DETERMINANTS OF PRICE-COST MARGINS AND ESTIMATES OF WELFARE LOSS IN SELECTED U. S. MANUFACTURING INDUSTRIES

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PREFACE

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CHAPTER I

INTRODUCTION

Statement of the Problem

A large number of empirical studies concerning the relationship between market structure and economic performance have been completed since Joe Bain's 1951 article.[1] Weiss, for example, reports in a 1971 paper that there had been "at least thirty-two tests of some form of the classic profit-determination hypothesis over the last 18 years, and the number seems to be accelerating if anything."[2] The primary issue in these studies is the degree to which variations in economic performance are caused by differences in market structure. The univariate studies[3] typically generate a strong to weak relationship between market structure (measured by seller concentration) and economic performance (measured by profit rates or price-cost margins).[4] In multivariate studies this relationship has again been isolated,[5] although some exceptions have been noted.[6]

Additional knowledge of this structure-performance relationship is important for antitrust policy recommendations. For example, in 1968 the White House Task Force on Antitrust Policy presented recommendations designed to strengthen antitrust statutes. One major proposal included was the "Concentrated Industries Act" which would search out all "oligopoly industries"[7] and bring legal proceedings against all "oligopoly firms"[8] within those industries. The goal of this act would be to lower the market shares of individual firms to below 12 per cent. These recommendations were said to be based on the existing evidence, both theoretical and empirical, about the relationship between market structure and economic performance. This evidence was described by the Task Force as follows:

> The adverse effects of persistent concentration on output and price find some confirmation in various studies that have been made of return on capital in major industries. These studies have found a close association between high levels of concentration and persistently high rates of return on capital, particularly in those industries in which the largest four firms account for more than 60% of the sales. High profit rates in individual firms or even in particular industries are of course consistent with competition. They may reflect innovation, exceptional efficiency, or growth in demand outrunning the expansion in supply. Above-average profits for additional resources and expanded output in the industry, which, in due time should return profits to a normal level. It is the persistence of high profits over extended time periods and over whole industries rather than in individual firms that suggest artificial restraints on output and the absence of fully effective competition. The correlation of evidence of this kind with very high levels of concentration appears to be significant.[9]

Shortly thereafter, this same issue was reexamined by the Task Force on Productivity and Competition headed up by George Stigler.[10] The Stigler Report rejects the view that seller concentration leads to antitrust violations. The report observes:

> Numerous statistical studies have been made of the relationship between concentration and rates of return on investment, and these studies generally yield positive but loose relationships: concentration is not a major determinant of differences among industries in profitability although it may be sometimes a significant factor . . . . The correlation between concentration and profitability is weak, and many factors besides the number of firms in a market appear to be relevant to the competitiveness of their behavior.

Purpose of the Study

The general goal of the study is to provide additional evidence regarding this structure-performance controversy and to provide estimates of costs of monopoly power. The purposes of the study are (1) to examine the structure-performance hypothesis using the price-cost margin as the dependent variable and 1967 data, (2) to compare the outcomes to other studies in the area, (3) to estimate the monopoly welfare loss by four-digit industry classification, and (4) to make policy recommendations suggested by the results of this study.

Organization of the Study

The material in this study is arranged under six chapter headings. The structure-performance model is developed in Chapter II. In Chapter III the empirical results from testing the theoretical model are presented. In Chapter IV a model to measure welfare loss is presented. Chapter V covers the empirical results of the welfare loss model. The final chapter consists of a general summary of the problem and conclusions of the study.

FOOTNOTES

[1] Joe S. Bain, "Relation of Profit Rates to Industry Concentration," Quarterly Journal of Economics, 65 (August, 1951), pp. 293-324.

[2] Leonard Weiss, "Quantitative Studies of Industrial Organization," Frontiers of Quantitative Economics, Michael D. Intriligator, ed. (Amsterdam, 1971), pp. 362-403.

[3] See, for example, Bain, pp. 293-324, H. Michael Mann, "Seller Concentration, Barriers to Entry, and Rates of Return in Thirty Industries," Review of Economics and Statistics, 48 (August, 1966), pp. 296-307, and Norman H. Collins and Lee E. Preston, Concentration and Price-Cost Margins in Manufacturing Industries (Berkeley, 1968).

[4] The exception to this is George J. Stigler, Capital and Rates of Return in Manufacturing Industries (Princeton, 1963).

[5] Joe S. Bain, Barriers to New Competition (Cambridge, 1956), pp. 296-307; W. S. Comanor and T. A. Wilson, "Advertising, Market Structure and Performance," Review of Economics and Statistics, 49 (November, 1967), pp. 423-440; and Norman R. Collins and Lee E. Preston, "Price-Cost Margins and Industry Structure," Review of Economics and Statistics, 51 (August, 1969), pp. 271-286.

[6] James V. Koch, "Industry Market Structure and Industry Price-Cost Margins," Industrial Organization Review, 2, No. 4 (1974), pp. 186-194.

[7] An oligopoly industry is defined as one in which "(i) any four or fewer firms had an aggregate market share of 70% or more during at least seven of the ten and four of the most recent five base years; and (ii) the average aggregate market share during the five most recent base years of the four firms with the largest average market shares during those base years amounted to at least 80% of the average aggregate market share of those same four firms during the five most recent base years decline by 20% or more from such average sales during the preceding five base years" Phil Neal et al., "White House Task Force on Antitrust Policy," Antitrust Law and Economics Review, 2 (Winter, 1968), p. 68.

[8] Defined as ". . . a firm engaged in commerce whose market share in an oligopoly industry during at least two of the three most recent base years exceeded 15%." Ibid.

[9] Ibid., p. 28.

[10]George J. Stigler et al., "Report on the Task Force on Productivity and Competition," <u>Antitrust Law and Economics Review</u>, 2 (Spring, 1969), pp. 13-40.

[11]Ibid., p. 26.

CHAPTER II

STRUCTURE-PERFORMANCE MODEL

Structural Variables

The basic hypothesis to be tested in this study is that, ceteris paribus, price-cost margins for industries are functionally related to the market structures of the industries. The specific independent structural variables that this study will consider are:

1. Seller concentration (CR),
2. Industry rate of growth in demand (D),
3. Barriers to entry (PRD or MES),
4. Geographic market (GM),
5. Import competition (I), and
6. Capital intensity (KO or TAO).

Seller Concentration

Economic theory implies that the higher the degree of concentration, the greater the probability that firms will be able to collude to raise prices above long-run average costs.[1] One hypothesis to be examined is that price-cost margins are positively related with the level of seller concentration.[2] Seller concentration will be measured by the share of the four largest firms in the industry's total value of shipments for 1967.

Industry Rate of Growth

In addition, it is hypothesized the price-cost margin, ceteris paribus, is positively related to the growth of industry demand. Firms in industries experiencing rapid growth in demand (relative to increases in unit costs) will experience widening price cost margins because they are less likely to face the competitive pressures found in slow-growth sectors.[3] Also, in concentrated industries facing a slow growth or decline in demand, collusive joint-profit maximization pricing behavior may break down resulting in lower price-cost margins.[4] Growth in industry demand will be measured by the percentage change in industry value of shipments between 1963 and 1967.

Barriers to Entry

Factors that impose costs on potential new entrants not incurred by existing firms are often referred to as barriers to entry. The effect of these barriers is to make it more costly for new firms to enter the production and sale of a product. The hypothesis to be tested is that price-cost margins are greater in those industries in which barriers to entry are higher. Two sources of barriers which will be investigated are (1) product differentiation (PRD), and (2) economies of plant size (MES).

Product differentiation reflects consumer preferences for products of particular manufacturers. When product differentiation exists in a market, new firms must undertake proportionately larger sales campaigns to attract customers at given prices than established firms must maintain; alternatively the new entrant must undercut established firms' current prices for the product in order to gain sales in the market.

Product differentiation will also make the demand curve faced by the firm less elastic. Increased product differentiation will rotate a demand curve from DD to D'D' as shown in Figure 1. As the demand curve becomes less elastic (more inelastic), and given a marginal cost curve, a firm's profit maximizing price will be increased.[5] Joe Bain has noted that

> the most important barrier to entry discovered by detailed study is probably product differentiation . . . . The most single important basis of product differentiation in the consumer-goods category is apparently advertising; in all cases it appears in significant volume.[6]

The ratio of industry advertising to industry sales (advertising intensity) is used, whenever possible, as a proxy for product differentiation. The reasoning is based on the idea that advertising expenditures are a prime source of differentiation in consumer good industries.[7]

Data on advertising expenditures are not readily available at the four-digit SIC level. Information for the Food and Kindred Products group (SIC 20) is developed from advertising data reported by the IRS at approximately the three-digit level. In addition, figures from Advertising Age for the 100 leading advertisers is used to modify the IRS data to reflect differentials in advertising expenditures at the four-digit level.[8] For industries outside SIC 20 a producer-consumer goods classification is used as a proxy for product differentiation. Consumer goods industries are assumed to reflect the presence of produce differentiation and producer goods industries reflect the lack of product differentiation.[9]

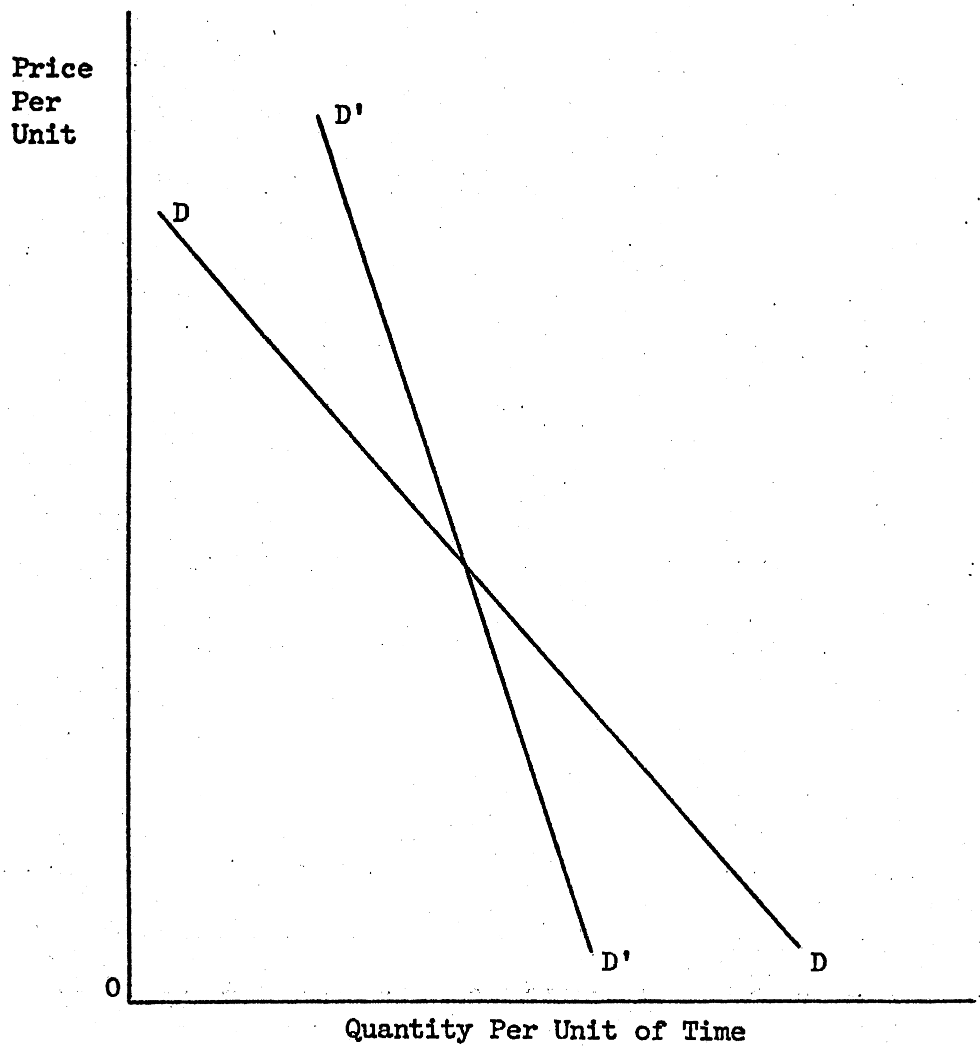

Figure 1. The Effect of Product Differentiation on the Demand Curve

Barriers to entry may also arise from economies of plant size. Economies of plant size result when per unit costs of production decline as the size of a plant is increased. Figure 2 illustrates a long-run average cost curve (LRAC) facing a firm in a given industry. The firm will gain lower per unit costs as it expands from small output levels toward output OD. The LRAC curve is horizontal beyond OD, reflecting a constant cost industry. In this industry, economies of size are significant enough to make it difficult for many firms to serve the market and continue to achieve the minimum efficient size (MES) of plant (equal to output OD). If a new entrant must produce at a level of output that is a sizable fraction of the entire market (assumed to be equal to OE), his entry will affect market price. The manner in which market price is affected depends on the response of existing firms.[10] Assume that the existing firms' response to a new entry is to maintain the same output at the initial level.[11] The additional output that is produced by the new entrant will lower market price. In Figure 3, the entrant's cost curve (AC) has been shifted so that his zero output corresponds with the current output of existing firms (OE). Figure 3 shows the new entrant producing the quantity EF and making a normal profit at price P^o. The limit price (entry deterring price) is P_L. Any pre-entry price lower than P_L will discourage entry of new firms. In summary, when economies of plant size are present and limit the number of efficient firms in an industry, it is likely that price will be set above the competitive level. The hypothesis is that price-cost margins will be positively associated with economies of plant size.

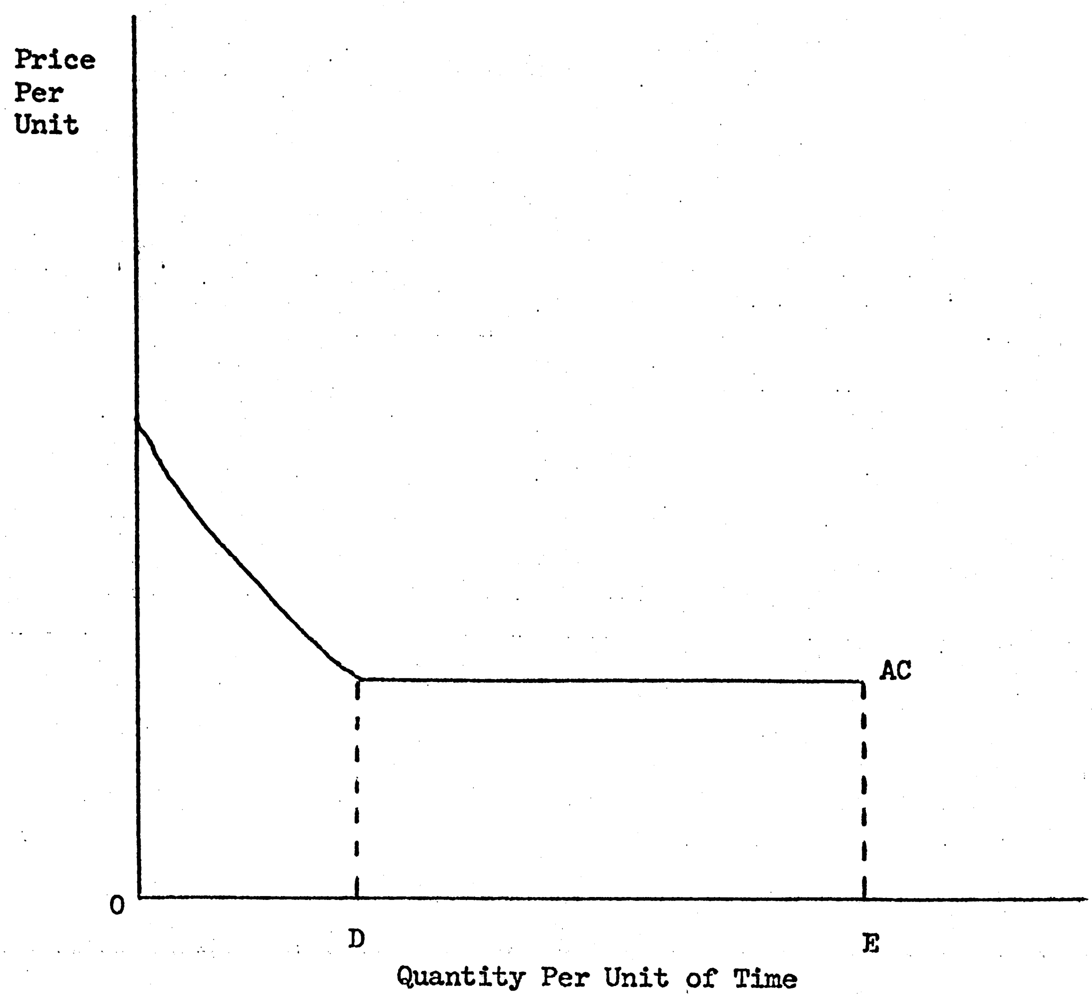

Figure 2. The Long Run Average Cost Curve

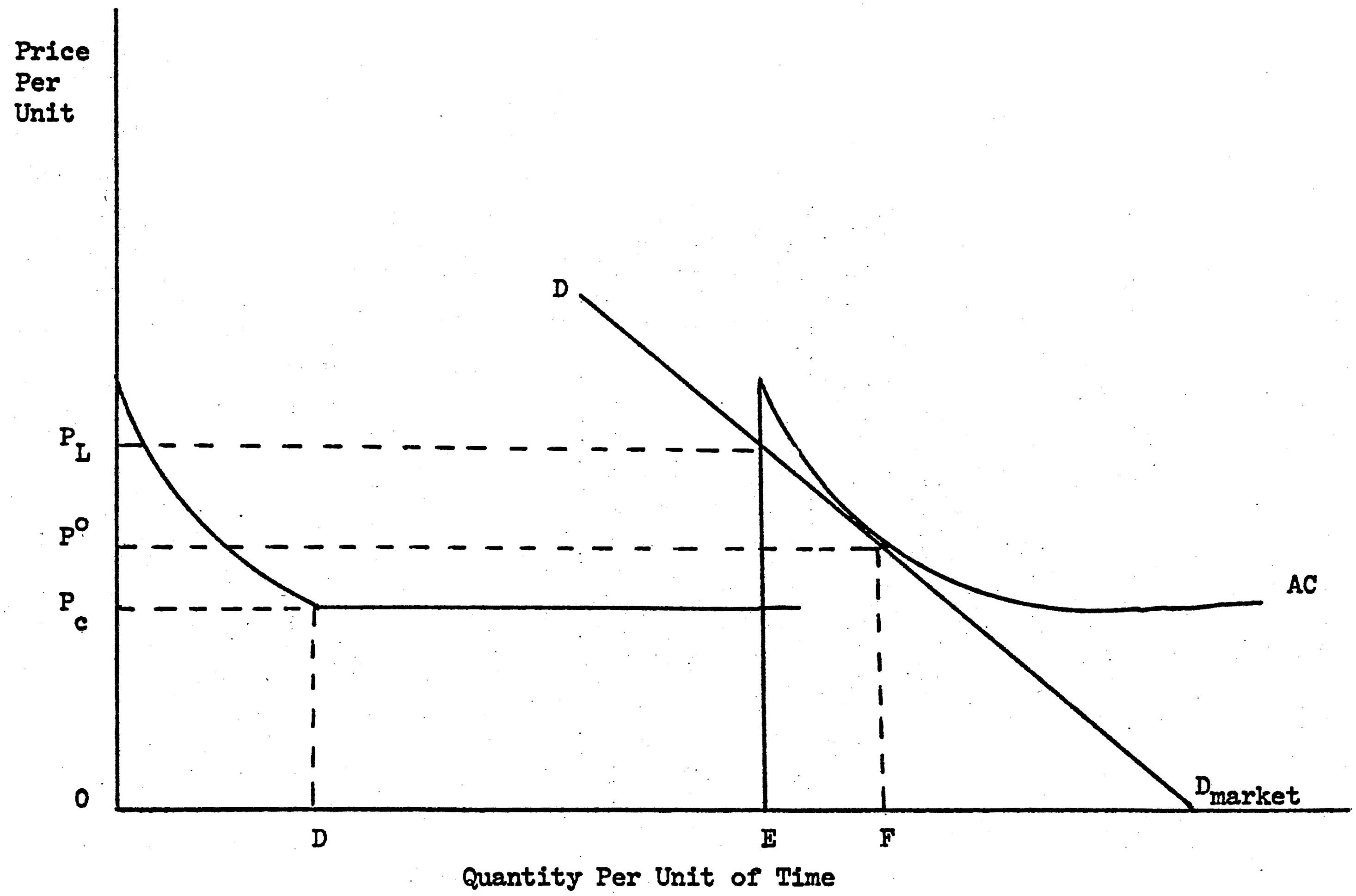

Figure 3. Limit Pricing and Price-Cost Differences

Three different measures of economies of size will be used. The first approach was suggested by George Stigler:

> Classify the firms in an industry by size, and calculate the share of industry output coming from each class over time. If the share of a given class falls, it is relatively inefficient, and in general is more inefficient the more rapidly the share falls.[12]

This technique is called the survivor principle.[13] Using this approach, minimum efficient size of plant (MES) is defined as the smallest establishment size class which increased its share of total industry value added by one per cent or more over a five year period. Estimates using this approach will be labeled MES 1.

Another estimate is derived by taking those plants in the single largest Census employment-size category, and expressing the output of that "average" plant as a fraction of the output of the industry as a whole. This technique is one suggested by Bain[14] and later used by Esposito[15] and will be designated as MES 2.

A third estimate for MES has been suggested by Comanor and Wilson.[16] The measure is based on the average plant size among the largest plants accounting for 50 per cent of industry output. This "average" plant size is divided by total output and expressed as a percentage. It will be symbolized by MES 3.

Geographic Market

Concentration data used in this study are generated on a nation-wide basis. Thus, where markets are regionalized the concentration measures will tend to understate the degree of monopoly power present in a particular industry. In order to take into account the regional market, an index of geographic dispersion is used. The geographic market index (GM) will be given by the radius (in miles) within which 80 per cent of the total tonnage of a four-digit industry is shipped. The value of GM will vary directly with the maximum distance shipped; that is, for a national market, GM will be higher than for localized markets.[17] The expectation is that, given a level of concentration in the national markets, price-cost margins will be greater in industries that are regionally segmented.

