 1980's at the level of the industry.

The other labour market variable, the 2-digit unemployment rate, is also included in column (2). It is appropriately instrumented by using lagged values of the variable itself and the log of total industry employment as instruments (see the notes to the Table). Like the union presence variable, the unemployment rate variable exerts a negative impact on margins. This is consistent with the idea that margins are procyclical, although given the short time period, the fact that UNEMP is an imperfect proxy and the high unemployment throughout the 1980's in Britain (as elsewhere in Europe) we would not like to emphasise this. Of course, it would be desirable to analyse this issue for a longer time period before reaching any stronger conclusions.[10] On the other hand, by considering UNEMP as very much a cross-sectional variable we feel we can offer a much more appealing interpretation of this result. If, because of the nature of this variable (based on the industry people worked in prior to becoming unemployed), we view it as actually picking up cross-sectional variation in demand conditions then it is entirely plausible that those de-industrialising industries with lower rates of return are the industries facing high unemployment rates. In this sense, UNEMP reflects structural demand conditions and it is for this reason that we observe a negative effect on profitability.

[10] For the U.S. Bils(1987) reports that margins are counter-cyclical, but Domowitz et. al.(1986) present results suggesting a pro-cyclical mark-up in some industries.

Instrumenting CONC is not unimportant and, indeed, comparison with Ordinary Least Squares estimates shows a rise in the estimated coefficient from an OLS estimate of 0.119 (with a standard error of 0.012) to the estimate of 0.146 given in Table 2. Whilst not dramatically different from one another, this does suggest that the issue of the endogeneity of CONC is not trivial, and that care needs to be taken in choice of the estimation techniques used in structure-performance studies.

However, the substantial result emerging from comparison of column (1) with column (2) is that omission of labour market factors seriously biases downwards the effect of concentration on the determination of profits. Indeed, the coefficient rises by 64% when one moves from the specification in column (1) to that in column (2). This testifies to the importance of including labour market variables in profitability equations.

Note that, despite the reasonable performance of the instrument validity test in columns (1) and (2), there is evidence of significant serial correlation which renders the test inappropriate and the resultant coefficient estimates inconsistent. One potential explanation for this serial correlation is that the reported equations are subject to dynamic misspecification. We allow for this in the remainder of Table 2 by specifying a partial adjustment mechanism for profitability and including a lagged dependent variable. Aside from the econometric issues, this can be justified for a number of reasons, like adjustment costs, habit persistence, delivery lags and so forth.[11]

The specifications including lagged profit margins are all free from first and second order serial correlation thus confirming that the problems of columns (1) and (2) can be thought of as dynamic misspecification. This has important implications when one considers that most (but not all) British

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[11] See, *inter alia*, Levy(1987) and Geroski and Masson(1987).

studies of the concentration-margin relation rely on a single years cross section.

In the dynamic models, we find an important role for market concentration and for the returns to scale measure although, in comparison with columns (1) and (2), there is less of a role for the foreign trade variables. The result that union presence dampens down margins is still valid even with the inclusion of the lagged profitability variable. This indicates that the ability of the union to affect margins (and presumably achieve higher wage gains) is not simply a transitory phenomenon but is the case even when one allows for the persistence in industrial profitability. Finally, the unemployment result appears somewhat less strong but remains significant at the 10% level. The weaker nature of this result adds weight to the idea raised above that the unemployment effect is essentially a cross-sectional effect related to structural demand conditions. Most importantly, notice that the omission of important labour market factors still results in a substantial downward bias of the concentration effect when moving from column (3) to column (4).

Table 3 reports estimates of the implied long term impact of the three key variables. Columns (a) and (d) refer to the specifications in columns (3) and (4) in Table 2. Despite the short time series element of the data we still view this as a useful exercise and two important points emerge. First, the long run impact of concentration derived from the dynamic models are similar to those from the static equations in Table 2. Second, the longer term impact of concentration is greater than the short run. The same explanation emerges with the unemployment and coverage variables, both of which exert important longer term effects on margins.

As a further diagnostic check of our models Table 3 also produces long run effects for models including $\ln(\Pi/Q)_{t-2}$ (in columns (b) and (e)) and including one period lags on all (time-varying) right-hand side variables (in columns (c) and (f)). The implied effects are very similar and highlight the positive concentration-margins relationship but, in addition, the importance of labour market variables and the way in which the relationship is severely understated when they are omitted.

