Cyclical Variation in the Concentration-Profit Relationship: Significance for Line of Business Studies

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By 1970 the prediction of oligopoly theory that market concentration and profits were positively related seemed confirmed by many empirical studies (Weiss 1971). Although there were skeptics, a sufficient consensus existed so that neo-Chamberlinian oligopoly theory was accepted as the basis for many public policy initiatives in the 1960s and early 1970s.

I. Unique Findings of the LB Studies

A series of studies published in the 1980s seemingly shattered the conventional wisdom. Most notable were studies using the rich data base supplied by the FTC line-of-business (LB) program. The LB data enabled researchers to include individual firms' own-market share, as well as market concentration and other variables, in exploring structure-performance relationships at the firm level. The most definitive of the LB studies, which included over 20 independent variables, found a statistically significant negative relationship between seller concentration and price-cost margins (Ravenscraft, 1983). Other studies using LB data generally confirmed this finding (Scott and Pascoe, 1984; Long and Ravenscraft, 1985; Martin and Ravenscraft, 1982; Kwoka and Ravenscraft, 1985).

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The seeming unanimity of the LB findings support the conclusion that "the positive association found in most studies between industry profitability and seller concentration, at least for the United States, appears to have been spurious, a construct of aggregating from the line of business to the industry level" (Scherer and Ross, 1990: 430).

Many users of the LB data and most reviewers of these studies ignored the possibility that the results were the product of the unusual years for which LB data were collected, 1974-1977.[1/] Two prominent users of the LB data caution that the results may be unique to the years involved. Ravenscraft (1983) suggests that the atypical nature of the years he relied on, 1974, 1975 and 1976, may have biased the case against concentration. Similarly, Scherer and Ross (1990: 432, note 75) believe it is possible "that both market share and concentration would have been found to be positively associated with profitability were lines of business data available for the 1950s and 1960s" (Scherer, 1990: 431 note 75). Weiss (1989) also believes the LB results could "conceivably" be the product of the turbulent years studied.

Several studies not using LB data also found that when market share as well as concentration is included as an independent variable, the latter is not positively related to profits. A negative relation between concentration

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1/ The first LB data were collected for 1973, but since they were very incomplete none of the LB studies is based on 1973 data.

and profits found by Gale and Branch (1982) may have resulted because their data cover the same atypical period as the LB data, the 1970s.

Only two studies based on pre-1970s data report a negative relationship between firm profits and concentration when firm market share is included in the analysis. The earliest of these is Shepherd's (1972) seminal study that first focused wide-spread attention to the importance of market share in determining the profitability of individual firms. The study is based on data for 231 of the largest manufacturing firms during 1960-1969. Shepherd's results indicating no relationship between profits and concentration very probably are driven by the composition of his sample, which consisted largely of leading firms.[2/] As Kwoka and Ravenscraft observe, results based on such samples "may be due to the mixing of models: Leaders are fewer than followers..., and the latter are disadvantaged by larger leading firms, whose shares are highly correlated with CR4."

Dennis Mueller (1990), using data for 1950-1971, found that whereas firm profits are positively related to market shares they are negatively related to concentration. However, in one equation that omits market share, the coefficient on his concentration variable is negative and statistically

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2/ Examination of his sample reveals that about 80% of the firms have market shares sufficient to rank among the top four firms in their markets and another 10% rank among the 5th to 8th largest firms in their markets. This explains the large difference in Shepherd and Ravenscraft's (Ravenscraft, 1983) mean market share values of 21 percent and 4 percent, respectively. Market share data for Shepherd (1972) were provided by Shepherd.

significant (Mueller, 1986: 79). In another equation that omits market share, the coefficient on concentration is negative but is not statistically significant (Mueller, 1990: 43). Hence, his findings that profits are not affected by concentration are not due to the inclusion of market share in his models but may result either from his measure of concentration (1-M)C4, where M denotes market share, or the unique nature of his sample.

Domowitz, Hubbard and Peterson (1986a), in annual cross-sectional regressions of Census Price-Cost Margin (PCM) on C4 and a capital-sales ratio, find a significant positive relationship between PCM and C4 in all years during 1958-1981. The t-values of the coefficients on C4 are significant in the LB years, but they are much lower than in all other years except 1980 and 1981. We believe all of the t-values in the study are substantially overstated because of the way the authors construct their PCMs.[3/] Unlike Ravenscraft, the study does not exclude advertising from the PCM. It is not uncommon in consumer goods industries for advertising-to-sales ratios to equal or exceed monopoly profit-to-sales ratios (Connor, et al.) and to be quite closely correlated with C4 (Kelly). As a result, as Hall (1990) observed: "Studies of Census margins are effectively studies of advertising in some industries." Hence, unless advertising is excluded from the PCM, or appropriately controlled for, a significant positive association between PCM

3/ Salinger (1990) replicated Domowitz et al., model using alternative measures of C4 for the 1971-1984 period.

and C4 may remain even in years when the true relationship between profits and concentration disappears or becomes negative. Domowitz et al. recognize the deficiencies of PCM as a measure of industry profit, and explain that their study deals primarily with the trend and variability of gross margins rather than with interindustry differences in profit levels (Domowitz et al., 1986b: 17).

In contrast to the findings of the LB studies, several studies have found a positive association between profits and concentration in models that include market share. An FTC study by Kelley (1969) appears to have been the first to introduce both market share and concentration as independent variables. It found profits to be positively related to both market share and concentration of food manufacturing firms during 1949-54.[4/] Imel and Helmberger (1971) also examined the profit performance of food manufacturing firms, using data for 1959-1967, and Rogers (1979) examined these relationships in food manufacturing during 1964-1967. Both studies found positive relationships between profits and <u>both</u> market share and C4.[5/]

[4/] Kelley used relative market share (RMS) rather than market share (MS). RMS measures a firm's market share as a percentage of the top four firms' share. He believed that in consumer product industries RMS captured more accurately than MS the price elevating effects of product differentiation and economies of scale in production and marketing. Another virtue of this measure is that it is less closely correlated with C4 than is market share. See infra notes 6 and 7 for studies that used both MS and RMS.

[5/] Both studies used RMS rather than MS. See supra note 4 and infra notes 6 and 7.

Ravenscraft (1982), using LB data for food manufacturing firms in 1975, found the coefficient on concentration positive and significant at the 10% level, a marked contrast with his various analyses based on all industries.

Marion et al. (1977) examined these relationships for profits and prices in food retailing during 1970-1974. The study found that both market share and C4 were positively related in both the profit and price models.[6/] Finally, a study of U.S. multinational manufacturing firms in Brazil and Mexico found that profits were positively related to both C4 and market share (Connor and Mueller, 1977).[7/] The significant positive relationship between profits and concentration in Brazil existed despite persistent inflation rates of about 30 percent during the period. This suggests the hypotheses that profits may remain positively related to concentration despite a high inflation rate if the inflation rate remains relatively stable for several years.

