

A STUDY OF INDIRECT COSTS IMPOSED BY
REQUIREMENTS FOR SUPPLEMENTAL
INFORMATION DISCLOSURE

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INFORMATION DISCLOSURE

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CHAPTER I

INTRODUCTION

Background

Policy making bodies, such as the Securities and Exchange Commission (SEC) and the Financial Accounting Standards Board (FASB) have the authority to require firms to supply supplemental information along with traditional historical cost financial statements prepared in accordance with generally accepted accounting principles (GAAP). Presumably supplemental information is required because the policy making bodies believe the information to be useful to users of the financial statements. Firms complying with supplemental information requirements must allocate resources to generate, compile, and report the additional data. Some firms may pass on the additional costs of supplying such information to consumers by increasing the selling price for their goods and services.¹ The consumer group is comprised of both users and nonusers of financial statements; therefore, to the extent that the costs of producing and disclosing additional information are passed on to consumers, such costs are borne by both users and nonusers of financial statements. Furthermore, the increased price for the product may not be the only additional cost that may be imposed on society. Less visible indirect costs, referred to in the economic literature as externalities, may be imposed.

They [externalities] are costs or benefits felt by persons who were 'external' to a decision, and not counted carefully as an influence in the decision maker's choice, in part because they are not weighed, measured, bought, sold, exchanged, or negotiated routinely in markets.²

These indirect costs are ignored primarily because of the difficulty in converting nonquantitative factors into monetary values. An example of such an indirect cost is the reduction in the quantity of a product consumed by a consumer because of a price increase. If the price of a product increases, the consumer having a fixed income has at least three alternatives: (1) decrease the quantity of the product consumed such that the total price paid for the product after the increase equals the total price paid before the increase; (2) seek a less expensive substitute; or (3) do without the product or its substitute altogether. All the alternatives result in a decrease in the consumption of the primary product.

Information evaluation models³ that could be used to determine the net benefits of the supplemental information typically consider only the difference between the costs incurred to supply the information and the estimated net future benefits that may accrue to the users of the information. Indirect costs to society associated with the production of such information are not considered. Demski observed that questions concerning the impact of costs for processing accounting information on individual consumption decisions have not been addressed, and he concluded that the question of resource allocation and social choice appeared to underlie the choice among reporting alternatives.⁴

Should a decision be made to require the disclosure of supplemental information based on an incorrect estimation of costs and benefits (incorrect in the sense that the less visible indirect costs on society

were not included), the implementation might result in a misallocation of resources. If the indirect costs associated with the production of supplemental information are significant, they should be considered in the information evaluation model. On the other hand, if the indirect costs are insignificant, then the implication might be that indirect costs need not be considered in the evaluation of the net benefits of supplemental information.

At the present time there is little, if any, theory in the accounting literature pertaining to the less visible indirect costs of complying with requirements for supplemental information. However, in a situation where a compliance group could be compared with a noncompliance group, it appears that the economic theories pertaining to externalities could be utilized to gain insight into the significance of the less visible indirect costs. Further, the SEC requirement for disclosure of replacement cost data appears to present such an opportunity.

Replacement Cost Disclosure

Since the beginning of the current inflationary period in the United States, concern has been expressed as to the adequacy of historical cost financial statements prepared in accordance with GAAP. Studies conducted by the American Institute of Certified Public Accountants,⁵ the American Accounting Association,⁶ the Accounting Principles Board,⁷ and the Financial Accounting Standards Board,⁸ as well as the writings of Bell,⁹ Staubus,¹⁰ Sprouse and Moonitz,¹¹ and Chambers,¹² have recommended some form of measurement change or supplemental information be supplied to account for inflation. Generally these studies emphasize the relevance and usefulness of the information.

Normative studies, such as the above, led to empirical research pertaining to the usefulness of supplemental information or changes in the measurement concepts. Estes,¹³ Brenner,¹⁴ Peterson,¹⁵ Benston and Krasney,¹⁶ and Ketz¹⁷ concluded users of financial statements perceived supplemental information to be useful only when such information was accompanied by historical cost statements. Heintz¹⁸ found no support for requiring presentation of price level restatements. An important question not answered was whether the supplemental information was of sufficient value to warrant the costs of gathering, reporting, and distributing the information.

In 1969, the Accounting Principles Board issued Statement No. 3 which suggested, but did not require, the disclosure of supplemental information concerning general price level adjustments. Dissatisfied with the lack of voluntary compliance and recognizing a need for additional information regarding the effects of inflation, the SEC issued Accounting Series Release No. 190.¹⁹ This release required SEC reporting companies with inventories and gross properties of over \$100 million which constituted more than 10 percent of the firm's total assets, to include, along with their traditional historical cost statements, supplemental information concerning replacement costs of certain assets.

The FASB continued to study the problem until 1979 when it released Statement No. 33, "Financial Reporting and Changing Prices."²⁰ This statement requires certain large companies to include, with their historical cost statements, information concerning general price level adjustments (GPLA) and current value (CV).

Since generally the same companies required by ASR 190 to submit replacement cost information were required by Statement No. 33 to submit

GPLA and CV information, the SEC rescinded its replacement cost requirement until the FASB has time to evaluate GPLA and CV reporting.

Both the SEC and the FASB recognized that reporting firms incur additional costs in preparing supplemental information; however, both believed the net benefits to the users of the financial statements outweigh such costs.²¹ The SEC noted that there could be an impact on competition if costs to prepare supplemental information were passed on to consumers in the form of higher prices, but it stated that the impact should not significantly burden the ability of the larger reporting companies to compete with smaller firms which did not meet the criteria for reporting replacement costs.²²

Purpose of the Study

The general goal of this study is to provide a step toward a theory of the determination of the indirect costs of complying with regulations imposed by policy making bodies. Specifically, the purpose of this study is to assess the significance of one component of the indirect costs that may have been incurred due to the SEC requirement for the supplemental disclosure of replacement cost data in historical cost financial statements.

This component is the welfare loss that may have been imposed on consumers who reduced consumption of a product due to an increase in price by producers who perceived the cost of compliance with ASR 190 as an increase in the marginal cost of production. An economic model for measuring deadweight welfare loss due to monopoly power to set price is adapted to assess the significance of the component.

The supplemental disclosure of replacement cost information is used in this study as a basis for assessing the significance of the

indirect cost component for two reasons. First, required disclosure of replacement cost data was limited to approximately 1,000 firms.²³ Since only a limited number of firms were required to make replacement cost disclosure, changes in the deadweight welfare loss due to the monopoly power to set price can be compared between firms which were required to make such disclosures and those which were not. This comparison provides a basis for determining whether the welfare loss increased as a result of increased information disclosure rather than as a result of some other market phenomenon which affected all firms. Second, since replacement cost data are not routinely maintained in the accounting records, the cost of obtaining and disclosing such information is likely to be high. If the incremental costs of increased disclosure are high, there is a greater probability that resources would be diverted from the production of goods to the production of information. If the production of goods is decreased, the deadweight welfare loss may be increased and the larger the increase in the deadweight welfare loss, the greater the likelihood that a change can be evaluated.

The purpose of this study is not to undertake the measurement of the indirect costs. Rather, it merely looks for evidence of an increase in the deadweight welfare loss data. If such an increase is found, further research might be directed toward the actual measurement of the indirect costs.

Organization of the Study

The material in this study is arranged in five chapters. Chapter II is concerned with developing the model used in this study. A rudimentary review of neoclassical economic price theory to explain the

theory behind the economic model is included along with a discussion of the assumptions necessary to implement the model. Chapter III is concerned with the application of the model developed in Chapter II. Sample selection and the a priori hypotheses to be tested are discussed. Chapter IV discusses the findings of the study and presents some a posteriori test results. Finally, Chapter V summarizes the study, discusses the conclusions to be drawn and the implications for future research.

ENDNOTES

¹This statement is in conflict with neoclassical price theory which states firms set price where marginal cost equals marginal revenue in order to maximize profits. In practice price is not always set to maximize profits. Although the purpose of this dissertation is not to examine price setting, a subsequent discussion will briefly review monopoly, oligopoly, and pure competition price theory.

²Roger Sherman, The Economics of Industry (Boston, 1974), p. 297.

³The literature on information evaluation is extensive. Some suggested readings are Joel S. Demski, Information Analysis (Reading, Mass., 1972), Gerald A. Feltham, "Information Evaluation," Studies in Accounting Research No. 5 (AAA, 1972), and Gerald A. Feltham and Joel S. Demski, "The Use of Models in Information Evaluation," The Accounting Review, 45 (October, 1970), pp. 623-638.

⁴Joel S. Demski, "Choice Among Financial Reporting Alternatives," The Accounting Review, 49 (April, 1974), p. 222.

⁵American Institute of Certified Public Accountants, "Reporting the Financial Effects of Price-Level Changes," Accounting Research Study No. 6, (New York, N.Y., 1963).

⁶American Accounting Association, A Statement of Basic Accounting Theory (Evanston, Ill., 1966).

⁷Accounting Principles Board, "Financial Statements Restated for General Price-Level Changes," Professional Standards Volume 3 (1979), (Stanford, Conn.), pp. 7491-7593.

⁸Financial Accounting Standards Board, "Financial Reporting and Changing Prices," Statement of Financial Accounting Standards No. 33 (1979).

⁹Phillip W. Bell, "On Current Replacement Costs and Business Income," Asset Valuation [Robert R. Sterling, ed.] (Lawrence, Kansas, 1971), pp. 19-41.

¹⁰G. J. Staubus, "The Relevance of Evidence of Cash Flows," Asset Valuation [R. Sterling, ed.] (Lawrence, Kansas, 1971), pp. 42-69.

¹¹R. T. Sprouse and M. Moonitz, "A Tentative Set of Board Accounting Principles for Business Enterprises," Accounting Research Study No. 3 (New York, N.Y., 1962).

¹²R. J. Chambers, Accounting, Evaluation, and Economic Behavior (Englewood Cliffs, N.J., 1966).

¹³Ralph W. Estes, "An Assessment of the Usefulness of Current Cost and Price-Level Information by Financial Statement Users," Journal of Accounting Research, 6 (Autumn, 1966), pp. 200-207.

¹⁴Vincent C. Brenner, "Financial Statement Users' Views of the Desirability of Reporting Current Cost Information," Journal of Accounting Research, 8 (Autumn, 1970), pp. 159-166.

¹⁵Russel J. Peterson, "A Portfolio Analysis of General Price-Level Restatement," The Accounting Review, 53 (July, 1975), pp. 525-532.

