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# INDUSTRY MARGINS AND THE BUSINESS CYCLE
## Some New Microeconomic Evidence

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Analysis of margin flexibility is an important item on the research agendas in macroeconomics and industrial economics. Using a new panel data set for U.S. manufacturing industries, we offer new evidence on the cyclical sensitivity of price–cost margins and on the concentration-margins debate in industrial organization.

## 1. Introduction

Analyses of price and margin flexibility are important items on the theoretical and empirical research agendas in macroeconomics and industrial economics. [1] Aggregate time-series studies of 'price-markup' equations have been used to test the effects of aggregate demand (and implicitly demand management policy) on price adjustment. Cross-sectional studies in industrial organization have emphasized links between industry concentration and levels of price–cost margins.

Based on our analysis of a new panel data set for U.S. manufacturing industries over much of the postwar period, we offer evidence that industry price–cost margins are cyclically sensitive, with increasingly procyclical margins in capital-intensive and highly concentrated industries. Industry differences in cyclical adjustment are reflected in a relative decline in price–cost margins in capital-intensive and concentrated industries during the sluggish growth of the 1970s. In addition, our results provide important new information for the concentration-margins debate in industrial organization, as interindustry variation in price–cost margins across levels of concentration has narrowed dramatically since the 1950s. This finding, in conjunction with the evidence of cyclical sensitivity, suggests that the relatively large economic fluctuations of the 1970s may have contributed to the narrowing of the dispersion of margins. These empirical results will be important in rationalizing time-series and cross-sectional studies of the behavior of industry margins.

We have extended the possibility of merging these lines of inquiry by constructing a large panel data base covering more than 300 industries. As our annual data cover at a minimum the period from 1958 to 1981, roughly 7500 data points are associated with each variable, as opposed to a few hundred in cross-section studies and far less in aggregate time-series studies. The data base is unique for U.S. manufacturing, and it offers rich possibilities for extending empirical research in macroeconomics, industrial organization and labor economics. [2]

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[1] At the macroeconomic level, see the excellent survey in Gordon (1981). Empirical 'structure–conduct–performance' studies in industrial organization are viewed in Weiss (1974) and Scherer (1980).

[2] A detailed discussion of the construction of the data base can be found in Domowitz, Hubbard and Petersen (1984).

Here we focus only on trends in, and adjustment of, industry price–cost margins (*PCM*s). Patterns by level of industry concentration [3] are summarized, and the influence of market structure and capital intensity on the adjustment of margins is examined via simple regression analysis. Cyclical adjustments differ according to concentration and capital intensity, so that macroeconomic 'price equations' are likely to suffer from severe aggregation problems. The importance of cyclical factors also calls into question the cross-sectional estimates used in the adjudication of the debate over the concentration-margins relationships in industrial economics. [4]

## 2. Trends and variability in industry price–cost margins

### 2.1. Data

Our panel is based primarily on information contained in the *Census of Manufactures* and *Annual Survey of Manufactures*. [5] Data for most industries go back to at least 1958, and for many industries as far as 1947, allowing for a panel of substantial length. Finally, four-digit Census industries are highly disaggregated, currently with over 400 industries.

The Census data have, of course, been widely used in the field of industrial organization. Beginning with the seminal study by Collins and Preston (1969), a large number of cross-sectional studies testing the structure–conduct–performance hypothesis have appeared. While almost all empirical research in industrial organization has been cross-sectional, a few recent studies have been performed with data on a large number of industries at more than one period in time. [6]

For most studies using Census data in industrial organization, the PCM is the standard variable constructed to study interindustry differences in profitability and to test certain hypotheses about links between market structure and macroeconomic outcomes [see the review in Scherer (1980)]. The *PCM* is traditionally represented as (Sales–Cost of Materials–Payroll)/Sales, which can be thought of as the excess of price over average cost divided by price. Here we define the *PCM* with respect to the value of output rather than sales. [7]

### 2.2. Preliminary evidence

To provide a foundation for empirical examination of interindustry and intertemporal variations in price–cost margins, we present some summary observations for movements in *PCM*s over the period from 1958 to 1981 in table 1. [8] First, for all industries on average, there is an upward drift in the *PCM* over the period. Second, grouping the data by market structure categories (quintiles of the four-firm concentration ratio), [9] we find that the level of the *PCM* rises with concentration. While

[3] Concentration levels refer to the four-firm concentration ratio available or Census years from the *Census of Manufactures*. A piecewise-linear procedure was used to generate a time series for each industry. See the discussion in Domowitz, Hubbard and Petersen (1984).

