WORKING PAPERS

STRUCTURE-PROFIT RELATIONSHIPS AT THE

LINE OF BUSINESS AND INDUSTRY LEVEL

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WORKING PAPER NO. 47

March 1982

BUREAU OF ECONOMICS
FEDERAL TRADE COMMISSION
WASHINGTON, DC 20580

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Federal Trade Commission

July 1981

The representations and conclusions presented herein are those of the author and have not been adopted in whole or in part by the Federal Trade Commission or its Bureau of Economics. The Assistant Director of the Bureau of Economics for Financial Statistics has certified that he has reviewed and approved the disclosure avoidance procedures used by the staff of the Line of Business Program to ensure that the data included in this paper do not identify individual company line of business data. I am especially indebted to Bill Long for his many useful comments and suggestions. I would also like to thank Leonard Weiss and George Pascoe for computing the data from the Census of Manufactures and for identifying the "births and deaths" in the sample; Steve Martin for computing the variables from the input-output table; John Scott for discussions on diversification; Dennis Mueller and F. M. Scherer for comments on a previous draft; and Joe Cholka for programming assistance.

This paper is based in whole or in part upon line of business data and has been authorized for release by the Commission. The paper has been reviewed to assure that it conforms to applicable statutes and confidentiality rules, and it has been certified as not identifying individual company line of business data.

Abstract

STRUCTURE-PROFIT RELATIONSHIPS

AT THE LINE OF BUSINESS AND INDUSTRY LEVEL

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This paper estimates using both OLS and GLS, a structure-performance equation utilizing the disaggregated line of business data. Market share, minimum efficient scale, growth, exports, vertical integration, diversification, and line of business (LB) advertising are found to be positive and significant in explaining LB operating income to sales, while concentration, imports, distance shipped, R&D, assets, supplier concentration, and supplier and buyer dispersion are negative and significant. When the LB equation is aggregated to the industry level, important differences arise. Concentration is found to be positive and weakly significant in the industry regression, revealing its role as a proxy for aggregated market share. Aggregated assets and vertical integration are significant and have the opposite sign of their LB counterparts. The size and significance of aggregated advertising and diversification also differ substantially from LB advertising and diversification. These differences persist when the LB variables and their industry counterparts are included in the same regression equation. Further analysis using interactions between market share and advertising, R&D, assets, MES and concentration reveals support for both the efficiency and monopoly power explanation of the positive profit - market share relationship. Dividing the sample into economically meaningful categories demonstrates that the positive profit - market share relationship is a pervasive phenomenon in manufacturing industries. A significant positive profit-concentration relationship is found in 6 of 20 2-digit manufacturing industries.

Estimation of structure-performance equations has been a major focus of industrial organization research. However, due to data constraints, comprehensive cross-sectional estimation of structure-performance equations has been restricted to industry level variables or firm level variables which aggregate quite different business activities within a single corporate financial statement.[1] The Federal Trade Commission has recently compiled disaggregated data on firm operations by individual lines of businesses. A line of business (LB) refers to a firm's operations in one of the 261 manufacturing and 14 nonmanufacturing categories defined by the FTC. The number of lines of business per company ranges from one to approximately 47, with an average of 8 lines per company. Information on pretax profit, advertising, research and development, assets, market share, diversification and vertical integration is available for an individual line of business. When combined with census and input-output data, the FTC line of business data allows the estimation of a structural-performance equation of unprecedented richness.

This paper uses the FTC line of business data to study the effects of industry structure and firm conduct on profitability.[2] A special emphasis is given to the efficiency vs. monopoly power question. Does a price-raising effect of concentration exist, when market share is held constant? What factors explain a positive profit-market share relationship? These questions are explored through the use of interaction terms and by comparing the market share and concentration coefficient for subsamples such as consumer and producer, convenience and nonconvenience; 2-digit industries and 4-digit industries. In addition, the theoretical and empirical differences between variables measured at the line of business level and the industry level are investigated.

To accomplish these tasks and to relate this paper to the previous literature, regressions are performed at both the line of business and industry level.

I. Variables and Hypotheses

A brief description of all variables is presented in Table I. The mean, variance, minimum and maximum of these variables are given in Appendix A.

The dependent variable for the line of business regression is operating income divided by sales (LBOPI). Operating income is defined as sales minus materials, payroll, advertising, other selling expenses, general and administrative expenses, and depreciation. For the industry regression the traditional price-cost margin (INDPCM) (value added minus payroll divided by value of shipments) computed from the 1975 Annual Survey of Manufactures is used as the dependent variable.[3] The ratios of industry advertising, R&D, and capital costs (depreciation) to sales are subtracted from the census price-cost margin to make it more comparable to operating income. These ratios are obtained by aggregating the LB advertising, R&D and depreciation costs to the industry level.

Based on past theoretical and empirical work, the following independent variables are included:

Market Share. Market share (MS) is defined as adjusted LB sales divided by adjusted census value of shipments. Adjustments are made, since crucial differences exist between the definition of value of shipments and LB sales. The exact nature of the differences and adjustments is detailed in appendix B. Market share is expected to be positively correlated with profits for three reasons. One, large share firms may have higher quality products or monopoly power, enabling them to charge higher prices. Two, large share firms may be more efficient, because of economies of scale or because efficient firms tend to grow more rapidly. Three, firms with large market shares may be more innovative or better able to develop an existing innovation.

Interaction Terms. To more clearly understand the cause of the expected positive relationship between profits and market share, the interaction between market share and LB advertising to sales (LBADVMS), R&D to sales (LBRDMS), LB assets to sales (LBASSMS) and minimum efficient scale (LBMESMS) are employed. LBMESMS should be positive if plant economies of scale are an important aspect of larger firm's relative profitability. A positive coefficient on LBADVMS, LBRDMS or LBASSMS may also reflect economies of scale, although each would represent a very distinct type of scale economy. The positive coefficient on these interaction terms could also arise from the opposite causation -- firms that are superior at using their advertising, R&D or assets expenditures tend to grow more rapidly. In addition to economies of scale or a superiority-growth hypothesis, the interaction between market share and advertising may also be positively correlated to profits because firms with a large market share charge higher prices. Advertising may enhance a large firm's ability to raise price by informing or persuading buyers of its "superior" product.

Investment Strategies. Line of business or industry profitability may differ from the competitive norm because firms have followed different investment strategies. Three forms of investment or the stock of investment are considered: media advertising to sales, private R&D to sales, and total assets to sales. Three components of these variables are also explored: a line of business, an industry, and (as discussed above) a market share interaction component. Most studies have found a positive correlation between profitability and advertising, R&D and assets, when only the industry, firm or the LB component of these variables is considered.

The industry variables are defined as the weighted sum of the LB variables for the industry. The weights are market share divided by the percent of the industry covered by the LB sample. When measured on an industry level, these variables have been traditionally interpreted as a barrier to entry, or as a correction for differences in the normal rate of return.[4] Either of these hypotheses should result in a positive correlation between profits and the industry investment strategy variables.