In sum, it appears that the only unequivocal studies finding no relationship between profits and concentration when firm market share is

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6/ Marion et al. used RMS rather than MS. See supra note 4. However, when market share is substituted for RMS, the coefficients of both MS and C4 are positive and statistically significant in the price regressions (Marion, 1989).

7/ The study reported results using relative market share (RMS) rather than market share (MS). See supra note 4. However, when MS is used, both MS and C4 are positively related to profits (Connor, 1976). Connor reports that substituting MS for RMS reduces the fit of his equations, which he attributes to the collinearily of MS and C4 (Connor, 1976: 266).

included as a separate variable are those using LB data for the 1970s. On the other hand, two studies based on data for the 1970s find a positive relationship between profits and both concentration and market share. Ravenscraft's (1982) study of food manufacturing firms is based on data for 1975 and Marion et al. examined grocery retailing using data for 1970-1974. Because the profit performance of food manufacturing and grocery retailing firms is less effected by business cycles than are profits in most manufacturing industries, these contrary findings are not inconsistent with the hypothesis that the LB results for all manufacturing industries are products of the atypical 1970s.

II. What a Difference a Year Can Make

Collins and Preston (1969:384) initially "entertained" but subsequently rejected the hypothesis that the concentration-profit relationship was a cyclical phenomenon, being stronger in recessions and weaker in prosperity. Weiss (1963, 1971), on the other hand, believed that the performance of the relationship was related to cyclical conditions. An unpublished dissertation by Gambles (1970) apparently was the first statistical analysis exploring the cyclical hypothesis. Using cross sectional regressions of 2-digit industries for each year during 1947-1966, Gambles found that profits are positively associated with concentration in all years except in years of "peak prosperity accompanied by inflation" (Gambles: 89).

A number of studies in the 1980s explored the cyclical hypothesis. The most definitive of these found that the coefficients of C4 were significantly higher when cyclical influences were controlled, "which suggests that cross sectional estimates will be high in good times and low in bad times" (Domowitz, Hubbard and Peterson, 1986a: 10).

The LB years clearly were among the worst of times in which to test the profit-concentration hypothesis which assumes that, in the long run, industry profits are determined by industry structure (Bain, 1972). During periods of economic stability, relatively few industry control variables are required to test the profit-concentration hypothesis. This may explain the success of simple models applied to data for the 1950s and 1960s. Researchers are well advised to recall Bain's (1972) admonition that when instability is present, testing the profit-concentration hypothesis with data for short intervals may lead to meaningless results.

The economic instability of the LB years was unique in American economic experience. The OPEC oil shocks of 1973 and 1979, and the ineffective macro policy responses to the shocks, unleashed virulent inflationary forces. Whereas the initial modest inflation of the late 1960s and early 1970s was triggered by excess demand, the post-1972 years involved a complex admixture of supply-push and demand-pull inflation that some economists have labelled stagflation. Rampant inflation was not checked until 1982, following a draconian monetary policy causing real interest rates that exceeded any in

American experience during this Century, and the highest unemployment rates since the Great Depression. By 1982, prices of industrial commodities had risen 164 percent above 1972, an increase exceeding that of any other 10-year period since the 18th Century. Adding to these events was growing import competition in manufacturing, as imports as a percent of domestic manufacturing rose from 5 percent in 1966 to 9.3 percent in 1983.

These happenings impacted some manufacturing industries much more and often in different directions than others. The subsequent slowing of aggregate demand created large variations in capacity utilization rates among manufacturing industries. These events created great uncertainty for business decision makers. And as economic theory teaches and industrial experience verifies, uncertainty is the great enemy of successful tacit or overt collusion among oligopolists (Stigler).

The LB years (1974-1977) were among the most atypical of the 1947-1990 period, as measured by high and changing unemployment and inflation rates (See Table 1, Columns 4 and 5). The unprecedented turbulence of these years caused great departures from the long-run equilibrium assumed by the empirical models examining the profit-concentration relationship. Studies in the 1960s often used no variables to control for cyclical conditions (Collins and Preston). Some studies dealt with the problem by averaging profits across a number of years (Bain, Kelly, Shepherd, and Imel and Helmberger). The turbulent events of 1974-1981 were too complicated to be captured by such simple methods.

The primary focus of this paper is to test Ravenscraft, Scherer and Weiss' suspicion that the reason profit is not positively associated with concentration in LB studies is the atypical nature of these years. To test this hypothesis we first examine the profit-concentration relationship by using annual cross sectional data for each year during 1947-1990. We then pool the data and include cyclical variables in the analysis.

III. Variables, Data, and Hypotheses

Profits (P): Pretax profits as a percent of stockholders equity are used because of the many changes in tax rates, depreciation practices, and other factors affecting after-tax profits during the four decades examined. Pretax profits are for industries reported annually in The Quarterly Financial Report for Manufacturing, Mining and Trade Corporations (QFR). These are two-digit SIC industries except for SIC 331-32, primary iron and steel; SIC 335-36, primary nonferrous metals; SIC 371, motor vehicles and equipment; and SIC 372, aircraft and equipment. There are financial data for 22 QFR industries for 1947-1973, and for 17 industries for 1947-1990. In the latter years, QFR

did not report financial data for five industries: SIC 23, 24, 25, 31, and 39.[8/]

While reliance on QFR industries limits the size of our panel of industries, there are some offsetting benefits. First, these data are available annually for the entire 1947-1990 period. Second, such important variables as unionization and capacity utilization rates, which are available only at two-digit SIC levels, can be used in analyses using QFR industries. Third, QFR industries represent weighted averages of quite closely related industries that differ markedly from other QFR industries in terms of profits, concentration, import ratios, unionization rates and capacity utilization rates. Although there are shortcomings in the QFR data, the reporting methods and definitions of variables are consistent over time. Hence the results reported below are not driven by biases inherent in the QFR panel of industries.

Concentration (C4): Industry concentration is measured using weighted average four-firm concentration ratios (C4) of the 5-digit SIC product classes within each QFR 2- or 3-digit SIC industry group. Weighted average concentration ratios for 2-digit SIC industry groups and QFR profit data have

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[8/] QFR did not report profits for SIC 21, tobacco, during 1985-1990. Profits and sales for these years were taken from Value Line Investment Survey. In years prior to 1985, Value Line pretax profit rates and total sales for tobacco corporations tracked quite closely those reported by QFR.

been used successfully by Levinson (1960), Weiss (1963), Sherman (1964), and Collins and Preston (1968). We first calculated weighted C4s of 5-digit product categories for QFR industries in each Census year, 1954-1982. We then adjusted the weighted 5-digit product C4s by either the 1972 or 1977 adjusted industry C4s calculated by Weiss and Pascoe (1971). C4s for inter-Census years and 1983-1990 were calculated by interpolation and extrapolation, and C4 for the years 1947-1953 was assumed to be the same as for 1954.

Imports (IM): Imports are expressed as the ratio of an industry's imports to its total QFR sales. Import data for 1958 to 1986 are from U.S. Commodity Exports and Imports as Related to Output, U.S. Department of Commerce. Comparable 2-digit SIC imports were not available for 1987 to 1990. Imports for the latter groups were based on the trend of imports in prior years.