¹⁶George J. Benston and Melvin A. Krasney, "DAAM: The Demand for Alternative Accounting Measurements," Journal of Accounting Research, 16 (Supplement, 1978), pp. 1-30.

¹⁷J. Edward Ketz, "The Effect of General Price-Level Adjustments on the Predictive Ability of Financial Ratios," Journal of Accounting Research, 16 (Supplement, 1978), pp. 278-290.

¹⁸James A. Heintz, "Price Level Restated Financial Statements and Investment Decision Making," The Accounting Review, 48 (October, 1973), pp. 679-689.

¹⁹Securities Exchange Commission, "Notice of Adoption of Amendments to Regulation S-X Requiring Disclosure of Certain Replacement Cost Data," Accounting Series Release No. 190 (Washington, March 23, 1976).

²⁰See footnote 8.

²¹SEC, p. 456 and FASB, p. 52.

²²SEC, p. 458.

²³Arthur Young & Co., Disclosing Replacement-Cost Data (New York, N.Y., 1977).

CHAPTER II

SOCIAL WELFARE LOSS MODEL

In this chapter a rudimentary review of price theory is presented as a foundation for the concept of consumer's surplus used in the development of the welfare loss model. The assumptions necessary to implement the model, modifications of the model, and the surrogates to be used for the economic values are discussed.

Price Theory

Economic price theory¹ examines the way various forms of market organizations work within the framework of consumer and seller behavior. The perfect competition and pure monopoly models are based on exacting conditions which are not usually found in the actual markets. Nevertheless, these models provide a useful framework with which actual market operations may be evaluated.

Perfect Competition

Perfect competition is an economic model of a market possessing the following characteristics: each economic agent acts as if prices are given, that is, each acts as a price taker; the product is homogeneous; there is free mobility of all resources, including free entry and exit of business firms; and all economic agents in the market possess complete and perfect knowledge.²

The fixed price for the good in the market is represented by P_c in Figure 1. The industry market demand curve, DD' , is an aggregate of

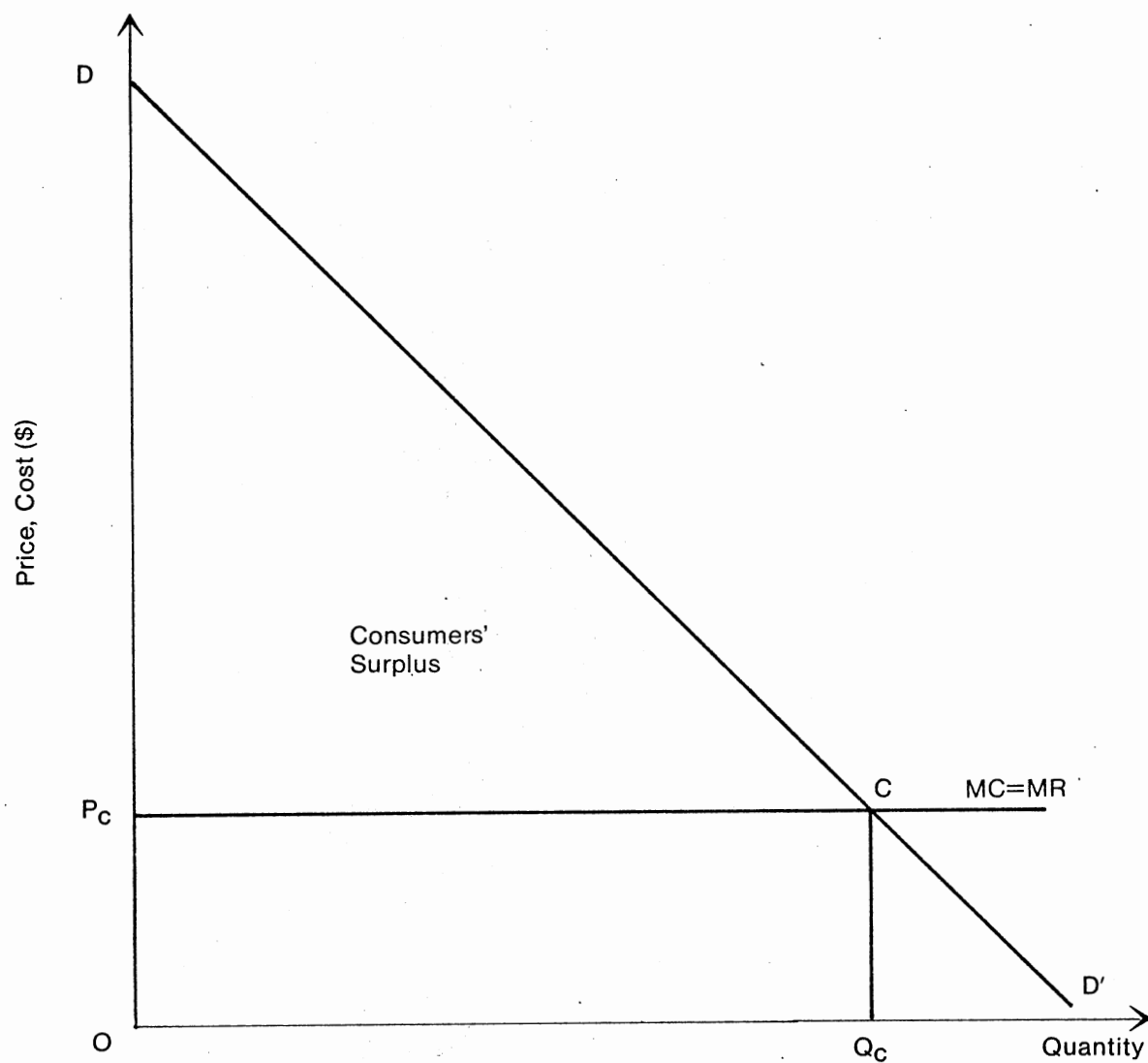


Figure 1. Perfect Competition

individual consumer demand curves and is assumed to be negatively sloped.³ Quantity produced is a function of price:

$$Q = f(P).$$

In order to maximize profit, each firm increases production until marginal cost equals marginal revenue. Under perfect competition, marginal revenue equals price which in turn equals marginal cost; thus,

$$\frac{dP}{dQ} = 0.$$

In Figure 1, profit maximization occurs when Q_c goods are produced and sold for price P_c . The quantity consumers are willing to purchase at P_c is Q_c . At this point, C, the market is in equilibrium. Consumers actually pay OP_cCQ_c for the product. However, they would be willing to pay $ODCQ_c$ rather than do without the product. The difference between $ODCQ_c$ and OP_cCQ_c , or P_cDC , is called consumers' surplus.

The concept of consumers' surplus, first mentioned in the economic literature by Dupuit,⁴ was popularized by Marshall in his Principles of Economics.⁵ A consumer purchases a good to maximize satisfaction derived from the good, subject to the constraint of the consumer's money income (budget). Marshall defines consumers' surplus as the excess of the price a consumer would be willing to pay for a good rather than go without it, over the price which the consumer actually does pay.⁶ "The theory of consumer behavior and demand is based on the assumption that consumers attempt to allocate limited money income among available goods and services so as to maximize satisfaction."⁷ Consumers' surplus is not precisely measurable because consumers' tastes, preferences, and income levels differ widely; however, the theory can be used to argue that consumers gain or lose benefits with the fluctuations in price

and/or quantities of a good. If price increases and the demand curve does not shift, consumers' surplus will shrink.

Pure Monopoly

"A pure monopoly exists when there is only one producer in a market. There are no direct competitors or rivals in either the popular or technical sense."⁸ A perfect competitor accepts the market price and maximizes profit by varying output level. Since a monopolist is the only firm in the market, a monopolist has the power to set price; therefore, a monopolist may maximize profit by varying either output or price. The profit-maximizing price-quantity combination is invariant with respect to the choice of the independent variable.⁹ If the monopolist sets price at a given level, a limited quantity of sales will result; therefore, quantity is a function of price:

$$Q = f(P)$$

where $dQ/dP < 0$. Marginal revenue is the first derivative of total revenue with respect to output level:

$$MR = \frac{dTR}{dQ} = \frac{dPQ}{dQ} = P + Q \frac{dP}{dQ}.$$

Since dQ/dP is negative, then dP/dQ is also negative and marginal revenue is less than price.

Total revenue (TR) and total cost (TC) can be expressed as functions of output:

$$TR = R(Q) \quad TC = C(Q)$$

Profit (π) is the difference between TR and TC:

$$\pi = R(Q) - C(Q).$$

To maximize profit the first derivative of π with respect to output must equal zero:

$$\frac{d\pi}{dQ} = R'(Q) - C'(Q) = 0.$$

Thus, profits are maximized when:

$$R'(Q) = C'(Q).$$

As long as the addition to revenue (MR) exceeds the addition to cost (MC), profits can be increased by expanding output. Second order conditions for profit maximization require the second derivative of profit with respect to output to be less than zero:

$$\frac{d^2\pi}{dQ^2} = R''(Q) - C''(Q) < 0.$$

This condition is satisfied if MR decreases as output increases and MC increases as output increases. For expositional purposes, assume a constant marginal cost. Thus, in Figure 2, the monopolist maximizes profit by setting price P_m and producing quantity Q_m because at this level MR equals MC.