4. Conclusions

This paper reports estimates of the determinants of profits in U.K. manufacturing over the period 1983-1986. It is careful to explicitly take into account the structural nature of the relevant model so that the industrial variable of interest (market concentration) and the two labour market variables under study (coverage and unemployment) are treated as endogenous in the empirical work. Doing so, and making modifications to the typically chosen empirical approach, produces a clear picture for the time period under study. Specifically, the oft cited positive structure performance relation is reproduced even when one controls for scale economies and the above labour variables. It is however the case that when the labour market variables are left out, the coefficient on concentration falls by almost one-half. These labour market variables also play an important role in their own right as, for this period anyway, trade union presence and high industrial unemployment reduce profit margins. The limited time series under examination, however, must temper our conclusions of union effects over the longer term.

Overall, our reported models suggest that both static and dynamic Industrial Organisation models of profitability determination should allow a role for the impact of the labour market. Whilst this has been the subject of recent theoretical work (e.g. Dewatripont(1988) or Dowrick(1988)) it has been by-passed in other relevant analyses. Hopefully, the empirical content of the paper acts as a step towards rectifying this.

Table 1 : Means of Key Variables 1983-86.

	Name	1983	1984	1985	1986	1983-86
Profit margin	Π/Q	0.644	0.647	0.655	0.656	0.651
Concentration	CONC	0.431	0.418	0.414	0.415	0.420
Unemployment	UNEMP	0.114	0.089	0.074	0.073	0.088
Union coverage	COVER	a	a	a	a	0.649
Import intensity	IMPS	0.303	0.321	0.344	0.338	0.327
Export intensity	EXPS	0.277	0.286	0.294	0.298	0.289
Returns to scale	RTS	a	a	a	a	1.050

Notes.
1. Definitions of variables are as follows : Π/Q - ratio of profits to value added, where π is the difference between gross value added and the operative wage bill. CONC - 5-firm concentration ratio by sales; UNEMP - industry unemployment rate; COVER - proportion of male manual employees covered by collective bargaining arrangements in 1985; IMPS - ratio of imports to home demand; EXPS - ratio of exports to sales; RTS - estimated average returns to scale for the firms in the industry (see text).
2. Data sources are as follows : Π/Q, CONC - Report on the Census of Production Summary Tables, PA1002, HMSO; UNEMP - unpublished Department of Employment data; COVER - 1985 New Earnings Survey; IMPS, EXPS - Business Monitor Publication MQ12, HMSO; RTS - estimated from value added, capital stock and employment data from the Census of Production and Blue Book (see text for details).
3. a denotes that a variable is time invariant so that only the 1983-86 mean is reported.

TABLE 2 : ESTIMATED MODELS OF PROFIT DETERMINATION 1983-86.

	(1)	(2)	(3)	(4)
Constant	-0.369(0.037)	-0.115(0.126)	-0.091(0.057)	-0.048(0.062)
ln(CONC)	0.089(0.025)	0.146(0.029)	0.028(0.016)	0.052(0.021)
ln(RTS)	-0.053(0.037)	-0.052(0.042)	-0.034(0.009)	-0.035(0.011)
IMPS≥0.35	-0.089(0.033)	-0.083(0.034)	-0.031(0.018)	-0.035(0.020)
EXPS≥0.30	0.122(0.038)	0.031(0.045)	0.046(0.021)	0.026(0.018)
ln(UNEMP)	-	-0.164(0.043)	-	-0.045(0.026)
ln(COVER)	-	-0.487(0.146)	-	-0.147(0.074)
$\ln(\Pi/Q)_{t-1}$	-	-	0.706(0.113)	0.645(0.111)
Time Dummies	Yes	Yes	Yes	Yes
Υ	11.36(17)	81.73(59)	23.22(17)	65.67(59)
W	27.07(4)	69.97(6)	697.62(5)	802.48(7)
R1	5.63	5.24	-1.12	-0.96
R2	4.86	4.82	1.30	1.57