Import Competition

The role of the foreign trade sector in the structure-performance relationship has not been examined except in studies by Esposito and Esposito[18] and Khalilyadeb-Shirayi.[19] The presence of foreign competition, it may be argued, will reduce the market power of firms within an industry.[20] The hypothesis is that the larger the import sector, ceteris paribus, the smaller will be price-cost margins. The size of the import sector will be measured by the amounts of imports as a percentage of total domestic sales. Information on imports will be obtained from the Bureau of the Census.[21]

Capital Intensity

The sixth structural variable to be considered is that of capital intensity. Specifically, since available data sources contain figures for current cost, but not capital costs, in industries that are relatively capital-intensive the ratio of profits to current costs would be expected to be greater than in industries that are less capital-intensive.[22] Thus, the hypothesis to be examined is that the greater the capital-intensity of an industry, the higher will be the price-cost margins. Two alternative measures of capital intensity will be employed. The first is the capital output ratio (KO) which was first used by Collins and Preston[23] and later used by other writers.[24] The second measure is also a capital to output ratio which uses as a proxy for capital (TAO) a measure of total assets reported on balance sheets of corporations. The merits of these two separate measures of capital intensity will be compared.

The Price-Cost Margin

Under conditions of pure competition, each firm employs least cost combinations of resoures and produces an allocatively efficient output where price equals marginal cost. In contrast, firms operating in imperfect markets sell their outputs at prices above marginal cost and buy resources at prices below the value of marginal product. Hence, relative market prices are unreliable indicators of relative scarcities and relative demands; thus, firms, using market prices as guides, may make socially undesirable decisions. That is, firms producing in imperfect markets will tend to produce too little and utilize too few resources. The result of output restriction is that an extra dollar's worth of resources produces more than a dollar's worth of output (price marginal cost) in a monopoly, and exactly a dollar's worth of output under pure competition. Thus, reallocating resources from a monopoly to a competitive industry would increase the value of total output.[25]

The dependent variable in this study is the price-cost margin (PM). The PM may be stated in terms of total revenue (price times quantity) and total cost (average cost times quantity). If total costs are defined to include a normal profit, then, in the long-run equilibrium, the total revenue-total cost ratio would have a value of unity for purely competitive firms, and reach an upper limit for a single firm monopoly.[26] However, since available data measure only accounting costs, then the minimum ratio, greater than one for a purely competitive industry, would indicate the gross margin necessary to generate a "normal profit." Greater relative differences between prices and cost would indicate the presence of "excess profits."

The price-cost margin (PM) has been used in several studies as a measure of allocative efficiency.[27] The price-cost margin is only one of several indicators of industry profitability. Rates of return using either total assets or stockholders' equity, have been used extensively by other authors.[28] A comparison of the PM with rate of return on assets (π/A) or rate of return on stockholder's equity (π/E) reveals that (1) when the rate of return measure (either π/A or π/E) indicates excess profits, so will the PM, and (2) when the PM indicates excess profits, a rate of return measure may or may not be in agreement. This is illustrated in Figure 4. In part (a) of Figure 4, $P_a > AC > MC$ at the profit-maximizing output Q_a. The PM and either rate of return measure would show that excess profits are present. In part (b) of Figure 4, $P_b = AC > MC$ at the profit-maximizing output Q_b. Since $P_b = AC$, either rate of return measures, π/A or π/E, would indicate that no excess profits are present. However, since $P_b > MC$, the PM will be positive indicating that excess profits did exist. Finally, in part (c) of Figure 4, a firm is depicted under conditions of constant costs (i.e., LRMC = AC); in this situation, the disagreement between the PM and rate of return measures disappears.

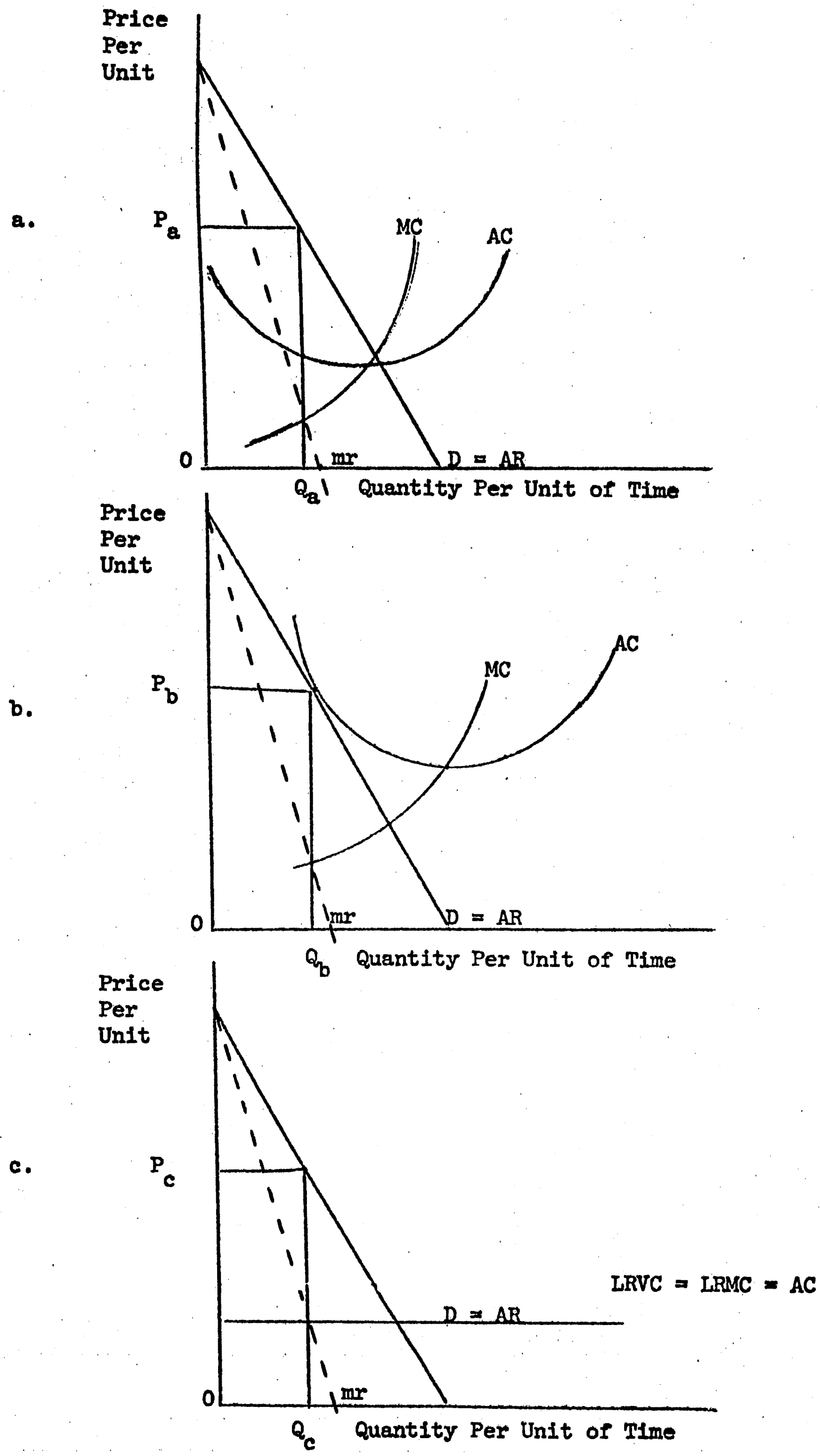

Figure 4. Price-Cost Margins, Rates of Return and Allocative Efficiency

The calculation of the rate of return requires as many adjustments and assumptions as does PM.[29] The major advantages of the PM are:

1. It can be calculated at the industry level for a large sample of four-digit industries.[30]

2. The PM is related to a theoretical model.

3. It is closely correlated with the rate of return.[31]

The basic limitations of the PM are:

1. Elasticity of demand must be the same in all industries. For example, for producers with some degree of monopoly power, the ratio of marginal cost to price is a function of the elasticity of demand. Since $MR = P\left(1 - \frac{1}{n}\right)$ and, assuming profit maximizing behavior (i.e., $MR = MC$), it follows that $MC = P\left(1 - \frac{1}{n}\right)$, or $\frac{MC}{P} = \left(1 - \frac{1}{n}\right)$. Thus, the greater the price elasticity of demand (in absolute value), the greater the ratio of marginal cost to price. Thus, in industries with monopoly power, PM should vary inversely with the (absolute value) price elasticity of demand. There is no adequate solution to this problem since reliable estimates of industry demand elasticities are not available. Thus, the study assumes that the price elasticity of demand is the same for all industries; or, alternatively, the relationship between the price elasticity and seller concentration must be the same.[32]

2. Capital costs must be included in the analysis since, in long-run equilibrium, if rates of return on total assets were equalized among industries, the ratio of profits to current costs would be higher in more capital intensive industries.[33]

3. The observations are short-run in nature and, thus, may reflect various stages of disequilibrium.[34]

4. In industries where a high degree of monopoly power is present, a part of the monopoly profits may be absorbed internally.[35]

5. In industries with monopoly power, the desire to maximize profits may be lessened.[36]

6. Another objection is that PM will be positively associated with advertising. This can be shown by an extension of the Dorfman-Steiner model.[37] Given that a firm's demand function is

$$Q = q(a,= A^o, \ P) \qquad (1)$$

and its cost function is

$$C = c(Q) \qquad (2)$$

where: P = price

Q = quantity

A = advertising expenditure for firm

A^o = advertising expenditures of all other firms in the industry.

The total profit of the firm is

$$\pi = PQ - C - A. \qquad (3)$$

Substituting (1) and (2) into (3) gives

$$\pi = P_q(A, \ A^o, \ P) - c \ q(a, \ A^o, \ P) - A.$$

Taking the first derivative of profits with respect to advertising of the firm and setting equal to zero gives

$$(P - MC) \ \frac{Q}{A} + \frac{Q_o}{A^o} \cdot \frac{A^o}{A} - 1 = 0.$$

Rearranging and multiplying through by A/A, A^o/A^o, Q/Q, and P/P generates

$$\frac{A}{Q(P - MC)} = \frac{PA}{PQ} \ \left(\frac{Q}{A} + \frac{Q_o}{A^o} \cdot A^o \ \frac{A^o}{A} \right)$$

Rearranging once more gives

$$\frac{A}{PQ} = \frac{P - MC}{P} \left(\frac{Q}{A} \cdot \frac{A}{Q} + \frac{Q}{A^o} \cdot \frac{A^o}{Q} \quad \frac{A^o}{Q} \quad \frac{A}{A^o} \right)$$

which can be rewritten as

$$\frac{A}{PQ} = \frac{P - MC}{P} \left(\Sigma_A + \Sigma_{A^o} \Sigma_{conj} \right), \qquad (4)$$

where: Σ_A = elasticity of Q with respect to A

Σ_{A^o} = elasticity of Q with respect to A^o

Σ_{conj} = conjectural elasticity of A^o with respect to A

MC = marginal cost of production.

Thus, industries with different PM will have different advertising-sales ratios.[38] Any least squares estimate of PM (or other measures of profitability) will lead to misleading estimates since any exogenous change that raises PM will, at the same time, increase the optimal level of advertising. Hence, it is difficult to accept the hypothesis that advertising barriers "cause" high profits on the basis of simple correlations and single-equation regressions. Schmalensee summarizes his view of advertising and profits with a criticism of Comanor and Wilson:

> Their (Comanor-Wilson) cross-section regressions account for only half of the variation in profit rates among industries, and without advertising the other variables would almost certainly explain less than 40% of the variance. There is nothing in their paper to refute the interpretation that industries which have high profits for reasons not captured by the other independent variables have thereby high optimal and observed advertising/sales ratios . . . . Since a reasonable model of advertising spending indicates profitability is associated with advertising intensity even when advertising has no impact on monopoly power, the traditional interpretation must be abandoned.[39]

The conclusion is that any study of the impact of advertising on industry structure should be undertaken within a simultaneous equation framework. Despite these limitations, the price-cost margin has received broad acceptance as a proxy for economic performance at the four-digit industry level. Thus, the price-cost margin will be used as the dependent variable in this study.

Calculation of Price-Cost Margin

The PM is defined as the percentage gross return (before taxes) on sales for an industry, or

$$PM = \frac{VA - LAB - RENT}{VS}$$

where PM = price-cost margin

VA = value added

LAB = cost of labor

RENT = rental payments

VS = value of shipments

Value added (VA) is obtained by subtracting the total cost of materials from the value of shipments and other receipts and adjusting the result by the net change in finished products and work-in-progress inventories between the beginning and end of year.[40]

Total labor costs (LAB) include (1) direct payroll payments to labor resources, (2) employer contributions to Federal old age and survivors insurance, (3) unemployment and workmen's compensation, and (4) employers payments for voluntary programs (e.g., insurance premiums, pension plans, and deferred profit sharing plans).[41]

Rental payment (RENT) figures include all items for which depreciation reserves would be maintained if they were owned by the establishment (e.g., structures and buildings, production, office and transportation equipment). Excluded from this definition are royalties and other payments for the use of intangible and depletable assets.[42]

Finally, value of shipments (VS) are reported for most industries as the net selling values, f.o.b. plant, after discounts and allowances and excluding freight charges and excise taxes. Multiunit companies report interplant transfers at their full economic value; the plant receiving the transferred goods would include them in its costs of materials.[43] One problem with U. S. data arises in the case of goods transferred to branches or sold through separate sales offices. The implication of the "f.o.b. plant" instruction is that the value of the goods would be slightly lower than the final invoice value, because the cost of selling the goods is excluded. There is some evidence that these instructions were not faithfully carried out by reporting companies. Specifically it appears that the VS reported by multiunit companies tends to be overstated. Separate figures are available for products for which there are large amounts of interplant shipments. Data of these shipments will be used where possible.[44] Using this "Adjusted" data for VS the following formula would be used for the price-cost margin:

$$PM_{adj} = \frac{VA - PAY - RENT}{VS_{adj}}$$

where PM_{adj} = price cost margin using the adjusted VS data, and VS_{adj} = adjusted VS data.[45]

The Final Form of the Model

The form of the basic regression equation to be tested is as follows:

$$PM = b_o + b_1 CR + b_2 D + b_3 B + b_4 GM + b_5 I + b_6 K + e$$

where

PM = Price-cost margin (unadjusted or adjusted),

CR = Four-firm seller concentration ratio,

D = Rate of growth in industry demand,

B = Barriers to entry (product differentiation or economies of plant size),

GM = Extent of the geographic market,

I = Degree of import competition,

K = Capital intensity (capital to output ratio or total assets to output ratio), and

e = Disturbance term.

The linear form of the model suggests that a one unit change in the level of each of the independent variables will have the same absolute impact on the price-cost margin. Other statistical forms of the regression model employing double-log and semi-log specifications were also examined. Preliminary investigation of these alternative forms indicated that the linear specification results in a better fit. On this basis, the linear form is preferred.

Summary

This chapter has discussed the independent variables to be examined in this study. The theoretical relationship between the independent variables and dependent variable has been presented. Two definitions of the price-cost margin have been developed for use as the dependent variable. Despite some shortcomings, it is argued that the price-cost margin is a satisfactory measure of economic performance. A final section summarizes the form of the regression model used in this study.

FOOTNOTES

[1]The reasoning of this theory rests on the idea that highly concentrated industries find it less costly to engage in collusive behavior (expressed or tacit). This point has been made by several authors, including Joe S. Bain, "Workable Competition in Oligopoly: Theoretical Considerations and Some Empirical Evidence," *American Economic Review*, 40 (May, 1950), pp. 35-57, and George J. Stigler, "A Theory of Oligopoly," *Journal of Political Economy*, 71 (February, 1964), pp. 44-61.

[2]The sufficient theoretical conditions for relating movements in concentration to similar movements in the degree of monopoly power are given by Thomas R. Saving, "Concentration Ratios and the Degree of Monopoly Power," *International Economic Review*, 11 (February, 1970), pp. 139-146.

[3]An Alternative hypothesis predicting an opposite outcome has been suggested in Richard Caves, *American Industry: Structure, Conduct, Performance* (New York, 1973), pp. 30-31. A test of this hypothesis is presented in Chapter III.

[4]An alternative view that firms in declining industries are more likely to collude than firms in growing industries was presented by John Palmer, "Some Economic Conditions Conducive to Collusion," *Journal of Economic Issues*, 6 (September, 1972), pp. 29-38.

[5]This is seen by taking the profit maximizing condition which is also equal to

$$\frac{P}{P - MC} = |\eta| , \quad \frac{P}{|\eta|} = P - MC.$$

The above may be written as: $\frac{P - P|\eta|}{|\eta|} = -MC$, or $P(1 - |\eta|) = (-MC)|\eta|$.

Solving for price (P) gives: $P = \frac{MC|\eta|}{|\eta| - 1}$

That is, as $|\eta|$ falls and approaches $|1|$, P will increase.

[6]Joe S. Bain, *Barriers to New Competition* (Cambridge, 1956), pp. 125 and 219.

[7]Advertising brings about product differentiation on the demand side of the market. On the supply side, differentiation occurs when products cannot be readily imitated due to the presence of product patents or superior product designs. This "supply side differentiation" will be more likely to occur in producer good industries. Thus, the advertising intensity variable is expected to perform best in consumer good industries. William S. Comanor and T. A. Wilson, "Advertising, Market Structure and Performance," Review of Economics and Statistics, 49 (November, 1967), p. 425.

[8]Gary A. Marple and Harry B. Wissman, editors, Grocery Manufacturing in the United States (New York, 1968), p. 590. The study uses the 1963 advertising-sales ratio as a measure of product differentiation and assumes that is has not changed significantly between 1963 and 1967.

[9]The source of this classification is Industrial Production, Board of Governors of the Federal Reserve System (Washington, 1972), pp. 5-14.

[10]See F. M. Scherer, Industrial Market Structure and Economic Performance (Chicago, 1971), esp. pp. 225-330.

[11]Paolo Sylos Labini, Oligopoly and Technical Progress (Cambridge, 1962), p. 43.

[12]George J. Stigler, "The Economies of Scale," The Journal of Law and Economics, 1 (October, 1958), p. 56.

[13]Joe S. Bain, "Survival-Ability as a Test of Efficiency," American Economic Review, 59 (May, 1969), pp. 99-104, and William G. Shepherd "What Does the Survivor Technique Show about Economies of Scale," Southern Economic Journal, 34 (July, 1967), pp. 113-122.

[14]Joe S. Bain, Barriers to New Competition, pp. 68-70.

[15]Louis Esposito et al., "Dissolution and Scale Economies: Additional Estimates," Antitrust Law and Economics Review, 5 (Fall, 1971), pp. 101-114.

[16]William S. Comanor and T. A. Wilson, pp. 423-440.

[17]Values for GM are taken from Leonard W. Weiss, "The Geographic Size of Markets in Manufacturing," Review of Economics and Statistics, 54 (February, 1972), pp. 245-257. Weiss looks at several variables summarizing distance-shipping and dispersion, and concludes that GM is the best index studied.

[18]Louis Esposito and Frances Esposito, "Foreign Competition and Domestic Industry Profitability," Review of Economics and Statistics, 53 (November, 1971), pp. 343-353.

[19]Javad Khalilzadeb-Shirazi, "Market Structure and Price-Cost Margins in United Kingdom Manufacturing Industries," Review of Economics and Statistics, 56 (February, 1971), pp. 67-76.

[20]George J. Stigler, "The Extent and Bases of Monopoly," American Economic Review, 32 (June, 1942), pp. 1-22. The importance of the foreign trade sector on competition was pointed out by Stigler in commenting on the limitations of concentration ratios: ". . . the production of domestic concerns is the basis for computation. Surely the domestic production plus imports should have been used if the findings are to be interpreted as evidence of the extent of monopoly in the domestic economy. This oversight introduces a fairly systematic bias in the direction of exaggerating concentration" (p. 7).

[21]U. S. Bureau of the Census, U. S. Commodity Exports and Imports as Related to Output, 1968 and 1967 (Washington, D.C., 1971).

[22]N. R. Collins and Lee E. Preston, Concentration and Price-Cost Margins in Manufacturing Industries (Berkeley, 1968), p. 9.

[23]Ibid., p. 9 and p. 74.

[24]See for example William G. Shepherd, "Elements of Market Structure: An Interindustry Analysis," Southern Economic Journal, 38 (April, 1972), p. 533.

[25]This statement ignores problems of "second best" and "spillovers." The issue of second best is one in which the resource allocation problem can also be described as too many resources in the competitive sector rather than too few in the monopolized sector. The implication of second best theory is that, within a general equilibrium framework, partial elimination of the monopoly elements may not be socially desirable. Otto A. Davis and Andrew B. Winston, "Welfare Economics and the Theory of Second Best," Review of Economics and Statistics, 32 (January, 1965), pp. 1-13. Another qualification of the purely competitive model is that demand represents the marginal resource cost to society of producing another unit of the good. When there is a divergence between the social benefits (or costs) and private benefits (or costs) a spillover is present. The purely competitive model will not lead to maximum social welfare if spillovers are present.

[26]See Richard H. Leftwich, The Price System and Resource Allocation, fifth edition (Homewood, 1973), chapters 10 and 11.

[27]Norman R. Collins, and Lee E. Preston, pp. 8-13; David Qualls, "Concentration, Barriers to Entry, and Long Run Economic Profit Margins," Journal of Industrial Economics, 20 (April, 1972), pp. 146-158; Donald G. McFetridge, "Market Structure and Price-Cost Margins," Canadian Journal of Economics, 6 (August, 1973), pp. 344-355; Javad Khalilzadeb-Shirazi, pp. 67-76.

[28]George J. Stigler, Capital and Rates of Return in Manufacturing Industries (Princeton, 1963), p. 123 and Joe Bain, "Relation of Profit Rates to Industry Concentration," Quarterly Journal of Economics, 65 (August, 1951), pp. 293-324.