If the monopolist followed the pricing rule of the perfect competitor and equated price to MC, quantity Q_c would be produced and sold for P_c . Consumers' surplus would be $P_c DC$. Under monopoly pricing, consumers' surplus is $P_m DA$. $P_c P_m AC$ is lost to consumers due to the monopolist's ability to set price at P_m . Part of this loss, $P_c P_m AB$, is transferred to the producer as part of the higher price. The area ABC is that part of the consumers' surplus that would have been available under perfect competition that is lost to consumers and not transferred to the producer as a result of the producer's monopoly power to set price. This area is referred to in the economic literature as the

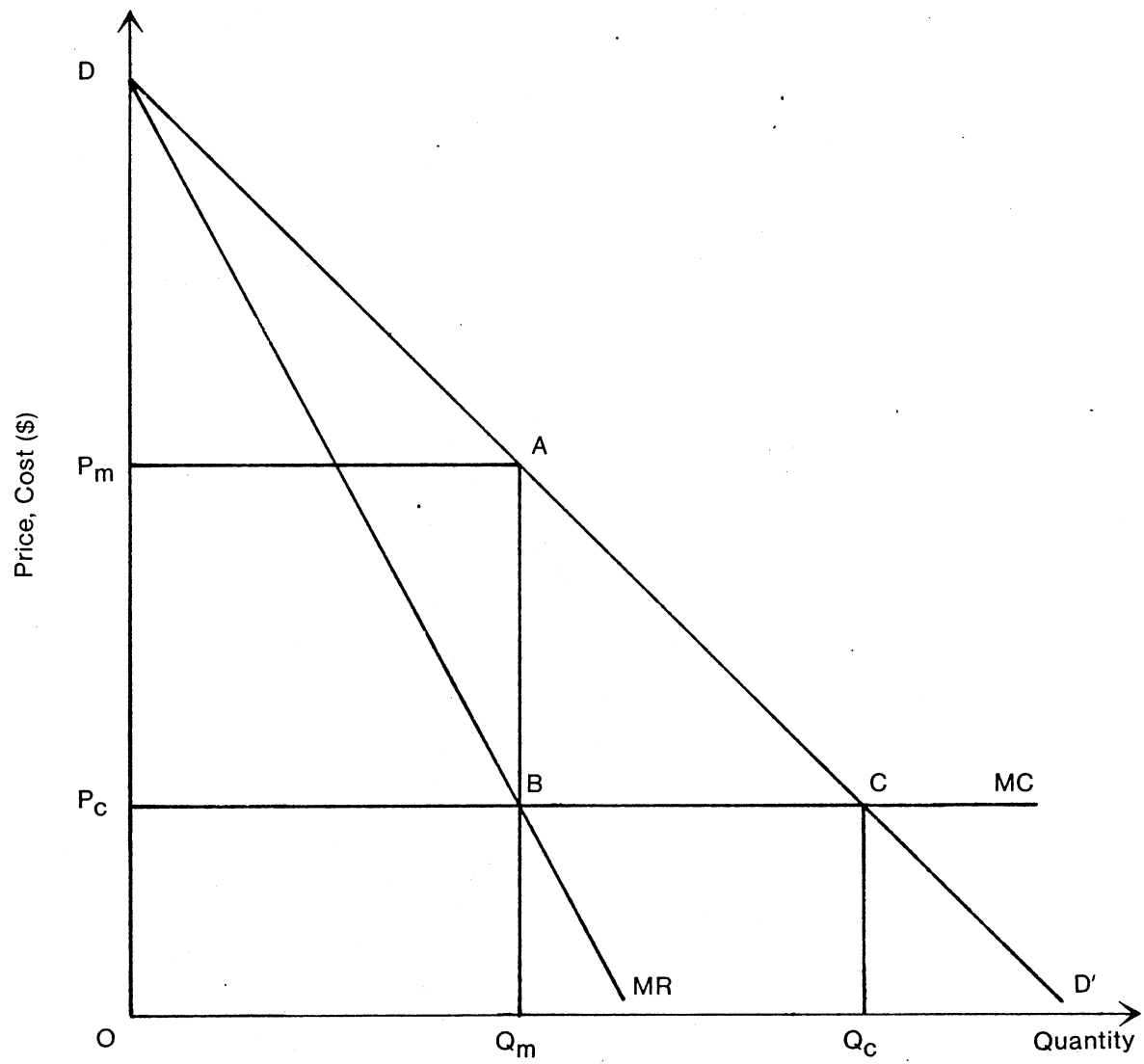


Figure 2. Pure Monopoly

deadweight welfare loss due to monopoly power to set price. Scherer defines this loss as that part of consumers' surplus which would have been realized by consumers under competitive pricing, but under monopoly pricing is captured by neither consumer nor producer.¹⁰

Imperfect Competition

Neither perfect competition nor pure monopoly is common in today's economy. Market situations vary on the continuum between the two extremes. When more than one seller is in the market but less than enough to constitute perfect competition, oligopoly or monopolistic competition may exist.

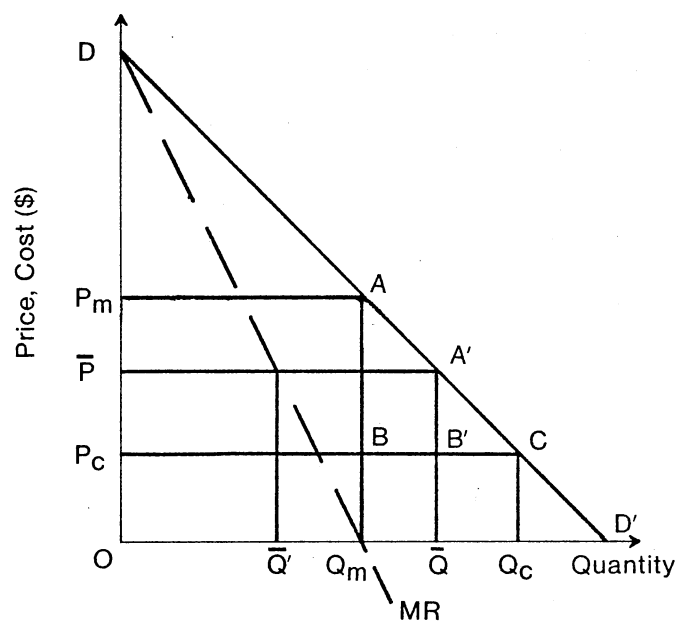
An oligopoly market may be tight, a few sellers, or loose, many sellers. Its principal feature is that the firms in the market are interdependent, i.e., policies adopted by one firm affect all other firms. There are several models of behavior for oligopoly markets¹¹ because firms in such markets have uncertainty about the reactions of competitors. Each different theory is based on a different behavioral assumption. However, the many models have at least three characteristics in common: (1) output is assumed to be produced at minimum unit cost, (2) price for goods includes pure economic profit, and (3) there is nonprice competition, such as advertising, and product design or quality differences. Since products in an oligopoly market are usually close substitutes for one another, the demand curve for the individual firm depends on reactions of other firms to changes in an individual firm's product price and/or the quantity of its output.

The rivals may spend their lives trying to 'second guess' each other; they may tactily agree to compete by advertising but not by price changes; or, recognizing their monopoly potential, they may form a coalition and cooperate rather than compete. In fact, there are just about as many different results as there are oligopolies; to examine each would carry taxonomy too far.¹²

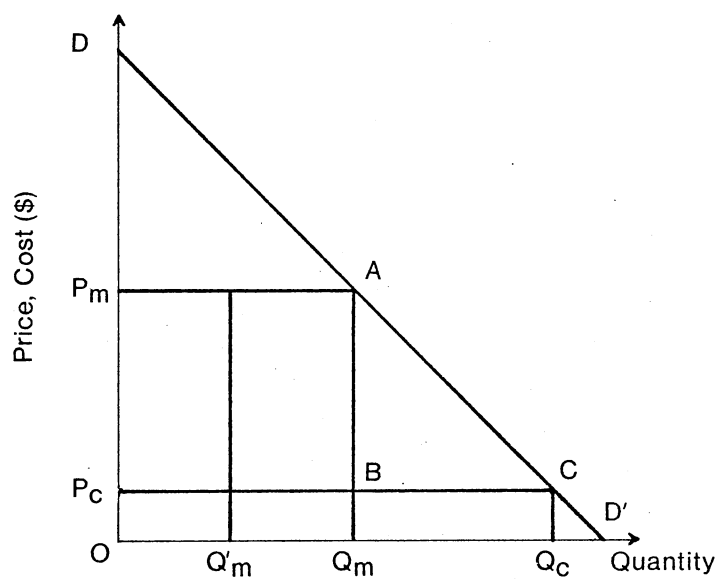
Like a monopolist, the oligopolist faces a downward sloping demand curve. Marginal revenue is less than price. Social welfare would be increased if production were increased to the level where marginal cost equaled price.

No matter what market situation exists, if price is established above marginal cost there can be observed a loss of consumers' surplus similar to the deadweight welfare loss due to monopoly power to set price. For example, consider two classical solutions to the duopoly¹³ problem. In the Cournot solution¹⁴ shown graphically in Figure 3, P_c represents the perfectly competitive price which results in Q_c units being sold. At this price consumers' surplus is $P_c DC$. Under monopoly pricing Q_m units are sold for price P_m . The deadweight loss due to monopoly power to set price is ABC . Assume firm A is in a monopoly market selling Q_m goods at P_m price. Further assume firm B enters the market. When a market is shared by two firms an action which benefits one firm is usually harmful to the other firm and results in a reaction by the affected firm. The Cournot solution suggests a process of action and reaction by the two firms results in firm A gradually decreasing sales and firm B gradually increasing sales until price converges at \bar{P} . At this price firm A sells $O\bar{Q}'$ units and firm B sells $\bar{Q}'\bar{Q}$ units. Total output for the market is $O\bar{Q}$ units. The deadweight welfare loss due to duopoly pricing under the Cournot solution is $A'B'C$.

In the Chamberlin solution¹⁵ to duopoly, Figure 3, P_c represents the perfectly competitive price for output Q_c . Consumers' surplus is



Cournot Solution



Chamberlin Solution

Figure 3. Duopoly

P_c DC. P_m represents monopoly price for output Q_m . Firm A sells Q_m goods at price P_m . Assume firm B enters the market. In the Chamberlin solution the firms recognize their mutual interdependence and that to share the monopoly profits is in their best interests. Therefore, the two sellers in the market decide to share the monopoly profits by each producing $1/2 \bar{Q}_m$, or Q'_m , units which are sold at P_m . The consumers' surplus lost due to the duopoly pricing under the Chamberlin solution is ABC, the same as the deadweight loss due to monopoly pricing.

When there are many sellers in the market, and the product of each seller is different in some way from the product of every other seller, and an action of one seller has little effect upon the actions of any other seller; monopolistic competition is said to exist.¹⁶ Graphic analysis of this market is usually restricted to an individual firm because the different sellers usually receive different prices for their products; thus, no one price prevails in the market. Also, because of the differences in the products, one common quantity is not considered.

Sellers may influence demand for their products through advertising and changes in the product quality or design. Note in Figure 4, the demand curve is downward sloping and very elastic in the relevant range of the price of the product because of the numerous close substitutes for the product. Marginal revenue is less than price and profit is maximized where marginal cost equals marginal revenue, i.e., where price P_{mc} is charged for quantity Q_{mc} . Although each producer acts individually to set price for his product, the existence of many close substitutes ensures that the price charged by the individual producers will cluster. The observed deadweight welfare loss due to monopolistic competition pricing is represented by area ABC.