The relative volume of imports impacts negatively an industry's profits for two reasons. First, Census concentration ratios, which are based on shipments from U.S. plants, overstate actual concentration when imports occur. Second, import competition may constrain profits independently of concentration because of some unique characteristics of the foreign competitors. Although it is not possible to disentangle the independent effects of these two influences, we follow Peltzman's suggestion that concentration and import variables be introduced independently (Peltzman, 1990). We expect imports to be negatively related to changes in demand.

Change in Demand (G): Growth in industry demand is measured using real industry output between year t and t-4 as reported by the Federal Reserve.[9/] Like Gambles, we found that a four-year lag performed somewhat better than a one-year lag. This may occur because changes in demand over a four-year period captures the overall growth trend of an industry, whereas year-to-year changes capture, in part, changes in capacity utilization rates, which we measure directly. Change in industry demand is expected to be positively related to industry profits.

Unionization Rate (UN): The unionization rate is the percentage of the labor force in an industry that is unionized. Karier reports estimates of unionization rates for 2-digit SIC industries in 1973-1975; we apply these to all years in the analyses. Where QFR industries are reported at the 3-digit level, the relevant 2-digit unionization rate is used. Because the degree of unionization is negatively related to an industry's profits (Karier, Voos and Mishel), we expect a negative sign on the coefficient for UN.

Capacity Utilization Rate (CU): Capacity utilization data are from Federal Reserve, Capacity Utilization, Mining, Utility and Industrial Materials. The Federal Reserve reports capacity utilization rates annually for all but two of

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9/ Growth in nominal sales, which Gambles used, also was tried but performed far less satisfactorily than changes in real growth.

the QFR industries used in the analysis. For the industries without such data, we use the capacity utilization rate of QFR industries believed to perform most similar to the industries without these data as follows: SIC 20 is used for SIC 21 and SIC 26 is used for SIC 27.

The capacity utilization rate of an industry often is the most important short-run determinant of its profitability. Since CU is industry specific, it more directly captures the effects of cyclical instability on an industry's profits than such other macro variables as overall unemployment and inflation rates. We therefore expect CU to exert a more direct and statistically significant effect on profits than the unemployment rate or producer inflation rate. CU is hypothesized to be positively related to profits.

Unemployment Rate (U): The rate of total civilian unemployment is a cyclical variable measuring changes in the macroeconomic environment. Since per unit labor costs are inversely related to the unemployment rate, we expect profits to be positively related to the unemployment rate (U). On the other hand, year-to-year changes in the unemployment rate (DU) are expected to be negatively related to profits because of the lagged influence of labor and other administered costs.

Producer Inflation Rate (PI): The producer inflation rate is a cyclical variable designed to capture the independent effect of inflation on the profits of manufacturing corporations. It is measured by changes in the price

index of industrial commodities. If all else remains the same, an increase in an industry's prices will increase its profits. We expect a positive relationship between industry profits and the annual producer inflation rate.

C4*PI. This interaction term is introduced to capture the joint effect of concentration and inflation on profitability. Means (1935) first set forth the theory that oligolistic and competitive industries respond differently to cyclical changes in aggregate demand. Simply put, competitive industries tend to equate prices and marginal costs over the entire business cycle whereas oligopolistic industries do not. As a result, during periods of demand-pull inflation prices and profits of competitive industries tend to rise relative to prices and profits in oligopolistic industries; during such periods of disequilibrium the profit-concentration relationship disappears or may even become negative. We therefore expect a negative sign on C4*PI.

IV. Empirical Procedures

1. Annual Regression

Following others, we test the following basic regression model with annual cross section regressions:

$$P_i = \beta_o + \beta_1 C4_i + \sum_{j=2}^{K} \beta_j Z_{ji} + \varepsilon_i, \qquad (1)$$

where (1) P_i denotes profitability in industry i; and (2) $C4_i$ and Z_{ji} (j=2...k) respectively denote concentration and other structural variables like demand growth, unionization and imports for industry i.

The annual regressions are designed to measure the strength of the profit-concentration relationship in each year during 1947-1990. Because data are not available for some variables in all years, we use the following annual regressions for the various time periods, the results of which are reported in Table 1.

1. 1947-1990: $P_i = b_o + b_1C4_i + e_i$

2. 1951-1990: $P_i = b_o + b_1C4_i + b_2G_i + b_3UN_i + e_i$

3. 1958-1990: $P_i = b_o + b_1C4_i + b_2G_i + b_3UN_i + b_4IM_i + e_i$

2. Pooled Regression

In general, the pooled regression model can be written as:

$$P_{it} = \beta_{oi} + \sum_{k=1}^{K} \beta_k X_{K_{it}} + \varepsilon_{it}, \qquad (2)$$

where (1) i = 1....N refers to a cross section of industries; (2) t = 1....T refers to the number of years; (3) P_{it} is profitability for industry i in year t; (4) X_{kit} is an observation on the kth explanatory variable for the ith industry and tth year; (5) ε_{it} is a classical disturbance term for ith industry and tth year; and (6) β_k, K=1....K are the slope coefficients and are

assumed to be constant over time and industries. The longitudinal nature of the data allows us to control for unobservable individual industry effects in our empirical analysis. That is, it allows us to specify the intercept term $\beta o_i = \beta_o + \mu_i$, implying βo_i varies over industries. Under this specification, the appropriate estimation procedure for (2) depends upon whether μ_i terms are assumed random or fixed. If μ_i's are fixed, model (2) is the fixed effect (FEM) or covariance model, while if μ_i's are random, it is a random effect model (REM).[10/]

Implementation of the relevant statistical tests[11/] reveal that REM is the appropriate specification for the pooled regression equation explaining profitability for the 1958-1990 period. Generalized least square estimates are reported in Table 2. The definitions and descriptions of variables used in the pooled analysis are given in Table 4.

10/ The FEM is a classical regression model with one dummy variable for each industry while REM is a generalized regression model. For a detailed discussion of the various assumption and specification for these models. See Judge et al., 1980.

11/ Econometric procedures for the analysis of panel data as available in the Limdep package were employed to test and estimate the models. The relevant F-test showed that the individual industry intercepts differ significantly from each other at the 1% level. Next, a Lagrange multiplier (LM) test (Breush and Pagan, 1980) was applied to test REM against a homoskedastic, nonautocorrelated classical regression Model which revealed REM as the appropriate model for our data. Finally, Hausman's chi-squared (H) test (Hausman, 1978) showed the GLS estimator was an appropriate alternative to the least squares dummy variable estimator.

Following the preceeding discussion, the expected signs for coefficients in the pooled models in Table 2 are:

Var:	C4	G	IM	UN	CU	U	DU	PI	C4*PI
	$b_1 > 0$,	$b_2 > 0$,	$b_3 < 0$,	$b_4 < 0$,	$b_5 > 0$,	$b_6 > 0$,	$b_7 < 0$,	$b_8 > 0$,	$b_9 < 0$.