[29]Joe Bain, "The Profit Rate as a Measure of Monopoly Power," Quarterly Journal of Economics, 55 (February, 1941), pp. 271-293. See also Collins and Preston, pp. 13-14 on this point.

[30]F. M. Sherer, p. 185.

[31]Collins and Preston, pp. 54-62.

[32]Ibid., p. 9.

[33]Ibid.

[34]See Yale Brozen, "The Antitrust Task Force Deconcentration Recommendation," Journal of Law and Economics, 13 (October, 1970), p. 303. Note that this criticism is directed at all cross-sectional studies, and not those using the PM alone.

[35]George Stigler, "The Statistics of Monopoly and Merger," Journal of Political Economy, 64 (February, 1956), and Leonard W. Weiss, "Concentration and Labor Earnings," American Economic Review, 56 (March, 1966), pp. 96-116.

[36]Tibor Scitovsky, "Economic Theory and the Measurement of Concentration," in George Stigler (ed.) Business Concentration and Price Policy, pp. 101-113.

[37]Robert Dorfman and Peter Steiner, "Optimal Advertising and Optimal Quality," American Economic Review, 44 (December, 1954), pp. 926-936. See also, Richard Schmalensee, The Economics of Advertising (Amsterdam: North Holland, 1972), esp. pp. 223-228. The extension of the Dorfman-Steiner model is suggested in John M. Vernon, Market Structure and Industrial Performance: A Review of Statistical Findings (Boston, 1972), pp. 90-91.

[38]It should be noted that since PM and profit rates are closely correlated, the level of advertising spending is directly related to other rate of return measures. See Schmalensee, pp. 225-226 for proof of this point.

[39]Ibis., pp. 226-227.

[40]U. S. Bureau of the Census, Census of Manufacturers, 1967 Volume I, Summary and Subject Statistics (Washington, 1971), p. 19.

[41]U. S. Bureau of the Census, _Annual Survey of Manufacturers: 1968 Book Value of Fixed Assets, Rental Payments for Buildings and Equipment, and Labor Costs_ (Washington, 1971), p. 2.

[42]Ibid., p. 1

[43]_Census of Manufacturers, 1967, Volume I_, p. 16.

[44]Ibid., p. 17.

[45]_Census of Manufacturers, 1967, Volume II_, Table 6A.

CHAPTER III

EMPIRICAL TEST OF STRUCTURE-PERFORMANCE MODEL

Introduction

The main purpose of this chapter is to present empirical evidence regarding the major hypotheses stated in Chapter II. The empirical results are a product of multiple regression analysis using 1967 data. The focus is on four two-digit manufacturing groups which comprise 115 four-digit industries. The study relies on the industry definitions provided by the Bureau of the Census in its Standard Industrial Classification (SIC) data. The two-digit manufacturing groups included in the study are: Food and Kindred Products (SIC 20), Chemicals and Allied Products (SIC 28), Electrical Machinery Group (SIC 36), and Transportation Equipment (SIC 37). These 115 industries accounted for over 40 per cent of the economy's 1967 value-added. The Food and Kindred Products group has been at the center of attention in numerous earlier studies regarding structure and performance.[1] The other three groups, Chemicals and Allied Products, Electrical Machinery, and Transportation Equipment, are examined because they have been cited as part of the Industrial Reorganization Act.[2] This act, also known as the Hart Bill, would revise current antitrust laws by establishing an Industrial Reorganization Commission with jurisdiction over these industries. Thus, these particular two-digit groups are selected because of their size relative to the rest of the manufacturing sector and because of the previous interest shown in them by policymakers.

Analysis of these industries is presented in two sections. First, the structure-performance hypothesis is examined within the respective two-digit SIC groups. For example, the 41 industries making up SIC 20 are analyzed independently of the other 74 industries; similarly, the 27 industries in SIC 28 are reported on separately from industries in other two-digit classifications and so forth. The rationale for this procedure is that each two-digit group differs in terms of age, size, pattern of technology, and market history. To control for some of these sources of diversity, the four-digit industries are collected into their respective two-digit groups for purposes of cross-sectional analysis. Collins and Preston present a defense of such a grouping:

> . . . The characteristics least easy to observe accurately and express quantitatively are those associated with the unique history and development of each major segment of industry. The age, record of technological change, level and pattern of change in demand, and interindustry position of each group of economic units we identify as an "industry" are, in part, unique and not comparable among industries even in an ordinal fashion. However, these elusive but important features of industry structure, often difficult to describe in general terms, are apt to be more similar among industries closely related in terms of products, technology, or specific sources of demand than among industries selected at random from the entire industry population.[3]

While some of the characteristics mentioned by Collins and Preston, such as change in demand, are explicitly treated as structural variables, their approach is used in the first part of this chapter. In a second section, all 115 industries are combined to test the structure-performance relationship.

Estimation of the Models by Two-Digit Groups

Food and Kindred Products (SIC 20)

Food and Kindred Products group (SIC 20) contains 41 four-digit industries. Two adjustments in the data were made. One industry, Manufactured Ice (SIC 2097), was excluded because of data deletions in the census report. Second, the four-digit classes Raw Cane Sugar (SIC 2061), Cane Sugar Refining (SIC 2062), and Beet Sugar (SIC 2063), were combined into a single industry by using a weighted average of the concentration ratios (by value of shipments) and a summation of other relevant data. One reason for combining these into one industry is that the census definitions for four-digit industries are based on technological factors; that is, industry groupings are based mainly on similarity of process and/or raw materials involved. In this case, it is widely agreed that the three-digit classification for sugar (SIC 206) is a more appropriate indicator of the sugar industry.[4]

Seller Concentration. Tables I and II summarize the multiple regression results for the two alternative dependent variables, price-cost margin (PM) and adjusted price-cost margin (PM_{adj}), respectively. It can be seen in all regression models, for either dependent variable, that seller concentration is a significant variable in explaining industry price-cost margins. In all models, regression coefficients for CR display the expected positive sign. The size of the regression coefficient is around 0.2 (the range is from 0.167 to 0.318), implying that a 1.0 per cent increase in CR results in an increase of about 0.2 per cent in the price-cost margin.

TABLE I

REGRESSION RESULTS FOR SIC 20, 1967 PRICE-COST MARGIN AS DEPENDENT VARIABLE

Model	CR	KO	TAO	MES 2	PRD	I	D	GM	Intercept	R^2	$\bar{R}^2$
1	0.201[c]		0.116[a]	0.517		-0.139	0.175[b]	0.002	3.080	0.63	0.55
	(1.63)		(3.23)	(0.97)		(0.87)	(1.83)	(0.52)			
2	0.167[b]		0.123[a]	0.696[b]		-3.581[c]	0.142[b]		4.151	0.60[a]	0.55
	(1.85)		(3.69)	(1.75)		(1.39)	(1.71)				
3	0.200[a]		0.123[a]		1.585[a]	-0.094	0.114[b]	-0.002	0.607	0.74[a]	0.69
	(2.81)		(4.10)		(3.39)	(0.71)	(1.4)	(0.70)			
4	0.184[a]		0.121[a]		1.810[a]	-0.124	0.063		0.645	0.74[a]	0.71
	(3.47)		(4.53)		(4.95)	(0.06)	(0.92)				
5	0.318[a]	0.235[b]		0.200		-1.849	0.200[b]		-1.288	0.48[a]	0.43
	(4.11)	(2.22)		(0.22)		(0.65)	(2.05)				

t-ratio shown in parentheses N=30 for models 1 and 3, N=41 for models 2, 4 and 5

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

TABLE II

REGRESSION RESULTS FOR SIC 20, 1967 ADJUSTED
PRICE-COST MARGIN AS DEPENDENT VARIABLE

Model	CR	KO	TAO	MES 2	PRD	I	D	GM	Intercept	R^2	$\bar{R}^2$
1	0.255[b] (2.12)		0.131[a] (3.74)	0.453 (0.87)		-0.129 (0.83)	0.154[c] (1.65)	-0.001 (0.36)	1.589	0.69[a]	0.62
2	0.191[b] (2.15)		0.141[a] (4.30)	0.759[b] (1.95)		-4.547[b] (1.80)	0.138[c] (1.69)		3.390	0.66[a]	0.63
3	0.233[a] (3.62)		0.137[a] (5.06)		1.722[a] (4.05)	-0.076 (0.63)	0.088 (1.19)	-0.001 (0.63)	-0.681	0.81[a]	0.77
4	0.207[a] (4.35)		0.138[a] (5.76)		2.002[a] (6.09)	-0.737 (0.39)	0.051 (0.82)		-0.458	0.82[a]	0.80
5	0.273[a] (2.72)	0.216[b] (2.12)		0.542 (1.19)		0.013 (0.09)	0.201[b] (1.97)		-2.046	0.54[a]	0.48

t-ratio shown in parentheses N=30 for models 1 and 3, N=41 for models 2, 4 and 5

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

These results are consistent with the findings of Collins and Preston in their study using 1958 data. Looking at 32 four-digit industries, within the Food and Kindred Products group (SIC 20), they found that:

> The analysis of data for this group of industries strongly supports the hypothesis of a positive relationship between price-cost margins and concentrations. The regression coefficients of the concentration variable . . . are position and statistically significant at the one per cent level.[5]

The specific regression relationship reported by Collins and Preston for 1958 was (t-ratio in parentheses):

$$PM = 2.04 + \underset{(4.49)}{.41CR}$$

with an R^2 of .40. The same simple linear model was also examined for 41 industries using 1967 data; the relationship found was (t-ratio in parentheses):

$$PM = 8.36 + \underset{(4.75)}{0.33CR}$$

with an R^2 of .37 and

$$PM_{adj} = 7.36 + \underset{(5.22)}{0.38CR}$$

with an R^2 of .41 significant at the one per cent level.

Capital Intensity. For models 2 and 5 (for both dependent variables), two alternative measures of capital intensity are employed. In model 5 the ratio of gross book value of depreciable assets to value of shipments (KO) is used as the capital intensity independent variable. This is the same measure suggested by Collins and Preston,[6] and adopted by several authors.[7] This is a crude measure of capital intensity because it reflects the acquisition cost of assets, but is defensible in that it does reflect inter-industry differences in asset holdings.

The results are that the KO variable is significant at the five per cent level; this means the hypothesis that the regression coefficient is zero cannot be accepted. This finding is similar to that of Collins and Preston.[8]

Another measure of capital intensity is the ratio of total assets to industry value of shipments (TAO). Total asset figures were those reported in the balance sheet of the corporation's books of account as of December 31, 1967.[9] For SIC 20, TAO values are 1.7 times larger than KO; in specific industries, the range of values is from 1.03 times in SIC 2096 to over eight times as large in SIC 2085 (see Appendix B). The two measures are related with a simple correlation coefficient of 0.52 which is significant at the 0.1 per cent level. The results for models one through four show that the independent variable TAO is significantly different from zero at the 1.0 per cent level. The value of the coefficient implies that a 1.0 per cent increase in TAO results in an increase of about 0.12 per cent in PM or 0.13 per cent in PM_{adj}.

A comparison of model 2 with model 5 provides a test of which of the two measures of capital intensity is superior. The two models are identical except for the measure of capital intensity used. For either dependent variable, TAO gives better explanatory power as measured by $\bar{R}^2$ and the regression coefficients are more robustly significant than KO.[10] The conclusion is that TAO is a better proxy for capital intensity than KO.

<u>Minimum Efficient Plant Size</u>. There are mixed findings on the role of barriers to entry in permitting high price-cost margins. Models 1, 2, and 5 investigate the effect of barriers as measured by

the minimum efficient size plant (MES). The variable reported is obtained by taking the plants in the largest census employment-size category, and expressing the output of the "average" plant as a fraction of industry output.[11] Although a positive sign was found in all cases, as expected, only in model 2 is the regression coefficient for MES significantly different from zero. Lack of significance for MES in explaining PM has also been reported by Imel[12] in a study of the United States food processing industry and Comanor and Wilson[13] in their study of 41 consumer goods industries.

Three explanations may be used to explain this result. First, it is possible that there are entry barriers but that MES does not properly reflect these barriers. While no evidence is available which unambiguously rejects this contention, it is possible to compare the MES estimates used in this study to other available estimates of scale economies. A study by Esposito, Noel and Esposito provides such a comparison.[14] Using 1963 data, estimates for scale economies were reported for 147 manufacturing industries. Of these industries, 19 were directly comparable to ones in SIC 20. The product-moment correlation between these two data sets is 0.78 which is significant at the 1.0 per cent level. This indicates that MES estimates used in this study are highly related to estimates of scale economies used elsewhere and can be considered equally as good (or bad).

A second explanation assumes there are entry barriers and that MES is an appropriate barrier proxy, but that presence of a high degree of inter-correlation between MES and CR makes it impossible to disentangle the relative influences of the two variables.[15] The simple correlation coefficient between MES and CR is 0.73.

A final view suggests that MES is a poor proxy for entry barriers and, therefore, a large MES is not a barrier to entry for new or potential firms. Stigler argues that an entry barrier is a cost of producing that faces a firm which seeks to enter the industry, but is _not_ faced by existing firms.[16] Since MES is viewed by both existing and potential firms, it is not a barrier to entry.

Product Differentiation. Models 3 and 4 test the hypothesis that barriers to entry, as measured by advertising intensity, are positively related to price-cost margins. Advertising intensity will be defined as the ratio of total advertising expenditures to total sales for the various four-digit industry groups. The results strongly support the stated hypothesis. The regression coefficients are significant at the 1.0 per cent level for both dependent variables with $\bar{R}^2$ between 0.69 and 0.80.

The findings about product differentiation is SIC 20 are consistent with those reported by Comanor and Wilson,[17] Shepherd,[18] and Imel.[19] In model 4, the value of the regression coefficient is about two (1.8 for PM and 2.0 for PM_{adj}). The standard interpretation of this would be that a one unit increase in advertising intensity will raise price-cost margins about two percentage points.

An alternative way to view the coefficient of advertising intensity involves calculating the elasticity of the price-cost margin with respect to advertising intensity and is defined as

$$\Sigma_{PM,PRD} = \frac{\partial(PM)}{PM} \quad \frac{PRD}{\partial(PRD)} \quad .20$$

This elasticity can be approximated by using the regression coefficient of advertising intensity in model 4 as a proxy for $\partial PM/\partial PRD$ and the respective means of advertising intensity and price-cost margins as estimates of PRD and PM. Elasticities for PM and PM_{adj} in SIC 20 are 0.29 and 0.31 respectively.[21] These elasticities suggest that a 1.0 per cent increase in advertising intensity is associated with a 0.3 per cent increase in the price-cost margin.

In order to interpret the relationship between advertising intensity and price-cost margins, it must be recognized that advertising expenditures are included in PM. Thus, PRD will affect price-cost margins even if it does not serve as a barrier to entry. McFetridge has reported that approximately 90 per cent of all Canadian advertising services are purchased externally to the firm.[22] The conclusion that advertising acts as a barrier is warranted only if advertising expenditures increase PM by an amount greater than the external portion of the expenditure. Hence, the value of the regression coefficient must be greater than 0.9 if PRD acts as a barrier. The t-values for model 4 were

$$t = \frac{0.9 - 1.810}{.366} = -2.49 \text{ and}$$

$$t = \frac{0.9 - 2.002}{.329} = -3.35$$

with both significant at the 1.0 per cent level. The conclusion is that advertising does act as a barrier to entry.

Import Competition. The impact of foreign competition on price-cost margins is examined by utilizing a dummy variable.[23] The dummy variable assumes a value of one when imports comprise more than one per cent of total sales and a value of zero otherwise. In all models, the sign of the regression coefficient is negative, indicating that the greater the degree of foreign competition the lower will be price-cost margins. However, in only one model (model 2) does the expected negative sign differ significantly from zero. The results provide limited support for the view that where imports comprise a substantial share of total sales, established firms will maintain lower price-cost margins.[24] The presence of foreign firms (and the threat of potential foreign entry) have only a marginal influence on industry performance.

Change in Demand and Geographic Market. The effect of a change in industry demand on price-cost margins indicates that in most cases (7 out of 10) the regression coefficient of the independent variable D, is significantly different from zero and possesses the hypothesized sign. The final independent variable tested is the size of the geographic market (GM). Results are shown in models 1 and 3 (note that because of imcomplete data only thirty observations were available for SIC 20). The results are that GM does not exhibit significant explanatory power about price-cost margins. This differs from findings of other authors.[25] Lack of significance for this variable suggests that (1) the size of geographic markets has no impact on industry performance (i.e., concentration ratios are adequate indicators of the market power), or (2) the GM measure developed by Weiss does not properly reflect the regional nature of some industries.

Summary. The findings for SIC 20 provide strong support for the expected relationship between seller concentration and price-cost margins. The strength of this findings weakens as other aspects of industry structure are introduced into the regression equations. Capital intensity and product differentiation are also found to be important independent variables in explaining price-cost margins. Other structural variables such as minimum efficient plant size, import competition, and change in demand are found to be only marginally important in the regression models.

Chemicals and Allied Products (SIC 28)

The Chemicals and Allied Products group covers 27 four-digit industries. As a group these industries generated over $42 billion worth of sales and almost $26 billion worth of valued-added in 1967. A change in the measurement of product differentiation (PRD) was made for this set of industries. A consumer-producer dummy variable is used as a proxy for PRD, where producer goods industries are classified zero and consumer goods industries with a one to indicate the presence of PRD.[26] This change was made necessary because advertising expenditures were not available by four-digit classes.

Seller Concentration. Tables III and IV summarize the regression results in SIC 28 for the alternative dependent variables, PM and PM_{adj}. The results lend only modest support to the hypothesis that seller concentration and price cost margins are positively related. In only half the models is the CR variable significantly different from zero. This is very similar to results reported by Collins and Preston for 19 industries within the Chemicals and Allied Products group. The results of their regression analysis were

$$PM = 32.12 - \underset{(0.69)}{0.09}\ CR$$

with an R^2 equal to 0.03. This same simple linear model for 27 industries in 1967 is

$$PM = 31.07 + \underset{(0.57)}{0.06}\ CR$$

with an R^2 of 0.01 and

$$PM_{adj} = 28.61 + \underset{(1.27)}{0.15}\ CR.$$

TABLE III

REGRESSION RESULTS FOR SIC 28, 1967 PRICE-COST MARGIN AS DEPENDENT VARIABLE

Model	CR	KO	TAO	MES 3	PRD	I	D	GM	Intercept	R^2	$\bar{R}^2$
1	0.297[c]		-0.017	-2.019[c]		-1.678	0.006	24.24	0.28	0.03	0.03
	(1.58)		(0.25)	(1.89)		(0.31)	(0.26)	(0.50)			
2	0.198		0.024	-1.388		-6.350[c]	0.027		30.31	0.24[c]	0.10
	(1.25)		(0.57)	(1.40)		(1.44)	(0.28)				
3	-0.086		0.112[b]		27.972[a]	7.222[c]	-0.034	-0.001	21.15	0.66[b]	0.54
	(0.87)		(2.18)		(4.88)		(0.49)	(0.12)			
4	0.066		0.019		11.496[b]	-2.677	-0.095		31.11	0.33[b]	0.21
	(0.57)		(0.48)		(2.27)	(0.59)	(1.15)				
5	0.209	0.022		-1.380		-7.197	0.033		30.97	0.23	0.09
	(1.30)	(0.35)		(1.38)		(1.59)	(0.33)				
6	0.196[c]		0.018	-1.226	10.954	-2.098	-0.037		27.28	0.39[b]	0.24
	(1.35)		(0.45)	(1.34)	(2.20)	(0.47)	(0.40)				

t-ratio shown in parentheses N=20 for models 1 and 3, N= 27 for models 2, 4, 5, and 6

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

TABLE IV

REGRESSION RESULTS FOR SIC 28, 1967 ADJUSTED PRICE-COST MARGIN AS DEPENDENT VARIABLE

Model	CR	KO	TAO	MES 3	PRD	I	D	GM	Intercept	R^2	$\bar{R}^2$
1	0.424[b] (2.41)		0.007 (0.11)	-1.697 (1.69)		-2.558 (0.51)	0.204[b] (2.08)	0.002 (0.19)	13.92	0.43	0.23
2	0.347[c] (1.86)		-0.020 (0.40)	-1.322 (1.14)		-6.346 (1.22)	0.120 (1.07)		25.74	0.19	0.05
3	0.088 (1.02)		0.126[a] (2.85)		26.506[a] (5.14)	6.197 (1.65)	0.153[b] (0.58)	-0.004 (0.58)	10.10	0.77[a]	0.69
4	0.213[c] (1.50)		-0.21 (0.41)		4.628 (0.72)	-5.362 (0.92)	0.036 (0.35)		28.55	0.17	0.01
5	0.301[c] (1.58)	0.017 (0.23)		-1.28 (1.09)		-6.255 (1.19)	0.131 (1.12)		24.16	0.19	0.04
6	0.347[b] (1.83)		-0.023 (0.44)	-1.261 (1.07)	4.071 (0.63)	-4.766 (0.82)	0.096 (0.81)		25.41	0.21	0.02

t-ratio shown in parentheses N=20 for models 1 and 3, N=27 for models 2, 4, 5 and 6

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

The results for this group are strongly affected by the presence of three high margin and relatively low concentration industries; these industries are:

1. SIC 2834 Pharmaceutical Preparations (PM = 59, CR = 24)
2. SIC 2844 Toilet Preparations (PM = 57, CR = 38)
3. SIC 2842 Polishes and Sanitation Goods (PM = 46, CR = 35).

One factor common to this "high margin, low concentration" group is that all three are consumer goods industries in a sample composed primarily of producer goods industries (20 of the 27 industries in SIC 28 are classified as producer goods industries).[27] To test the possible impact of this, the regression models were recomputed with all seven consumer goods industries excluded. The results are presented in Table V. In general the structural variables do a better job in explaining variation in the price-cost margins. The multiple correlation coefficient between CR, TAO, and MES is 0.76 and between CR, KO, and MES it is 0.71. This is evidence of multicollinearity between these variables making it impossible to attribute exact meacning to the individual coefficients.