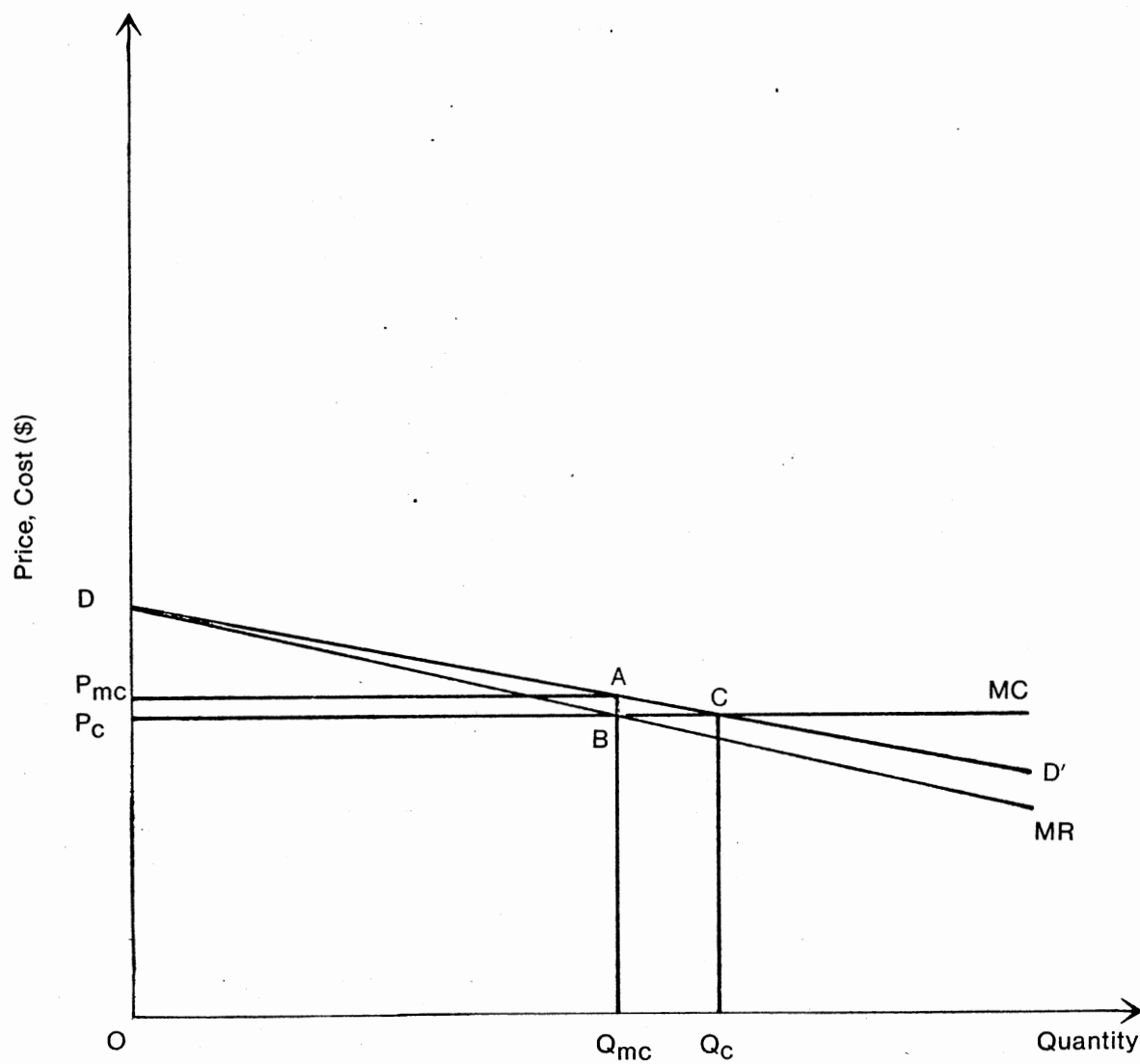


Figure 4. Monopolistic Competition

Pricing Practices

Cost is an important ingredient in any pricing policy. Many firms do not use the economic price models to set price for two major reasons: (1) the difficulty in estimating the demand curve, and (2) not all firms are profit maximizers. Other corporate goals, such as sales maximization, growth, prestige, or a certain cash flow position, may take precedence over profit maximization and, thus, influence price. Therefore, a gulf between economic price theory and actual pricing policies appears to exist.

Many firms in America use the cost plus formula to set price.¹⁷ This formula totally ignores the demand curve as it sets price at:

$$P = C + aC$$

where P = selling price per unit,

C = production costs per unit, and

a = percentage return on costs to cover fixed costs and contribute to profits.

If this price is equal to P_c in the foregoing figures, then the firm is said to be in a perfectly competitive market. On the other hand, if P is greater than P_c , then the firm is said to be in a monopoly or imperfectly competitive market and a deadweight welfare loss due to cost plus pricing can be demonstrated. Thus, for any firm making above a "normal" profit, it appears a deadweight welfare loss can be observed.

The implication of this statement is demonstrated in Figure 5. As discussed above, area ABC represents the deadweight welfare loss due to monopoly power to set price. Assume the firm is required to submit supplemental information with its traditional historical cost based financial statements. Further assume the cost incurred to generate,

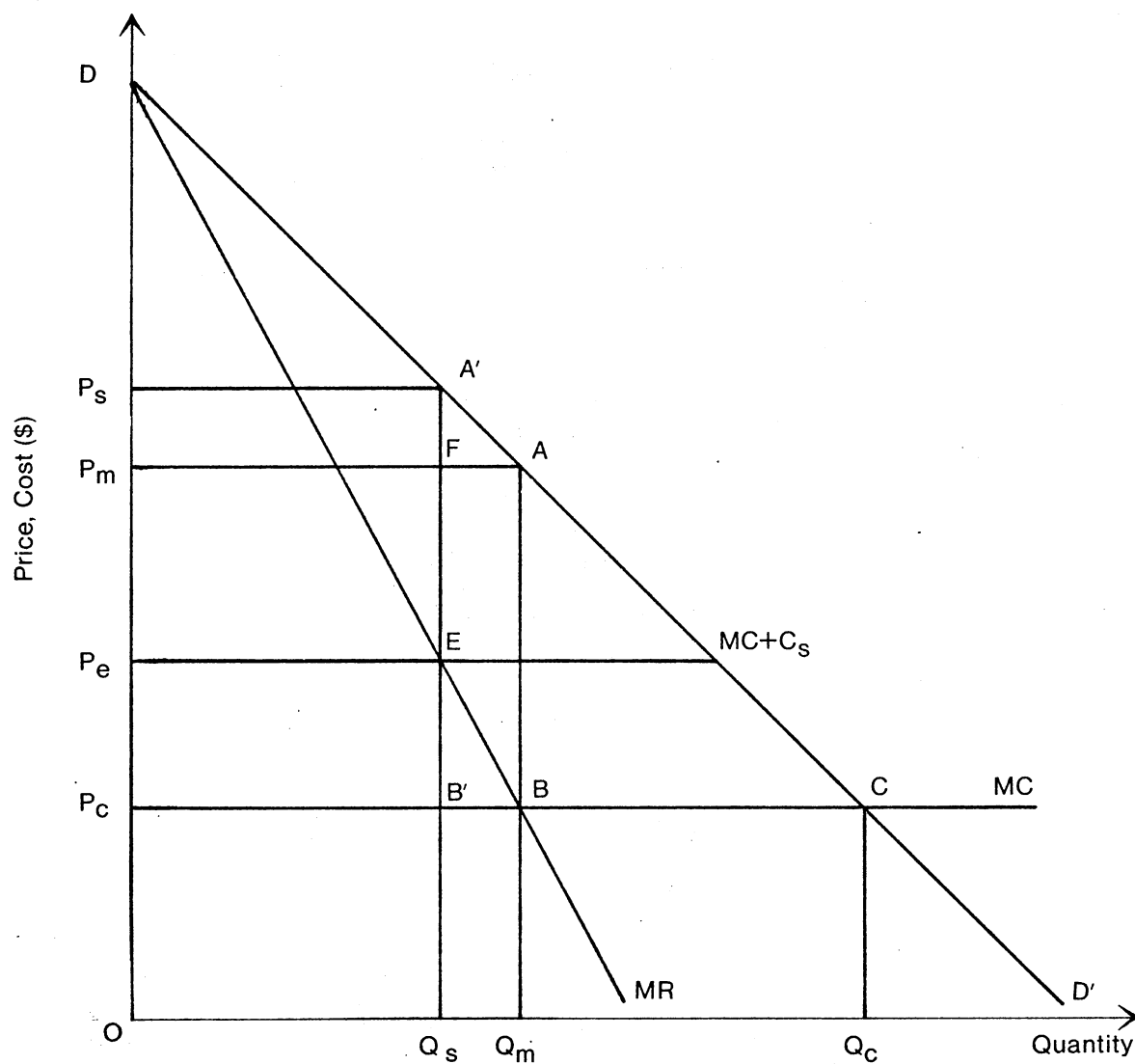


Figure 5. Increase in Deadweight Welfare Loss Due to a Supplemental Information Requirement Imposed on a Monopoly Firm

compile and report the supplemental data is perceived by the producer to cause the marginal cost curve to shift upward to $MC + C_s$; the producer increases the price for the product to P_s where the perceived marginal cost equals the marginal revenue of the product. Assuming no change in the demand curve, there is movement along the demand curve as consumers unwilling to pay the higher price decrease consumption of the product or leave the market. Quantity demanded decreases to Q_s . Consumers who continue to buy the product suffer a loss in consumer surplus which may or may not be offset by the additional revenue gained by the producer. Consumers who stop purchasing the product suffer a loss not offset by any gain to the producer. Both users and nonusers of financial statements are affected.

If the costs of the required increase in disclosure are true marginal costs, the area $P_e P_s A'E$ must be at least as large as area $P_c P_m AB$ for the producer to be no worse off after the increase in disclosures than before. On the other hand, if the costs of the required increase in disclosure are not true marginal costs, the area $P_c P_s A'B'$ must be at least as large as area $P_c P_m AB$ for the producer to be no worse off after the increase in disclosure than before. If the area $P_e P_s A'E$ in the former case (or area $P_c P_s A'B'$ in the latter case) is less than the area $P_c P_m AB$, the producer's profits would be reduced as a result of the required increase in disclosure.

In either case the consumers' surplus would be decreased by $P_m P_s A'A$. Furthermore, since output has been reduced by $Q_s Q_m$ as a result of an increase in a regulated cost (i.e., a cost imposed on the producer and society by a regulatory body) and not an increase in the cost of the factors of production due to market forces (e.g., changes in consumer

preferences or changes in the relative scarcity of goods and services), the total welfare loss becomes area $A'B'C$. An indirect cost of the disclosure to society is the difference between the deadweight loss due to monopoly power to price, area ABC , and the total welfare loss, area $A'B'C$, or in other words, area $B'A'AB$ would be the increase in the indirect cost to society.