When measured on a line of business level, the investment strategy variables are likely to reflect a very different phenomenon. Once the industry variables are held constant, differences in the level of LB investment or stock of investment may be due to differential efficiency. If these efficiency differences are associated with economies of scale, or persist over time so that efficiency results in an increase in market share, then the interaction between market share and the LB variables should be positively related to profits. Once both the industry and relative size effects are held constant, the expected sign of the investment strategy variables is less clear. One possible hypothesis is that higher values correspond to an inefficient use of the variables, resulting in a negative coefficient.

Since 1975 was a recession year, it is important that assets be adjusted for capacity utilization. A crude measure of capacity utilization (LBCU) can be obtained from the ratio of 1975 sales to 1974 sales. Since this variable is used as a proxy for capacity utilization, instead of growth, values which are greater than one are redefined to equal one. Assets are multiplied by capacity utilization to reflect the actual level of assets in use. Capacity utilization is also used as an additional independent variable. Firms with a higher capacity utilization should be more profitable.

Diversification. There are several theories justifying the inclusion of diversification in a profitability equation.[5] However, they have received very little empirical support. Recent work using the LB data by Scott (1981) represents an exception. Using a unique measure of intermarket contact, Scott found support for three distinct effects of diversification. One, diversification increased intermarket contact, which increases the probability of collusion in highly concentrated markets. Two, there is a tendency for diversified firms to have lower R&D and advertising expenses, possibly due to multi-market economies. Three, diversification may ease the flow of resources between industries. Under the first two hypotheses, diversification would increase profitability; under the third hypothesis, it would decrease profits. Thus, the expected sign of the diversification variable is uncertain.

The measure of intermarket contact used by Scott is available for only a subsample of the LB sample firms. Therefore, this study employs a Herfindahl index of diversification, first used by Berry (1975), which can be easily computed for all LB companies. This measure is defined as:

$$LBDIV = 1 - \Sigma sls_i^{\,2}/(\Sigma sls_i)^2.$$

sls_i represents the sales in the ith line of business for the company, and n represents the number of lines in which the company participates. It will have a value of zero when a firm has only one LB and will rise as a firm's total sales are spread over a number of LB's. As with the investment strategy variables, we also employ a measure of industry diversification (INDDIV), defined as the weighted sum of the diversification of each firm in the industry.

Vertical Integration. A special form of diversification which may be of particular interest, since it involves a very direct relationship between the combined lines, is vertical integration. Vertical integration at the LB level (LBVI) is measured with a dummy variable. The dummy variable equals one for a line of business if the firm owns a vertically related line whose primary purpose is to supply (or use the supply of) the line of business. Otherwise, it equals zero. The level of industry vertical integration (INDVI) is defined as the weighted average of LBVI. If vertical integration reflects economies of integration, reduces transaction costs or eliminates the bargaining stalemate between suppliers and buyers, then LBVI should be positively correlated with profits. If vertical integration creates a barrier to entry or improves oligopolistic coordination, then INDVI should also have a positive coefficient.

Adjusted Concentration Ratio. Adjusted concentration ratio (CR4) is the four-firm concentration ratio corrected by Weiss (1980) for non-competing sub-products, inter-industry competition, local or regional markets, and imports. Concentration is expected to reflect the ability of firms to collude (either tacitly or explicitly) and raise price above long run average cost.

Ravenscraft (1981) has demonstrated that concentration will yield an unbiased estimate of collusion when market share is included as an additional explanatory variable (and the equation is otherwise well specified) if the positive effect of market share on profits is independent of the collusive effect of concentration, as is the case in Peltzman's model (1977). If, on the other hand, the effect of market share is dependent on the concentration effect (ie., in the absence of a price-raising effect of concentration, competition forces all firms to operate at minimum efficient scale or larger) then the estimates of concentration's and market share's effect on profits will be biased downward. An indirect test for this posssible bias, using the interaction of concentration and market share (LBCR4MS) is employed here. If low concentration is associated with the competitive pressure towards equally efficient firms, while high concentration is associated with a high price, allowing sub-optimal firms to survive, then a positive coefficient on LBCR4MS should be observed.

There are at least two reasons why a negative coefficient on LBCR4MS might arise. First, Long (1981) has shown that if firms with a large market share have some inherent cost or product quality advantage, then they gain less from collusion than firms with a smaller market share, because they already possess some monopoly power. His model predicts a positive coefficient on share and concentration and a negative coefficient on the interaction of share and concentration. Second, the ability to exploit an inherent advantage of size may depend on the existence of other large rivals. Kwoka (1979) found that the size of the top two firms was positively associated with industry profits, while the size of the third firm was negatively correlated with profits. If this rivalry hypothesis is correct, then we would expect a negative coefficient of LBCR4MS.

Economies of Scale Proxies. Minimum efficient scale (MES) and the cost-disadvantage ratio (CDR) have been traditionally used in industry regressions as proxies for economies of scale and the barriers to entry they create. CDR, however, is not included in the LB regressions, since market share already reflects this aspect of economies of scale.[6] It will be included in the industry regressions, as a proxy for the omitted market share variable.

Distance Shipped. The computation of a variable measuring distance shipped (DS), the radius within 80% of shipments occured, was pioneered by Weiss (1972). This variable is expected to display a negative sign, reflecting increased competition.

Demand Variables. Three variables are included to reflect demand conditions: industry growth (GRO), imports (IMP) and exports (EXP). Industry growth is meant to reflect unanticipated demand increases which allows positive profits even in competitive industries. It is defined as 1976 census value of shipments divided by 1972 census value of shipments. Imports and exports divided

Table I. A Brief Definition of the Variables.

Abbreviated Name	Definition	Source
BCR	Buyer concentration ratio, weighted average of the buyers four-firm concentration ratio.	1972 Census and input-output table.
BDSP	Buyer dispersion, weighted herfindahl index of buyer dispersion.	1972 input-output table
CDR	Cost disadvantage ratio as defined by Caves et. al. (1975).	1972 Census of Manufactures
COVRAT	Coverage rate, percent of the industry covered by the FTC LB Data.	FTC LB Data
CR4	Adjusted four-firm concentration ratio.	Weiss (1980)
DS	Distance shipped, radius within which 80% of shipments occured.	1963 Census of Transportation
EXP	Exports divided by value of shipments	1972 input-output table
GRO	Growth, 1976 value of shipments divided by 1972 value of shipments.	1976 Annual Survey of Manufactures
IMP	Imports divided by value of shipments.	1972 input-output table
INDADV	Industry advertising, weighted sum of LBADV for an industry.	FTC LB data
INDADVMS	weighted sum of LBADVMS for an industry.	FTC LB data
INDASS	Industry assets, weighted sum of LBASS for an industry.	FTC LB data
INDASSMS	weighted sum of LBASSMS for an industry.	FTC LB data
INDCR4MS	weighted sum of LBCR4MS for an industry.	FTC LB data
INDCU	industry capacity utilization, weighted sum of LBCU for an industry.	FTC LB data

Table 1 (continued).