Capital Intensity. Examining models 2 and 5 (for both dependent variables) indicates that neither measure of capital intensity, KO or TAO, is significant in explaining variation in the price-cost margins. Also a comparison of R^2 suggests that there is little difference between the two variables.[28]

TABLE V

REGRESSION RESULTS FOR SIC 28, 1967 PRODUCER GOODS SUBCLASS

Dependent Variable	CR	KO	TAO	MES 3	I	D	Intercept	R^2	$\bar{R}^2$
PM	0.110 (0.74)		0.10^b (2.14)	-1.008 (1.33)	5.983^b (1.56)	0.012 (0.19)	14.90	0.56^b	0.44
PM	0.162 (1.17)	0.109^b (2.14)		-1.162 (1.55)	2.460 (0.67)	0.026 (0.38)	16.48	0.54^b	0.42
PM	-0.042 (0.43)		0.123^a (3.01)		5.875^c (1.49)	-0.015 (0.24)	17.10	0.50^b	0.41
PM_{adj}	0.139 (0.97)		0.117^a (2.81)	-0.637 (0.87)	7.321^b (1.99)	0.177^a (2.84)	6.79	0.68	0.60
PM_{adj}	0.233^c (1.63)	0.109^b (2.07)		-0.919 (1.18)	3.265 (0.86)	0.186^a (2.66)	9.12	0.62^b	0.52
PM_{adj}	0.043 (0.47)		0.132^b (3.48)		7.253^b (1.99)	0.160^a (2.73)	7.38	0.66^a	0.60

t-ratio shown in parentheses N = 20

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

Minimum Efficient Plant Size. Models 1, 2, 5, and 6 examine the relationship between barriers to entry and price-cost margins. The minimum efficient size plant (MES) is used as a proxy for barriers to entry. The measure of MES used is defined as the average plant size among the largest plants accounting for 50 per cent of the industry output.[29] The models show that the coefficient of MES is significantly different from zero at the 10 per cent level in five of eight cases and negative in all equations. This is contrary to the stated hypothesis.[30]

The insignificance of CR and both the capital intensity measures while the MES variable is significant has two possible explanations. First, a relatively serious problem of multicollinearity is present between these three variables. The simple correlation coefficients for the three are shown in Appendix C. The range is between 0.47 and 0.65. The multiple correlation coefficient between CR, TAO, and MES is 0.53; and between CR, KO, and MES it is 0.57. Such a high collinearity makes it impossible to attach precise meaning to the estimated value and the level of significance of the individual coefficients of CR, TAO, KO, and MES. It would be, however, incorrect to leave out from the specification any of these variables for the purpose of improving the significance level of the retained variable.[31] A second possible explanation is that organizational inefficiences (X - inefficiency) increase with plant size. Thus, the expected positive relationship between PM and MES is outweighed by the presence of X - inefficiencies.

Product Differentiation. Models 3, 4, and 6 look at the role of product differentiation (PRD) where PRD is a dummy variable indicating whether the industry is consumer good oriented or producer good industry. In general, a strong positive relationship is found which supports the stated hypothesis. That is, the higher PRD (consumer goods industries) the greater the price-cost margins.

Import Competition. The effect of foreign competition on price cost margins is examined in the models shown in Tables III and IV. A dummy variable, taking on a value of one when imports make up more than 1.0 per cent of all sales and zero when imports are less than 1.0 per cent of all sales, is utilized.[30] The results are generally supportive of the hypothesis that more foreign competition will lower price-cost margins. Only in model 3 is the opposite outcome found. However, when the producer goods industry subclass is tested in Table V, the sign of I changes to positive and it is significant in four of six cases. This positive sign means that price cost margins and degree of import competition move in the same direction. These results are in opposition to the conclusion of Esposito and Esposito, although they did report that the degree of import competition was different between producer and consumer good groups.[32] Each in his 1963 study also notes that import competition varies between consumer and producer groups, but in an opposite way to findings reported here.[33]

One explanation for this positive relationship is that relatively high imports are a result of increasing total demand. For example, if there is a disequilibrium situation in which incomes are rising, the demand for imports will also be likely to rise. Empirically, this would show up as price-cost margins and import intensity being positively related. Another possibility is that if many imports are made up of component parts used as inputs for final processing in the United States, then high imports would be consistent with higher price-cost margins.[34]

Rate of Growth in Demand and Geographic Market. Evidence on the final two independent variables, change in sales (D) and geographic market (GM), suggests that they are not very important in explaining price-cost margins. However, for the 20 producer goods industries, Table V shows that the regression coefficients for D are significantly different from zero using adjusted price cost margin as the dependent variable. The size of the coefficients suggests that a 1.0 per cent growth in sales will raise price-cost margins about 0.2 points.

Summary. The structural model developed in Chapter II does not prove to be a good predictor of industry price-cost margins for SIC 28. Specifically, seller concentration is not an important predictor of economic performance (as measured by price-cost margins). As noted, this result is similar to the finding of Collins and Preston.

Electrical Machinery Group (SIC 36)

Electrical Machinery Group (SIC 36) is made up of 33 four-digit industries. These 33 industries had total sales of over $43 billion and value-added of almost $25 billion in 1967. This makes SIC 36 the fourth largest two-digit group within the manufacturing sector and it accounts for nearly 10 per cent of value-added in manufacturing. As in SIC 28, product differentiation (PRD) is entered into the analysis as a dummy variable representing consumer good industries.

Seller Concentration. Tables VI and VII summarise the findings related to SIC 36 for both PM and PM_{adj}. In all models examined seller concentration (CR is directly related to price-cost margins (however measured). This supports the stated hypothesis.

TABLE VI

REGRESSION RESULTS FOR SIC 36, 1967 PRICE-COST MARGIN AS DEPENDENT VARIABLE

Model	CR	KO	TAO	MES 2	PRD	I	D	GM	Intercept	R^2	$\bar{R}^2$
1	0.184[b] (2.06)		-0.029 (1.09)	-0.157 (0.43)		1.964 (0.55)	0.044 (0.81)	0.002 (0.79)	11.28	0.30	0.14
2	0.108[b] (1.85)		-0.012 (0.55)	0.350 (1.16)		1.263 (0.42)	0.025 (0.87)		15.87	0.28[c]	0.19
3	0.214[a] (3.11)		-0.025 (1.00)		-3.874 (1.42)	1.431 (0.43)	0.020 (0.37)	0.003 (0.95)	12.94	0.36	0.21
4	0.147[a] (2.81)		-0.007 (0.32)		-1.499 (0.60)	0.321 (0.11)	0.021 (0.68)		17.31	0.27	0.16
5	0.112[b] (1.77)	-0.025 (0.29)		0.325 (1.08)		0.852 (0.29)	0.023 (0.78)		16.09	0.29[c]	0.19

t-ratio shown in parentheses N=27 for models 1 and 3, N=33 for models 2, 4 and 5

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

TABLE VII

REGRESSION RESULTS FOR SIC 36, 1967 ADJUSTED PRICE-COST MARGIN AS DEPENDENT VARIABLE

Model	CR	KO	TAO	MES 2	PRD	I	D	GM	Intercept	R^2	$\bar{R}^2$
1	0.254[b] (2.67)		-0.042 (1.52)	0.294 (0.71)		1.671 (0.45)	0.067 (1.16)	0.004 (0.98)	7.15	0.46[b]	0.34
2	0.141[b] (2.23)		-0.026 (1.07)	0.655[b] (2.01)		1.858 (0.57)	0.030 (0.94)		13.65	0.43[a]	0.35
3	0.318[a] (4.25)		-0.043 (1.61)		-3.735 (1.26)	1.021 (0.28)	0.043 (0.72)	0.006[c] (1.65)	7.02	0.49[b]	0.37
4	0.206[a] (3.43)		-0.018 (0.74)		-0.468 (0.17)	0.435 (0.13)	0.030 (0.85)		15.73	0.35[b]	0.25
5	0.158[b] (2.30)	-0.080 (0.87)		0.595[c] (1.82)		0.990 (0.31)	0.024 (0.75)		14.62	0.42[a]	0.34

t-ratio shown in parentheses N=27 for models 1 and 3, N=33 for models 2, 4 and 5

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

The size of the regression coefficient is around 0.2 (the range for models 1 and 3 is from 0.18 to 0.32 and the range for models 2, 4, and 5, is from 0.11 to 0.21). The standard interpretation is that a 1.0 per cent increase in CR results in price-cost margins rising by 0.2 per cent.

Also tested was the model PM = a + BCR where

PM = price-cost margin

CR = four firm seller concentration.

The result is (t-ratio in parentheses):

$$PM = 17.93 + \underset{(3.08)}{0.14}\ CR$$

with R^2 equal to 0.23, significant at the 1.0 per cent level. The model for the adjusted price-cost margin yields somewhat stronger results; they are

$$PM_{adj} = 16.35 + \underset{(3.77)}{0.20}\ CR$$

and an R^2 of 0.31 (also significant at the 1.0 per cent level). The findings reported by Collins and Preston differ from the above in that the CR variable was not found to be significant. Their regression analysis was

$$PM = 16.36 + \underset{(1.46)}{0.11}\ CR$$

with an R^2 of only 0.12.[35] One possible reason for this difference is that the Collins and Preston study combined several of the four-digit industries together. For example, observations on SIC 3613 and 3622 (switchgear-switchboards and industrial controls were averaged together. Also all industries in the 366 and 367 were not included in their study. No explanation of these data adjustments is is offered by Collins and Preston, but it is apparently due to extensive census data revision in 1957.[36]

Capital Intensity. Models 2 and 5 compare the two measures of capital intensity, KO and TAO. None of the regression coefficients for either measure of capital intensity is significant in explaining variations in price-cost margins. However, the signs of the coefficients were negative which is opposite the a prioi expectation. A similar outcome is found in Collins and Preston.[37]

Minimum Efficient Plant Size. Models 1, 2 and 5 look at the effect of barriers to entry on price-cost margins. As was the case for SIC 20 and 28, three different estimates of minimum efficient size plant (MES) are tested, but only the best is reported. The MES that gave the best results is the same as the one used for SIC 20. The variable is equal to the output of the "average" size plant expressed as a per cent of industry output. The "average" size plant is calculated by means of the plants in the largest census employment-size category. For dependent variable PM, the regression coefficient for MES was not significantly different from zero (and in one case, Model 1, possessed a negative sign).

However, using dependent variable PM_{adj} as the performance variable, the regression coefficient is significantly different from zero in two of these models. The exception is for model 1 which is due to missing data for another variable, GM, is limited to only 27 observations. Ths size of the regression coefficients imply that a 1.0 per cent increase in MES will raise PM_{adj} by about 0.6 per cent. Presence of multicollinearity is not as sever for SIC 36 as with the previous two groups. The simple correlation coefficient between MES and CR is 0.49 and the multiple correlation coefficient between CR, TAO, and MES is 0.26.

Product Differentiation, Growth in Demand, and Geographic Market. Product differentiation (PRD) is looked at in models 3 and 4. The results provide no support for the hypothesis that PRD and price-cost margins are positively related since in both models the regression coefficient is negative. The effect of foreign competition (I) and change in demand (D) is viewed in models 1 through 5. As with PRD, there is no evidence to support the *a prioi* view regarding the role of these variables. Finally, geographic market (GM) is found to have a significant effect on the dependent variable in model 3 (for PM_{adj}) but in an opposite fashion to that hypothesized.

Summary. The hypothesized relationship between seller concentration and price-cost margins is supported by the data for SIC 36. In the simple model about one-fourth of the variation in price-cost margins is explained by seller concentration. The strength of this relationship weakens as additional structural variables are added to the model. None of the other structural variables, except the proxies for barriers to entry in models 2 and 5 for adjusted price-cost margin, were significant predictors of price-cost margins.

Transportation Equipment Group (SIC 37)

The Transportation Equipment Group (SIC 37) covers only 14 four-digit industries. These industries accounted for over $68 billion worth of sales and over $28 billion of value-added in 1967. This meant that SIC 37 produced over 10 per cent of sales and value-added in manufacturing in 1967. The dominate industry within this group is

Motor Vehicles (SIC 3711). It accounts for over 25 per cent of this group's value-added and almost two-fifths of its total sales.

The regression results of SIC 37 are presented in Table VIII.[38] The structure variables, seller concentration (CR), capital intensity (KO or TAO), change in demand (D), and product differentiation (PRD), are not found to be significantly related to price-cost margins. The effect of barriers to entry (measure by MES 3) is significantly different from zero in all models examined. The coefficient averages around 0.68 and is relatively stable in all models. The simple correlation coefficient between CR, TAO, and MES is 0.44. This, together with the presence of high R^2 and few independent variables significant, indicates that multicollinearity is present in these regression results.

The final variable, import competition (I), possesses a positive sign in all cases with t-values ranging as high as 2.15. This runs counter to the view that degree of import competition will lower price-cost margins.

Estimation of Model for 115 Industries

This subsection reports results of the model for all 115 four-digit industries included in the study. These selected industries account for over $100 billion dollars of 1967 value-added; or, stated another way, these industries made up almost 41 per cent of total manufacturing value-added in 1967.

The five models tests are shown in Tables IX and X. Seller concentration and capital intensity are directly related to price-cost margins, and are generally statistically significant. Barriers to entry, import competition, industry growth, and geographic market carry

TABLE VIII

REGRESSION RESULTS FOR SIC 37, 1967

Dependent Variable	CR	KO	TAO	MES 3	PRD	I	D	Intercept	R^2	$\bar{R}^2$
PM	-0.054		-0.008	0.655[a]		4.787	-0.041	15.41	0.67[c]	0.53
	(0.87)		(0.59)	(3.22)		(2.15)	(0.51)			
PM	0.089		0.012		0.743	3.273	0.045	6.19	0.25	-0.08
	(1.35)		(0.55)		(0.20)	(0.92)	(0.36)			
PM	-0.039	0.000		0.608[a]		4.620	-0.029	13.79	0.66[c]	0.51
	(0.65)	(0.05)		(3.15)		(2.01)	(0.36)			
PM_{adj}	-0.001		0.007	0.719[a]		3.823	-0.013	11.36	0.72[b]	0.60
	(0.01)		(0.43)	(3.04)		(1.47)	(0.14)			
PM_{adj}	0.157[c]		0.030		1.300	1.992	0.075	1.36	0.40	0.14
	(2.11)		(1.26)		(0.31)	(0.50)	(0.54)			
PM_{adj}	0.009	0.006		0.720[a]		3.512	-0.009	10.79	0.75[b]	0.64
	(0.14)	(1.04)		(3.46)		(1.42)	(0.10)			

t-ratio shown in parentheses N = 14

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

TABLE IX

REGRESSION RESULTS FOR SELECTED FOUR-DIGIT INDUSTRIES
PRICE-COST MARGINS DEPENDENT VARIABLE, 1967

Model	CR	KO	TAO	MES 2	PRD	I	D	GM	Intercept	R^2	$\bar{R}^2$
1	0.204[c] (2.85)		0.030 (1.47)	0.056 (0.16)		-1.635 (0.68)	0.028 (0.62)	-0.001 (0.22)	13.63	0.22[a]	0.17
2	0.118[b] (2.25)		0.056[a] (3.23)	0.261 (1.06)		-2.577[c] (1.33)	-0.004 (0.13)		15.65	0.22[a]	0.19
3	0.213[a] (4.03)		0.032[c] (1.57)		1.844 (0.82)	-1.165 (0.48)	0.036 (0.78)	-0.001 (0.27)	12.09	0.23[a]	0.18
4	0.153[a] (3.63)		0.050[a] (3.46)		2.999[c] (1.56)	-1.93 (0.98)	0.006 (0.19)		13.07	0.23[a]	0.20
5	0.141[a] (2.62)	0.015 (1.12)		0.312 (1.22)		-1.996 (0.99)	0.003 (0.07)		17.01	0.16[a]	0.13

t-ratio shown in parentheses N = 85 for models 1 and 3, N = 115 for models 2, 4 and 5

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

TABLE X

REGRESSION RESULTS FOR SELECTED FOUR-DIGIT INDUSTRIES ADJUSTED PRICE-COST MARGIN AS DEPENDENT VARIABLE, 1967

Model	CR	KO	TAO	MES 2	PRD	I	D	GM	Intercept	R^2	$\bar{R}^2$
1	0.310[a] (4.38)		0.013 (1.02)	0.088 (0.25)		-1.544 (0.64)	0.084[c] (1.80)	-0.001 (0.08)	9.50	0.34[b]	0.30
2	0.167[a] (2.95)		0.051[a] (2.76)	0.337 (1.27)		-2.555 (1.22)	0.017 (0.46)		13.69	0.26[b]	0.24
3	0.301[a] (5.63)		0.033[c] (1.60)		1.773 (0.78)	-1.412 (0.57)	0.086[c] (1.87)	-0.001 (0.38)	7.91	0.35[a]	0.31
4	0.211[a] (4.61)		0.055[a] (2.91)		2.155 (1.03)	-2.064 (0.96)	0.027 (0.73)		11.69	0.26[a]	0.23
5	0.188[a] (3.28)	0.018[c] (1.36)		0.387[c] (1.43)		-2.124 (0.99)	0.023 (0.62)		14.74	0.22[a]	0.20

t-ratio shown in parentheses N = 85 for models 1 and 3, N = 115 for models 2, 4 and 5

[a]Statistically significant at the one per cent level (one-tailed test)
[b]Statistically significant at the five per cent level (one-tailed test)
[c]Statistically significant at the 10 per cent level (one-tailed test)

the expected signs, but are statistically significant in less than one-third of the possible cases.

Rhodes and Cleaver, in their study of 352 four-digit industries, reported regression results for price-cost margins as a function of seller concentration as:

$$PM = 17.08 + \underset{(7.01)}{0.136}\ CR$$

with an adjusted R^2 of 0.121.[39] The same model was tested for the 115 four-digit industries and the results are:

$$PM = 16.67 + \underset{(4.14)}{0.176}\ CR$$

with R^2 of 0.132 and

$$PM_{adj} = 15.20 + \underset{(5.14)}{0.234}\ CR$$

with R^2 of 0.189 significant at the 1.0 per cent level. These results indicate both dependent variables give support for the structure-performance hypothesis, but that the adjusted price-cost margin (PM_{adj}) shows a stronger relationship in terms of R^2 and the t-values. One possible reason for the superiority of PM_{adj} is the presence of an unintended, but systematic, bias in the reporting of goods transferred within branches or sold through separate sales offices. This problem is most severe in multiplant companies. The result is that price-cost margins (unadjusted) tend to understate the "true" margin. Correction for this problem is seen to improve the hypothesized relationship.

A similar evaluation of the two capital intensity measures, TAO and KO, can be made by examining models 2 and 5. These models indicate that both terms of R^2 and t-values, TAO is the best measure of capital industry.

The role of industry growth is shown in Tables IX and X to be positively, but weakly, related to price-cost margins. In Chapter II, an alternative hypothesis suggested that there may be a differential effect of growth on price-cost margins in highly concentrated (or oligopolistic) industries. In concentrated markets, rapid growth of demand will encourage firms to behave highly competitively. The firms will attempt to increase their individual market shares in order that future profits will be greater. Caves states this view:

> Firms in the fast-growing industry will see hugh profits in the offing if they increase their individual shares of the market. Even if cutting the price or raising the quality of the product sacrifices profits this year, the return from having a bigger share of next year's bigger market may more than compensate for this year's profit recution. Firms in the fast-growing industry are likely to be highly competitive in their behavior.[40]

In static, or slow-growth industries, efforts by one firm to increase its market share will probably cut total profits for the industry. Therefore, firms in the static industry may have less incentive to behave competitively.

In order to test this hypothesis a highly concentrated industry was identified as an industry whose four-firm seller concentration equaled or exceeded 50 per cent.[41] By this definition, 51 of the four-digit industries are concentrated. Next, these industries were classified as either fast or slow-growth industries based on the change in industry sales between 1963 and 1967. Industries that experienced growth in sales greater than 30 per cent were designated as fast-growth industries; industries where rates of growth were less than 30 per cent are assigned a slow-growth classification. Twenty-six concentrated industries were fast-growth and 25 were slow-growth.

The question asked is, do price-cost margins in concentrated industries vary with rates of growth? Specifically, the null hypothesis is

$$H_O : PM_F = PM_S$$

where PM_F equals price-cost margins in fast-growth industries and PM_S is the price-cost margin in slow-growth industries. The alternative hypothesis is

$$H_A : PM_F \neq PM_S$$

This hypothesis will also be examined using the adjusted price-cost margin.

The results are given in Table XI. As may be observed, the price-cost margins for highly concentrated, fast growth industries are not significantly different from price-cost margins in highly concentrated, slow growth industries. The null hypothesis cannot be rejected. Since other factors, such as capital intensity and minimum efficient size plant, affect price-cost margins a model examining the differential impact of growth on PM, holding these other factors constant, was tested. The 51 concentration industries results were (t-ratio in parentheses)

$$\underset{}{PM} = 4.96 + \underset{(2.19)}{0.24CR} + \underset{(2.88)}{0.07TAO} + \underset{(0.69)}{0.18\ MES\ 2} - \underset{(0.73)}{0.03D}$$

with an $R^2 = 0.25$. The value of the regression coefficient for D is negative, but not significantly different from zero. This simple test for these selected industries fails to support the view that there is a differential impact of growth or price-cost margin in highly concentrated industries.

TABLE XI

COMPARISON OF MEANS IN HIGHLY CONCENTRATED INDUSTRIES

	Mean	S.D.
PM_F	28.57[a]	12.22
PM_S	28.88[a]	9.06
$PMAD_F$	31.93[b]	12.78
$PMAD_S$	30.99[b]	10.52

[a] t-ratio = 0.10

[b] t-ratio = 0.26

Symbols:

PM_F : price-cost margin in fast-growth group

PM_S : price-cost margin in slow-growth group

$PMAD_F$: adjusted price-cost margin in fast-growth group

$PMAD_S$: adjusted price-cost margin in slow-growth group

Finally, a brief look at a variable omitted from this study is in order. The impact of buyer concentration on price-cost margins is not considered in this study. It is anticipated that increases in buyer concentration would result in a reduction in price-cost margins. Recently, this expected negative relationship between buyer concentration and the price-cost margin has received empirical support in a study by Lustgarten.[42] In this study, the exclusion of the buyer concentration variable was found to have its greatest impact where seller concentration is high. Thus, the introduction of a buyer concentration variable would be expected to reinforce, rather than eliminate, the relationship between the structural variables and price-cost margins observed in this study.