The question posed by this study is whether or not this increase in welfare loss is significant. If such costs are significant, they should be considered in determining the net benefit to be derived by society from increased disclosure requirements.

Review of the Literature

In 1938 Hotelling argued that when authoritative measures, such as taxes and public utility regulations distort prices there is a deadweight loss to society that can be approximated by using the consumers' surplus concept.¹⁸ Hotelling's theory led to the development of several techniques of estimating welfare loss due to monopoly pricing.

The first study concerned with estimating deadweight welfare loss was reported by Harberger.¹⁹ Using the formulas developed by Hotelling, Harberger estimated the loss for 73 manufacturing firms that operated during the period 1924 to 1928. Harberger assumed a price elasticity of one for his study,²⁰ and computed the average of the profit rates of the industries represented by the firms in his study as the "normal" rate of return on capital.

Swartzman²¹ used a sample of Canadian and United States firms operating in 1954 to replicate the Harberger study. Aware of the criticisms of the Harberger study, Swartzman developed his own profit

data and used an elasticity of two. His results were similar to Harberger's.

Scherer²² criticized these studies on two major points. First, he believed the observed welfare losses were biased on the low side since long run price elasticities are often higher than one or two due to substitution of related products. Second, the studies were based on static analysis; i.e., no consideration of the transmission of monopoly distortions through verticle price flows was presented.

The model was further refined by Kamerschen.²³ Using profit data for the period 1956 to 1961, Kamerschen used a method based on the Lerner index of monopoly power to estimate the price elasticities for the industries in the study. Kamerschen believed the improvements of statistical procedures, developed subsequent to Harberger's study, and the estimated elasticities resulted in a more accurate estimate of the welfare loss.

Worcester used less aggregated data for his study.²⁴ Stating that a large share of firms with monopoly power to set price were probably among Fortune's 500, Worcester used this group to observe fluctuations of welfare loss over the period 1956 to 1969. Worcester used an elasticity of two and estimated an average yearly profit rate to use for the "normal" rate of return.

Siegfried and Tiemann limited their study to mining and manufacturing industries in an attempt to identify specific industries that contributed the greater proportion of welfare losses.²⁵ Their study was the first to use the less aggregated three-digit industry classification data as the representation of economically meaningful markets. Their data were derived from published Internal Revenue Statistics of Income for the year 1963.

The Siegfried and Tiemann model was subsequently replicated by Bumpass.²⁶ Using four-digit industry classification data, the Bumpass findings supported Siegfried and Tiemann's conclusions.

All of the above studies utilized a number of simplifying assumptions in order to estimate the welfare loss. These assumptions included:

1. All production is subject to constant costs;²⁷
2. Industries are in "long run equilibrium" with accounting values near actual capital values;²⁸
3. No redistributive effects are present, i.e., necessary fiscal adjustments keep everyone's money income constant as resources are shifted;²⁹
4. All industries are producing for direct consumption;³⁰
5. Cross price effects are ignored, therefore the model is a partial equilibrium analysis;³¹
6. Within industries each producer charges the same price and there is no price discrimination;³²
7. The demand curve is linear in the region of actual output;³³
and
8. Most of the traditional economists' assumptions as to firm and consumer behavior are retained.³⁴

Deadweight Welfare Loss Model

For the purpose of this study the Siegfried and Tiemann model was chosen because the model is able to use accounting data for the estimation of values for the difference between price and marginal cost (\overline{AB} in Figure 2) and the difference between the actual quantity sold and the quantity which could be sold if price were equal to marginal cost

(BC in Figure 2). The following development of the model is derived from their exposition. Because of the assumption that the demand curve for each market is independent of the price in other markets, this is a partial equilibrium analysis.

The triangular area of the deadweight welfare loss can be measured by the formula:

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

The vertical distance \overline{AB} is found by calculating the difference between price and marginal cost. Since a constant cost has been assumed, long run average variable cost can be substituted for long run marginal cost. The value for the line segment \overline{AB} can then be expressed as:

$$\overline{AB} = P - VC \quad (2)$$

where P = price, and

VC = long run average variable costs.

Since price and average variable cost cannot be determined from available data because quantity is unknown, price and average variable cost are changed to total revenue and total variable cost by multiplying equation (2) by total quantity (Q) divided by total quantity:

$$\begin{aligned} \overline{AB} &= (P - VC)(Q/Q) \\ &= \frac{PQ - VCQ}{Q} \\ &= \frac{TR - TVC}{Q} \end{aligned} \quad (3)$$

where TR = total revenue,

TVC = accounting long run total variable cost, and

Q = total quantity.

Since a return on capital employed is not added to unit cost, accounting data understate economic costs of production. Therefore,

an adjustment must be made to the accounting data for the omission of an economic "normal" return on capital in the accounting costs.

An economic "normal" return on assets is the monetary return required on the capital employed in the production process in order for the firm to continue to devote the capital to the existing line of production. Two surrogates are needed to estimate this economic value: (1) a "normal" rate of return, and (2) capital (assets) employed in the production process.

Most studies used an average rate of return based on accounting profit data to represent the "normal" rate of return. The accounting profit data was gleaned from U.S. Census and Internal Revenue publications. Since profit computed in accordance with generally accepted accounting principles or taxable income computed in accordance with revenue statutes includes revenues and expenses from activities other than production, accounting profit data usually misstate the true return on production activities. Therefore, a weighted average cost of capital approach, similar to that used by Public Utility Commissions to determine a "normal" return for utility firms, is used to determine a surrogate for the economic rate of return.

The data in Table I is used to demonstrate this method.³⁵ Column (1) lists the components of capital for the firm; balance sheet amounts for each component are given in column (2); the percentage of each component to total capital is presented in column (3); and the after tax component rate is given in (4). Multiplying each component percentage of total capital invested, by the after tax component rate, gives the component's weighted average rate, (3) x (4). The weighted average rate of return is the sum of the component weighted rates.

TABLE I
CALCULATION OF A WEIGHTED AVERAGE RATE OF RETURN

Capital Components (1)	Balance Sheet Figures (2)	Percent of Total Capital (3)	After Tax Component Rate (4)	Weighted Average Rate (3) x (4)
Debt	\$ 30	30%	3%	.9 %
Preferred Stock	5	5	7	.35
Common Equity	<u>65</u>	<u>65</u>	<u>10</u>	<u>6.5</u>
Total	<u>\$100</u>	<u>100%</u>		<u>7.75%</u>

All data needed for the computation of the weighted average rate of return are available in the COMPUSTAT files except the after tax component rate for common equity. Current dividends understate the true return on equity capital. A constant rate does not reflect the differences in risk between firms. Therefore, an average of the return on net worth for the period 1975-1978 for each industry classification in the study was used for the common equity after tax rate for the individual sample firms.

The weighted average rate of return is multiplied by the average of the sum of the book value of assets (net of depreciation) at the beginning of the period and the book value at the end of the period. Using an average for a period helps avoid the "spuriousness resulting when industries have unusually large asset growths."³⁶

Thus, the surrogate for the economic "normal" return is a weighted average rate of return (p) multiplied by the average book value of

employable capital (A).³⁷ Including this in the model gives:

$$\overline{AB} = \frac{TR - TVC - pA}{Q} \quad (4)$$

where p = average rate of return, and

A = book value of assets.

Equation (4) is an estimate of the above "normal" economic profit per unit of output. Since Q is not available, multiplying equation (4) by (P/P) gives:

$$\begin{aligned} \overline{AB} &= \left(\frac{TR - TVC - pA}{Q} \right) (P/P) \\ &= \left(\frac{TR - TVC - pA}{TR} \right) (P). \end{aligned} \quad (5)$$

The quantity reduction, \overline{BC} , must be calculated indirectly. If the demand curve is assumed linear between the actual price-quantity equilibrium and the competitive price-quantity equilibrium, then the price displacement times the inverse of the slope of the demand curve equals the quantity reduction due to monopoly;³⁸ thus:

$$\overline{BC} = \overline{AB} (dQ/dP). \quad (6)$$

Multiplying through by (P/P) and (Q/Q) :

$$\overline{BC} = \overline{AB} (dQ/dP) (P/P) (Q/Q). \quad (7)$$

Price elasticity of demand, η ,³⁹ is the percentage change in quantity divided by the percentage change in price. When economists speak of the magnitude of elasticity they refer to the absolute value of the coefficient; therefore, η equals $|(P/Q)(dQ/dP)|$. Rearranging terms and substituting the price elasticity of demand η into equation (7) gives:

$$\begin{aligned} \overline{BC} &= \overline{AB} (P/Q) (dQ/dP) (Q/P) \\ &= \overline{AB} \eta (Q/P). \end{aligned} \quad (8)$$

Although most studies assumed a price elasticity of one, the elasticity can be estimated by a method based on the Lerner index of monopoly power.⁴⁰

Values for total revenues and accounting long run variable costs may be observed directly from the financial statements. Net sales are total revenues generated from product sales. Cost of sales is the accumulation of production costs for products sold during the period and reflects the variable cost of an additional unit sold.

Substituting the values for AB and BC into the original equation, the deadweight welfare loss for each firm, W, can be expressed as:

$$\begin{aligned}
 W &= 1/2 \left(\frac{TR - TVC - pA}{TR} \right) (P) \left(\frac{TR - TVC - pA}{TR} \right) (P) (Q/P) \eta \\
 &= 1/2 \left(\frac{TR - TVC - pA}{TR} \right)^2 (P)^2 (Q/P) \eta \\
 &= 1/2 \left(\frac{TR - TVC - pA}{TR} \right)^2 (TR) \eta
 \end{aligned} \tag{9}$$

where TR = net sales,

TVC = cost of sales,

p = average rate of return,

A = book value of assets, and

η = price elasticity of demand.

Summary

Economic theory and the concept of consumers' surplus can be used to demonstrate that if the price of a good is established above the marginal cost to produce the good, a loss of consumers' surplus, similar to the deadweight welfare loss due to monopoly power to set price, can be observed. An increase in the observed loss attributed to

a regulation of a policy making body for additional disclosure of information is an indirect cost to society.

Although a number of simplifying assumptions must be made, a model to measure the deadweight welfare loss due to monopoly power to set price can be adapted for use with accounting data in order to assess the significance of an increase in the observed welfare loss.

ENDNOTES

¹For a complete review of price theory see James M. Henderson and Richard E. Quandt, Microeconomic Theory (New York, 1971), or Richard H. Leftwich, The Price System and Resource Allocation (Hinsdale, Ill., 1976); or J. P. Gould and C. E. Ferguson, Microeconomic Theory, 5th edition (Homewood, Ill., 1980).