Abbreviated Name	Definition	Source
INDDIV	Industry members' diversification, weighted sum of LBDIV for an industry.	FTC LB data
INDMESMS	weighted sum of LBMESMS for an industry.	FTC LB data
INDPCM	Industry price cost margin, industry value of shipments minus cost of material, payroll, advertising, R&D and depreciation divided by value of shipments.	1975 Annual Survey of Manufactures and FTC LB data
INDRD	Industry R&D, weighted sum of LBRD for an industry.	FTC LB data
INDRDMS	weighted sum of LBRDMS for an industry.	FTC LB data
INDVI	Industry vertical integration, weighted sum of LBVI for an industry.	FTC LB data
LBADV	Line of business advertising, media advertising expenditures divided by sales.	FTC LB data
LBADVMS	LBADV * MS.	FTC LB data
LBASS	Line of business assets (gross plant, property and equipment plus inventories and other assets) * capacity utilization divided by LB sales.	FTC LB data
LBASSMS	LBASS * MS.	FTC LB data
LBCR4MS	CR4 * MS.	FTC LB data
LBCU	Capacity utilization, 1975 sales divided by 1974 sales, constrained to be less than or equal to one.	FTC LB data
LB	Company diversification, herfindahl index of LB sales for a company.	FTC LB data
LBMESMS	MES * MS.	FTC LB data

Table I. (continued).

Abbreviated Name	Definition	Source
LBOPI	Line of business operating income divided by sales, LB sales minus both operating and nonoperating costs divided by sales.	FTC LB data
LBRD	Line of business R&D, private R&D expenditures divided by LB sales.	FTC LB data
LBRDMS	LBRD * MS.	FTC LB data
LBVI	Line of business vertical integration, dummy variable equal to one if vertically integrated, zero otherwise.	FTC LB data
MES	Minimum efficient scale, the average plant size of the plants in the top 50% of the plant size distribution.	1972 Census of Manufactures
MS	Market share adjusted LB sales divided by an adjusted census value of shipments.	FTC LB data, Annual survey, and I-O table
SCR	Suppliers concentration ratio, weighted average of the suppliers four-firm concentration ratio.	1972 Census and input-output table
SDSP	Suppliers dispersion, weighted herfindahl index of buyer dispersion.	1972 input-output table

The weights for aggregating an LB variable to the industry level are MS/COVRAT.

by value of shipments are computed from the 1972 input-output table. Exports are expected to have a positive effect on profits. Imports should be negatively correlated with profits.

Buyer and Supplier Structure. Four variables are included to capture the relative bargaining power of buyers and suppliers: a buyer concentration index (BCR), a herfindahl index of buyer dispersion (BDSP), a supplier concentration index (SCR), and a herfindahl index of supplier dispersion (SDSP).[7] Lustgarten (1975) has shown that BCR and BDSP lowers profitability. In addition, these variables improved the performance of the concentration variable. Martin (1981) extended Lustgarten's work to include SCR and SDSP. He found that the supplier's bargaining power had a significantly stronger negative impact on seller's industry profits than buyer's bargaining power.

II. Data

The data set covers 3007 lines of business in 257 4-digit LB manufacturing industries for 1975. A 4-digit LB industry corresponds to approximately a 3½ digit SIC industry. 3589 lines of business reported in 1975, but 582 lines were dropped because they did not report in the LB sample for 1974 or 1976. These "births and deaths" were eliminated to prevent spurious results caused by high advertising to sales, low market share and low profitability of a firm at its inception and high assets to sales, low market share, and low profitability of a dying firm. After the "births and deaths" were eliminated, 257 out of 261 LB manufacturing industry categories contained at least one observation. The FTC sought to obtain information on the top 250 Fortune 500 firms, the top 2 firms in each LB industry, and additional firms to give adequate coverage for most LB industries. For the sample used in this paper, the average percent of the total industry covered by the LB sample was 46.5%.

III. Results

Table II presents the OLS and GLS results for a linear version of the hypothesized model. Heteroscedasticity proved to be a very serious problem, particularly for the LB estimation. Furthermore, the functional form of the heteroscedasticity was found to be extremely complex. Traditional approaches to solving heteroscedasticity, such as multiplying the observations by assets, sales or assets divided by sales, were completely inadequate. Therefore, we elected to use a methodology suggested by Glejser (1969), which allows the data to identify the form of the heteroscedasticity. The absolute value of the residuals from the OLS equation was regressed on all the independent variables along with the level of assets and sales in various functional forms. The variables that were insignificant at the 10% level were eliminated via a stepwise procedure.[8] The predicted errors from this regression were used to correct for heteroscedasticity. If necessary, additional iterations of this procedure were performed, until the absolute value of the error term was characterized by only random noise.

All of the variables in equation (1), Table II, are significant at the 5% level in the OLS and/or the GLS regression. Most of the variables have the expected sign.[9]

Statistically, the most important variables are the positive effect of higher capacity utilization and industry growth, with the positive effect of market share running a close third.[11] Larger minimum efficient scales lead to higher profits, indicating the existence of some plant economies of scale. Exports increase demand, and thus profitability, while imports decrease profits. The farther firms tend to ship their products, the more competition reduces profits. The countervailing power hypothesis is supported by the significantly negative coefficient on BDSP, SCR, and SDSP. However, the positive and

Table II.

Variable Name	Equation (1) LBOPI OLS	Equation (1) LBOPI GLS	Equation (2) INDPCM OLS	Equation (2) INDPCM GLS
Intercept*	-.1512 (-6.41)	-.1495 (-7.54)	.0140 (0.22)	.0576 (1.07)
CR4	-.0133 (-0.82)	-.0303 (-2.36)	.0139 (0.57)	.0277 (1.31)
MS (eg. 1) CDR (eg. 2)	.1859 (4.71)	.1569 (5.46)	-.0106 (-0.59)	.0026 (0.15)
MES	.2569 (2.26)	.2702 (3.07)	.2450 (1.92)	.0599 (0.50)
BCR	.0471 (2.76)	.0325 (2.56)	-.0355 (-1.33)	-.0184 (-0.77)
BDSP	-.0191 (-2.00)	-.0050 (-0.69)	-.0149 (-0.99)	-.0269 (-1.84)
SCR	-.0881 (-2.86)	-.0637 (-2.66)	-.0016 (-3.56)	-.0021 (-5.23)
SDSP	-.0835 (-4.20)	-.0644 (-3.81)	-.1657 (-5.03)	-.1469 (-4.18)
GRO	.0468 (6.66)	.0514 (8.92)	.0177 (1.58)	.0177 (1.67)
IMP	-.1040 (-2.76)	-.1158 (-3.42)	-.1006 (-2.25)	-.1075 (-4.29)
EXP	.0380 (0.88)	.0857 (2.42)	.0393 (0.58)	.0402 (0.62)
DS	-.0000085 (-1.27)	-.0000195 (-3.65)	-.000027 (-2.50)	-.000013 (-1.35)
LBVI (eg. 1) INDVI (eg. 2)	.0223 (2.49)	.0105 (1.58)	-.0242 (-1.37)	-.0459 (-2.79)
LBDIV (eg. 1) INDDIV (eg. 2)	.0197 (1.67)	.0220 (2.46)	.0344 (1.17)	.0213 (0.80)