V. Results

Annual Regressions

The annual regressions reported in Table 1 display the ordinary least squares (OLS) regression results for a linear version of three models for various periods. Only the coefficients on C4 and their respective t-values are reported.[12/] Columns 4 and 5 show the annual civilian unemployment rates and industrial commodity inflation rates to facilitate discussion of the regression results. The results of annual regressions based on the 22 QFR industries for which data were available only for the 1947-1973 period followed the same general pattern reported in Table 1 for 17 QFR industries (Appendix A-4).

The t-value of the coefficient on C4 is statistically significant at the 5 percent level in at least one model in all but four years during 1947-1973. Two of these years were 1947 and 1948, both high inflation and low

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12/ The coefficients and t-values for all variables are reported in Appendix A-1 to A-3.

Table 1. Estimated Coefficients of Concentration in Annual Regressions Explaining Profitability in Manufacturing Industries, 1947-1990.

Year	Model 1 P=f(C4)	Model 2 P=f(C4,G,UN)	Model 3 P=f(C4,G,UN,IM)	Unemployment Rate	Industrial Inflation Rate
	(1)	(2)	(3)	(4)	(5)
1947	-0.04			3.9%	14.9%*
	(0.32)				
1948	0.08			3.8	8.4
	(1.18)				
1949	0.22[a]			5.9	-2.0
	(3.20)				
1950	0.32[a]			5.3	3.7
	(3.02)				
1951	0.21[b]	0.20[b]		3.3	10
	(2.20)	(1.93)			
1952	0.14	0.21[b]		3	-2.5
	(1.31)	(2.08)			
1953	0.16[c]	0.22[a]		2.9	1.1
	(1.63)	(3.02)			
1954	0.11	0.20[a]		5.5	0.0
	(1.19)	(2.91)			
1955	0.31[a]	0.29[a]		4.4	2.2
	(3.29)	(4.21)			
1956	0.10	0.04		4.1	4.7
	(0.97)	(0.41)			
1957	0.19[b]	0.16[c]		4.3	2.8
	(1.88)	(1.42)			
1958	0.14[c]	0.17[c]	0.14[c]	6.8	0.3
	(1.46)	(1.75)	(1.56)		
1959	0.24[a]	0.30[a]	0.28[a]	5.5	1.7
	(3.15)	(4.23)	(3.93)		
1960	0.25[a]	0.25[a]	0.24[a]	5.5	0.0
	(3.64)	(4.06)	(3.60)		
1961	0.22[a]	0.26[a]	0.21[a]	6.7	-0.3
	(3.30)	(3.87)	(3.26)		
1962	0.28[a]	0.33[a]	0.28[a]	5.5	0.0
	(3.62)	(4.03)	(3.41)		
1963	0.29[a]	0.32[a]	0.27[a]	5.7	0.3
	(4.04)	(4.63)	(4.03)		
1964	0.20[a]	0.29[a]	0.26[a]	5.2	0.7
	(2.70)	(3.87)	(3.38)		
1965	0.22[a]	0.28[a]	0.24[a]	4.5	1.3
	(2.60)	(4.00)	(3.18)		
1966	0.13[c]	0.25[a]	0.22[b]	3.8	1.9
	(1.36)	(3.08)	(2.56)		
1967	0.11	0.25[a]	0.24[a]	3.8	1.6
	(1.23)	(3.32)	(2.82)		
1968	0.19[b]	0.29[a]	0.27[a]	3.6	2.5
	(2.32)	(4.28)	(3.70)		

1969	0.13[c]	0.23[a]	0.23[b]	3.5	3.4
	(1.58)	(2.90)	(2.66)		
1970	0.06	0.22[b]	0.18[c]	4.9	3.8
	(0.53)	(2.06)	(1.77)		
1971	0.19[b]	0.31[a]	0.30[a]	5.9	3.7
	(1.86)	(3.78)	(3.75)		
1972	0.16[c]	0.29[a]	0.29[a]	5.6	3.6
	(1.72)	(3.25)	(3.23)		
1973	0.08	0.15[b]	0.15[b]	4.9	6.6
	(1.11)	(2.14)	(2.07)		
1974	-0.15[b]	-0.16[c]	-0.16[c]	5.6	22.0
	(1.76)	(1.57)	(1.54)		
1975	-0.02	0.04	0.04	8.5	11.6
	(0.16)	(0.34)	(0.42)		
1976	0.12	0.17[c]	0.13[c]	7.7	6.4
	(1.28)	(1.69)	(1.42)		
1977	0.19[c]	0.32[a]	0.30[a]	7.1	7.0
	(1.65)	(3.24)	(3.37)		
1978	0.16[c]	0.31[a]	0.28[a]	6.1	7.2
	(1.63)	(3.36)	(3.06)		
1979	0.04	0.10	0.13[c]	5.8	12.9
	(0.37)	(1.03)	(1.39)		
1980	-0.16	-0.007	0.04	7.1	16.2
	(0.94)	(0.04)	(0.30)		
1981	-0.09	0.03	0.05	7.6	10.7
	(0.77)	(0.29)	(0.72)		
1982	0.08	0.28[b]	0.32[a]	9.7	2.7
	(0.37)	(2.55)	(3.16)		
1983	0.26	0.41[a]	0.42[b]	9.6	1.1
	(1.22)	(2.71)	(2.66)		
1984	0.31[b]	0.40[a]	0.37[a]	7.5	2.2
	(2.20)	(3.59)	(4.24)		
1985	0.35[b]	0.43[a]	0.39[a]	7.2	0.4
	(2.09)	(3.23)	(4.97)		
1986	0.33	0.52[b]	0.52[a]	7	-3.6
	(1.26)	(2.30)	(2.70)		
1987	0.19[c]	0.23[b]	0.22[b]	6.2	2.6
	(1.74)	(1.86)	(2.10)		
1988	0.24[a]	0.24[b]	0.22[b]	5.5	3.6
	(2.90)	(2.49)	(2.63)		
1989	0.26[b]	0.25[b]	0.22[b]	5.3	5.0
	(2.45)	(1.89)	(1.93)		
1990	0.29[b]	0.30[b]	0.31[a]	5.5	3.8
	(2.58)	(2.37)	(2.79)		

Note: A one-tail test is applied to determine statistical significance. *t*-statistics are in parentheses: *a* denotes 1% level of significance; *b* denotes 5% level of significance; and *c* denotes 10% level of significance.
*Estimate
Source: Appendix A

unemployment years. The other years were 1956 and 1958; in 1958 the t-value of the coefficient on C4 was significant at the 10 percent level in all models. The especially weak relationship in 1956 may have reflected the inflationary surge in industrial prices in 1956 (Table 1, Column 5). As the inflation rate moderated in 1957 and 1958, the t-values for the C4 coefficients rose.

During 1959-1965, the t-values for the coefficient on C4 were highly significant in all models. In these years inflation rates were very low and unemployment rates moderate. Although the inflation rate increased somewhat beginning with 1966, the t-values for the C4 coefficient remained significant in at least one model through 1973.