²Gould and Ferguson, p. 215. Leftwich, pp. 28-29, noted that the perfect knowledge condition is the difference between pure and perfect competition.

³Gould and Ferguson, pp. 92-94. Consumer demand and behavior theory establishes the proposition that individual demand curves are downward sloping. A market demand curve is the sum of all consumer demand curves for the market good, therefore, the market demand curve is assumed negatively sloped.

⁴R. W. Pfouts, "A Critique of Some Recent Contributions to the Theory of Consumer Surplus," Southern Economic Journal, XIX (1953), p. 315.

⁵Alfred Marshall, Principles of Economics, 8th Edition (New York, 1950), p. 124.

⁶*Ibid.*, p. 124.

⁷Gould and Ferguson, p. 34.

⁸*Ibid.*, p. 246.

⁹See Henderson and Quandt, pp. 208-215.

¹⁰F. M. Scherer, Industrial Market Structure and Economic Performance (Chicago, 1973), p. 401.

¹¹For a more complete discussion see Leftwich, pp. 238-266, or Gould and Ferguson, pp. 316-348, or for a mathematical approach, Henderson and Quandt, pp. 206-251.

¹²Gould and Ferguson, p. 317.

¹³*Ibid.*, duopoly is a special case of oligopoly where there are only two sellers, see p. 316.

¹⁴*Ibid.*, see pp. 318-320, especially Figure 12.2.1, p. 319.

- ¹⁵ Ibid., pp. 323-324, especially Figure 12.2.2, p. 324.
- ¹⁶ Leftwich, see Chapter 12, pp. 270-279.
- ¹⁷ Alfred R. Oxenfeldt and William T. Baxter, "Approaches to Pricing: Economist Verses Accountant," Contemporary Cost Accounting and Control, Geroge J. Benston, ed. (Encino, California, 1977), pp. 58-77.
- ¹⁸ H. Hotelling, "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates," Econometrica, VI (1938), pp. 242-269.
- ¹⁹ A. C. Harberger, "Monopoly and Resource Allocation," American Economic Review, 64 (May, 1954), pp. 77-87.
- ²⁰ A price elasticity of one implies a firm is operating where marginal revenue equals zero.
- ²¹ David Schwartzman, "The Burden of Monopoly," Journal of Political Economy, LXVIII (1960), pp. 627-630.
- ²² Scherer, pp. 401-403.
- ²³ David Kamerschen, "An Estimation of the 'Welfare Losses' from Monopoly in the American Economy," Western Economic Journal, IV (1966), pp. 221-236.
- ²⁴ D. A. Worcester, Jr., "New Estimates of the Welfare Loss to Monopoly in the United States, 1956-1969," Southern Economic Journal, 40 (October, 1973), pp. 234-245.
- ²⁵ John J. Siegfried and Thomas K. Tiemann, "The Welfare Cost of Monopoly: An Inter-Industry Analysis," Economic Inquiry, 12 (June, 1974), pp. 190-202.
- ²⁶ Donald Lynn Bumpass, "Determinants of Price Cost Margins and Estimates of Welfare Loss in Selected U.S. Manufacturing Industries." (Unpublished Ph.D. dissertation, Oklahoma State University, 1973.) pp. 66-104.
- ²⁷ Kamerschen, pp. 228-229.
- ²⁸ Ibid., p. 229.
- ²⁹ Ibid.
- ³⁰ Ibid.
- ³¹ Siegfried and Tiemann, p. 191.
- ³² Ibid.
- ³³ Ibid.
- ³⁴ Kamerschen, p. 229.

³⁵For a discussion on weighted average cost of capital see J. Fred Weston and Eugene F. Brigham, Essentials of Managerial Finance, 3rd Ed. (Dryden, 1974), Chapter 20, pp. 475-504. Also of interest may be Robert N. Anthony, Accounting for the Cost of Interest (Heath, 1975), pp. 11-18.

³⁶Kamerschen, p. 233.

³⁷The use of the average book value of assets for computing the "normal" return may be subject to criticism by those who advocate that the current value or the replacement value of the assets would result in a more meaningful return. The accounting profession is currently considering the problem of differing valuation bases. Since the required primary financial statements for the period of concern in this study were given in historical dollars and current or replacement values attached to this data would be arbitrary, the average book value was used. Future research could be concerned with a comparison of the difference between measurements with the different valuation bases.

³⁸Ibid., p. 193. The slope of the demand curve is the ratio

$$\frac{P_m - P_c}{Q_m - Q_c} = \frac{dP}{dQ}; \text{ therefore, the inverse of the slope is } \frac{dQ}{dP}.$$

³⁹Usually price elasticity of demand is denoted by the symbol ϵ . However, Siegfried and Tiemann use η . Since this study uses their model η is used to denote price elasticity of demand.

$$\begin{aligned} \eta &= \frac{dQ}{Q} / \frac{dP}{P} \\ &= \left(\frac{dQ}{Q} \right) \left(\frac{P}{dP} \right) \\ &= \left(\frac{P}{Q} \right) \left(\frac{dQ}{dP} \right) \end{aligned}$$

⁴⁰Microeconomic theory shows the relationship between marginal revenue (MR) and price (P) as:

$$MR = P \left(1 - \frac{1}{\eta} \right) \quad (1)$$

where

$$\eta = \left| \frac{-P}{P - MR} \right| \quad (2)$$

Assuming the firm is in long run equilibrium and is maximizing profits,

$$MR = MC = AVC \quad (3)$$

thus,

$$\eta = \left| \frac{-P}{P - AVC} \right| \quad (4)$$

This provides an estimate of the point elasticity of demand providing that price and variable cost data are available. Since these are not, but total revenue and total variable costs are, multiplying by total quantity (Q) over total quantity gives:

$$\eta = \left| \frac{-TR}{TR - TVC} \right| . \quad (5)$$

It is important to remember that accounting data is to be used and equation (5) was modified to include the "normal" return; thus,

$$\eta = \left| \frac{-TR}{TR - TVC - pA} \right| . \quad (6)$$

CHAPTER III

APPLICATION OF THE MODEL

This chapter is concerned with the application of the model developed in Chapter II. The discussion includes the selection of the sample firms, an adjustment to the model to reduce the variance that may be caused by inflation during the test period, the hypotheses to be tested and a priori expectations of the results of the statistical tests.

Sample Selection

The sample for this study was taken from the COMPUSTAT files which contain financial data for several thousand of the largest firms on the major stock exchanges.¹ The SEC estimated 1,000 firms submitted replacement cost data for 1976.² The assumption was made that data for most, if not all, of the submitting firms were contained in the COMPUSTAT files.

The sample was selected by the splitting sampling method which is based on a variance reduction technique used by von Neumann and Ulan.³ Splitting allows the examination of a possible entry to the sample at each stage of the sample selection and the dichotomous classification of the entry, i.e., of interest or not of interest. Only those firms which meet the criterion of each stage of the sample selection enter the final sample.

The first stage of the sample selection was to determine the group membership of the firm, i.e., submitting or nonsubmitting. In order to be considered as an entry to the sample of submitting firms, a firm had to meet the SEC criteria for submission of replacement cost data for the four periods of interest, 1975 to 1978.⁴ Any firm required to report to the SEC had to disclose replacement cost data if the firm reported in its balance sheet at the beginning of the year: (1) a total of inventory and gross property, plant, and equipment (i.e., before deduction of accumulated depreciation, depletion, and amortization) of at least one hundred million dollars, and (2) this total constituted at least 10 percent of the total assets of the firm.⁵ A firm which met only one of the SEC criteria was considered as an entry to the nonsubmitting firm group.

In addition to the above, to enter the final sample a firm had to satisfy the criterion of each of the following stages:

1. The firm operates on the calendar year.⁶
2. The firm operated under the same corporate name for the years 1975-1978.⁷
3. The firm is not classified in an extractive⁸ or regulated⁹ industry.
4. All firm data needed for the study was available in the COMPUSTAT file.

The final sample consisted of 59 submitting firms and 13 nonsubmitting firms.

Measurements

Before determining the observed welfare loss measurements a further refinement of the model developed in Chapter II was made. The testing

period, 1975 to 1978, was a period of spiraling inflation. In order to exert some control over the variance due to inflation effects, average yearly general price level indices were used to restate the yearly observed deadweight welfare losses in common 1975 dollars.

The two observed welfare loss measurements calculated for each year of interest were:

1. The observed deadweight welfare loss with price elasticity of demand equal to one restated in 1975 common dollars, DWLAD, and
2. The observed deadweight welfare loss with price elasticity of demand estimated with the Lerner index method restated in 1975 common dollars, ELAD.

Testing Procedures

A two-factor, repeated measures on one factor, experimental design was selected to test the data for both the DWLAD and the ELAD measurements.¹⁰ This design is represented schematically in Table 2.¹¹ Levels of a_1 represent the submitting group (a_1) and the nonsubmitting group (a_2). Levels of b_j represent the observed deadweight welfare loss for the test period (i.e., 1975(b_1), ..., 1978(b_4)). The symbol G_{1j} represents the total observed deadweight welfare loss for the 59 submitting firms, and G_{2j} the total observed deadweight welfare loss for the 13 nonsubmitting firms. The firms are observed under all levels of b_j but only under one level of a_1 .

The linear model upon which the analysis is based has the following form:¹²

TABLE II
REPEATED MEASURES ON ONE FACTOR

Group a \ b	Observed Deadweight Welfare Loss			
	b ₁	b ₂	b ₃	b ₄
a ₁	G ₁₁	G ₁₂	G ₁₃	G ₁₄
a ₂	G ₂₁	G ₂₂	G ₂₃	G ₂₄

$$X_{ijk} = \mu + \alpha_i + \pi_{k(i)} + \beta_j + \alpha\beta_{ij} + \beta\pi_{jk(i)} + \epsilon_{m(ijk)}$$

where X_{ijk} = an observation of deadweight welfare loss on firm k in group i for the year and group combination of ab_{ij} ,

μ = mean of all potential observations,

α_i = main effect of group i,

$\pi_{k(i)}$ = the effect of firm k nested under the group level a_i ,

β_j = main effect of year j,

$\alpha\beta_{ij}$ = the interaction effect of group i and year j,

$\beta\pi_{jk(i)}$ = the interaction effect of year j and firm k in group a_i , and

$\epsilon_{m(ijk)}$ = experimental error associated with X_{ijk} , the subscript m indicates that the error is nested within the individual observation.

Since repeated measurements tend to be positively correlated and the observations dependent rather than independent, the observed losses are assumed to have an underlying multivariate normal distribution with a sample distribution approximated by the F distribution. A significance level of $\alpha = .05$ was used for all tests of hypotheses in this study.