Table II. (continued)

Variable Name	Equation (1) LBOPI		Equation (2) INDPCM	
	OLS	GLS	QLS	GLS
LBADV (eg. 1)	.1537	.0737	.3431	.3085
INDADV	(2.09)	(1.25)	(2.17)	(1.91)
LBRD (eg. 1)	-.8929	-.5437	-.5911	-.5233
INDRD (eg. 2)	(-11.11)	(-4.73)	(-2.26)	(-2.04)
LBASS (eg. 1)	-.0864	-.0002	.0799	.0889
INDASS (eg. 2)	(-14.05)	(-0.03)	(4.20)	(4.36)
LBCU	.2421	.1780	.2186	.1681
INDCU	(14.21)	(11.72)	(3.84)	(3.66)
R^2**	.2049	.1362	.4310	.5310

t statistic is in parentheses.

* For the GLS regressions the constant term is one divided by the correction factor for heteroscedasticity.

** R^2 in the GLS regressions is computed from the F statistic obtained by constraining all the coefficients to be zero, except the heteroscedastic adjusted constant term.

$R^2 = F / \{ F + [(N - K - 1) / K] \}$.

Where K is the number of independent variables and N is the number of observations.[10]

significant coefficient on BCR is contrary to the countervailing power hypothesis. Suppliers' bargaining power appears to be more influential than buyers' bargaining power. If a company vertically integrates or is more diversified, it can expect higher profits. As many other studies have found, increased advertising expenditures raise profitability, but its effect dwindles to insignificant in the GLS regression. Concentration, R&D, and assets do not conform to prior expectations.

The OLS regression indicates that a positive relationship between industry profitablility and concentration does not arise in the LB regression, when market share is included. This is consistent with previous cross-sectional work, involving firm or LB data.[12] Surprisingly, the negative coefficient on concentration becomes significant at the 5% level in the GLS equation. There are apparent advantages to having a large market share, but these advantages are somewhat less if other firms are also large.[13]

The importance of correcting for heteroscedasticity can be seen by comparing the OLS and GLS results for the R&D and assets variable. In the OLS regression, both variables not only have a sign which is contrary to most empirical work, but have the second and third largest t ratios. The GLS regression results indicate that the presumed significance of assets is entirely due to heteroscedasticity. The t ratio drops from -14.05 in the OLS regression to -.031 in the GLS regression. A similar bias in the OLS t statistic for R&D is observed. However, R&D remains significant after the heteroscedasticity correction. There are at least two possible explanations for the significant negative effect of R&D. First, R&D incorrectly assumes an immediate return, which biases the coefficient downward. Second, Ravenscraft and Scherer (1981) found that R&D was not nearly as profitable for the early 1970's as it has been found to be for the 1960's and late 1970's. They observed a negative return to R&D in 1975, while for the same sample the 1976-78 return was positive.

A comparable regression was performed on industry profitability. With three exceptions, equation (2) in Table II is equivalent to equation (1) multiplied by MS and summed over all firms in the industry. First, the industry equivalent of the market share variable, the herfindahl index, is not included in the industry equation because its correlation with CR4 has been generally found to be .9 or greater. Instead, CDR is used to capture the economies of scale aspect of the market share variable.[14] Second, the industry equivalent of the LB variables is only an approximation, since the LB sample does not include all firms in an industry. Third, some differences between an aggregated LBOPI and INDPCM exist (such as the treatment of general and administrative expenses and other selling expenses) even after industry advertising, R&D and depreciation expenses are subtracted from industry price-cost margin.[15]

The majority of the industry specific variables yield similar results in both the LB and industry profit equation. The significance of these variables is often lower in the industry profit equation due to the loss in degrees of freedom from aggregating. A major exception is CR4, which changes from significantly negative in the GLS LB equation to positive in the industry regression, although the coefficient on CR4 is only weakly significant (20% level) in the GLS regression. One can argue, as is often done in the profit-concentration literature, that the poor performance of concentration is due to its collinearity with MES. If only the cost disadvantage ratio is used as a proxy for economies of scale, then concentration is positive, with t ratios of 1.97 and 1.79 in the OLS and GLS regressions. For the LB regression, without MES but with market share, the coefficient on concentration is .0039 and -.0122 in the OLS and GLS regressions with t values of 0.27 and -1.06. These results support the hypothesis that concentration acts as a proxy for market share in the industry regression. Hence, a positive coefficient on concentration in the industry level regression cannot be taken as an unambiguous representation of market power. However, the small t statistic on concentration relative to those observed using 1960 data (i.e., see Weiss (1974)), suggest that there may be something more to the industry concentration variable for the economically stable 1960's, than just a proxy for market share. Further testing of the concentration-collusion hypothesis will have to wait until LB data is available for a period of stable prices and employment.

The LB and industry regressions exhibit substantially different results in regard to advertising, R&D, assets, vertical integration, and diversification. Most striking are the differences in assets and vertical integration, which display significantly different signs. More subtle differences arise in the magnitude and significance of the advertising, R&D, and diversification variables. The coefficient of industry advertising in equation (2) is approximately 2 to 4 times the size of the coefficient of LB advertising in equation (1). Industry R&D and diversification are much lower in statistical significance than the LB counterparts.

The question arises, therefore, why do the LB variables display quite different empirical results when aggregated to the industry level? To explore this question, we regress LB operating income on the LB variables and their industry counterparts. A related question is, why does market share have such a powerful impact on profitability? The answer to this question is sought by including interaction terms between market share and advertising, R&D, assets, MES and CR4.

Table III equation (3) summarizes the results of the LB regression for this more complete model. Several insights emerge.

First, the interaction terms, with the exception of LBCR4MS, have the expected positive sign although only LBADVMS and LBASSMS are significant. Furthermore, once these interactions are taken into account, the linear market share term becomes insignificant. Whatever causes the positive share-profit relationship is captured by these five interaction terms, particularly LBADVMS and LBASSMS. The negative coefficient on concentration and the concentration-share interaction in the GLS regression does not support the collusion model of either Long or Ravenscraft. These signs are most consistent with the rivalry hypothesis, although their insignificance in the GLS regression implies the test is ambiguous.

Second, the differences between the LB variables and their industry counterparts observed in Table II equation (1) and (2) are even more evident in equation (3), Table III. Clearly, these variables have distinct influences on profits. The results suggest that a high ratio of industry assets to sales creates a barrier to entry which tends to raise the profits of all firms in the industry. However, for the individual firm, higher LB assets to sales, not associated with relative size, represents inefficiencies that lowers profitability. The opposite result is observed for vertical integration. A firm gains from its vertical integration, but loses (perhaps because of industry-wide rent eroding competition) when other firms integrate. A more diversified company has higher LB profits, while industry diversification has a negative but insignificant impact on profits. This may partially explain why Scott (1981) was able to find a significant impact of intermarket contact at the LB level, while Strickland (1980) was unable to observe such an effect at the industry level.