The significant relationship between profits and concentration disappeared in all but two years during 1974-1981. Indeed, in 1974 the relationship was negative, though not statistically significant. In the following seven years, profits were only positively and significantly related to concentration for 1977 and 1978. A possible explanation for the temporary reemergence of the significant positive relationship in 1977 and 1978, despite the high inflation rates of these years, is that the rates were only modestly above that in 1976. As explained above,[13/] the profit-concentration

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13/ See the discussion of the profit-concentration relationship in Brazil. Supra, p. 6.

relationship may manifest itself despite high inflation if the rate remains stable from year-to-year.

From 1982 to 1990, a significant positive relationship between profit and concentration again manifested itself. As displayed in Columns 4 and 5, this was a period of moderate inflation accompanied by quite high unemployment rates. The lowest t-value on the C4 coefficient appeared in 1989, which had the highest post-1981 industrial inflation rate.

Variation in the values of the coefficients on C4 provides further insight into the cyclical performance of the profit-concentration relationship. In all but three years during 1951-1971, the coefficients on concentration ranged from 0.20 to 0.33 and averaged 0.24 (Model 2). In contrast, during 1973-1981 these coefficients ranged from -0.16 to 0.32 and averaged 0.12. With the return of price stability in 1982 accompanied by high unemployment, the coefficients rose sharply, averaging 0.34 per year, and reached record post-war highs in four years.

These results suggest that cyclical factors, especially inflation rates, play an important role in the profit-concentration relationship. We now examine the effect of including three cyclical variables in pooled time-series cross-sectional analysis.

Pooled Regressions With and Without Cyclical Variables

Table 2 reports the results of the OLS and GLS estimates of the pooled regressions for the 1958-1990 period. The first model replicates model 3 in Table 1. The second model includes four additional variables related to changes in macroeconomic conditions. The third model extends model two by adding the interaction term, C4*PI. We refer only to the GLS results in discussing these models.

The coefficients on all variables in all GLS models have the expected signs and, except for unionization, are significant at the 1 percent level. The weaker result for unionization may occur because the degree of unionization existing in 1973-1975 is assigned to all years. As a result, the degree of unionization may be understated for the 1950s and 1960s and overstated for the 1980s.

Comparing equations 1B and 2B shows that the inclusion of cyclical variables, CU, U, DU, and PI, increases the explanatory power of the model. It also shows that each of these cyclical variables has a significant independent effect on profitability. The inclusion of these variables in the GLS models reduces by about one-half the coefficients and t-values of G and UN. The decline in the coefficient on G most likely occurs because G is in part a cyclical as well as an individual industry growth variable. We have no explanation for the declining importance of UN except as mentioned above that the variable may not accurately measure union strength over the entire period.

Table 2. The Determinants of Profitability: OLS and GLS Estimates of Pooled Regressions, U.S. Manufacturing Industries, 1958-1990

Equation	Constant	C4	G	IM	UN	CU	U	DU	PI	C4 x PI	R^2
1A OLS	12.94	0.23[a] (12.12)	0.17[a] (10.52)	-0.34[a] (7.50)	-12.81[a] (6.10)	--	--	--	--	--	0.40
1B GLS	14.40	0.18[a] (5.26)	0.17[a] (10.50)	-0.24[a] (4.57)	-12.06[a] (2.87)	--	--	--	--	--	0.40[1]
2A OLS	-7.09	0.24[a] (13.50)	0.14[a] (7.71)	-0.41[a] (9.17)	-10.84[a] (5.47)	0.16[a] (3.62)	0.83[a] (4.09)	-1.37[a] (5.44)	0.34[a] (7.30)	--	0.49
2B GLS	-18.31	0.15[a] (3.75)	0.08[a] (3.79)	-0.33[a] (6.08)	-7.70[c] (1.35)	0.34[a] (6.05)	0.84[a] (4.35)	-1.03[a] (4.32)	0.32[a] (7.53)	--	0.45[1]
3A OLS	-10.01	0.31[a] (14.25)	0.14[a] (7.71)	-0.39[a] (8.98)	-11.08[a] (5.37)	0.16[a] (3.61)	0.80[a] (4.02)	-1.38[a] (5.60)	1.15[a] (7.33)	-0.02[a] (5.39)	0.52
3B GLS	-22.33	0.22[a] (5.18)	0.08[a] (3.52)	-0.29[a] (5.56)	-7.78 (1.27)	0.35[a] (6.41)	0.80[a] (4.26)	-0.99[a] (4.33)	1.20[a] (8.47)	-0.02[a] (6.47)	0.47[1]

Note: A one-tail test is applied to determine statistical significance. *t*-statistics are in parentheses: *a* denotes 1% level of significance; *b* denotes 5% level of significance; and *c* denotes 10% level of significance.
[1]R^2 statistics for GLS equations are the squares of the correlation coefficient between actual and predicted values.

PI has a significant independent effect on profitability in equation 2B. PI is interacted with C4 in equation 3B. Comparing equations 2B and 3B shows that including C4*PI increased substantially the coefficients for the independent variables C4 and PI. Moreover, interacting PI with C4 in equation 3B permits us to examine how inflation effects the relative profitability of concentrated and unconcentrated industries. The significant negative sign on the coefficient for C4*PI indicates that as the inflation rate increases, the profits of less concentrated industries rise relative to those of concentrated industries.[14/]

The magnitudes of the effect of inflation on the level of profits in concentrated and unconcentrated industries for our panel sample is shown in Table 3. The values displayed in the table are the predicted profit rates at various inflation rates of industries with C4s of 25, 50, and 75. (In our panel, the lowest actual C4 was 23.5 and the highest was 86). The predicted values were calculated using the estimated coefficients reported in equation 3B. All variables except C4 and PI are held at their mean values. For example, with zero inflation rate, an industry with a C4 = 75 has predicted profits that are 11.0 percentage points higher than those of an industry with a C4 = 25. (We report the results obtained by using a 2.4 percent inflation

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[14/] We also tested a model that included interaction terms between C4 and capacity utilization and C4 and unemployment rate. Neither of these interaction terms were statistically significant (Appendix B).

Table 3. Predicted Pretax Profits at Various Concentration Levels and Inflation Rates

	Industrial Inflation Rate						
	0	2.4[a]	5.0	10	15	20	22[b]
Four-Firm Concentration	Pretax Profits as Percent of Net Worth						
75	24.2%	23.7%	22.2%	21.2%	19.7%	18.2%	17.6%
50	18.7	19.2	19.7	20.7	21.7	22.7	23.1
25	13.2	14.9	16.7	20.2	23.7	27.2	28.6
Difference Between C4=75 & C4=25	11.0%	8.8%	5.5%	1.0%	-4.0%	-9.0%	-11.0%

Source: Table 2, equation 3B.
[a]Mean inflation rate in 1958-1972 and 1982-1990.
[b]Inflation rate in 1974.

Table 4. Definitions and Descriptions of Variables: US Manufacturing Sector 1958-1990.