The summary of the analysis of variance for the repeated measure design is given in Table III. In order to determine the degrees of freedom, N represents the total number of sample firms, p represents the number of groups, and q represents the number of measures taken on each firm.

TABLE III
ANALYSIS OF VARIANCE, REPEATED MEASURES ON ONE FACTOR

Source of Variance	df	E (MS)
<u>Between subjects</u>	<u>N-1</u>	
A	p-1	$\delta_{\epsilon}^2 + q\delta_{\pi}^2 + nq\delta_{\alpha}^2$
Subjects within groups	N-p	$\delta_{\epsilon}^2 + q\delta_{\pi}^2$
<u>Within subjects</u>	<u>N(q-1)</u>	
B	q-1	$\delta_{\epsilon}^2 + \delta_{\beta\pi}^2 + np\delta_{\beta}^2$
AB	(p-1)(q-1)	$\delta_{\epsilon}^2 + \delta_{\beta\pi}^2 + np\delta_{\alpha\beta}^2$
B x subjects within groups	(N-p)(q-1)	$\delta_{\epsilon}^2 + \delta_{\beta\pi}^2$

The a priori expectation was that the submitting and nonsubmitting groups would consist of an equal number of firms. Since this was not true, the computational procedure for the unweighted means solution for repeated measures on one factor was used because this solution compensates for the unequal group sizes by using a harmonic mean (\bar{n}_h). The computational procedures are given in Appendix C.

The underlying premise of the study is that any increase in the observed deadweight welfare loss attributable to the required disclosure of replacement cost data would most likely occur in the first year of disclosure. Assuming the initial cost of implementing the data gathering process was passed on to consumers in the first year of disclosure, the observed welfare losses for submitting firms in subsequent periods are expected to decrease or remain constant, *ceteris paribus*.¹⁴ No significant increase in the observed losses of the nonsubmitting group is expected for any year. If an increase is found in the non-submitting group, it will be considered a result of factors not considered in this study. Since the nonsubmitting group is as similar as possible to the submitting group, similar movements in the observed deadweight losses of both groups in the same period will imply that factors other than the replacement cost disclosures affected the observable welfare losses.

The following discussion pertains to the hypotheses used to test the premise of the study and the a priori expectation of the results of the statistical tests. The first hypothesis of interest is:

H_0 : There is no difference in the observed deadweight welfare loss of the sample firms for the test period, 1975 to 1978.

H_A : There is an increase in the observed deadweight welfare loss of the sample firms in at least one year of the test period.

Acceptance of the null hypothesis implies there was no increase in the observed welfare loss attributable to the replacement cost disclosure. If this is true, the underlying premise of the study is rejected; no further tests are indicated. A priori it was expected that the null hypothesis would be rejected. The hypothesis of interest would then be:

H_0 : There is no difference in the observed deadweight welfare loss of the sample group required to disclose replacement cost data and the sample group not required to disclose the replacement cost data.

H_A : There is a difference between the observed deadweight welfare loss of the sample group required to disclose replacement cost data and the sample group not required to disclose the replacement cost data.

Acceptance of this null hypothesis implies any differences found in the observed deadweight loss may be attributable to factors not considered in this study. A priori, it was expected that this null hypothesis would be rejected. If this were true, individual comparisons would be made on each group, i.e., submitting and nonsubmitting. The new hypotheses would be:

H_0 : There is no difference in the observed deadweight welfare loss of the (submitting/nonsubmitting) group for the predis-closure year (1975) and the year of first disclosure (1976).

H_A : There is a difference in the observed deadweight welfare loss of the (submitting/nonsubmitting) group for the predis-closure year (1975) and the year of first disclosure (1976).

H_0 : There is no difference in the observed deadweight welfare loss for the year of first disclosure (1976) and the average of the two post-first-disclosure years (1977 and 1978) for the (submitting/nonsubmitting) group.

H_A : There is a difference in the observed deadweight welfare loss for the year of first disclosure (1976) and the average of the two post-first disclosure years (1977 and 1978) for the (submitting/nonsubmitting) group.

The F ratios in tests on individual group comparisons for the unweighted-means solutions take the form:¹⁵

$$F = \frac{(\overline{AB}_{ij} - \overline{AB}_{ij'})^2}{MSE_{within} (2/\bar{n}_h)}$$

where \overline{AB}_{ij} = the mean observed deadweight welfare loss for firms in group i for year j,

MSE_{within} = mean square error, and

$$\bar{n}_h = \frac{P}{\sum (1/n_i)} = \text{harmonic mean.}$$

A priori, it was expected that these hypotheses would be accepted for the nonsubmitting group and rejected for the submitting group. These findings would lend support to the premise of this study that the economic theory of deadweight welfare loss due to monopoly power to set price can be used to observe an indirect cost imposed by a regulatory body's requirements for additional information disclosure.

Summary

Seventy-two firms which report to the SEC were selected from the COMPUSTAT files to comprise the sample used in this study. Fifty-nine firms which met the SEC criteria for disclosure of replacement cost data for the years 1975 to 1978, were designated as the submitting group. Thirteen firms which met one, but not both, of the SEC criteria for disclosure of replacement cost data for the years 1975 to 1978, were designated as the nonsubmitting group. Two observed deadweight welfare loss measurements were calculated for each firm. The first measurement, DWLAD, was calculated with the price elasticity of demand assumed to be one. The second measurement, ELAD, was calculated with a price elasticity of demand estimated by the Lerner Index method. Both measurements were adjusted to common 1975 dollars in order to exert some control over the effects of inflation on the dollar during the testing period.

The experimental design selected to test the hypotheses of interest was a two factor, repeated measures on one factor, with unequal group size design. The major hypotheses of interest to be tested are:

(1) no differences in the observed deadweight welfare loss during the test period, and (2) no differences between the submitting and non-submitting groups. If these hypotheses are rejected, two comparisons

for each group to be made are: (1) the observed differences between the welfare loss in the pre-disclosure year (1975) and the year of first disclosure (1976), and (2) the differences between the observed welfare loss in the first disclosure year (1976) and the two post-first disclosure years (1977 and 1978).

ENDNOTES

¹See Standard and Poors Compustat Services, Inc., Industrial COMPUSTAT (May, 1980), Section 3, pp. 1-2.

²Arthur Young & Company, Disclosing Replacement-Cost Data, (New York, 1977), p. 1.

³Robert E. Shannon, Systems Simulation, (Englewood Cliffs, N.J., 1975), pp. 201-202.

⁴This criterion insured that a firm not meeting the SEC criteria in 1975 did not enter the sample in a subsequent year and vice versa.

⁵See Endnote 19 in Chapter 1.

⁶To minimize variance due to external effects on operations.

⁷To minimize distortions of the loss due to mergers. See F. M. Scherer, Industrial Market Structure and Economic Performance (Chicago, 1973), pp. 112-122 for a discussion of merger effects and motives.

⁸The SEC delayed one year the beginning date of submission of replacement cost data by the extractive industries.

⁹There is a time lag in price changes for regulated industries because their prices are set by regulatory bodies.

¹⁰See B. J. Winer, Statistical Principles in Experimental Design, Second Edition, (New York, 1971), Chapter 7, especially pp. 599-603.

¹¹Ibid., p. 515.

¹²Ibid., p. 519.

¹³Ibid., p. 520.

¹⁴If all other relevant things, factors or elements remain unaltered.

¹⁵Winer, p. 603.

CHAPTER IV

FINDINGS

This chapter is concerned with the statistical findings of the tests of the a priori hypotheses for the DWLAD, price elasticity assumed to be unity, and ELAD, price elasticities estimated with the Lerner index method, measurements. Also a posteriori tests, suggested by the findings, are discussed. Finally, the conclusions which may be drawn from the findings of the a priori and a posteriori tests are summarized.

A Priori Test Findings

The null hypothesis of equality of DWLAD observed deadweight welfare losses for the test period could not be rejected. With $\alpha = .05$ significance level:

$$F_{\text{CALC}} = 0.418 < F_{.95(3,210)} = 2.64$$

This finding does not support the a priori expectation of an observable difference between the pre-disclosure year and at least one of the disclosure years.

The null hypothesis of equality of the observed deadweight welfare loss for the two groups could not be accepted. With $\alpha = .05$ significance level,

$$F_{\text{CALC}} = 8.818 > F_{.95(1,70)} = 3.987.$$

This finding was obvious by inspection of the mean losses of the two groups over the test period:

	<u>SUB</u>	<u>NONSUB</u>
1975	\$44.20	\$ 2.17
1976	47.39	2.53
1977	48.31	2.85
1978	51.41	2.85

Note there was an increase in the observed mean deadweight welfare loss in both groups over the test period. Acceptance of the first hypothesis suggests these increases are not significantly different. Since the null hypothesis of equality of the DWLAD observed losses was accepted, it appears the observed mean increases during the test period may have been due to factors not considered in the study which affected all firms. No further tests were conducted for the DWLAD measurement.

The null hypothesis of equality of ELAD observed deadweight welfare losses for the test period could not be accepted. With $\alpha = .05$ significance level:

$$F_{\text{CALC}} = 5.526 > F_{.95(3,210)} = 2.64.$$

The null hypothesis of equality of the observed deadweight welfare loss for the two groups for the test period could not be accepted.

With $\alpha = .05$ significance level:

$$F_{\text{CALC}} = 11.28 > F_{.95(1,70)} = 3.987.$$

These findings support the a priori expectations that differences would exist between the pre- and post-disclosure periods, and that a difference would exist between the submitting group and the nonsubmitting group of firms. Since the null hypotheses were rejected, the a priori planned comparisons were made for the individual groups.

For the nonsubmitting group the comparison of the pre-disclosure observed welfare loss (1975) with the year of first disclosure observed welfare loss resulted in:

$$F_{\text{CALC}} = 0.0412 < F_{.95(1,210)} = 3.88.$$

The comparison of the observed welfare loss in the first disclosure year (1976) with the average of the two post-first disclosure years (1977 and 1978) resulted in:

$$F_{\text{CALC}} = 0.021981 < F_{.95(1,210)} = 3.88$$

With $\alpha = .05$ significance level, neither null hypothesis can be rejected.

There appears to be no significant difference between the observed deadweight welfare losses for the nonsubmission group in any of the test period years. This finding supports the a priori expectations.

For the submitting group, the comparison of the pre-disclosure observed welfare loss (1975) with the year of first disclosure observed welfare loss (1976) resulted in:

$$F_{\text{CALC}} = 6.30 > F_{.95(1,210)} = 3.88.$$

With $\alpha = .05$ significance level, the null hypothesis of equal losses in these years could not be accepted.