Table III.

Variable Name	Equation (3) LBOPI OLS	Equation (3) LBOPI GLS	Equation (4) INDPCM OLS	Equation (4) INDPCM GLS
Intercept	-.1766 (-5.96)	-.1693 (-7.11)	.0382 (0.57)	.0755 (1.36)
CR4	.0060 (0.31)	-.0126 (-0.81)	-.0079 (-0.20)	.0027 (0.08)
MS (eg.3) CDR (eg.4)	-.1770 (-1.27)	.0151 (0.15)	-.0112 (-0.62)	-.0008 (-0.04)
MES	.1184 (0.79)	.1790 (1.46)	.1894 (0.80)	.1561 (0.81)
BCR	.0498 (2.88)	.0372 (2.84)	-.0317 (-1.17)	-.0234 (-1.00)
BDSP	-.0161 (-1.59)	-.0012 (-0.17)	-.0134 (-0.87)	-.0280 (-1.86)
SCR	-.0698 (-2.24)	-.0479 (-2.00)	-.1657 (-3.64)	-.2414 (-5.91)
SDSP	-.0653 (-3.13)	-.0526 (-3.10)	-.1679 (-5.01)	-.1311 (-3.67)
GRO	.0477 (6.78)	.0467 (8.52)	.0179 (1.58)	.0170 (1.53)
IMP	-.1134 (-2.95)	-.1308 (-3.93)	-.1139 (-2.48)	-.1241 (-4.40)
EXP	-.0070 (-0.16)	.0876 (2.43)	.0352 (0.51)	.0358 (0.54)
DS	-.000014 (-2.07)	-.000018 (-3.43)	-.000026 (-2.33)	-.000017 (-1.69)
LBVI	.0219 (2.30)	.0123 (1.85)		
INDVI	-.0126 (-0.98)	-.0208 (-2.29)	-.0271 (-1.48)	-.0455 (-2.80)
LBDIV	.0231 (1.91)	.0254 (2.82)		

Table III. (continued)

Variable Name	Equation (3) LBOPI OLS	Equation (3) LBOPI GLS	Equation (4) INDPCM OLS	Equation (4) INDPCM GLS
INDDIV	-.0067 (-0.32)	-.0102 (-0.64)	.0367 (1.22)	.0394 (1.46)
LBADV	-.0516 (-0.51)	-.1175 (-1.47)		
INDADV	.1843 (1.45)	.0936 (0.87)	.2020 (0.75)	.0383 (0.14)
LBRD	-.9157 (-10.03)	-.4124 (-3.04)		
INDRD	.2333 (1.33)	-.3385 (-1.98)	-.2079 (-0.53)	-.2598 (-0.70)
LBASS	-.1156 (-16.18)	-.0258 (-2.68)		
INDASS	.0544 (3.40)	.0624 (4.50)	.0639 (2.35)	.0732 (2.83)
LBADVMS (eg.3) INDADVMS (eg.4)	2.1125 (1.75)	2.9746 (3.77)	1.0641 (0.60)	2.5742 (1.34)
LBRDMS (eg.3) INDRDMS (eg.4)	.6122 (0.43)	.6358 (0.53)	-2.5706 (-1.47)	-1.9767 (-1.10)
LBASSMS (eg.3) INDASSMS (eg.4)	.7345 (6.10)	.2413 (2.18)	.1404 (0.97)	.2025 (1.40)
LBMESMS (eg.3) INDMESMS (eg.4)	1.0983 (1.05)	.1847 (0.25)	-.1878 (-0.15)	-1.0772 (-1.05)
LBCR4MS (eg.3) INDCR4MS (eg.4)	-.4267 (-2.14)	-.1497 (-1.02)	.0462 (0.26)	.0189 (0.13)
LBCU (eg.3) INDCU (eg.4)	.2474 (14.69)	.1803 (11.90)	.2038 (3.50)	.1592 (3.46)
R^2	.2302	.1544	.4394	.5667

Third, caution must be employed in interpreting either the LB, industry, or market share interaction variables, when one of the three variables is omitted. This is particularly true for advertising. LB advertising changes from positive to negative when INDADV and LBADVMS are included, although in both cases the GLS estimates are only significant at the 20% level. The significant positive effect of industry advertising observed in equation (2), Table II, dwindles to insignificant in equation (3), Table III. The interaction between share and advertising is the most important factor in their relationship with profits. The exact nature of this relationship remains an open question. Are higher quality products associated with larger shares and advertising or does the advertising of large firms influence consumer preferences yielding a degree of monopoly power?[16] Does relative size confer an advertising advantage, or does successful product development and advertising lead to a larger market share?[17]

Further insight can be gained by analyzing the net effect of advertising, R&D, and assets. The partial derivatives of profit with respect to these three variables are:

$\partial\pi/\partial LBADV = -.1175 + .0936(MS/COVRAT) + 2.9746(MS).$

$\partial\pi/\partial LBRD = -.4124 - .3385(MS/COVRAT) + .6358(MS).$

$\partial\pi/\partial LBASS = -.0258 + .0624(MS/COVRAT) + .2413(MS).$

Assuming the average value of the coverage ratio (.465), the market shares (in ratio form) for which advertising and assets have no net effect on profits are .0370 and .0687. Market shares higher (lower) than this will on average yield positive (negative) returns. Only fairly large firms show a positive return to assets, whereas even a firm with an average market share tends to have profitable media advertising campaigns. For all feasible market shares, the net effect of R&D is negative. Furthermore, for the average coverage ratio, the net effect of market share on the return to R&D is negative.

The significance of the net effects can also be analyzed. The ratio of the partial derivative to its corresponding standard deviation (computed from the variance-covariance matrix of the β's) yields a t statistic, which is a function of market share and the coverage ratio. Assuming a coverage ratio of .465 and a critical t value of 1.96, significance bounds can be computed in terms of market share. The net effect of advertising is significantly positive for market shares greater than .0803. It is not significantly negative for any feasible market share. For market shares greater than .1349, the net effect of assets is significantly positive, while for market shares less than .0236, it is significantly negative. For R&D, the net effect is significantly negative for market shares less than .2079.

Equation (4), Table III presents the industry equivalent of LB equation (3). Some of the insights gained from equation (3) can also be obtained from the industry regression. CR4, which was positive and weakly significant in the GLS equation (2) Table II, is now not at all significant. This reflects the insignificance of share once the interactions are included. Industry advertising is positive and insignificant, while the interaction of advertising and share aggregated to the industry level is positive and weakly significant in the GLS regression. Industry assets, on the other hand, dominate the share-assets interaction. Both of these observations are consistent with the results in equation (3).