[4] For example, most studies are unable to detect influences of the business cycles on margins [e.g., Nordhaus and Godley (1972), Schultze (1975)]. Gordon (1977) does find an effect on markups of changes in demand.

[5] A big advantage of using Census data over Internal Revenue Service data, a possible alternative, is that Census data assign individual plants, as opposed to whole companies, to their primary SIC industry. It is well known that American corporations have become increasingly more diversified, especially since the 1960s; since plants are typically more specialized than companies, the problem of contamination is reduced.

[6] See Ripley and Segal (1973), Peltzman (1977), Qualls (1979) and Martin (1983).

[7] We use output rather than sales in constructing the price–cost margin, so that variable costs in a given period are associated with the output of that particular period. This distinction is especially important for a panel study.

[8] The price–cost margin is defined as (Value of Output–Payroll–Cost of Materials)/Value of Output.

[9] Such a pattern need not, of course, be evidence of a causal concentration-margin relationship, and could reflect differences in capital intensity and related differences in productivity. In Domowitz, Hubbard and Petersen (1984), we find that capital intensity and output per worker-hour do rise with capital intensity but that there, too, the dispersion has narrowed.

Table 1
Price–cost margins by concentration quintile 1958–1981 (all industries). [a]

| Period | Total (312) | $0 < C4 \leq 20$ (75) | $21 < C4 \leq 40$ (98) | $41 < C4 \leq 60$ (80) | $61 < C4 \leq 80$ (45) | $81 < C4 \leq 100$ (14) |
|---|---|---|---|---|---|---|
| 1958–1965 | 0.244 | 0.213 | 0.232 | 0.246 | 0.287 | 0.339 |
| 1966–1973 | 0.268 | 0.246 | 0.256 | 0.267 | 0.306 | 0.353 |
| 1974–1981 | 0.274 | 0.259 | 0.269 | 0.271 | 0.294 | 0.333 |

[a] Numbers in parentheses indicate the number of industries in the category in 1958.

Table 2
Price–cost margins by concentration quintile 1958–1981 (producer-goods industries). [a]

| Period | Total (222) | $0 < C4 \leq 20$ (47) | $21 < C4 \leq 40$ (71) | $41 < C4 \leq 60$ (59) | $61 < C4 \leq 80$ (33) | $81 < C4 \leq 100$ (12) |
|---|---|---|---|---|---|---|
| 1958–1965 | 0.245 | 0.227 | 0.228 | 0.247 | 0.280 | 0.324 |
| 1966–1973 | 0.269 | 0.257 | 0.256 | 0.265 | 0.304 | 0.334 |
| 1974–1981 | 0.273 | 0.271 | 0.268 | 0.268 | 0.300 | 0.294 |

[a] Numbers in parentheses indicate the number of industries in the category in 1958.

concentrated industries exhibit higher margins over the whole period, their margin growth has stagnated, so that the dispersion of concentration-specific *PCM*s about the mean for all industries narrows considerably by the 1980s.

As shown in table 2, this pattern of differing *PCM* movements by concentration class is due principally to the producer-goods sector (where margin growth faltered over the post-OPEC period), suggesting that examinations of patterns in real wages and productivity are important. [10] The narrowing of the differences in *PCM*s by concentration categories is so pronounced that differentials are almost eliminated by the early 1980s. For example, the spread between the average *PCM*s for industries in the top and bottom concentration quintiles narrows from 0.097 in the 1958–1965 period to 0.023 in the 1974–1981 period, for a reduction of about 76 percent. To the extent that *PCM*s are responsive to aggregate-demand conditions, it is important to sort out cyclical and structural influences in assessing the concentration-margins relationship.

### 2.3. Empirical analysis of industry price–cost margins

Cross-sectional models explaining interindustry variations in price–cost margins have dominated the structure–conduct–performance literature in industrial economics. In a panel setting we can test explicitly for the intertemporal stability of such models, as well as for the influence of demand fluctuations on margins.

Since the seminal study by Collins and Preston (1969), cross-sectional studies have typically regressed the *PCM* on measures of concentration [11] and capital intensity, as well as such industry-specific characteristics as advertising, minimum efficient scale of production, etc. Particularly with

[10] See Domowitz, Hubbard and Petersen (1984).