Notes.
1. The dependent variable is $\ln(\Pi/Q)$.
2. Heteroskedastic consistent standard errors are in parentheses.
3. ln(CONC), ln(UNEMP) and ln(COVER) are treated as endogenous. Instruments used are as follows : ln(CONC) - lags on CONC from t-1 back to a maximum of t-6; ln(UNEMP) - lags of t-1 in each period for ln(UNEMP) and all lags from t-1 back on ln(total industry employment); ln(COVER) : all lags from t-1 back on ln(proportion of manual employees in total employment) and lags of t-1 in each period on ln(Union density).
4. Υ is a test of the overidentifying restrictions provided by the instruments. It is distributed as a Chi-square statistic, the degrees of freedom are in parentheses (see Technical Appendix).
5. W is a Wald test of the significance of the included regressors (excluding the constant and time dummies), with degrees of freedom reported in parentheses.
6. R1 and R2 are respectively tests for first order and second order serial correlation. Both are N(0,1) statistics (see Technical Appendix).

TABLE 3 : IMPLIED LONG-RUN EFFECTS.

	Excluding UNEMP and COVER			Including UNEMP and COVER		
	(a)	(b)	(c)	(d)	(e)	(f)
CONC	0.095	0.108	0.095	0.146	0.151	0.144
UNEMP	-	-	-	-0.127	-0.127	-0.126
COVER	-	-	-	-0.414	-0.373	-0.375

Notes.
1. Columns (a) and (d) correspond to columns (3) and (4) of Table 2 respectively.
2. Columns (b) and (e) are derived from models including one and two period lags of $\ln(\Pi/Q)$.
3. Columns (c) and (f) are derived from models including lags of t-1 on all time-varying right hand side variables.

Technical Appendix.

1. Estimation Technique

Denote the model to be estimated as

(A1) $$y_{jt} = X_{jt}\beta + u_{jt}$$

where j (= 1,2, ...J) denotes the number of cross-sectional units and t (= 1,2,.....T) the number of cross-sections. The two-stage Instrumental Variables estimator used is of the form $\beta^{IV} = (X'QX)^{-1}X'Qy$, where (in matrix notation) $Q = W(W'\hat{\Omega}W)^{-1}W'$, W is the appropriate instrument set and $\hat{\Omega}$ is a diagonal matrix with $\hat{u}^2_{jt}$ on the diagonal ($\hat{u}^2_{jt}$ is the squared estimated residuals from a first-stage I.V. regression).

2. Test of Instrument Validity

The instruments contained in W are of some interest. Those available are, in period t, all values of X dated t-1 or earlier, plus any outside instruments. Hence, the model is over-identified. A test of the over-identifying restrictions is given as (see Hansen(1982) or Arellano and Bond(1988b))

(A2) $$\Upsilon = \hat{u}'\,Q\,\hat{u}$$

which is asymptotically distributed as $\chi^2(k)$, where k is the number of over-identifying restrictions present.

3. Tests of Serial Correlation

The consistency of the β^{IV} estimator (for (A1) specified in levels) depends on the assumption that $E(u_{jt}\,u_{jt-1}) = 0$. Tests for first order serial correlation are thus presented and computed as follows (see Arellano and Bond(1988a) :

(A3) $$R_1 = \hat{u}'_{-1}\hat{u}_* / \nu^{1/2}$$

where $\nu = \hat{u}'_{-1}\hat{u}_*\hat{u}'_*\hat{u}_{-1} - 2\hat{u}_{-1}X(X'QX)^{-1}X'W(W'\Omega W)^{-1}W'\hat{u}_*\hat{u}'_*\,\hat{u}_{-1} + \hat{u}'_{-1}X\,avar(\beta^{IV})X'\hat{u}_{-1}$

(a * subscript denoting a trimmed series - here to match t-1) and the asymptotic variance of the I.V. estimator $avar(\beta^{IV})$ = $(X'QX)^{-1}[X'W(W'\Omega W)^{-1}\bar{u}(W'\Omega W)^{-1}W'X](X'QX)^{-1}$, $\bar{u}$ being the sample average of the residuals. This is a one degree of freedom test statistic for first-order serial correlation. An analogous test for second-order serial correlation is obtained by replacing $\hat{u}_{-1}$ with $\hat{u}_{-2}$ throughout.

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