Summary

The empirical results of the structure-performance hypothesis have been presented in this cahpter. The tests were designed to determine the relative influence of certain elements of industry structure on industry price-cost margins in the year 1967. A positive relationship between seller concentration and industry price-cost margins is consistently found in SIC 20 and SIC 36. No such support is noted for SIC 28 and 37. Other structural variables receive only tentative support in the industries investigated. The structural model for all 115 four-digit industries taken together explains only about one-quarter of the variation in price-cost margin.

FOOTNOTES

[1]For example, see Federal Trade Commission, Economic Report on the Influence of Market Structure on the Profit Performance of the Food Manufacturing Companies (Washington, 1969).

[2]U. S. Congress, Senate, Committee on the Judiciary, The Industrial Reorganization Act, Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary on S. 1167. 93rd Cong., 1st sess., 1973, pp. 9-12.

[3]Norman R. Collins and Lee E. Preston, Concentration and Price-Cost Margins in Manufacturing Industries (Berkeley, 1968), p. 72.

[4]Douglas Needham, Economics Analysis and Industrial Structure (New York, 1969), pp. 27-28.

[5]Norman R. Collins and Lee E. Preston, p. 82.

[6]Ibid., p. 9.

[7]See Stephen A. Rhodes, "The Concentration-Profitability Relationship," Antitrust Bulletin, 18 (Summer, 1973), pp. 333-354 as an example.

[8]Collins and Preston, p. 83.

[9]U. S. Bureau of the Census, Enterprise Statistics: 1967 (Washington, 1973).

[10]The adjusted multiple correlation coefficient, ($\bar{R}^2$), used in this study is defined as

$$\bar{R}^2 = 1 - (1 - R^2)\ \frac{n - 1}{n - k}$$

where n is the number of observations, k is the number of parameters, and R^2 is the multiple correlation coefficient. In general, the value of R^2 is larger than the value of $\bar{R}^2$, except when $k = 1$ where $R^2 = \bar{R}^2$. The use of R^2 has the disadvantage that when the number of parameters (k) is larger as compared with the number of observations (n), the mean squares of the residual tends to be on the low side and hence $\bar{R}^2$ gives an overly optimistic view of the performance of the explanatory variable. Also, $\bar{R}^2$ is useful when comparing the performance of different sets of explanatory variables.

[11]The other two measures of minimum efficient plant size were also investigated (see Chapter II). These measures, however, gave poorer results than those reported. Also, other formulations of these measures, such as a dummy variable, were tried without any improvement in the results.

[12]Blake Imel et al., Market Structure and Performance (Lexington, 1972), p. 57.

[13]William S. Comanor and Thomas A. Wilson, "Advertising, Market Structure and Performance," Review of Economics and Statistics, 49 (November, 1967), pp. 431-432. The dependent variable tested by Comanor and Wilson is profits after taxes as a percentage of stockholders' equity.

[14]Louis Esposito et al., "Dissolution and Scale Economics: Additional Estimates and Analysis," Antitrust Law and Economics Review, 5 (Fall, 1971), pp. 103-114.

[15]Comanor and Wilson, pp. 434-435.

[16]George Stigler, The Organization of Industry (Homewood, 1968), p. 67.

[17]Comanor and Wilson, pp. 432-433.

[18]William G. Shepherd, "Elements of Market Structure: An Inter-industry Analysis," Southern Economic Journal, 38 (April, 1972), pp. 536-537.

[19]Imel, p. 47.

[20]See Richard A. Miller, "Concentration and Marginal Concentration, Advertising and Diversity," Industrial Organization Review, 1, No. 1 (1973), pp. 31-32 for development of this concept.

[21]Using data reported by William G. Shepherd, pp. 531-537, an elasticity coefficient of 0.39 for a cross section of over 300 industries was calculated.

[22]Donald McFetridge, "Market Structure and Price-Cost Margins," Canadian Journal of Economics, 6 (August, 1973), pp. 348-349.

[23]Import competition was also examined as a continuous variable. In general, the results were poorer than those reported here with regression coefficients for I not significantly different from zero.

[24]Louis Esposito and Frances F. Esposito, "Foreign Competition and Domestic Industry Profitability," Review of Economics and Statistics, 53 (November, 1971), pp. 343-353.

[25]Collins and Preston, pp. 82-83 and Rhodes, p. 344.

[26]The source for the classification is Board of Governors of the Federal Reserve System, Industrial Production 1971 (Washington, 1972), pp. 5-14.

[27]This same reason is reported by Collins and Preston, p. 95.

[28]Ibid., pp. 84-85

[29]This measure is identified as MES 3 in Chapter II. The two other measures of MES were also examined but they gave poorer results than those reported.

[30]See Esposito and Esposito, pp. 348-349 for a similar finding.

[31]J. Johnston, Econometric Methods (New York, 1972), p. 160.

[32]Esposito and Esposito, pp. 350-351.

[33]James V. Koch, "Industry Market Structure and Industry Price-Cost Margins," Industrial Organization Review, 2, No. 4 (1974), pp. 191-193.

[34]These possibilities are cited by J. C. H. Jones et al., "Market Structure and Profitability in Canadian Manufacturing Industry," Canadian Journal of Economics, 6 (August, 1973), p. 360.

[35]Collins and Preston, pp. 81 and 89.

[36]A brief mention appears in Ibid., p. 73.

[37]Ibid., pp. 81 and 89.

[38]There were only nine observations on geographic market (GM) for this group. Therefore, the GM variable was not included in the regression runs.

[39]Stephen A. Rhodes and Joe M. Cleaver, "The Nature of the Concentration--Price-Cost Relationship for 352 Manufacturing Industries: 1967," Southern Economic Journal, 40 (July, 1973), pp. 90-102.

[40]Richard Caves, American Industry: Structure, Conduct Performance (Englewood Cliffs, 1972), p. 31.

[41]This figure, while arbitrary, is used by several authors as a demarcation of high concentration. For example, see Stanley Boyle, Industrial Organization (New York, 1972), p. 25.

[42]Steven H. Lustgarten, "The Impact of Buyer Concentration in Manufacturing Industries," Review of Economics and Statistics, 57 (May, 1975), pp. 125-132.

CHAPTER IV

WELFARE LOSS MODEL

Introduction

The purpose of this chapter is threefold. First, a theoretical framework for estimating welfare loss due to monopoly is developed. Next, the theoretical model is related to available data indicating how the model can be estimated. Finally some of the limitations of the model are examined.

Theoretical Model

Assume there are two industries in the economy and one is competitive and the other is a monopoly. In Figure 5, X_c is the output of the competitive industry, X_m is the output of the monopoly industry, and RR' is community production possibilities curve. If price were set equal to marginal cost (P = MC) in both industries (i.e., budget line PP'), point A on indifference curve III would represent society's equilibrium position for the two products.[1] With monopoly pricing for X_m (i.e., $P > MC$), the price line rotates around point P forming budget line PT. The new equilibrium position is combination B lying on indifference curve I; however, at B there will be unemployed and under utilized resources. Elimination of the unemployment and underutilization occurs if income increases by PQ to OQ forming new budget line QQ'. Society's preferred position with a monopoly sector will be

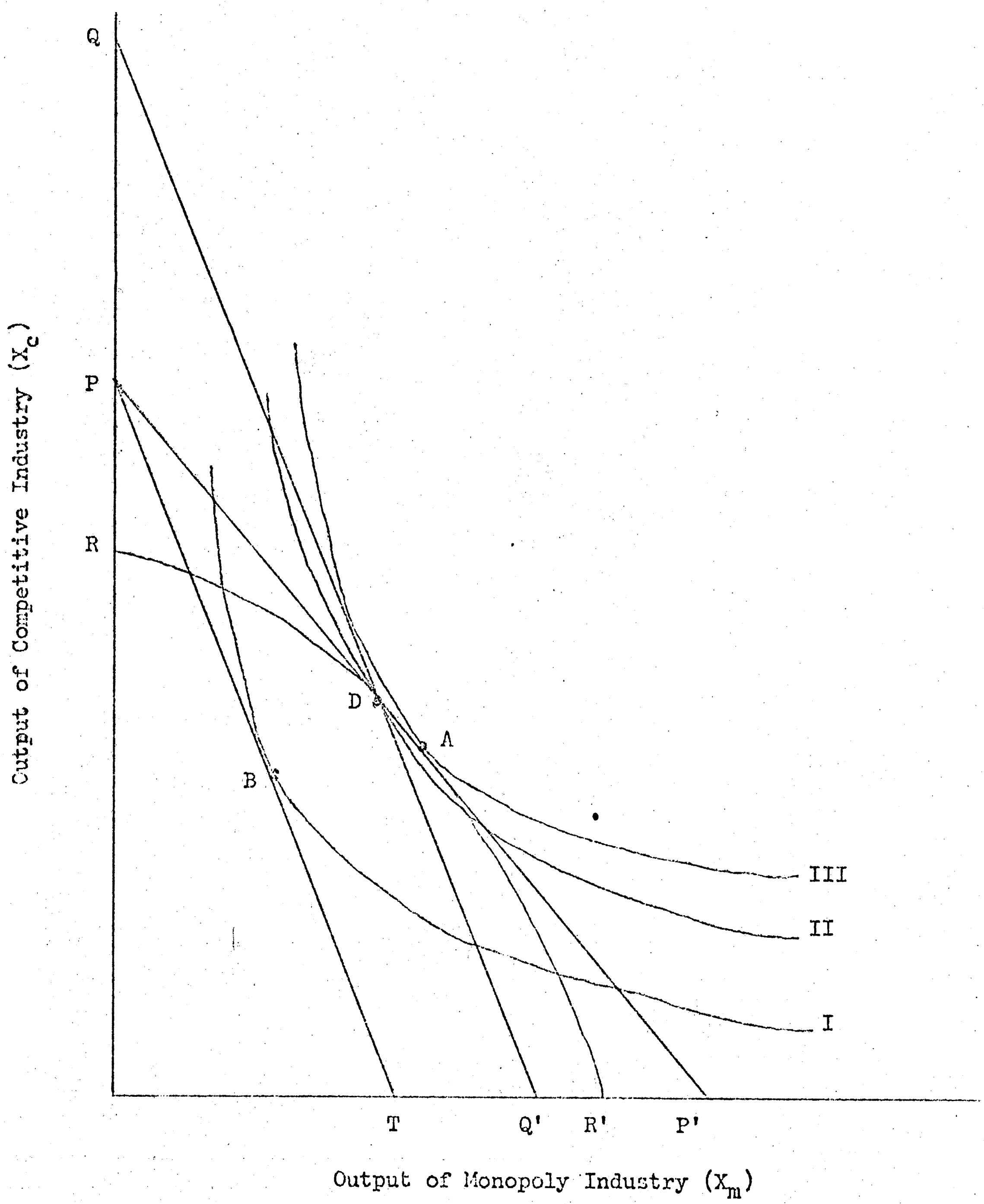

Figure 5. Equilibrium with Competitive Pricing and With Monopoly Pricing

at D which lies on indifference curve II and also on the production possibilities curve RR'. The welfare loss due to monopoly pricing is represented by the shift from III to II.[2]

This welfare loss can also be shown within the framework of demand and supply analysis as seen in Figure 6c and 6d and where Figure 6a is a scaled-down version of Figure 5.[3] The supply curve is the slope of the production possibilities curve RR' which represents the opportunity cost of each product. The demand curve is equal to the slope of the indifference curve at various points along the production possibilities curve. For example, at combination D, output in the monopoly industry is M_D (see Figure 6d) and output in the competitive industry is C_D (see Figure 6c). At output M_D the marginal rate of substitution (MRS_{MC}) is greater than the marginal rate of transformation (MRT_{MC}); the demand price (E in Figure 6d) exceeds the supply price (G in Figure 6d) at that output. Similarly, at C_D the MRT_{CM} and supply price (J in Figure 6c) is greater than demand price (K in Figure 6c). The welfare loss can be measured by either area EGF (Figure 6d) or area JHK (Figure 6c). It also can be noted that the price in the monopoly industry (P'_D in Figure 6d) is higher than the price in the competitive industry (denoted by P_D in Figure 6c). This difference in prices is a result of difference in profits between the two industries.

The welfare loss due to monopoly can be estimated by either area EGF, area JHK, or by the difference between indifference curve II (with monopoly) and indifference III (without monopoly).[4] Traditionally, welfare loss studies have additionally assumed firms were operating under conditions of constant costs. In terms of Figures 5

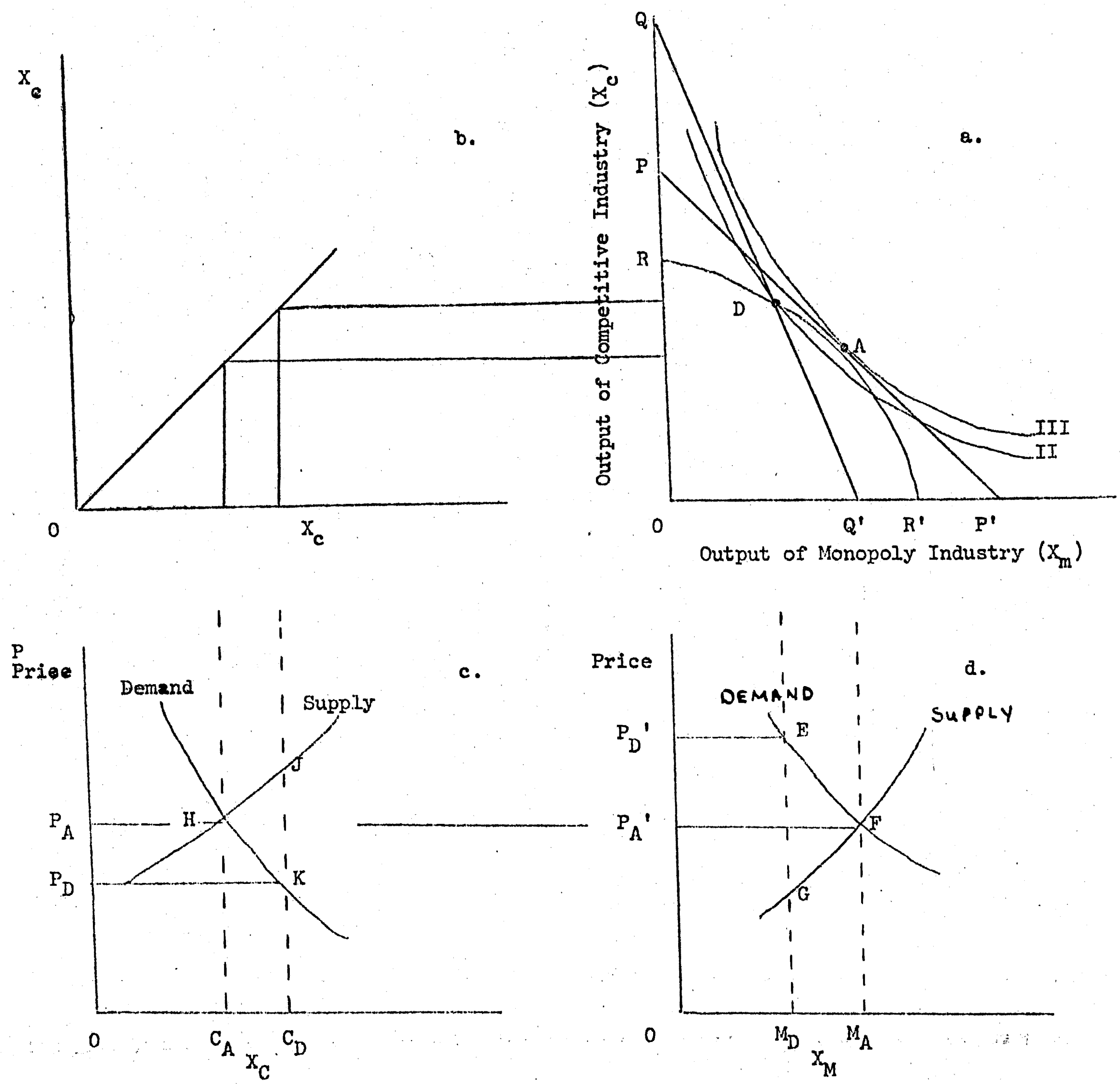

Figure 6. A General Equilibrium Model of Welfare Loss

and 6 this means that (1) production possibilities curve RR' would be linear and (2) the respective supply curves would be perfectly elastic. The resultant welfare loss triangle is presented in Figure 7 as area ABC. Welfare loss (W) results from a divergence of price and opportunity (marginal) cost. The area of the triangle is equal to 1/2 (BASE) (HEIGHT); thus, the values of $\overline{AB}$ and $\overline{BC}$ would provide sufficient information to calculate the welfare loss.

Estimation of Welfare Loss

A technique for finding the values of $\overline{AB}$ and $\overline{BC}$ was provided in a study by Siegfried and Tiemann.[5] The following is derived from their exposition. The line segment $\overline{AB}$ may be found by calculating the difference between price and long-run marginal cost. Thus, the value of $\overline{AB}$ is given by

$$\overline{AB} = TR/Q_M - LRMC \qquad (1)$$

where

$TR/Q_M = P_M$ = price, and

LRMC = long-run marginal cost.

Assuming constant costs and calculating economic profit, $\overline{AB}$ may be expressed as

$$\overline{AB} = \frac{|TR - LRVC - pA|}{Q_M} \qquad (2)$$

where LRVC = accounting total variable cost

A = book value of assets

p = "normal" rate of profit.

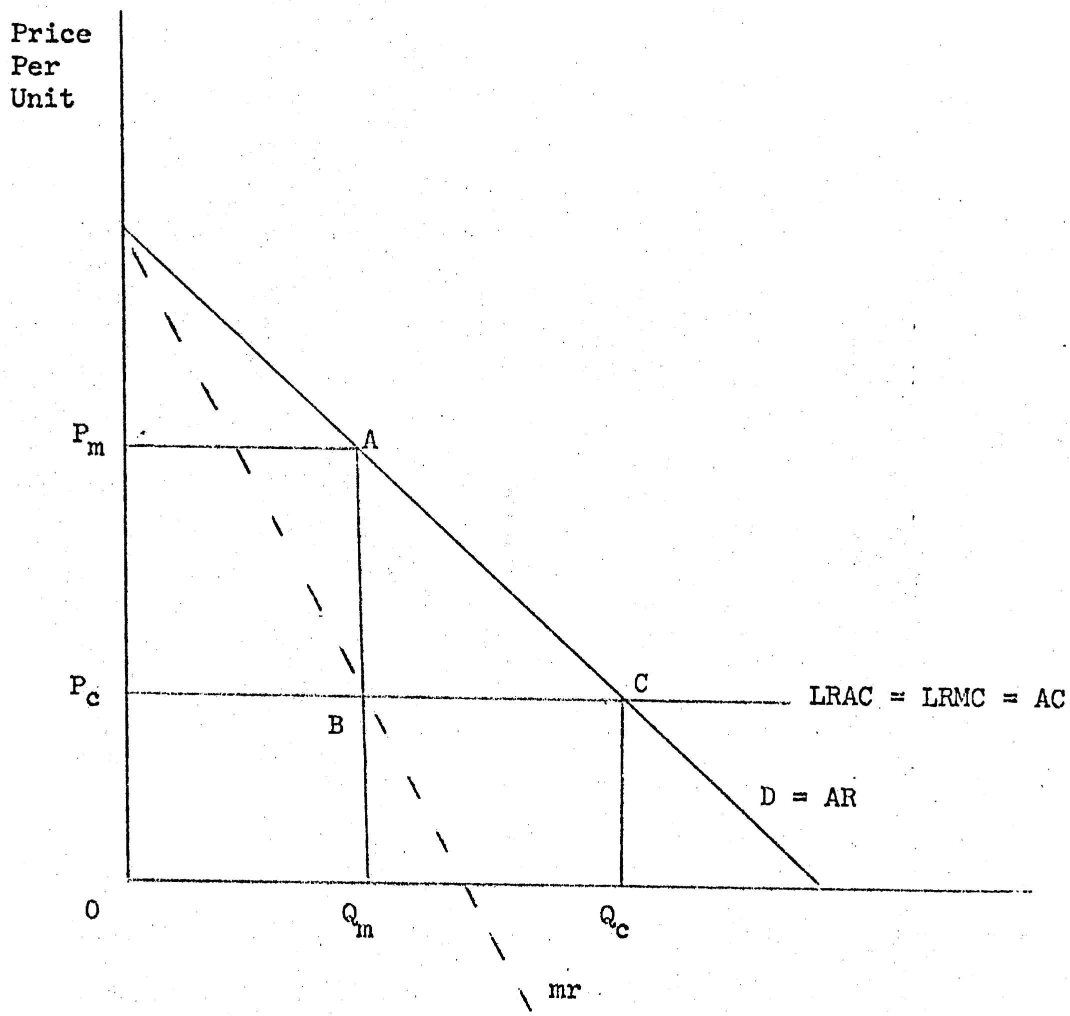

Figure 7. The Welfare Loss Triangle

Equation (2) is an estimate of the economic profits per unit of output. Mutiplying the expression by P_M/P_M produces

$$\overline{AB} = \left| \frac{TR - LRVC - pA}{TR} \right| \cdot P_M. \qquad (3)$$

Next, estimate the quantity reduction resulting from monopoly restriction of output. The quantity reduction is given by

$$\overline{BC} = \overline{AB}\ (dQ/dP), \qquad (4)$$

if the demand curve is linear between quantities OQ_M and OQ_C. Multiplying (4) by P_M/P_M and Q_M/Q_M produces

$$\overline{BC} = \overline{AB}\ (dQ/dP) \cdot P_M/P_M \cdot Q_M Q_M \qquad (5)$$

which can be rearranged into

$$\overline{BC} = \overline{AB}\ \eta\ (Q_M/P_M) \qquad (6)$$

where η = price elasticity of demand.