[11] As Telser (1972) points out, such a cross-sectional relationship is likely to carry over a longitudinal setting to the extent that one would expect to see high entry rates in the highly concentrated industries.

respect to the two principal explanatory variables, an obvious potential source of differences between cross-section and panel results is the possibility of biased estimates in the former depending upon whether the reference period occurred during a cyclical 'peak' or 'trough'.

As a first step, we reproduce the canonical cross-sectional specification for our sample of 313 four-digit industries over the period from 1958 to 1981. *C4* and *K/Q* refer to the four-firm concentration ratio and the capital–output ratio, respectively. Standard errors are in parentheses; *i* and *t* refer to the industry and time period, respectively. OLS regression results appear in the following equation:

$$PCM_{it} = \underset{(0.002)}{0.201} + \underset{(0.005)}{0.088}C4_{it} + \underset{(0.004)}{0.071}(K/Q)_{it}, \tag{1}$$

$$\bar{R}^2 = 0.12, \quad S.E.E. = 0.083.$$

Definitional issues notwithstanding, the estimated coefficients of concentration and capital intensity compare favorably with the cross-sectional findings of Collins and Preston (1969).

To consider cyclical differences, we regress the *PCM* on the four-firm concentration ratio *C4*, the capital–output ratio *K/Q*, the aggregate unemployment rate *U* (as a measure of business cycle conditions), and interactions between *C4* and *U* and between *K/Q* and *U* (to capture differences in cyclical influences by level of concentration or capital intensity). OLS regression results yielded: [12]

$$PCM_{it} = \underset{(0.010)}{0.149} + \underset{(0.021)}{0.156}C4_{it} + \underset{(0.017)}{0.118}(K/Q)_{it} + \underset{(0.172)}{0.937}U_t \tag{2}$$

$$- \underset{(0.360)}{1.190}(C4_{it} * U_t) - \underset{(0.299)}{0.866}\left[(K/Q) * U_t\right],$$

$$\bar{R}^2 = 0.13, \quad S.E.E. = 0.08.$$

The importance of the choice of time period in the cross-section studies is apparent. The cyclical effect (as measured by changes in unemployment) is important not only directly, but as a shift in the measured impact of concentration and capital intensity on the level of the *PCM*. The coefficient estimates suggest that cross-section estimates will be 'high' in 'good times' and 'low' in 'bad times'. The negative estimated coefficients on the interaction terms involving concentration and unemployment and capital intensity and unemployment could be explained by the existence of sticky real wages in highly concentrated or capital-intensive industries, or by more procyclical responses of productivity in those sectors.

To illustrate the importance of differences in adjustment of *PCM*s according to differences in concentration and capital intensity, consider two illustrative cases of an industry with average values for *C4* and *K/Q* in the top concentration quintile, and an industry with average values for *C4* and *K/Q* in the bottom concentration quintile. A one-percentage-point increase in the unemployment rate would, respectively, lower the *PCM* by 0.6 percentage points, or raise the *PCM* by 0.5 percentage points. The multiplicity of possible combinations suggests the diversity of adjustments.

[12] Eq. (2) is estimated for 312 four-digit industries over the 1958–1981 period.

## 3. Conclusions and extensions

Economic theory suggests that decisions are made simultaneously by firms on a set of 'stocks', including the size and utilization of the labor force and levels of inventories. Long-run 'strategies' and methods of responding to demand variability are in a sense mutual substitutes; increased costs of adjusting one lead to greater use of others.

Our findings illustrate the need to consider a set of potential industry adjustments to cyclical fluctuations. Theories purporting to explain adjustments in one variable – here *PCM*s – imply restrictions on the response of other variables. For example, a highly capital-intensive firm (with a large fixed cost relative to variable cost) may choose to make greater use of inventories to smooth sales fluctuations than a less capital-intensive counterpart, implying smaller fluctuations in worker-hours and real wages. We will pursue these extensions in future work.

We believe these results are suggestive of the importance of using panel data in industrial economics. Again, two conclusions are particularly noteworthy. First, the marked contraction by the 1980s of the dispersion of price–cost margins by degree of concentration casts some doubt on the claim that capital in the manufacturing sector is receiving extensive monopoly rents. Further research is needed to determine the extent to which the macroeconomic problems of the 1970s are responsible for the decline in margins experienced by highly concentrated and capital-intensive producer-good industries. Second, the dual significance of industry and business cycle variables highlights potential aggregation problems in macroeconomic models of the adjustment of prices and quantities.

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