Abbreviated Name	Definition	Mean	Std. Dev.	Minimum	Maximum
P	Industry/Pretax profits as a percent of net worth	19.70	7.79	-36.32	42.49
C4	Weighted 5-digit 4-firm concentration ratio of each 2-digit industry	48.74	14.38	23.50	86.03
G	Industrial output growth (%) using a 4 year lag	16.10	16.62	-47.84	76.14
IM	Imports as a percent of sales	6.17	5.99	0.06	37.35
UN	Union membership as a ratio of total employment	0.4047	0.1418	0.15	0.64
CU	Capacity utilization rate of an industry	82.45	7.58	47.80	103.5
U	Economy-wide unemployment rate	6.07	1.52	3.50	9.70
DU	Unemployment rate in year t, less unemployment rate in year t-1	0.061	1.07	-2.10	2.90
PI	Economy-wide industrial inflation rate	4.31	5.21	-3.57	22.08
C4 x PI	Interaction of C4 and PI	210.38	272.54	-297.30	1824.00

rate in Table 3 because this is the mean rate for all years excluding 1972-1981.) As expected, the difference in the profit rate of a C4 = 75 industry and a C4 = 25 industry decreases as the inflation rate increases. The difference virtually disappears at a 10 percent inflation rate. At a 22 percent inflation rate, the actual rate for 1974, an industry with C4 = 75 has a lower profit rate than an industry with C4 = 25. Among other things, these results explain the negative relationship between C4 and profits reported in the annual regressions for 1974 (Table 1). In sum, these findings illustrate why in our cross sectional equations there was not a significant positive relationship between profits and concentration in most years during 1974-1981.

V. Significance of Findings

The findings reported here support the hypotheses that the three years (1974, 1975 and 1976) used in all reported LB studies were so atypical as to distort seriously the long-run relationship between profits and concentration. In none of these years are profits positively and significantly related to concentration in the annual regressions. These findings suggest that testing the profit-concentration relationship in these years of serious disequilibrium is, as Bain (1972:173) put it, "as good as throwing the experiment away." These results give substance to the suspicions harbored by Ravenscraft, Scherer, and Weiss that the LB findings regarding the profits-concentration relationships were driven by the atypical years involved.

Interestingly, in the annual regression for 1977, the last LB year, profits and concentration are positively and significantly related. To our knowledge no reported studies have been based on the 1977 data, which apparently were not processed until after the reported studies were completed.[15/] If models used in reported LB studies are re-run with 1977 data, concentration as well as market share may well be positively related to profits. The results reported here indicate, as have several other studies, the importance of including variables that capture the impact of cyclical conditions. Gambes, Domowitz et al. and other studies rely on the unemployment rate to capture the effects of cyclical factors on the concentration-profit relationship. Our annual regressions suggest that the relationship is more closely related to the inflation rate than to the unemployment rate. Whereas in the 1950s, 1960s, and 1980s high unemployment was associated with low inflation, during the stagflation years of the 1970s both unemployment and inflation were high. The results of the pooled regressions suggest that unemployment and inflation exert independent effects on profits, but that the interaction of inflation and C4 is primarily responsible for the performance of the concentration-profit relationship.

15/ The Statistical Report: Annual Line of Business Report 1977, has an April 1985 publication data whereas the Statistical Report: Annual Line of Business Report 1976, has a publication date of May 1982.

We have not addressed the important issue of whether studies that include both market share and concentration are misspecified. Cotterill (1991) makes a persuasive theoretical and empirical case that in firm-level profit-concentration studies the most appropriate model specification is relative market share and concentration, not market share and concentration. As reported above, several studies found that when the concentration-profit relationship is robust, concentration is positively and significantly related to profits in models with either market share or relative market share.[16/] However, these studies, like Cotterill's, report that the relationship between concentration and profit is strongest in the models specifying relative market share.

Studies based on the FTC LB data have made enormous contributions to empirical analysis of competitive processes. If we are correct that these studies are partially flawed because of the years covered, this provides additional evidence that the abandonment of the LB program in the early 1980s had unfortunate consequences for the advancement of scientific inquiry in the field of industrial organization.

16/ Supra, pp. 4-6.

Appendix A-1. OLS Estimates: Annual Equations Explaining Profitability in U.S. Manufacturing Industries, 1947-1990. Model 1: P=f (C4)

Year	Constant	C4	R^2	Year	Constant	C4	R^2
1947	26.57	-0.04 (0.32)	0.01	1969	14.53	0.13[c] (1.58)	0.14
1948	20.93	0.08 (1.18)	0.08	1970	13.37	0.06 (0.53)	0.02
1949	7.60	0.22[a] (3.20)	0.41	1971	7.22	0.19[b] (1.86)	0.19
1950	11.73	0.32[a] (3.02)	0.38	1972	10.50	0.16[c] (1.72)	0.16
1951	19.14	0.21[b] (2.20)	0.24	1973	17.72	0.08 (1.11)	0.08
1952	16.88	0.14 (1.31)	0.10	1974	30.55	-0.15[b] (1.76)	0.17
1953	15.96	0.16[c] (1.63)	0.15	1975	18.89	-0.02 (0.16)	0.002
1954	14.47	0.11 (1.19)	0.09	1976	16.37	0.12 (1.28)	0.10
1955	9.08	0.31[a] (3.29)	0.42	1977	13.63	0.19[c] (1.65)	0.15
1956	19.66	0.10 (0.97)	0.06	1978	16.41	0.16[c] (1.63)	0.15
1957	12.25	0.19[b] (1.88)	0.19	1979	23.26	0.04 (0.37)	0.01
1958	10.29	0.14[c] (1.46)	0.12	1980	28.01	-0.16 (0.94)	0.06
1959	8.37	0.24[a] (3.15)	0.40	1981	24.88	-0.09 (0.77)	0.04
1960	5.16	0.25[a] (3.64)	0.47	1982	8.53	0.08 (0.37)	0.01
1961	6.46	0.22[a] (3.30)	0.42	1983	3.10	0.26 (1.22)	0.09
1962	5.00	0.28[a] (3.62)	0.47	1984	4.59	0.31[b] (2.20)	0.24
1963	5.17	0.29[a] (4.04)	0.52	1985	-1.30	0.35[b] (2.09)	0.23
1964	10.96	0.20[a] (2.70)	0.33	1986	-1.08	0.33 (1.26)	0.10
1965	11.93	0.22[a] (2.60)	0.31	1987	12.51	0.19[c] (1.74)	0.17
1966	17.39	0.13[c] (1.36)	0.11	1988	12.44	0.24[a] (2.90)	0.36
1967	14.79	0.11 (1.23)	0.09	1989	8.60	0.26[b] (2.45)	0.29
1968	12.33	0.19[b] (2.32)	0.26	1990	3.90	0.29[b] (2.58)	0.31

Note: A one-tail test is applied to determine statistical significance. *t*-values are in parentheses: *a* denotes 1% level of significance, *b* denotes 5% level of significance, and *c* denotes 10% level of significance.