Welfare loss (W) is expressed as

$$W = 1/2\ (\overline{AB})\ (\overline{BC}). \qquad (7)$$

Substituting equations (3) and (6) into (7) produces

$$W = 1/2 \left([(TR - LRVC - pA)\ /TR]\ P_M \right)^2 \ (\eta)\ (Q_M/P_M) \qquad (8)$$

or

$$W = 1/2 \left[\frac{TR - LRVC - pA}{TR} \right]^2 \ (TR)\ (\eta). \qquad (9)$$

Limitations of Welfare Loss Estimate

The welfare loss (W) estimated by equation (9) is only one of several sources of welfare losses that may result from the existence of monopoly power in an economic system. Other losses may arise from technical inefficiencies in combining factors of production together. The Pareto optimal condition concerning the combining of resources together is given by

$$\frac{MPP_{ac}}{MPP_{bc}} = \frac{MPP_{am}}{MPP_{bm}} ,$$

where a and b are factor inputs and c and m are outputs. If this condition is not satisfied, it implies that the profit motive has been insufficient to insure technical efficiency; hence, output could be increased without increasing the use of factors of production.

This can be illustrated with the aid of Figure 8 where it is assumed that the shift from monopoly to competition lowers costs from LAC_m to LAC_c. The triangle ABC is now only a partial measure of welfare loss of monopoly because the shift to competition has also reduced the level of costs. The full measure of welfare loss, under this view, is measured by triangle AEF. An example of the possible size of this addition to welfare loss is provided by Comanor and Leibenstein.[6] They assume that actual costs are six per cent below the monopoly price and that one-half of the total output of the economy is monopolized. Given a price elasticity of 2, triangle ABC would be approximately 0.18 per cent of total output. If the cost lowering effect from LAC_m to LAC_c were 18 per cent, the triangle AEF would be about three per cent of total output.

A second type of welfare loss occurs when monopsony power is present in the factor markets. The monopsonistic buyer will maximize profits by equating the marginal revenue product for a (MRP_a) and the marginal resource cost of a (MRC_a). As seen in Figure 9, the monopsonist pays a price of only P_{a_1} for a quantity of A_1; the MRP_a

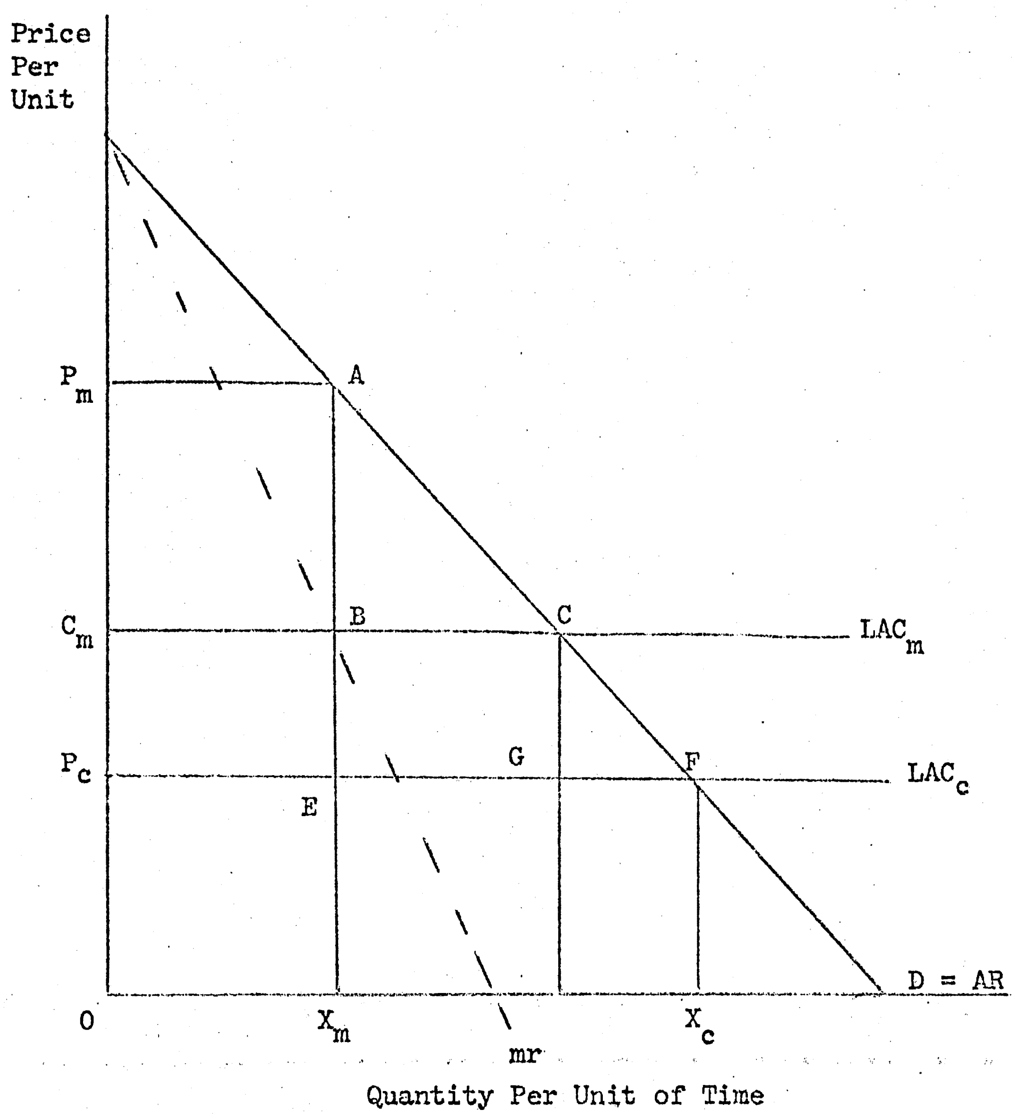

Figure 8. The Welfare Loss Due to Technical Inefficiencies

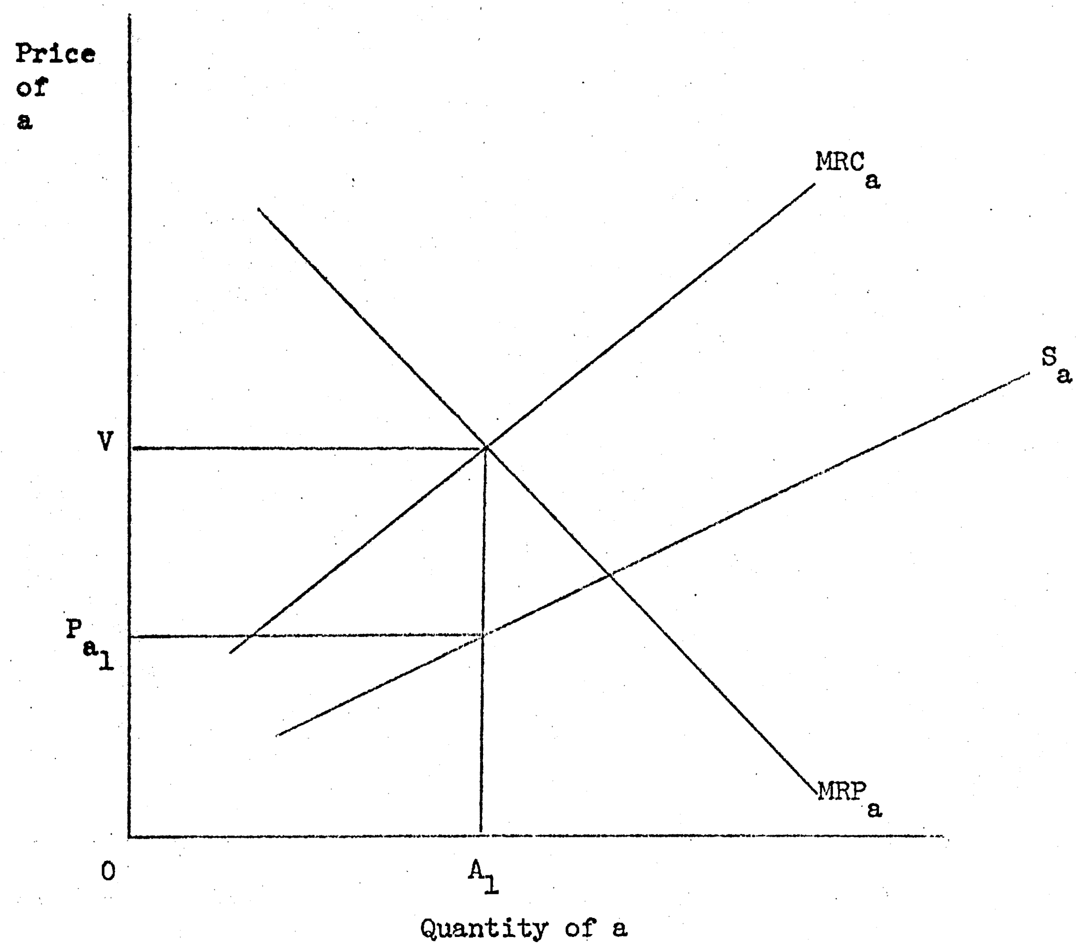

Figure 9. Monopsony Power

at that level of employment is V. Thus, under monopsonistic buying conditions, the quantity of the factor used will be restricted and the price per unit will be less than the marginal revenue product. The effect of the presence of a monopsonistic buyer of factor inputs is to shift the production possibilities curve towards the origin. This can be seen in Figure 10 where the production possibilities curve shifts from RR' to SS' because of monopoly pricing of factor inputs. The distortion of factor prices makes indifference curve I, passing through points T and U, the highest one attainable. Traditional welfare loss measures, such as those used by Harberger, do not include any loss due to monopsonistic buying of factor inputs.[7] Worcester suggests two approaches for allowing for this problem. First, the welfare loss, calculated in the traditional fashion, is multiplied by 1.2 "to adjust for welfare loss due to monopoly gains achieved by workers in the form of higher wages."[8]

The second approach to this problem allows for an expansion of total output when the monopoly is eliminated. This can be seen with the aid of Figure 11 (which is taken from Figure 6). Initially, output in the competitive sector, X_c is C_D and the output in the monopoly sector, X_m, is M_D. Using the average rate of return for the entire economy associated with price OP_A, the welfare loss area would be EGF or JHK. The implication is that, given a stable production possibilities curve, one could expand output in the monopoly sector from M_D to M_A only by reducing output in the competitive sector from C_D to C_A. If, however, that rate of return associated with price OP_D were the appropriate rate of return for the entire economy, no contraction of the competitive sector is necessary; thus, output in the competitive

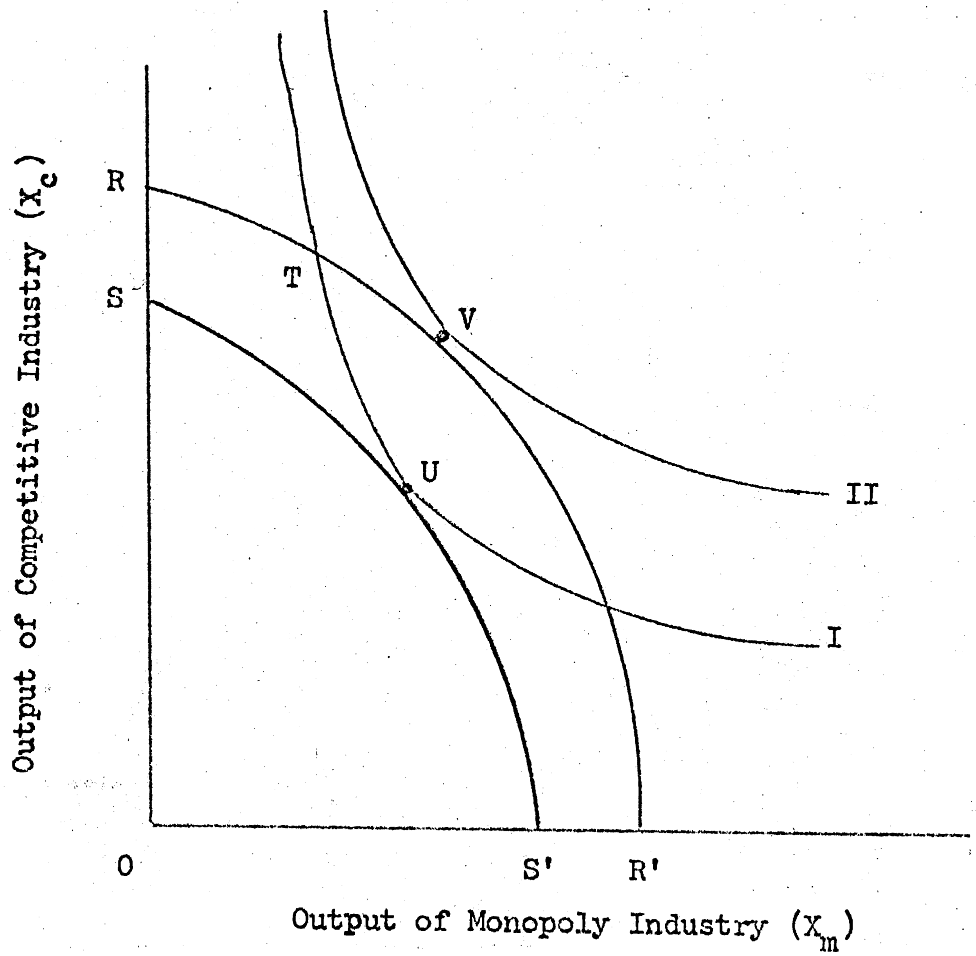

Figure 10. The Effect of Monopsony Power on Production Possibilities Curve

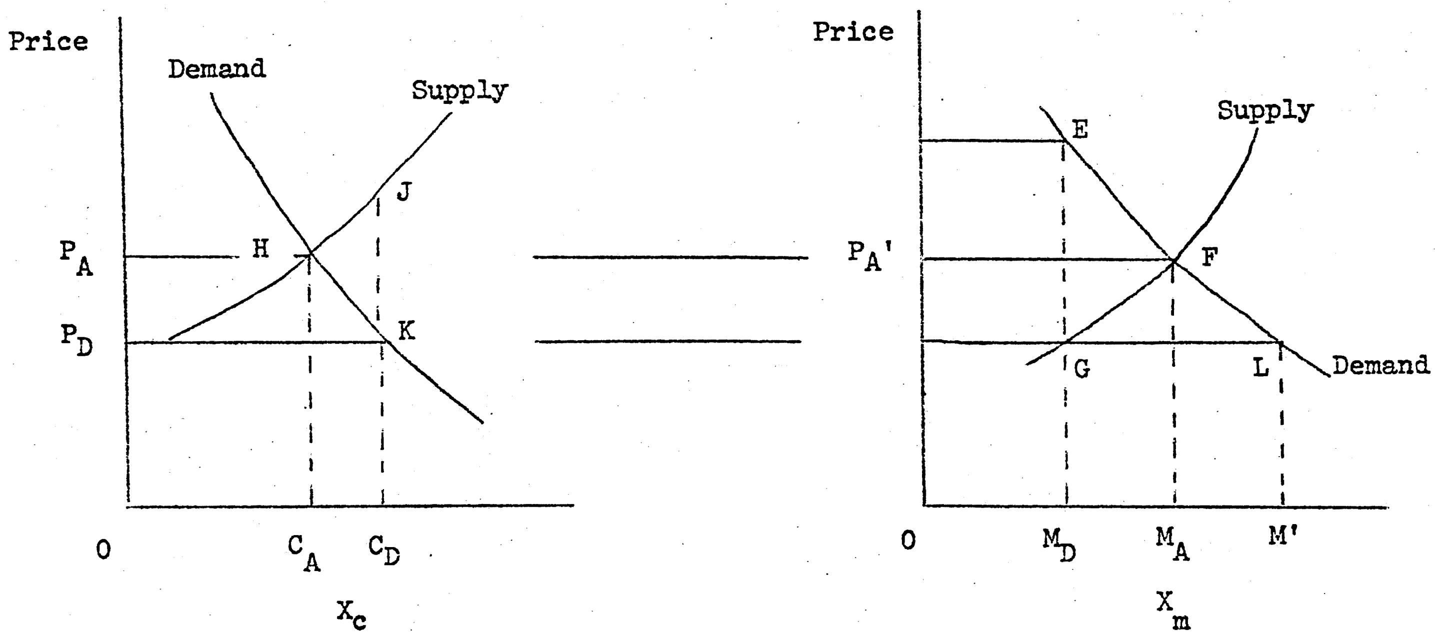

Figure 11. The Welfare Loss Triangle with Monopsony Power

sector would remain at C_D. Output in the monopoly sector should, on the other hand, expand until the rate of return delines to the competitive level (i.e., that rate of return associated with price OP_D). For this to occur, output of X_m must expand from M_D to M'. The welfare loss is now measured by triangle EGL. The elimination of this loss is only possible if the production possibilities curve can be shifted to the right. Worcester suggests that this larger welfare loss area (which arises because of monopoly power in factor markets) can be measured by selecting a rate of profit below the average rate of return. Thus, Worcester uses a rate of return which is equal to 90 per cent of the median in order to allow for the monopoly pricing of factors.[9]

A final, and more controversial point, is that the existence of monopoly power may have an adverse effect on technological progress. This follows if monopolists have less incentive for developing new products and improving production processes than do competitive firms.[10] Equation (9) does not measure any of these potential adverse effects.

Summary

This chapter has presented a theoretical framework from which an estimate of the welfare loss triangle can be made. The chapter concludes with a discussion of some reasons why the welfare loss triangle may underestimate the welfare loss due to monopoly.

FOOTNOTES

[1]At A, MRS = MRT = $\frac{P_M}{P_C}$, where MRS_{CM} is the marginal rate of substitution of good C for good M, MRT_{CM} is the slope of budget line PP'. This yields the necessary equilibrium conditions:

$$(1) \quad MRS_{CM} = \frac{MU_M}{MU_C} = \frac{P_M}{P_C} \quad \text{or}$$

$$\frac{MU_M}{P_M} = \frac{MU_C}{P_C}, \text{ and}$$

$$(2) \quad MRT_{CM} = \frac{MC_M}{MC_C} = \frac{P_M}{P_C} \quad \text{or}$$

$$\frac{MC_M}{P_M} = \frac{MC_C}{P_C}$$

where MC_M is the opportunity cost of producing another unit of good M and MC_C is the opportunity cost of producing a unit of good C.

[2]See Abram Bergson, "On Monopoly Welfare Losses," American Economic Review, 63 (December, 1973), pp. 853-856 for a similar presentation of this point.

[3]This discussion follows from Dean A. Worcester, "New Estimates of Welfare Loss to Monopoly, United States: 1956-1969," Southern Economic Journal, 40 (October, 1973), esp. pp. 235-237.

[4]For a discussion of the theoretical controversy surrounding measurement of welfare loss triangle see Bergson, pp. 855-858 and James E. Anderson, "A Note on Welfare Surpluses and Gains from Trade in General Equilibrium," American Economic Review, 64 (December, 1974), pp. 758-762.

[5] John J. Siegfried and Thomas K. Tiemann, "The Welfare Cost of Monopoly: An Inter-Industry Analysis," Economic Inquiry, 12 (June, 1974), pp. 190-202.

[6] William S. Comanor and Harvey Leibenstein, "Allocative Efficiency, X-Efficiency and the Measurement of Welfare Losses," Economica, 36 (August, 1969), pp. 304-309.

[7] See Worcester, p. 237, for a discussion of this point.

[8] Ibid., p. 237. This factor of 1.2 was drawn from a study by Albert Rees, "The Effects of Unions on Resource Allocation," Journal of Law and Economics, 6 (October, 1973), pp. 69-78.

[9] Worcester, pp. 237-238.

[10] An excellent survey of this issue is found in F. M. Scherer, Market Structure and Economic Performance (Chicago, 1971), pp. 363-366.

CHAPTER V

EMPIRICAL ESTIMATES OF WELFARE LOSS

Introduction

The purpose of an industry-by-industry examination of welfare loss is to determine if the bulk of the loss due to monopoly is concentrated in relatively few industries. The following section summarizes previous studies which have found, in general, that the welfare loss due to monopoly is relatively small. The next section will present in the United States for 1967 estimates of welfare loss for selected manufacturing industries. Finally, the results of this study are compared to earlier estimates.

Review of the Literature

Estimations of welfare loss were first reported in a 1954 study by Arnold Harberger.[1] Looking at seventy-three (73) manufacturing industries for the period 1924-1929, Harberger estimated that the welfare loss due to monopoly was less than 0.1 per cent of national income. In 1967 this would have amounted to less than $.7 billion. The Harberger study has been criticized on several general points. First, the assumption of a unitary elasticity of demand can be questioned because it implied that a monopolist would operate where marginal revenue is zero.[2] Second, Harberger's use of the average rate of profit in the manufacturing sector as a proxy for the "normal" rate of return causes a biased downward estimate because some economic profits are included in this average. Finally, it has been observed that some monopoly profits are capitalized in such a manner that only competitive rates of return are being earned.[3]

David Schwartzman attempted to generate a new set of welfare loss estimates in response to the criticisms of Harberger.[4] Using the same framework as Harberger, Schwartzman used estimates of profits for the year 1954 and he assumed a price elasticity of demand of 2. His findings were that "the welfare loss is less than $234 million; or less than 0.1 per cent of the national income in 1954."[5]

David Kamerschen made another estimate of the welfare loss due to monopoly using a loss equation similar to that of Harberger and Schwartzman.[6] Kamerschen made several adjustments in data for a five year period between 1956-57 and 1960-61 to approximate a long-run period. In addition to the new profit data, Kamerschen made a further refinement by estimating the elasticity of demand for the selected industries. This contrasts with Harberger and Schwartzman who had assumed the price elasticity of demand to be 1 and 2 respectively. Kamerschen found that the welfare loss ranged from $4 billion to $31 billion (between one per cent and eight per cent of national income). In comparing this results with Harberger-Schwartzman, Kamerschen estimates the welfare loss to be about $7.2 billion or 1.9 per cent of national income.