There are several problems with the industry equation aside from the high collinearity and low degrees of freedom relative to the LB equation. The most serious one is the industry and LB effects, which may work in opposite directions, cannot be dissentangled. Thus, in the industry regression, we lose the fact that higher assets to sales tend to lower profits once the industry and relative size effects are held constant. A second potential problem is that the industry equivalent of the interaction between market share and advertising, R&D, and assets is not publically available information. However, in an unreported regression, the interaction between CR4 and INDADV, INDRD, and INDASS were found to be reasonable proxies for the share interactions.

IV. Subsamples

Many studies have found important differences in the profitability equation for well-defined subsamples of manufacturing industries, particularly in regards to concentration. This section will briefly discuss the results of dividing the sample used in Tables II and III into the following groups: consumer, producer and mixed goods; convenience and nonconvenience goods; 2-digit LB industries; and 4-digit LB industries. To conserve space, no individual regression equations are presented and only the coefficients of concentration and market share in the LB regression are discussed.

Following Scherer (1980, p. 114) industries are classified into 3 categories: consumer goods, in which the ratio of personal consumption to industry value of shipments is .60 or larger; producer goods, in which the ratio is .33 or smaller; and mixed goods, in which the ratio is between .33 and .60. Concentration negatively influences profitability in all three categories. However, in all cases the effect of concentration is not at all significant (t ratios in the GLS regressions of -.139 for consumer goods, -.90 for producer goods and -.118 for mixed goods). The coefficient of market share is positive and significant at a 10% level or better for consumer, producer and mixed goods (GLS coefficient values of .1348, .1034 and .1735 and t ratios of 3.00, 2.88, and 1.69). Although differences in market share's coefficient between the three categories are not significant, the results suggest that market share has the smallest impact on producer goods, where advertising is relatively unimportant and buyers are generally better informed.

Consumer goods are further divided into convenience and nonconvenience goods as defined by Porter (1974). Concentration is again negative for both categories and significantly negative, at the 10% level, for the nonconvenience goods subsample. There is very little difference in the market share coefficient or its significance for these two subsamples.

For some manufacturing industries, evidence of a concentration-profitability relationship exists, even when market share is taken into account. Dalton and Penn (1971) and Imel and Helmberger (1971) have found concentration and market share significant in explaining the profits of food related industries. To investigate this possibility, a simplified version of equation (1) was estimated for the LB's in 20 separate 2-digit industries.[18] A drawback of this approach is/that some variables, such as concentration, may be too homogeneous within a 2-digit industry to yield significant coefficients. Despite this caveat, the coefficient of concentration in the GLS regression is positive and significant at the 10% level in two industries (food and kindred products, and lumber and wood products, except furniture). Concentration's coefficient is negative and significant for three industries (apparel and other fabric products, chemical and allied products and miscellaneous manufacturing industries). Concentration's coefficient is not significant in any of the OLS regressions. Several studies have suggested that the high collinearity between MES and CR4 may hide the significance of concentration. If we drop MES, concentration's coefficient becomes significant at the 10% level in one additional industry (leather and leather products).

If the interaction term between concentration and market share is added, support for either Long's or Ravenscraft's concentration-collusion hypothesis is found in four industries (tobacco manufacturing; printing, publishing, and allied industries; leather and leather products; measuring, analyzing, and controlling instruments, photographic, medical and optical goods, and watches and clocks). All together, there is some statistically significant support for a concentration-collusion hypothesis in a linear or non-linear form for six distinct 2-digit industries.

The positive effect of market share on profits dominates most of the 2-digit industry regressions. The coefficient of market share is positive in 15 industries and significant at the 10% level in 10. A significant negative coefficient arose in only the GLS regression for the primary metals industry.

The most basic unit of analysis for the LB sample is the 4-digit LB industry. Profits were regressed on market share for 241 4-digit LB industries containing four or more observations. A positive relationship resulted for 169 of the industries. In 49 industries, the relationship was also significant. This indicates that the positive profit-market share relationship is a pervasive phenomenon in manufacturing industries. However, exceptions do exist. For 11 industries, the profit-market share relationship was negative and significant. Similar results were obtained for a smaller number of industries, in which profits were regressed on market share, advertising, R&D, and assets.

The 4-digit industry estimation also provides an alternative approach to studying the cause of the profit-market share relationship. The coefficients of market share from the 241 4-digit LB industry equations were regressed on the industry specific variables used in equation (3) Table III.

The only variables that significantly affect the profit-market share relationship are CR4, SDSP, and INDASS. The coefficient is negative for CR4 and SDSP and positive for INDASS. This suggests that if rival firms in the industry are large or supplies come from only a few industries, the advantage of market share is lessened. The positive INDASS coefficient could represent economies of scale or industry barriers to entry. The R^2 from this regression is only .091. Therefore, there is a lot left unexplained. As equation (3), Table III showed, LBADV and LBASS are the key variables in explaining the positive market share coefficient.

V. Summary

This study has demonstrated that diversified, vertically integrated firms with a high average market share tend to have significantly higher profitability. Higher capacity utilization, industry growth, exports and minimum efficient scale also raise profits, while higher imports tend to lower profitability. The countervailing power of suppliers lowers profits.

Further analysis revealed that firms with a large market share had higher profitability because their returns to advertising and assets were significantly higher. This result suggests that larger firms are more efficient with respect to advertising or asset expenditures due to either economies of scale or superior firms exhibiting higher growth rates leading to higher market shares. The positive market share advertising interaction is also consistent with the hypothesis that a large market share leads to higher profits through higher prices. Further investigation is needed to more clearly identify these various hypotheses.

This paper also discovered large differences between a variable measured at the LB level and the industry level. Industry assets to sales have a significantly positive impact on profits, while LB assets to sales, not associated with relative size, have a significantly negative impact. Similar differences were found between diversification and vertical integration measured at the LB and industry level. Both LB advertising and industry advertising were insignificant once the interaction between LB advertising and market share was included.

Strong support was found for the hypothesis that concentration acts as a proxy for market share in the industry profit regression. Concentration was significantly negative in the line of business profit regression when market share was held constant. It was positive and weakly significant in the industry profit regression, where the industry equivalent of the market share variable, the Herfindahl index, cannot be included because of its high collinearity with concentration.

Finally, dividing the data into well-defined subsamples demonstrated that the positive profit-market share relationship is a pervasive phenomenon in manufacturing industries. With market share held constant, some form of a significant concentration-collusion hypothesis was found in six of twenty 2-digit LB industries. Therefore, there may be specific instances where concentration leads to collusion and thus higher prices, although the cross-sectional results indicate that this cannot be viewed as a general phenomenon.