Appendix A-2. OLS Estimates: Annual Equations Explaining Profitability in U.S. Manufacturing Industries, 1951-1990. Model 2: P = f (C4, G, UN)

Year	Constant	C4	G	UN	R^2
1951	15.79	0.20[b]	0.09	3.40	0.30
		(1.93)	(0.93)	(0.28)	
1952	8.84	0.21[b]	0.11[b]	2.17	0.43
		(2.08)	(2.57)	(0.19)	
1953	4.94	0.22[a]	0.10[a]	7.30	0.69
		(3.02)	(4.08)	(0.85)	
1954	4.16	0.20[a]	0.11[a]	7.65	0.67
		(2.91)	(4.30)	(1.03)	
1955	-1.93	0.29[a]	0.18[a]	20.62[a]	0.78
		(4.21)	(3.30)	(2.82)	
1956	8.14	0.04	0.21[c]	24.61[a]	0.45
		(0.41)	(1.61)	(2.72)	
1957	6.62	0.16[c]	0.12	14.03	0.27
		(1.42)	(0.79)	(1.16)	
1958	3.17	0.17[c]	0.24[b]	6.45	0.32
		(1.75)	(1.85)	(0.59)	
1959	7.36	0.30[a]	0.11[c]	-8.31	0.61
		(4.23)	(1.36)	(0.96)	
1960	5.94	0.25[a]	0.17[b]	-5.82	0.76
		(4.06)	(2.37)	(0.84)	
1961	7.32	0.26[a]	0.06	-8.78	0.56
		(3.87)	(0.75)	(1.11)	
1962	6.76	0.33[a]	0.06	-13.77[c]	0.59
		(4.03)	(0.87)	(1.73)	
1963	5.14	0.32[a]	0.18[c]	-12.09[c]	0.69
		(4.63)	(1.69)	(1.75)	
1964	10.02	0.29[a]	0.13	-17.41[b]	0.54
		(3.87)	(1.24)	(2.35)	
1965	11.00	0.28[a]	0.17[a]	-19.66[a]	0.69
		(4.00)	(3.22)	(2.75)	
1966	12.66	0.25[a]	0.21[a]	-20.79[b]	0.58
		(3.08)	(3.10)	(2.55)	
1967	12.29	0.25[a]	0.15[b]	-22.12[a]	0.57
		(3.32)	(2.42)	(2.88)	
1968	11.14	0.29[a]	0.13[b]	-18.41[b]	0.66
		(4.28)	(2.33)	(2.61)	
1969	15.86	0.23[a]	0.06	-19.65[b]	0.46
		(2.90)	(0.71)	(2.48)	
1970	11.28	0.22[b]	0.19	-19.49[c]	0.42
		(2.06)	(1.13)	(1.60)	
1971	9.75	0.31[a]	0.11	-24.41[a]	0.60
		(3.78)	(1.24)	(2.66)	
1972	10.18	0.29[a]	0.13	-19.26[b]	0.52
		(3.25)	(1.25)	(2.11)	

Year	Constant	C4	G	UN	R^2
1973	17.08	0.15[b]	0.12[c]	-12.24[c]	0.41
		(2.14)	(1.52)	(1.71)	
1974	30.41	-0.16[c]	-0.01	1.75	0.17
		(1.57)	(0.02)	(0.17)	
1975	18.89	0.04	0.21	-10.21	0.25
		(0.34)	(1.25)	(0.82)	
1976	19.09	0.17[c]	0.20	-16.44[c]	0.44
		(1.69)	(0.96)	(1.46)	
1977	16.08	0.32[a]	0.22	-24.35[b]	0.60
		(3.24)	(1.32)	(1.86)	
1978	23.33	0.31[a]	-0.05	-31.96[a]	0.55
		(3.36)	(0.44)	(3.09)	
1979	29.50	0.10	-0.06	-18.76[b]	0.23
		(1.03)	(0.67)	(1.89)	
1980	23.66	-0.007	0.21[c]	-15.38	28
		(0.04)	(1.41)	(0.81)	
1981	22.33	0.03	0.23[b]	-13.55	0.49
		(0.29)	(2.56)	(1.25)	
1982	15.35	0.28[b]	0.39[a]	-35.08[b]	0.79
		(2.55)	(3.80)	(2.64)	
1983	11.12	0.41[a]	0.40[b]	-33.91[b]	0.66
		(2.71)	(2.32)	(1.85)	
1984	10.58	0.40[a]	0.21[b]	-30.49[a]	0.66
		(3.59)	(2.23)	(2.74)	
1985	8.87	0.43[a]	0.22[b]	-40.48[a]	0.65
		(3.23)	(2.02)	(3.07)	
1986	9.79	0.52[b]	0.28	-65.65[a]	0.46
		(2.30)	(1.33)	(2.85)	
1987	14.19	0.23[b]	0.05	-10.83	0.22
		(1.86)	(0.25)	(0.89)	
1988	11.65	0.24[b]	-0.001	2.82	0.36
		(2.49)	(0.01)	(0.28)	
1989	9.04	0.25[b]	-0.04	1.77	0.29
		(1.89)	(0.11)	(0.13)	
1990	0.07	0.30[b]	0.15	2.64	0.32
		(2.37)	(0.49)	(0.20)	

Note: A one-tail test is applied to determine statistical significance. *t*-values are in parentheses: *a* denotes 1% level of significance, *b* denotes 5% level of significance, and *c* denotes 10% level of significance.

Appendix A-3. OLS Estimates: Annual Equations Explaining Profitability in U.S. Manufacturing Industries, 1958-1990. Model 3: P = f (C4, G, UN, IM)