William Shepherd has argued that the misallocation burden of monopoly is between two and three per cent of national income (approximately $16 billion of welfare loss in 1966).[7] His estimate is derived from assuming (1) profits increase one per cent for each 10 concentration points, (2) that the price elasticity of demand is unitary, (3) the output restriction (due to monopoly) will be one per cent for each 10 concentration points, (4) at low concentration (30 per cent), the output restriction (or price) effect is negligible, and (5) degree of output restriction varies linearly between zero (at 30 per cent concentration) and 10 per cent of sales (at 100 per cent concentration). Given these assumptions and using concentration ratios (adjusted by Shepherd for regional markets and imports) for each industry, Shepherd observes that "by conservative estimate . . . the direct loss (distinct from X-inefficiency) is not less than one per cent and probably between two and three per cent."[8]

F. M. Scherer estimates the welfare loss due to monopoly to be around 0.9 per cent of GNP (approximately $7 billion in 1966).[9] He points out, however, that this figure is "only the tip of the iceberg" and that other welfare losses amount to over five per cent of 1966 GNP ($39.7 billion). The other losses cited by Scherer are (1) those due to pricing distortions in regulated sectors ($4.5 billion), (2) those due to deficient cost controls ($19 billion), (4) wasteful promotional efforts such as advertising and styling changes ($7 billion), (4) excess capacity due to industrial caterlization ($4.5 billion), and (5) all others ($4 billion). Scherer concludes:

> While each of the individual estimates is subject to a wide margin of error, it seems improbable that the true combined social cost of monopoly, if it could be ascertained, would prove to be less than half or more than twice the estimated total of 6.2 per cent i.e. between $23.2 billion and $93.0 billion . . . [T]he static inefficiency burden of monopoly does not appear to be overwhelming. But it is also not so slight that it can be ignored.[10]

Frederick Bell, using 1954 data, found that the welfare loss from monopoly in the manufacturing sector averaged about .03 per cent of national income (i.e., $97 million in 1954).[11] This figure was obtained by developing an equation to estimate the deadweight loss triangle and assuming a price elasticity of demand 1.5. Bell's results can be compared to those of Schwartzman by assuming a price elasticity of two. For Bell's data and assuming a price elasticity of demand of two, the total welfare loss would be about $130 million (.04 per cent of 1954 national income); this is about one-half the size found by Schwartzman. The difference is due to the estimated price impact of monopoly. Schwartzman's estimate was 8.3 per cent while Bell's was only 1.94 per cent. The higher value by Schwartzman is a result of identifying the monopoly sector as one in which the four firm concentration ratio exceeds 50 per cent. The price impact for this group of industries would be expected to be greater than the price impact for the whole of manufacturing.

Dean Worcester in a 1973 study, using data for the 500 largest firms, estimated the welfare loss due to monopoly at about 0.33 per cent of national income over the fourteen year period between 1956 and 1969.[12] Worcester concluded:

> The 0.329 per cent is more than 4.1 times Harberger's estimate of 0.08 per cent, but it is still small, less than two months of normal growth . . . I can conclude that there is little ground for the common belief that a large loss of welfare exists due to the economic impact of monopoly power.

Summary

The original measurement of welfare loss for the United States was by Arnold Harberger. Subsequent estimates of the cost of monopoly due to allocative inefficiencies have been in the range of 0.1 to 8 per cent of national income. The majority of the studies have placed the loss at less than two per cent of national income.

Results for 115 Manufacturing Industries

In this section is an interindustry examination of welfare loss for 115 manufacturing industries. The model developed in Chapter IV provides the framework for the welfare loss measures. The various data sources and assumptions necessary for estimating welfare loss are presented in this section. Five measures of welfare loss are given.

Using equation (9) from Chapter IV, an estimate of welfare loss can be derived. Equation (9) is written

$$W = 1/2 \left[\frac{TR - LRVC - pA}{TR} \right]^2 (TR)\ (\eta)$$

where

TR = Value of shipments for the four-digit industry in 1967,

LRVC = Total direct costs (i.e., costs of materials, labor costs, rental payments),

p = "Normal" rate of return (assumed to be equal to 10 per cent of the stock of capital),

A = Stock of capital for the industry, and

η = Price elasticity of demand (assumed to be equal to one).

A shortcoming of the above welfare loss equation is that it provides an estimate using before-tax income rather than after-tax income. This criticism has been noted by at least one study.[14] An after-tax income will provide the most relevant estimate of welfare loss.

To obtain an estimate of after-tax income, data from a study by John Siegfried[15] is used. In this study Siegfried derives the effective tax rates for U. S. corporations by IRS codes for the year 1963. These effective tax rates will be used to calculate an after-tax income for the respective four-digit industry groups. Thus, the welfare loss equation to be estimated is

$$W' = 1/2 \left[\frac{TR - LRVC - TX - pA}{TR} \right]^2 (TR)\ (\eta)$$

where

TX = total corporation income tax by four-digit industry class, and all the other terms are defined above.

A number of assumptions about the industry are necessary for estimating W. These assumptions[16] are:

1. firms are producing under conditions of constant costs,
2. industries are in long-run equilibrium (i.e., accounting values are near economic values),
3. no redistributional effects are present or, alternatively, that whatever redistribution of income occurs is not a welfare loss,[17]
4. the SIC four-digit industries are close approximations to theoretical industries,
5. producers are operating at lowest possible cost,
6. industries are producing for direct consumption,[18] and
7. long-run profits are identified as monopoly profits.

Assumption number 6 above eliminates the possibility of monopoly distortions being transmitted through vertical price flows. Consider two industries, A and B, each with total sales of $1 million per year and constant long-run marginal costs of \$900,000. Assuming unitary elasticity of demand and substituting into equation (9), total welfare loss in A and B would be \$10,000 per year. If industry B purchased \$450,000 of output from industry A, the long-run marginal social cost of B's output is only \$855,000 (i.e., \$450,000 + .9 X 450,000 = \$855,000). The welfare loss estimate increases to \$13012.5 (\$2500 on final sales by A plus \$10,512.5 on final sales by B).

One attempt to measure the effect on welfare loss of this interdependence is the study by Michael Klass.[19] Klass' study, summarized briefly by Scherer,[20] reports that under certain conditions vertical price flows actually reduce the total welfare loss due to monopoly. However, using more sophisticated measurement of the monopoly distortions, the impact of vertical price flows is to increase welfare loss estimates by roughly 40 per cent. It is not clear what effect the vertical price distortions have on the welfare loss estimates presented below.

Using the basic equation for W, five separate estimates of welfare loss are derived for 115 four-digit industry classes in 1967. One estimate, W_1, is for before-tax profits and uses total stock of capital data from the Census of Manufacturers. The estimate for W_2 is identical to W_1 above except it uses total stock of capital data reported in the Enterprise Statistics.[21] The estimate, W_3, is like W_2 except it uses "adjusted" value of shipments. The fourth estimate, W_4, uses after-tax profits and data from the census as a proxy for the stock of capital. Finally, W_5 uses after-tax profits and data reported in the Enterprise Statistics to measure the stock of capital. These welfare loss estimates are summarized in Table XII.

TABLE XII

AGGREGATE WELFARE LOSS ESTIMATES, 1967

Method	Welfare Loss for 115 Industries (Millions of $)	% of VA	Welfare Loss for all Manufacturing (Millions of $)	% of NI
W_1	5483.403	5.34	13,440.986	2.06
W_2	4380.954	4.26	10,738.638	1.64
W_3	4652.951	4.53	11,405.352	1.75
W_4	1688.615	1.64	4,139.151	0.63
W_5	1102.627	1.07	2,702.751	0.41

The before-tax estimates range between $4.7 billion and $5.5 billion which represents between 4.3 and 5.3 per cent of the value-added in the 115 industries. If this per cent of welfare loss were found in the entire manufacturing sector, the annual dollar cost would be between $10.7 and $12.4 billion. These before-tax welfare losses may be compared to those found by Kamerschen.[22] His model that is closest to the before-tax models discussed above is model V; in that model, using price elasticity of demand equal to unity, he finds a welfare loss equal to over four per cent of national income (in 1967 this would be over 26 billion). The before-tax models (W_1, W_2, W_3), give losses of around two per cent of national income. Thus, the before-tax Kamerschen model V estimates losses at around two times the size of values suggested by this data.

The after-tax estimates are presented in Table XII as W_4 and W_5. The after-tax welfare loss estimates range from \$1.1 and \$1.7 billion; this represents from 1 to 1.6 per cent of the value-added in the 115 industries. If this percentage welfare loss were the same for all manufacturing, the 1967 welfare loss would be between \$2.7 and \$4.1 billion. Kamerschen's model I is the one most similar to Models W_4 and W_5; his estimate for the 1956-1961 period is about 1.6 per cent of national income.[23]

Estimates W_4 and W_5 amount to about 0.5 per cent of 1967 national income. These figures compare favorably to those of Scherer,[24] and Worcester.[25] Thus, the aggregate welfare loss estimates generated by this model and using primarily Census data gives values that are consistent with other studies using different techniques and data sources.

The figures in Table XIII are the inter-industry comparisons of the welfare loss for all five measures. The five measures are closely related to one another with the simple correlation coefficients as: $r_{12} = 0.98$, $r_{13} = 0.98$, $r_{14} = 0.90$, $r_{15} = 0.95$, $r_{23} = 0.99$, $r_{24} = 0.83$, $r_{25} = 0.97$, $r_{34} = 0.83$, $r_{35} = 0.96$, and $r_{45} = 0.86$.

TABLE XIII

WELFARE LOSS ESTIMATES BY FOUR-DIGIT INDUSTRY CLASS
FOR 115 SELECTED INDUSTRIES, 1967
(IN MILLIONS OF DOLLARS)

SIC Code	W_1	W_2	W_3	W_4	W_5
2011	13.12	8.21	10.81	4.95	2.15
2013	10.56	6.95	3.86	4.07	1.97
2015	6.09	3.88	4.05	2.31	1.05
2021	1.09	0.61	0.70	0.23	0.04
2022	2.01	1.26	1.40	0.46	0.15
2023	25.08	21.79	19.35	7.88	6.09
2024	15.34	11.25	9.36	4.10	2.13
2026	55.94	42.82	50.75	15.56	9.06
2031	7.43	6.09	7.57	1.74	1.13
2032	52.49	44.44	50.83	12.77	8.96
2033	80.49	64.73	69.66	18.44	11.34
2034	8.85	6.86	6.40	1.94	1.08
2035	15.48	12.80	13.22	3.66	2.43
2036	3.91	3.13	3.29	0.86	0.52
2037	29.22	21.79	22.45	8.07	4.42
2041	16.06	12.90	13.65	4.31	2.75
2042	59.99	50.94	53.94	17.17	12.50
2043	72.23	51.61	57.18	22.49	11.75
2044	4.03	3.42	3.42	1.15	0.84
2045	22.05	19.84	19.84	6.75	5.55
2046	15.42	8.33	9.68	2.58	0.32
2051	93.47	88.58	104.62	23.30	20.90
2052	60.06	57.84	58.45	16.21	15.06
206	18.87	13.12	13.12	2.61	0.80
2071	47.58	44.77	46.19	10.99	9.66
2072	12.94	12.00	11.43	2.82	2.39
2073	28.93	27.87	31.13	7.30	6.77
2082	99.83	91.34	92.28	22.51	18.58
2083	0.38	0.27	0.30	0.02	0.00
2084	19.09	14.54	14.38	5.57	3.25
2085	104.85	22.46	24.59	27.82	0.05
2086	78.65	55.60	58.87	24.30	12.38
2087	114.71	107.68	104.69	43.35	39.06
2091	0.38	0.36	0.40	0.08	0.07
2092	3.20	3.14	3.87	1.39	1.34
2093	1.30	1.29	1.48	0.61	0.59
2094	5.13	5.03	3.96	2.20	2.13
2095	73.09	68.11	68.11	27.46	24.43
2096	13.44	13.27	13.54	6.23	6.11
2098	6.73	5.43	5.43	2.20	1.48
2099	83.43	73.50	73.50	29.74	23.93

TABLE XIII (Continued)

SIC Code	W_1	W_2	W_3	W_4	W_5
2812	9.11	8.64	9.99	0.41	0.31
2813	37.35	36.52	39.56	7.26	6.89
2815	24.04	55.72	53.77	3.61	19.91
2816	21.75	21.40	20.96	5.16	4.98
2818	244.30	239.52	275.77	52.17	49.97
2819	161.80	159.33	182.01	39.76	38.53
2821	68.32	61.99	45.79	11.46	8.95
2822	23.07	21.36	19.70	4.54	3.79
2823	18.97	16.90	22.40	2.70	1.95
2824	67.43	60.48	62.29	10.23	7.64
2831	4.43	0.86	0.62	0.91	0.05
2833	22.20	7.94	5.95	5.23	0.15
2834	729.73	555.07	629.72	213.01	124.13
2841	214.72	183.14	215.80	77.85	59.32
2842	109.42	98.51	101.31	40.67	34.13
2843	5.63	2.70	1.97	1.60	0.28
2844	383.42	332.56	299.40	111.05	84.51
2851	77.96	55.68	59.96	20.42	9.93
2861	5.35	1.93	2.03	1.01	0.00
2871	14.98	14.74	19.00	5.93	5.78
2872	5.22	5.17	6.43	2.43	2.40
2879	36.44	36.31	35.55	19.11	19.01
2891	12.77	8.00	7.73	3.72	1.39
2892	8.23	4.37	11.38	2.24	0.52
2893	6.83	4.34	4.75	2.00	0.77
2895	9.96	3.13	3.13	2.26	0.01
2899	63.38	42.68	41.19	18.98	8.58
3611	33.44	4.73	4.80	7.81	0.66
3612	32.62	1.51	1.58	7.18	3.25
3613	56.69	14.71	15.55	13.86	0.00
3621	48.16	47.41	49.12	10.83	10.47
3622	38.21	37.84	38.95	9.54	9.35
3623	14.34	14.19	16.17	3.54	3.46
3624	7.11	6.83	6.84	0.93	0.82
3629	5.38	3.29	4.36	1.18	1.14
3631	7.64	4.53	3.95	1.94	0.57
3632	26.40	15.12	27.34	6.60	1.74
3633	21.99	14.32	25.10	5.80	2.26
3634	39.20	31.02	32.14	11.26	7.10
3635	20.74	17.16	10.78	6.08	4.22
3636	4.25	1.80	1.90	0.94	0.06
3639	10.53	7.09	6.67	2.82	1.20
3641	61.53	63.24	65.37	16.73	17.62
3642	35.49	36.80	38.01	9.18	9.86
3643	27.55	28.49	30.19	7.24	7.72

TABLE XIII (Continued)

SIC Code	W_1	W_2	W_3	W_4	W_5
3644	16.62	17.34	20.16	4.16	4.52
3651	47.77	17.34	19.69	13.82	0.94
3652	11.99	2.70	2.75	3.32	0.00
3661	44.94	43.64	50.29	14.26	13.49
3662	85.59	83.93	95.97	29.65	28.68
3671	9.44	5.36	6.37	4.91	2.13
3672	32.49	20.38	22.16	17.21	8.77
3673	4.29	1.60	1.63	2.09	0.41
3674	8.06	0.79	0.78	3.39	0.01
3679	72.36	44.09	47.97	38.12	18.55
3691	6.42	2.25	2.25	1.22	0.01
3692	20.29	25.40	14.45	5.13	2.84
3693	7.44	5.13	6.66	1.81	0.78
3694	26.75	13.48	15.30	5.75	0.81
3699	5.87	3.66	2.10	1.37	0.44
3711	247.90	223.32	235.17	67.03	54.56
3713	133.29	9.20	10.90	166.62	19.32
3714	233.18	214.44	212.40	70.79	65.90
3715	5.38	1.36	1.38	1.32	0.00
3721	61.57	63.99	77.31	14.72	15.92
3722	48.39	26.03	28.79	10.08	1.74
3729	53.32	34.99	29.64	12.47	4.60
3731	4.62	3.49	3.73	0.69	0.31
3732	21.98	9.94	12.05	5.42	0.63
3742	1.60	0.91	0.94	0.15	3.38
3751	4.12	2.44	2.79	1.12	0.35
3791	8.48	6.25	6.38	2.50	1.36
3799	3.27	2.19	1.82	0.93	0.40

Table XIV presents the ten industries which have the largest welfare loss by each of the five measures. Depending on the measure used, these ten industries account for between 40 and 53 per cent of the total welfare loss within the 115 industries.[26] The four-digit industries which account for a sizeable portion of the welfare loss are: Pharmaceutical Preparations (2834), Toilet Preparations (2844),

TABLE XIV

INDUSTRIES WITH THE LARGEST WELFARE LOSS

Industry	W_1 Amount (in millions \$)	Industry	W_2 Amount (in millions \$)	Industry	W_3 Amount (in millions \$)	Industry	W_4 Amount (in millions \$)	Industry	W_5 Amount (in millions \$)
2834	729.73	2834	555.07	2834	629.72	2834	213.01	2834	124.13
2844	383.42	2844	332.56	2844	299.40	3713	166.62	2844	84.51
3711	247.90	3818	275.77	2818	275.77	2844	111.05	3714	65.90
2818	239.52	3711	223.32	3711	235.17	2841	77.85	2841	59.33
3714	223.18	3714	214.44	2841	215.80	3714	70.79	3711	54.56
2841	214.72	2841	183.14	3714	212.40	3711	67.03	2818	49.97
2819	161.80	2819	159.33	2819	182.01	2818	52.17	2087	39.07
3713	133.29	2087	107.68	2087	104.69	2087	43.35	2819	38.54
2087	114.71	2842	98.51	2051	104.62	2842	40.67	2842	34.14
2842	109.42	2082	91.35	2842	101.31	2819	39.76	3662	28.68
Total Loss	2557.69		1741.17		2360.89		782.3		578.83
% of Welfare	46.64		39.74		50.74		46.33		52.50

Soaps (2841), Industrial Organic Chemicals, N.E.C. (2818), Motor Vehicles (3711), and Motor Vehicle Parts (3714). These results suggest that sizeable benefits of industry-wide reorganization are concentrated in a relatively few industries. Any policy design to reduce this deadweight loss must also compare these potential benefits to the costs of the policy.

Only one other study has formally looked at inter-industry welfare loss; the study is by Siegfried and Tiemann.[27] Their procedure was identical to that used in this paper. The data source for their study were 124 IRS minor industries which roughly correspond to the three-digit SIC classification. Their estimate of the total welfare loss of monopoly in mining and manufacturing was 0.07 per cent of national income.

Their comparison of welfare loss estimates between the industry groupings found that most of the loss was accounted for in three industries --Plastic materials (SIC 281), Drugs (SIC 283), and Motor Vehicles and Parts (SIC 371). As seen in Table XV, two of the above groups--Drugs and Motor Vehicles--also rank as high sources of welfare loss in this study. Table XV compares the findings of Siegfried-Tiemann with those of the present study. The four-digit SIC code industries are grouped into their appropriate three digit IRS classification. Then, the welfare losses are stated as a per cent of total welfare loss for the industries covered in the Bumpass study. The Bumpass figures give losses that are about five times those of Siegfried-Tiemann (0.07 per cent of national income to 0.41 per cent of national income for W_5). The Spearman rank correlation between the two studies is 0.33 (significant at the five per cent level).

TABLE XV

COMPARISON OF WELFARE LOSS ESTIMATES FOR SIEGFRIED-TIEMANN AND BUMPASS

Industry	SIC Code IRS Code	Per Cent Welfare Loss for Siegfried-Tiemann[a]	 Bumpass[b]
Meat Products	201 2010	0.07	0.47
Dairy Products	202 2020	0.01	1.58
Canned and Frozen Foods	203 2030	0.02	2.71
Grain Mill Products	204 2040	0.10	3.06
Bakery Products	205 2050	0.00	3.26
Sugar	206 2060	0.16	0.07
Confectionary Products	207 2070	0.53	1.71
Malt Liquors and Malt	2082,2083 2082	0.07	1.68
Wines, Brandy, Brandy Spirits	2084 2084	0.01	0.29
Distilled Liquor	2085 2085	0.17	0.00
Bottled Soft Drinks	2086,2087 2086	0.72	4.67
Vegetable and Animal Oils	2091-4, 2096 2091	0.31	0.93
Food and Kindred Products NEC, NA	2095, 2097-9 2098, 2099	1.16	4.52
Basic Chemicals	281 2811	0.03	10.76

TABLE XV (Continued

Industry	SIC Code IRS Code	Per Cent Welfare Loss for Siegfried-Tiemann[a]	Bumpass[b]
Plastic Materials and Synthetics	282 2812	6.96	2.03
Drugs	283 2830	5.59	11.28
Soap	2841-3 2841	0.82	8.50
Toiletries	2844 2842	1.09	7.66
Paints, Gum and Wood Chemical	2851, 2861 2850	0.14	0.90
Agricultural Chemicals	287 2870	0.36	2.47
Chemical Products, MIS	2898, 2899	1.19	1.02
Electrical Transmission and Distribution	361 3611	1.35	0.35
Electrical Industry Apparatus	362 3612	0.07	2.29
Household Appliances	363 3630	0.02	1.56
Radio and TV Receivers	365 3650	0.01	0.09
Communication Equipment	366 3661	1.40	3.82
Electronic Components	367 3662	0.66	2.71
Lighting and Wiring Equipment	364 3691	0.03	3.60
Electrical Machinery, NEC, NA	369 3698, 3699	0.70	0.44

TABLE XV (Continued)

Industry	SIC Code IRS Code	Per Cent Welfare Loss for Siegfried-Tiemann[a]	Bumpass[b]
Motor Vehicles & Parts	3711, 3713, 3714, 3715 3711	75.77	12.68
Aircraft, Complete Missiles	3721 3721	0.08	1.44
Aircraft Parts	3722-3, 3729 3722	0.04	0.58
Ship and Boat Building	373 3730	0.25	0.12
Railroad Equipment	374 3791	0.08	0.36
Transportation Equipment NEC	3751, 379 3798	0.03	0.19

[a]John J. Siegfried and Thomas K. Tiemann, "The Welfare Cost of Monopoly: An Inter-Industry Approach," Economic Inquiry (June, 1974).

[b]Figures are for Bumpass estimate W_5.