Appendix A

Variable	Mean	Std. Dev.	Minimun*	Maximum*
BCR	.1984	.1531	.0040	.9970
BDSP	.2665	.2769	.0128	1.000
CDR	.9226	.1824	.2335	2.2890
COVRAT	.4646	.2301	.0346	1.0
CR4	.3886	.1713	.0790	.9230
DS	829.99	373.61	0.0	1936.00
EXP	.0637	.0662	0.0	.4759
GRO	1.5717	.3558	.0047	3.3713
IMP	.0528	.0643	0.0	.6635
INDADV	.0140	.0256	0.0	.2151
INDADVMS	.0013	.0033	0.0	.0327
INDASS	.6344	.1822	.1742	1.7887
INDASSMS	.0519	.0641	.0036	.6557
INDCR4MS	.0394	.0570	.0010	.5829
INDCU	.9379	.0656	.6164	1.0
INDDIV	.7201	.1175	.1418	.9273
INDMESMS	.0031	.0059	.000005	.0576
INDPCM	.2220	.0701	.0096	.4050
INDRD	.0159	.0172	0.0	.1052
INDRDMS	.0017	.0044	0.0	.0583
INDVI	.1269	.1988	0.0	.9725
LBADV	.0132	.0317	0.0	.3175
LBADVMS	.00064	.0027	0.0	.0324
LBASS	.6507	.3849	.0438	4.1220
LBASSMS	.0251	.0502	.00005	.5082

Variable	Mean	Std. Dev.	Minimun*	Maximum*
LBCR4MS	.0187	.0427	.000044	.4331
LBCU	.9167	.1355	.1846	1.0
LBDIV	.7470	.1890	0.0	.9403
LBMESMS	.0016	.0049	.000003	.0523
LBOPI	.0640	.1319	-1.1335	.5388
LBRD	.0147	.0292	0.0	.3171
LBRDMS	.00065	.0024	0.0	.0322
LBVI	.0678	.2515	0.0	1.0
MES	.0258	.0253	.0006	.2475
MS	.0378	.0644	.00018	.5460
SCR	.2462	.0738	.0290	.6120
SDSP	.1216	.1154	.0314	.8184

*To avoid disclosing individual line of business data, the minimum and maximum of the LB variables are the average of the highest or lowest ten observations. For the aggregated LB variables, two or more industries were combined if the minimum or maximum occurred in an industry with less than four firms.

Appendix B. Calculation of Market Shares.

Market share is defined as the sales of the jth firm divided by the total sales in the industry. The problem in computing market shares for the FTC LB data is obtaining an estimate of total sales for an LB industry. Since the FTC LB data do not cover all firms in the industry, the summation of LB sales cannot be used. An obvious second best candidate is value of shipments by product class from the Annual Survey of Manufactures. However, there are several critical definitional differences between census value of shipments and line of business sales. Thus, dividing LB sales by census value of shipments yields estimates of market shares which, when summed over the industry, are often significantly greater than one. In some cases, the estimates of market share for an individual business unit are greater than one. Obtaining a more accurate estimate of the crucial market share variable requires adjustments in either the census value of shipments or LB sales.

LB sales (LBS) are defined as the sales of the LB product, including service and installation (SI), plus secondary product sales (SPS) (provided they are less than 15% of the total sales), goods purchased for resales (GPS) (up to 50% of the total sales), and sales to other firms or lines of businesses of a vertically integrated line (OSVI) (if 50% of the total product is used internally). Except in a few industries, value of shipments by product class (CENVS) are defined as net selling values, f.o.b. plant. Value of shipments include interplant intraindustry shipments (IIPS), whereas, LB sales do not.

If there is no vertical integration the definition of market share for the jth firm in the ith industry is fairly straightforward:

$$\text{(B1)}\quad MS_{ij} = \frac{ALBS_{ij}}{ACENVS_i} = \frac{LBS_{ij} - SP_{ij} - GPR_{ij} - SI_{ij}}{CENVS_i - IIPS_i}$$

LB reporting firms are required to include an estimate of SP, GPR, and SI. $IIPS_i$ is defined as $(VS_{ii}/VS_i) \times LBS_{ij}$, where VS_{ii} is the value of shipments within industry i and VS_i is the total value of shipments from industry i, as reported by the 1972 input-output table. This assumes that all intraindustry interplant shipments occur within a firm. (For the few cases where the input-output industry category was more aggregated than the LB industry category, VS_{ii} was assumed to be zero since shipments between LB industries would probably dominate the VS_{ii} value.)

If vertical integration is present, the definition is more complicated, since it depends on how the market is defined. For example, should compressors and condensors which are produced primarily for one's own refrigerators be part of the refrigerator market or compressor and condensor market? The inclusion of compressors and condensors into the refrigerator market is consistent with the LB definition of markets, while the census industries separate compressors and condensors from refrigerators regardless of the vertical ties. Market shares are calculated using both definitions of the market.

Assuming the LB definition of markets, adjustments are needed in the census value of shipments, but these adjustments differ for forward and backward integration and whether there is integration from or into the industry. If any firm j in industry i integrates a production process in an upstream industry k, then market share is defined as:

$$\text{(B2)}\quad MS_{ij} = \frac{ALBS_{ij}}{ACENVS_i + \Sigma_j OSVI_{ikj}}$$

$OSVI_{ikj}$ is defined as the sales to outsiders (firms other than j or firm j not in line i or k) of industry k's product. $OSVI_{ikj}$ is reported by the LB firms. For the upstream industry k, market share is defined as:

$$\text{(B3)} \quad MS_{kl} = \frac{ALBS_{kl}}{ACENVS_k - \Sigma_j OSVI_{ikj} - \Sigma_j ISVI_{ikj}}$$

$ISVI_{ikj}$ is firm j's transfer or inside sales of industry k's product to industry i. This is estimated by the maximum of $((V_{ik}/V_i) \times LBS_{ij}, OSVI_{ikj})$, where V_{ik} is the value of shipments from industry i to industry k according to the input-output table. The FTC LB guidelines require that 50% of the production must be used internally for vertically related lines to be combined. Thus, ISVI must be greater than or equal to OSVI.

For any firm j in industry i integrating a production process in a downstream industry m, (ie., textile finishing integrated back into weaving mills), MS is defined as:

$$\text{(B4)} \quad MS_{ij} = \frac{ALBS_{ij}}{ACENVS_i + \Sigma_j OSVI_{imj} - \Sigma_j ISVI_{imj}}$$

For the downstream industry m, the adjustments are:

$$\text{(B5)} \quad MS_{ij} = \frac{ALBS_{ml}}{ACENVS_m - \Sigma_j OSLBI_{imj}}$$

For the census definition of the market adjustments for vertical integration are made in the numerator, $ALBS_{ij}$. For a firm j that engages in vertical integration B2 - B5 becomes:

$$\text{(B6)} \quad CMS_{ij} = \frac{ALBS_{ij} - OSVI_{ikj}}{ACENVS_k}$$

$$(B7)\ CMS_{kj} = \frac{OSVI_{ikj} + ISVI_{ikj}}{ACENVS_i}$$

$$(B8)\ CMS_{ij} = \frac{ALBS_{..} - OSVI_{..} + ISVI_{..}}{ACENVS_i}$$

$$(B9)\ CMS_{mj} = \frac{OSLBI_{imj}}{ACENVS_m}$$

An advantage of the census definition of markets is that the accuracy of the adjustments can be checked. Four-firm concentration ratios were computed from the market shares calculated by equations (B6) - (B9) and compared to the 1972 census CR4 or (to account for the cases in which the FTC LB data does not include the top four firms) the sum of the market shares for the largest four firms in the FTC sample obtained from the 1974 Economic Information System's market share data. In only 13 industries out of 257, did the LB CR4 obtained from CMS differ by more than +/- .10 from the census CR4 or EIS CR4. In most of the 13 industries, this large difference arose because a reasonable estimate of installation and service for the LB firms could not be obtained. In these cases, the ratio of census CR4 to LB CR4 was used as a correction factor for both the census and LB definitions of market share.