Year	Constant	C4	G	IM	UN	R^2
1958	4.85	0.14[c]	0.25[b]	-0.96[b]	12.28	0.52
		(1.56)	(2.25)	(2.27)	(1.24)	
1959	8.23	0.28[a]	0.12[c]	-0.40	-5.58	0.65
		(3.92)	(1.39)	(1.11)	(0.63)	
1960	6.73	0.24[a]	0.18[b]	-0.27	-3.94	0.77
		(3.60)	(2.42)	(0.93)	(0.54)	
1961	8.34	0.21[a]	0.10[c]	-0.74[b]	-1.53	0.67
		(3.26)	(1.49)	(2.08)	(0.20)	
1962	8.96	0.28[a]	0.08	-0.74[c]	-9.32	0.67
		(3.41)	(1.18)	(1.71)	(1.19)	
1963	7.40	0.27[a]	0.19[b]	-0.70[b]	-8.01	0.76
		(4.03)	(1.94)	(1.87)	(1.20)	
1964	11.46	0.26[a]	0.16[c]	-0.65[c]	-13.76[b]	0.62
		(3.38)	(1.60)	(1.60)	(1.87)	
1965	12.30	0.24[a]	0.17[a]	-0.52	-14.81[b]	0.73
		(3.18)	(3.37)	(1.27)	(1.86)	
1966	13.93	0.22[b]	0.21[a]	-0.43	-18.42[b]	0.60
		(2.56)	(3.10)	(0.72)	(2.06)	
1967	12.90	0.24[a]	0.15[b]	-0.20	-20.23[b]	0.58
		(2.82)	(2.30)	(0.40)	(2.18)	
1968	11.82	0.27[a]	0.13[b]	-0.34	-14.40[c]	0.68
		(3.70)	(2.28)	(0.82)	(1.66)	
1969	16.23	0.23[b]	0.06	-0.14	-18.54[b]	0.47
		(2.66)	(0.65)	(0.28)	(2.03)	
1970	14.92	0.18[c]	0.14	-0.91[c]	-13.47	0.53
		(1.77)	(0.87)	(1.71)	(1.13)	
1971	8.50	0.30[a]	0.18[b]	-0.69[c]	-14.26	0.66
		(3.75)	(1.84)	(1.44)	(1.26)	
1972	9.05	0.29[a]	0.17[c]	-0.36	-14.29	0.54
		(3.23)	(1.42)	(0.72)	(1.23)	
1973	16.58	0.15[b]	0.15[c]	-0.22	-9.57	0.42
		(2.07)	(1.51)	(0.50)	(1.05)	
1974	29.67	-0.16[c]	0.03	-0.26	6.00	0.20
		(1.54)	(0.23)	(0.63)	(0.48)	
1975	19.64	0.04	0.19	-0.71[b]	-1.66	0.43
		(0.42)	(1.21)	(1.91)	(0.14)	
1976	18.20	0.13[c]	0.34[c]	-0.48[c]	-5.40	0.54
		(1.42)	(1.60)	(1.61)	(0.43)	
1977	14.23	0.30[a]	0.39[b]	-0.72[b]	-7.17	0.71
		(3.37)	(2.32)	(2.18)	(0.51)	
1978	22.21	0.28[a]	0.01	-0.25	-25.25[b]	0.58
		(3.06)	(0.10)	(0.81)	(1.88)	
1979	24.64	0.13[c]	0.07	-0.63[c]	-8.90	0.38
		(1.39)	(0.60)	(1.70)	(0.81)	
1980	22.00	0.04	0.20[c]	-0.97[a]	2.74	0.57
		(0.30)	(1.63)	(2.80)	(0.17)	

Year	Constant	C4	G	IM	UN	R^2
1981	23.02	0.05	0.18[b]	-0.72[a]	-2.27	0.75
		(0.72)	(2.67)	(3.60)	(0.27)	
1982	15.57	0.32[a]	0.31[a]	-0.52[b]	-30.57[b]	0.84
		(3.16)	(3.13)	(2.02)	(2.51)	
1983	10.95	0.42[b]	0.40[b]	-0.15	-31.15[c]	0.66
		(2.66)	(2.22)	(0.45)	(1.56)	
1984	9.42	0.37[a]	0.31[a]	-0.57[a]	-12.27	0.81
		(4.24)	(3.93)	(3.07)	(1.17)	
1985	8.43	0.39[a]	0.36[a]	-0.78[a]	-17.33[b]	0.89
		(4.97)	(5.26)	(5.10)	(1.94)	
1986	6.80	0.52[a]	0.49[b]	-0.79[b]	-46.10[b]	0.64
		(2.70)	(2.48)	(2.43)	(2.17)	
1987	13.31	0.22[b]	0.11	-0.44[b]	0.82	0.45
		(2.10)	(0.62)	(2.25)	(0.07)	
1988	14.83	0.22[b]	-0.11	-0.38[b]	10.71	0.55
		(2.63)	(0.62)	(2.27)	(1.14)	
1989	11.47	0.22[b]	-0.11	-0.46[b]	11.97	0.48
		(1.93)	(0.34)	(2.10)	(0.90)	
1990	-2.74	0.31[a]	0.30	-0.49[b]	15.51	0.51
		(2.79)	(1.06)	(2.18)	(1.19)	

Note: A one-tail test is applied to determine statistical significance. *t*-values are in parentheses: *a* denotes 1% level of significance, *b* denotes 5% level of significance, and *c* denotes 10% level of significance.

Appendix A-4. OLS Estimates: Annual Equations Profitability in 22 U.S. Manufacturing Industries, 1947-73. Model 1: P=f(C4)

Year	Constant	C4	R^2	Year	Constant	C4	R^2
1947	30.16	-0.10 (1.35)	0.08	1961	8.50	0.18[a] (3.81)	0.42
1948	22.16	0.05 (1.10)	0.06	1962	9.67	0.20[a] (3.61)	0.39
1949	9.15	0.18[a] (4.30)	0.48	1963	9.84	0.20[a] (4.07)	0.45
1950	16.97	0.23[a] (3.10)	0.32	1964	14.34	0.14[a] (2.79)	0.28
1951	15.60	0.26[a] (3.69)	0.41	1965	15.46	0.16[a] (2.74)	0.27
1952	13.28	0.19[a] (2.86)	0.29	1966	19.27	0.10[c] (1.52)	0.10
1953	12.32	0.22[a] (3.40)	0.37	1967	17.22	0.07 (1.10)	0.06
1954	10.57	0.17[a] (2.94)	0.30	1968	18.91	0.08 (1.27)	0.07
1955	11.28	0.28[a] (4.57)	0.51	1969	18.47	0.06 (1.02)	0.05
1956	16.71	0.15[b] (2.35)	0.22	1970	14.55	0.04 (0.52)	0.01
1957	10.60	0.22[a] (3.60)	0.39	1971	13.63	0.08 (1.07)	0.05
1958	10.24	0.14[b] (2.54)	0.24	1972	18.11	0.03 (0.43)	0.01
1959	12.63	0.16[a] (3.47)	0.38	1973	22.17	0.003 (0.05)	0.00
1960	8.52	0.19[a] (4.01)	0.45				

Note: A one-tail test is applied to determine statistical significance. *t*-values are in parentheses: *a* denotes 1% level of significance, *b* denotes 5% level of significance, and *c* denotes 10% level of significance.

Appendix B: Pooled Regression Result: Adding Two Additional Intraction Terms C4 x CU and C4 x U to Equation 3A and 3B, Table 2.

Equation	Constant	C4	G	IM	UN	CU	U	DU	PI	C4 x PI	C4 x CU	C4 x U	R^2
OLS	21.42	-0.30	0.13[a]	-0.38[a]	-11.40[a]	-0.13	-0.50	-1.37[a]	1.14[a]	-0.02[a]	0.01[b]	0.02[b]	0.53
		(1.17)	(7.08)	(8.75)	(5.89)	(0.96)	(0.75)	(5.57)	(7.19)	(5.23)	(2.27)	(1.95)	
GLS	-15.43	0.07	0.07[a]	-0.30[a]	-7.31	0.30[b]	0.39	-0.99[a]	1.20[a]	-0.02[a]	0.001	0.01	0.36[1]
		(0.28)	(3.25)	(5.55)	(1.05)	(2.06)	(0.60)	(4.30)	(8.40)	(6.40)	(1.41)	(0.66)	

Note: A one-tail test is applied to determine statistical significance. *t*-statistics are in parentheses: *a* denotes 1 % level of significance; *b* denotes 5% level of significance; and *c* denotes 10% level of significance.

[1] R^2 statistic for GLS equation is the square of the correlation coefficient between actual and predicted values.

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