A study by the Federal Trade Commission reported by Paul Scanlon in 1972 examined welfare loss by four-digit industry classes for 1967.[28] The study first estimated the monopoly margin which was equal to industry profits minus the opportunity cost of capital expressed as a percentage of company sales. The opportunity cost of capital was chosen to be five per cent of stockholders equity (after-taxes). In addition, estimates were made regarding probable inefficiencies in these industries. These two estimates, the monopoly margin and probable inefficiencies, were combined into an adjusted profit margin; the adjusted profit margin is the difference between the actual and the competitive price. These adjusted profit margins are then used in the traditional welfare loss formula to generate estimates for individual four-digit industries.

An error is made in the article in calculating these estimates. Welfare loss (W) equals one-half the square of the adjusted profit margin $(t)^2$, times value of shipments (s), times elasticity of demand (n), or $W = 1/2\ (t)^2\ S(n)$. The welfare loss estimates are made, however, "by simply multiplying the Federal Trade Commission percentage estimate of the monopoly margin times the industry's sales Volume" (p. 22). Clearly, the correct calculation is the square of the margin times the sales volume. These figures are given in column 2 of Table XVI.

Finally, it is useful to determine the relationship between the five measures of welfare loss and seller concentration (CR). Seller concentration is the proxy frequently used to determine the presence or absence of monopoly. Because of this emphasis on CR a test of the correlation between the two provides a simple test of the former's efficacy in estimating the latter. The model investigated is

$$W = a + b\ CR$$

where

W = welfare loss estimate and

CR = four-firm concentration ratio.

TABLE XVI

COMPARISON WELFARE LOSS ESTIMATES FOR FTC AND BUMPASS
(IN MILLIONS OF DOLLARS)

SIC Code	FTC	BUMPASS
3711	226.57	54.56
3714	46.92	65.90
2011	14.99	2.15
2834	30.38	124.13
2818	19.79	38.53
2819	17.31	38.53
2026	8.39	9.06
2086	17.10	12.38
2042	8.47	12.50
2082	13.25	18.58
2051	7.21	20.90
2821	9.57	8.95
2841	11.99	59.32
3731	10.21	0.31
2844	9.52	84.51
2033	6.00	11.34
2851	6.85	9.93
3621	5.81	10.47
3613	7.12	0.00
2071	4.85	9.66
2041	3.24	2.75
2085	5.86	0.05
2037	3.50	4.42
3612	5.75	3.25
3642	3.92	9.86
2062	3.79	0.80
2823	5.63	1.95
2032	3.83	8.96
3611	3.26	0.66
3791	2.66	1.36
2052	2.58	15.06
3641	3.25	17.62
2812	2.89	0.31
3721	1.93	15.92
3713	1.23	19.32
3671	1.80	2.12
3673	1.47	0.41
2831	0.04	0.05
Total	538.93	707.98

The results (shown in Table XVII) indicate that for these 115 industries the four-firm concentration ratio is not a useful indicator of welfare loss. This contrasts with Kamershen's findings of a simple correlation between welfare loss and CR of 0.56. Kamershen's study used data aggregated at the two-digit SIC level, while the present study utilizes four-digit data.

TABLE XVII

RELATIONSHIP BETWEEN WELFARE LOSS AND SELLER CONCENTRATION

Dependent Variable	CR	Intercept	R^2
W_1	-0.195 (0.54)	57.08	0.00
W_2	-0.095 (0.32)	42.67	0.00
W_3	-0.81 (0.25)	44.36	0.00
W_4	-0.124 (1.02)	20.68	0.01
W_5	-0.026 (0.35)	10.85	0.00

Summary

Estimates of welfare loss in 115 U. S. manufacturing industries have been presented in this section. Welfare loss (before-taxes) for these industries was between \$4.4 billion and \$5.5 billion; welfare loss (after-taxes) was between \$1.1 billion and \$1.7 billion. These aggregate welfare loss values were similar to those of earlier authors using different data sources. Around one-half of this welfare loss was centered in only ten of the 115 industries. Thus, the aggregate welfare loss value is outside the "steak-dinner range" (\$67 per person using W_1 measure and \$21 per person using W_5), and the great bulk of this loss is accounted for by a relatively few industries. For antitrust policy, these welfare loss values may be viewed as potential benefits from a reduction in monopoly power. These potential benefits must be compared to the costs of the antitrust policy.

FOOTNOTES

[1]Arnold C. Harberger, "Monopoly and Resource Allocation," American Economic Review, 44 (May, 1954), pp. 77-87.

[2]George J. Stigler, "The Statistics of Monopoly and Merger," Journal of Political Economy, 64 (February, 1954), p. 34.

[3]Ibid., pp. 34-35. Stigler observed that ". . . it is not possible to form any good estimate of the probable force of this criticism . . ."

[4]David Schwartzman, "The Burden of Monopoly," Journal of Political Economy, 68 (December, 1960), 627-630.

[5]Ibid., pp. 629-630.

[6]David R. Kamerschen, "An Estimation of the 'Welfare Losses' From Monopoly in the American Economy," Western Economic Journal, 4 (Summer, 1966), pp. 221=236.

[7]William G. Shepherd, Market Power and Economic Welfare, (New York, 1970), pp. 197-198.

[8]Ibid., p. 198.

[9]F. M. Scherer, Industrial Market Structure and Economic Performance (Chicago, 1971), p. 408.

[10]Ibid., p. 408.

[11]Frederick W. Bell, "The Effect of Monopoly Profits and Wages on Prices and Consumers' Surplus in U. S. Manufacturing," Western Economic Journal, 6 (June, 1968), pp. 233-241.

[12]Dean Worcester, "Now Estimates of the Welfare Loss to Monopoly, United States: 1956-1969," Southern Economic Journal, 40 (October, 1973), pp. 234-245.

[13]Ibid., pp. 240-244.

[14]Kamerschen, p. 229.

[15]John J. Siegfried, "Effective Average U. S. Corporation Income Tax Rates," National Tax Journal, 27 (June, 1974), pp. 245-260.

[16]Kamerschen, pp. 228-229.

[17]This is not the same as assuming that the marginal utility of money is constant. The latter assumption has been criticized by Samuelson (P. A. Samuelson, "Constancy of the Marginal Utility of Income," Studies in Mathematical Economics and Econometrics, Oscar Lange, editor (Chicago, 1942), pp. 75-91) and shown to be unnecessary by Winch (David M. Winch, "Consumer's Surplys and Compensation Principles," American Economic Review, 55 (June, 1965), pp. 395-423.

[18]L. W. McKenzie, "Ideal Output and the Interdependence of Firms," Economic Journal, 61 (December, 1951), pp. 795-803.

[19]Michael Klass, "Inter-Industry Relations and the Impact of Monopoly" (unpublished Ph.D. dissertation, University of Wisconsin, 1970.)

[20]Scherer, pp. 403-404.

[21]U. S. Bureau of the Census, Enterprise Statistics: 1967. Washington: Government Printing Office, 1971. The values on the total stock of capital were 1.6 times greater in the Enterprise Statistics than reported in the Census of Manufacturers. The simple correlation coefficient between the two measures is 0.79.

[22]Kamerschen, p. 231. This study uses average data from the IRS over the period 1956-1961 for corporations, partnerships, and sole proprietorships.

[23]Ibid., p. 230.

[24]Scherer, p. 408.

[25]Worcester, p. 240.

[26]The omission of the intangible assets of each of the industries will bias the welfare loss estimates. This bias will be most important in industries that are in research and development, and advertising intensive. See Douglas L. Cocks, "Comment on the Welfare Cost of Monopoly: An Inter-Industry Analysis," Economic Inquiry (forthcoming) for an attempt to measure the size of this bias for the pharmaceutical industry.

[27]John J. Siegfried and Thomas K. Tiemann, "The Welfare Cost of Monopoly," Economic Inquiry, 12 (June, 1974), pp. 190-202.

[28]Paul D. Scanlon, "FTC and Phase II: The McGovern Papers," Antitrust Law and Economics Review, 5 (Spring, 1972), pp. 19-36.

CHAPTER VI

SUMMARY AND CONCLUSION

This study has provided evidence concerning the structure-performance hypothesis. Some features of the statistical evidence from the models are as follows:

1. The structure-performance model receives its strongest support for the Food and Kindred Products group (SIC 20). The relationship between seller concentration and price-cost margins is strongest for this group of industires.

2. The adjusted price-cost margin generates superior results in almost all models tested. Two separate measures of capital intensity were considered. One measure, using the ratio of total assets to output (TAO), provided consistently better results than did the commonly used ratio of gross book value to output (KO).

3. The significance of the minimum efficient size plant (MES) variable received strong support in two groups, Food and Kindred Products (SIC 20) and Transportation Equipment (SIC 37). In Chemicals and Allied Products (SIC 28) the sign of MES was opposite to the *a priori* expectation.

4. Product differentiation (PRD) receives strong empirical support in two of the two-digit subgroups, SIC 20 and SIC 28 with the sign of the regression coefficient consistent with the theoretical expectation.

5. The signs of the regression coefficient for growth in demand variable are, in general, positive; this is in accord with the hypothesized relationship. In less than one-fourth of the cases is the estimated coefficient significantly different from zero. The evidence in this study fails to support the view that there is a differential affect of growth on price-cost margins in oligopolistic industries.

6. The import competition variable (I) generates the expected relationship for SIC 20 and SIC 28. The sign for I in SIC 36, 37 and for the producer subgroup in SIC 28 was opposite the expected relationship. Two explanations for this result are (1) a disequilibrium situation is being observed and/or (2) the imports are made up of component parts which are used as inputs for final processing. Either of these cases would give a positive relationship between price-cost margin and import competition.

7. The geographic market index variable (GM) is not significant in any of the models examined.

Welfare losses due to monopoly were also calculated for 115 manufacturing industries. This study is one of the first to present welfare loss estimates by four-digit SIC classification. The major results from the welfare loss section are:

8. The aggregate welfare loss for the industires examined ranges between \$5.5 billion for the before-tax estimate and \$1.1 billion for the after-tax estimate. Extrapolated to the economy as a whole, this amounts to between two per cent and 0.4 per cent of 1967 national income.

9. While the after-tax aggregate welfare loss is relatively low, representing about two months real growth, the distribution of this loss is concentrated in a relatively few industries. Specifically, just 10 of the four-digit industries account for almost one-half of the total welfare loss due to monopoly.

10. A final finding of the paper is that the simple correlation between monopoly welfare loss and seller concentration is extremely low. This suggests that seller concentration alone is a poor proxy for monopoly profit.

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APPENDIXES

APPENDIX A

STANDARD INDUSTRIAL CLASSIFICATION AND INDUSTRY NAMES

SIC Code	Industry Name
2001	Meatpacking Plants
2002	Sausages and other Prepared Meats
2015	Poultry Dressing Plants
2021	Creamery Butter
2022	Cheese, Natural Processed
2023	Condensed and Evaporated Milk
2024	Ice Cream and Frozen Desserts
2031	Canned and Cured Seafoods
2032	Canned Specialities
2033	Canned Fruits and Vegetables
2034	Dehydrated Food Products
2035	Pickles, Sauces, and Salad Dressings
2036	Fresh or Frozen Packaged Fish
2037	Frozen Fruits and Vegetables
2041	Flour and Other Grain Mill Products
2042	Prepared Feeds for Animals and Fowls
2043	Cereal Preparations
2044	Rice Milling
2045	Blended and Prepared Flour
2046	Wet Corn Milling
2051	Bread, Cake, and Related Products
2052	Cookies and Crackers
206	Sugar
2071	Confectionery Products
2072	Chocolate and Cocoa Products
2073	Chewing Gum
2082	Malt Liquors
2083	Malt
2084	Wines, Brandy, and Brandy Spirits
2085	Distilled Liquor, Except Brandy
2086	Bottled and Canned Soft Drinks
2087	Flavoring Extracts and Syrups, Nec
2091	Cottonseed Oil Mills
2092	Soybean Oil Mills
2093	Vegetable Oil Mills, Nec
2094	Animal and Marine Fats and Oils
2095	Roasted Coffee
2096	Shortening and Cooking Oils
2097	Manufactured Ice
2098	Macaroni and Spaghetti
2099	Food Preprarations, Nec.

SIC Code	Industry Name
2812	Alkalies and Chlorine
2813	Industrial Gases
2815	Cyclic Intermediates and Crudes
2816	Inorganic Pigments
2818	Industrial Organic Chemicals, Nec
2819	Industrial Inorganic Chemicals, Nec
2821	Plastics Materials and Resins
2822	Synthetic Rubber
2823	Cellulosic Manmade Fibers
2824	Organic Fibers, Noncellulosic
2841	Soap and other Detergents
2842	Polishes and Sanitation Goods
2843	Surface Active Agents
2844	Toilet Preparations
2851	Paints and Allied Products
2861	Gum and Wood Chemicals
2871	Fertilizers
2872	Fertilizers, Mixing only
2879	Agricultural Chemicals, Nec
2891	Adhesives and Gelatin
2892	Explosives
2893	Printing Ink
2895	Carbon Black
2899	Chemical Preparations, Nec
3611	Electric Measuring Instruments
3612	Transformers
3613	Switchgear and Switchboard Apparatus
3621	Motors and Generators
3622	Industrial Controls
3623	Welding Apparatus
3624	Carbon and Graphite Products
3629	Electrical Industrial Apparatus, Nec
3631	Household Cooking Equipment
3632	Household Refrigerators and Freezers
3633	Household Laundry Equipment
3634	Electric Housewares and Fans
3635	Household Vacuum Cleaners
3636	Sewing Machines
3639	Household Appliances, Nec

SIC Code	Industry Name
3641	Electric Lamps
3642	Lighting Fixtures
3643	Current-Carrying Wiring Devices
3651	Radio and TV Receiving Sets
3652	Phonograph Records
3661	Telephone and Telegraph Apparatus
3662	Radio and TV Communications Equipment
3671	Electron Tubes, Receiving Type
3672	Cathode Ray Picture Tubes
3673	Electron Tubes, Transmitting
3674	Semiconductors
3679	Electronic Components, Nec
3691	Storage Batteries
3692	Primary Batteries, Dry and Wet
3693	X-ray Apparatus and Tubes
3694	Engine Electrical Equipment
3699	Electrical Equipment, Nec
3711	Motor Vehicles
3714	Motor Vehicle Parts and Accessories
3713	Truck and Bus Bodies
3715	Truck Trailers
3721	Aircraft
3722	Aircraft Engines and Engine Parts
3729	Aircraft Equipment, Nec
3731	Ship Building and Repairing
3732	Boat Building and Repairing
3741	Locomotives and Parts
3742	Railroad and Street Cars
3751	Motocycles, Bicycles, and Parts
3791	Trailer Coaches
3799	Transportation Equipment, Nec

APPENDIX B

DEFINITION AND SOURCES OF INDEPENDENT AND DEPENDENT VARIABLES

The variables used in the regression model and the sources of the data are listed below:

PM = Price-cost margin expressed in per cent. Source: U. S. Bureau of the Census. Census of Manufacturers, 1967. Washington, D.C.: Government Printing Office, 1971.

PM_{adj} = Adjusted price-cost margin expressed in per cent. Source: U. S. Bureau of the Census. Census of Manufacturers, 1967. Washington, D.C.: Government Printing Office, 1971.

CR = Four-firm seller concentration ratio expressed in per cent. Source: U. S. Bureau of the Census. Census of Manufacturers, 1967. Washington, D.C.: Government Printing Office, 1971, Chapter 9.

D = Rate of growth in industry expressed in per cent. Source: U. S. Bureau of the Census. Census of Manufacturers, 1967. Washington, D.C.: Government Printing Office, 1971, Chapter 1.

MES1 = Smallest establishment size class which increased its share of value-added by 1 per cent or more between 1963 and 1967 expressed as a per cent of total industry sales. Source: U. S. Bureau of the Census. Census of Manufacturers, 1967. Washington, D.C.: Government Printing Office, 1971.

MES2 = Output of the average size plant, for the largest employment-size category, expressed as a per cent of total industry sales. Source: U. S. Bureau of the Census. Census of Manufacturers, 1967. Washington, D.C.: Government Printing Office, 1971.

MES3 = Output of the average size plant, among the largest plants which account for 50 per cent of industry output, expressed as a per cent of total industry sales. Source: U. S. Bureau of the Census, Census of Manufacturers, 1967. Washington, D.C.: Government Printing Office, 1971.

PRD = Industry advertising to industry sales ratio expressed in per cent for SIC 20. Source: Gary A. Marple and Harry B. Wissman, editors, Grocery Manufacturing in the United States (New York, 1968), p. 590. For industries outside SIC 20 (and for SIC 20 in the models examining all 115 industries) a dummy product differentiation variable is used with produce goods industries = 0 and consumer goods industries = 1. Source: Board of Governors of the Federal Reserve System. Industrial Production 1971 Edition. Washington, D.C.: Publications Services, 1972, pp. 5-14.

GM = Geographic market index. It is defined as the radius within which 80 per cent of the total tonnage of a four-digit industry is shipped. Source: Leonard W. Weiss, "The Geographic Size of Markets in Manufacturing," Review of Economics and Statistics, 54 (February, 1972), pp. 255-257.

I = Import competition dummy variable. When imports are greater than 1 per cent of total industry sales, I = 1; when imports are less than 1 per cent of total industry sales, I = 0. Source: U. S. Bureau of the Census, U. S. Commodity Exports and Imports as Related to Output, 1968 and 1967. Washington, D.C.: Government Printing Office, 1971.

KO = Capital to output ratio expressed in per cent. Source: U. S. Bureau of the Census, U. S. Census of Manufacturers, 1967. Washington, D.C.: Government Printing Office, 1971.

TAO = Total asset to output ratio expressed in per cent. Source: U. S. Bureau of Census. Enterprise Statistics: 1967. Washington, D.C.: Government Printing Office, 1973.

APPENDIX C

SIMPLE CORRELATION COEFFICIENTS

CORRELATION MATRIX OF THE MAIN VARIABLES, SIC 20, 1967

	PM	PM_{adj}	CR	D	PRD	MES1	MES2	MES3	I	KO	TAO	GM
PM	1.0	.984	.606	.153	.663	.373	.566	.531	-.006	.307	.490	-.095
PM_{adj}		1.0	.641	.137	.691	.396	.591	.574	.017	.317	.519	-.083
CR			1.0	-.074	.391	.498	.734	.743	.131	.160	.202	-.173
D				1.0	.221	.059	-.042	-.006	-.302	-.237	-.034	.120
PRD					1.0	.312	.471	.357	-.159	.021	.042	.036
MES1						1.0	.648	.739	-.083	.295	.184	-.098
MES2							1.0	.867	.030	.208	.173	.039
MES3								1.0	.035	.289	.283	.013
I									1.0	.034	.292	.519
KO										1.0	.522	-.090
TAO											1.0	.053
GM												1.0

CORRELATION MATRIX OF THE MAIN VARIABLE, SIC 28, 1967

	PM	PM_{adj}	CR	D	PRD	MES1	MES2	MES3	I	KO	TAO	GM
PM	1.0	0.79	0.11	-0.15	0.46	-0.17	-0.09	-0.19	-0.34	0.10	0.23	0.06
PM_{adj}		1.0	0.25	0.07	0.23	-0.27	-0.03	0.02	0.21	0.09	0.09	-0.04
CR			1.0	-0.08	-0.12	0.01	0.56	0.65	0.15	0.49	0.47	0.17
D				1.0	0.23	-0.08	0.26	0.32	0.12	-0.34	-0.15	-0.20
PRD					1.0	0.11	0.03	-0.09	-0.42	-0.43	0.06	0.00
MES1						1.0	-0.08	0.00	-0.02	-0.10	0.24	0.11
MES2							1.0	0.83	0.32	0.11	0.23	0.10
MES3								1.0	0.25	0.18	0.22	0.18
I									1.0	0.22	-0.11	0.14
KO										1.0	0.52	0.11
TAO											1.0	0.09
GM												1.0

CORRELATION MATRIX OF THE MAIN VARIABLES, SIC 36, 1967

	PM	PM_{adj}	CR	D	PRD	MESI	MES2	MES3	I	KO	TAO	GM
PM	1.0	0.87	0.48	0.16	-0.05	0.44	0.39	0.37	0.18	0.15	0.08	-0.09
PM_{adj}		1.0	0.56	0.15	0.03	0.51	0.51	0.52	0.18	0.11	0.04	-0.02
CR			1.0	0.04	0.18	0.53	0.49	0.60	0.33	0.43	0.26	-0.30
D				1.0	0.26	0.26	0.05	0.04	0.04	0.06	0.11	0.11
PRD					1.0	0.12	0.37	0.42	-0.03	-0.20	0.11	0.10
MES1						1.0	0.54	0.60	0.05	0.12	0.01	-0.01
MES2							1.0	0.93	0.01	0.16	0.19	0.16
MES3								1.0	0.16	0.16	0.12	0.10
I									1.0	0.15	0.30	-0.19
KO										1.0	0.31	-0.03
TAO											1.0	0.20
GM												1.0

CORRELATION MATRIX OF THE MAIN VARIABLES, SIC 37, 1967

	PM	PM_{adj}	CR	D	PRD	MES1	MES2	MES3	I	KO	TAO	GM
PM	1.0	0.94	0.33	-0.16	0.01	0.08	0.66	0.64	0.27	0.06	0.12	0.54
PM_{adj}		1.0	0.48	-0.13	-0.08	0.17	0.78	0.77	0.10	0.15	0.24	0.45
CR			1.0	-0.38	-0.24	0.25	0.55	0.62	-0.12	-0.29	-0.19	0.50
D				1.0	0.38	0.05	0.04	0.04	-0.37	-0.08	-0.12	-0.55
PRD					1.0	0.29	-0.13	-0.22	0.15	0.21	-0.32	-0.13
MES1						1.0	0.29	0.13	0.21	0.15	-0.16	0.21
MES2							1.0	0.97	0.04	0.11	0.13	0.29
MES3								1.0	0.04	0.14	0.10	0.43
I									1.0	0.26	0.19	-0.06
KO										1.0	0.93	-0.35
TAO											1.0	-0.37
GM												1.0

VITA

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