For the analysis in this paper, the LB definition of market share was used, partly because of its intuitive appeal, but mainly out of necessity. When a firm vertically integrates its production in industry k into its production in industry i, all its profit, assets, advertising and R&D data are combined with industry i's data. To consistently use the census definition of markets, some arbitrary allocation of these variables, back into industry k, would be required.

Footnotes

1. An exception to this is the PIMS data set. For an example of using the PIMS data set to estimate a structure-performance equation see Gale and Branch (1979). For a summary of the results using the PIMS data see Scherer (1980) Ch. 9.

2. Estimation of a structure-performance equation using the LB data was pioneered by Weiss and Pascoe (1981). They regressed line of business profits on concentration, a consumer goods concentration interaction, market share, distance shipped, growth, imports to sales, line of business advertising and assets divided by sales. This work extends their results as follows: One, corrections for heteroscedasticity are made. Two, many additional independent variables are considered. Three, an improved measure of market share is used. Four, possible explanations for the positive profit-market share relationship are explored. Five, differences between variables measured at the line of business level and industry level are discussed. Six, equations are estimated at both the line of business level and the industry level. Seven, estimations are performed on several subsamples.

3. Industry price-cost margin from the census is used instead of aggregating operating income to sales, to capture the entire industry not just the firms contained in the LB sample. It also confirms that the results hold for a more conventional definition of profit. However, sensitivity analysis using aggregated operating income to sales is performed. (See footnote 15).

4. This interpretation has been criticized by several authors. For a review of the criticisms with respect to the advertising barrier to entry interpretation, see Comanor and Wilson (1979). One of the main critics is Schmalensee (1972 and 1974), who demonstrates the possibility of a simultaneity bias

in the OLS estimate of advertising. However, Comanor and Wilson (1974) and Martin (1979) have shown that advertising remains highly significant in a profitability equation when it is included in a simultaneous system. To check for a simultaneity bias in this study, the 1974 values of advertising and R&D were used as instrumental variables. No significant differences resulted.

5. For a survey of the theoretical and empirical results of diversification see Scherer (1980) Ch. 12.

6. In an unreported regression, this hypothesis was tested. CDR was negative but insignificant at the 10% level, when included with MS and MES.

7. For an exact definition and description of these variables see Martin (1981).

8. For the LB regressions the independent variables CR4, BCR, SCR, SDSP, IMP, LBRD, LBASS as well as linear and nonlinear forms of sales and assets were significantly correlated to the absolute value of the OLS residuals. For the industry regressions the independent variables CR4, BDSP, SDSP, EXP, DS, the level of industry assets and the inverse of value of shipments were significant.

9. Since operating income to sales is a richer definition of profits than is commonly used, sensitivity analysis was performed using gross margin as the dependent variable. Gross margin is defined as total net operating revenue plus transfers minus cost of operating revenue. Most of the variables retain the same sign and significance in the gross margin regression. The only qualitative difference in the GLS regression (aside from the obvious increase in the coefficient of advertising, R&D, and assets) is the coefficient of LBVI which becomes negative but insignificant.

10. I would like to thank Bill Long for suggesting this measure of R^2. R^2 in the GLS LB equation is much lower than the R^2 in the OLS LB equation because the presumed explanatory power of LBRD and LBASS is biased upward in the OLS regression.

11. If the capacity utilization variable is dropped, market share's coefficient and t value increases by approximately 30%. This suggests that one advantage of a high market share is a more stable demand. In fact, CU and MS have a significantly positive correlation of .1166.

12. Shepherd (1972), Gale and Branch (1979), and Weiss and Pascoe (1981) found concentration insignificant when market share was included as an additional independent variable. Gale and Branch, and Weiss and Pascoe further showed that concentration becomes positive and significant when market share and MES are dropped.

13. A negative coefficient on concentration is not uncommon in the profit-concentration literature, although it is generally insignificant and hypothesized to be a result of collinearity. (For example, see Comanor and Wilson (1974).) Graboski and Mueller (1978) found a negative and significant coefficient on concentration in a firm profit regression. They interpreted this result as evidence of rivalry between the largest firms. Additional work revealed that a significantly negative interaction between R&D and concentration explained most of this rivalry. To test this hypothesis with the LB data, interactions between CR4 and LBADV, LBRD, and LBASS were added to the LB regression equation. All three interactions were highly insignificant once corrections were made for heteroscedasticity.

14. Ravenscraft (1981) has shown that the coefficient on CR4 is less biased and better in terms of mean square error when both CDR and MES are included in the industry equation, than if only one (or neither) of these variables

is included. Including CDR and MES is also superior, in terms of mean square error, to including the herfindahl index.

15. Despite these differences, INDPCM should be used instead of aggregating LBOPI if the results are to be comparable to the previous literature which uses INDPCM. For example, the LB equation (1) Table II is implicitly summed over only the LB firms in the industry when aggregated LBOPI is used, instead of all the firms in the industry as with INDPCM. Thus, aggregated market share in the aggregated LBOPI regression is somewhat smaller (and significantly less highly correlated with CR4) than the Herfindahl index, which is the aggregated market share variable in the INDPCM regression. The coefficient of concentration in the aggregated LBOPI regression is, therefore, much smaller in size and significance. MES and CDR increase in size and significance, capturing the omitted market share effect better than CR4. Other qualitative differences between the aggregated LBOPI regression and the INDPCM regression arise in the size and significance of GRO (which has a much stronger effect in the aggregated LBOPI regression) and INDASS, SDSP and INDVI (which have a much weaker effect in the aggregated LBOPI regression).

16. Gale and Branch (1979) have shown that larger firms do tend to have higher relative prices and that the higher prices are largely explained by higher quality. However, their measure of quality is highly subjective.

17. Some evidence on this question can be obtained from the exchange between Peltzman (1977) and Scherer (1979). Scherer found that industries experiencing rapid increases in concentration were predominately consumer good industries which had experienced important product innovations and/or large-scale advertising campaigns. This indicates that successful advertising leads to a large market share.

18. Within many 2-digit industries there are only a few 4-digit industries. Therefore, the only 4-digit industry specific independent variables included in the 2-digit analysis are CR4, MES and GRO. For two 2-digit industries (tobacco manufacturing and petroleum refining and related industries) only CR4 and GRO could be included.

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