The comparison of the first disclosure year's observed welfare loss with the average of the two post first disclosure years' losses resulted in:

$$F_{\text{CALC}} = 3.93 > F_{.95(1,210)} = 3.88.$$

With $\alpha = .05$ significance level, the null hypothesis of equal losses in these years could not be accepted. There appears to be a significant increase in the observed deadweight welfare loss for the submitting group in the year of first disclosure. Although not as significant, there also appears to be an increase in the observed welfare losses in the two post-first disclosure years in the submitting group. The increase in the two post-first disclosure years may be due to factors not considered in this study. These findings support the a priori expectations of a significant increase in the first year of disclosure of replacement cost data. However, a priori, the observed welfare losses

in the post-first disclosure years were expected to decrease or remain constant.

A Posteriori Tests

Several economic studies suggest that if four firms in an industry account for at least 50 percent of the industry sales the four-firm concentration ratio (CR4) may be a surrogate for monopoly power to set price.¹ Since this study is based on a premise that large firms may have monopoly power to increase price in order to cover a perceived cost, the question became, would the division of the submitting group by industry four-firm concentration ratios² lend support to a position that firms in highly concentrated seller industries were responsible for the increase in the observed deadweight welfare loss in the year of first disclosure?

Subsequent division of the submitting group by CR4 ratios resulted in one subgroup of 41 firms in industries with four-firm concentration ratios less than 50 percent and another subgroup of 18 firms in industries with four-firm concentration ratios of at least 50 percent. A single factor repeated measure experimental design was used to test the following hypothesis for the ELAD measurement:

H_0 : There is no difference in the observed deadweight welfare loss for the test period 1975 to 1978.

H_A : There is a difference in the observed deadweight welfare loss in at least one year of the test period.

Since a difference was found between the pre-disclosure year (1975) and the post-disclosure years in the previous tests, the null hypothesis was expected to be rejected for both subgroups.

Dunnett's t statistic was used to compare the post-disclosure welfare losses with the pre-disclosure welfare loss, i.e., comparison of means with a control, three for each subgroup.³ A significant difference in each comparison was expected. The calculated t statistic for the differences between the post-disclosure welfare losses (μ_j) and the pre-disclosure welfare losses (μ_o) takes the form:

$$t_{j-o} = \frac{\mu_j - \mu_o}{\sqrt{2 \text{ MSE}/n}} .$$

Two additional comparisons were performed for each subgroup to test the following hypotheses:

H_0 : The observed deadweight welfare losses for 1977 and 1978 are equal.

H_A : The observed deadweight welfare losses for the post-first disclosure years are not equal; and

H_0 : The observed deadweight welfare loss for the first disclosure year (1976) is equal to the average welfare loss for the post-first disclosure years (1977 and 1978).

H_A : The observed deadweight welfare loss for the first disclosure year (1976) is not equal to the average welfare loss for the post-first disclosure years (1977 and 1978).

The expectation based on the a priori test findings was that the null hypotheses would be accepted for both subgroups, i.e., that the post-first disclosure welfare losses would be equal and not significantly greater than the first disclosure year's welfare loss.

For the subgroup of submitting firms in industries with CR4 less than 50 percent, with $\alpha = .05$ significance level, the null hypothesis of equality of observed deadweight welfare losses over the testing period cannot be accepted since:

$$F_{\text{CALC}} = 20.95 > F_{.95(3,120)} = 2.68$$

The comparison of the pre-disclosure loss with the three post-disclosure losses resulted in calculated t-statistics of:

$$t_{76-75} = 3.75$$

$$t_{77-75} = 4.79$$

$$t_{78-75} = 7.68.$$

With a Dunnett's t statistic critical value for $t_{.975(4,120)} = 2.38$, all observed post-disclosure welfare losses were significant for this subgroup.

At the $\alpha = .05$ level of significance, the null hypothesis of equal losses for 1977 and 1978 could not be accepted:

$$F_{\text{CALC}} = 8.37 > F_{.95(1,41)} = 4.08.$$

At the $\alpha = .05$ level of significance, the null hypothesis of the first disclosure year's observed deadweight welfare loss being equal to the average welfare loss for the post-first disclosure years could not be accepted:

$$F_{\text{CALC}} = 8.23 > F_{.95(1,41)} = 4.08.$$

It appears that although there was a significant increase in the observed welfare loss of this subgroup in the year of first submission of replacement cost data, factors other than the requirement for submission of replacement cost data may have affected the observed losses in the two post-first disclosure periods.

For the subgroup of submitting firms in industries with a CR4 not less than 50 percent, with $\alpha = .05$ significance level, the null hypothesis of equality of the observed deadweight welfare losses over the test period could not be accepted:

$$F_{\text{CALC}} = 4.94 > F_{.95(3,51)} = 2.80.$$

The comparison of the pre-disclosure loss with the three post-disclosure losses resulted in calculated t statistics of:

$$t_{76-75} = 1.45$$

$$t_{77-75} = 2.73$$

$$t_{78-75} = 3.60.$$

With a Dunnett's t statistic critical value for $t_{.975(4,51)} = 2.42$, the findings suggest that there was no significant increase in the period of first disclosure of the replacement cost data for the firms in industries with a CR4 not less than 50 percent. A significant increase was found for the two periods following first disclosure.

At the $\alpha = .05$ level of significance, the null hypothesis of equal losses for 1977 and 1978 could not be rejected:

$$F_{\text{CALC}} = 0.75 < F_{.95(1,51)} = 4.04.$$

The null hypothesis of the 1976 observed deadweight welfare loss being equal to the average of the 1977 plus 1978 losses could not be rejected at the $\alpha = .05$ significance level:

$$F_{\text{CALC}} = 3.96 < F_{.95(1,51)} = 4.04.$$

These findings imply that although the welfare losses for the periods following the first disclosure period were significantly higher than the pre-disclosure observed welfare loss, there was no significant increase in the post-disclosure observed welfare losses. This could imply that firms in the subgroup with CR4 not less than 50 percent may have gathered data needed to report replacement cost information along with data necessary to prepare historical cost financial statements. If this were true, then an increase in price to cover a perceived increase in marginal cost would not be necessary. The initial cost to implement the gathering of the replacement cost data may have been passed on to consumers in a prior period. On the other hand, there may have been a time lag before firms in this subgroup could pass on

the costs to consumers. If this were true, the increased welfare loss attributable to the disclosure of replacement cost data might be explained by the significant increase in the welfare loss found in 1977 and/or 1978. To assess this possibility the a posteriori tests were performed for the nonsubmitting group. If similar movements in 1977 and 1978 could be observed, the assumption might be that the significant increases in 1977 and 1978 for both subgroups of the submitting firms were due to factors not considered in the study that affected all of the firms in the sample.

For the nonsubmitting firms, with $\alpha = .05$ level of significance, the null hypothesis of equal observed deadweight welfare losses for the test period, could not be accepted:

$$F_{\text{CALC}} = 3.89 > F_{.95(3,36)} = 2.87.$$

The comparison of the observed post-disclosure welfare losses with the pre-disclosure loss revealed calculated t statistics of:

$$t_{76-75} = 1.83$$

$$t_{77-75} = 3.13$$

$$t_{78-75} = 2.48.$$

With a Dunnett's t statistic critical value of $t_{.975(4,36)} = 2.46$ the significance of the increases in the observed deadweight welfare losses for the nonsubmitting group are similar to those of the subgroup of submitting firms in industries with a CR4 of not less than 50 percent. This tends to support the possibility that factors other than increased disclosure, such as other regulated costs imposed on all reporting firms, affected the observed deadweight welfare losses in the post-first disclosure years.

Summary

For the DWLAD measurement, i.e., price elasticity assumed to be one, no significant increase in the observed deadweight welfare loss could be observed for either the submitting or nonsubmitting group. For the ELAD measurement, i.e., price elasticity estimated for individual firms with the Lerner Index method, a significant increase in the observed deadweight welfare loss in the post-disclosure years could be observed for the group of firms required to disclose replacement cost data. No significant increase was observed in the period of first disclosure for the nonsubmitting firms. These findings imply the increase in the observed deadweight welfare loss of the submitting firms was due to the requirement by the SEC for the disclosure of replacement cost data.

Based on these findings, four-firm concentration ratios were used to separate the submitting group of firms into two subgroups in an attempt to gain insight as to whether those firms in the highly concentrated seller markets were responsible for the increase in the observed welfare loss in the first disclosure year. The a posteriori tests imply that the subgroup of firms in industries with four-firm concentration ratios less than 50 percent was responsible for the significant increase in the observed deadweight welfare loss in the year of first disclosure of replacement cost data. Comparison of the movements of welfare losses for the other post-disclosure years suggest factors not considered in this study may have influenced the increase in those years for both the submitting and nonsubmitting group.

ENDNOTES

¹F. H. Scherer, Industrial Market Structure and Economic Performance (Chicago, 1973), pp. 50-57. Also see Donald L. Bumpass, "Determinants of Price Cost Margins and Estimates of Welfare Loss in Selected U.S. Manufacturing Industries," (Unpublished Ph.D. dissertation, Oklahoma State University, 1973), p. 101.

²U. S. Bureau of the Census, Census of Manufacturers (Washington, D.C. , 1976).

³B. J. Winer, Statistical Principles in Experimental Design, Second Edition (New York, 1971), pp. 201-203 and 261-269.

CHAPTER V

SUMMARY AND CONCLUSIONS

The objective of this study was to provide an analysis which can be used to move toward a theory for measuring the indirect costs imposed on society when regulatory bodies require increased supplemental information disclosure with historical cost based financial statements. This objective is important because the allocation of resources to supply the supplemental information affects both users and nonusers of the supplemental information. Information evaluation models used to assess the net benefits of information ignore the costs, both direct and indirect, to nonusers of the information and the indirect costs to users of the information.

This study addressed the question of whether the economic theory pertaining to deadweight welfare loss due to monopoly power to set price can be used to help evaluate such indirect costs. Deadweight welfare loss is the portion of consumers' surplus available to consumers under competitive pricing that is lost to both consumers and producers under monopoly pricing. This study was not a general treatment of economic theory or of the measurement of deadweight welfare loss due to monopoly power to set price, but the application of those tools was used to observe and assess the significance of an indirect cost in an accounting problem. The various aspects of economic theory were pursued only as far as necessary for the limited purpose of this study. The assumptions

of the pricing methods, discussed in Chapter II, may not necessarily describe how the sample firms actually behave. Various objectives other than profit maximization may affect the behavior of the firms. Firms may respond to objectives that are not evident in the foregoing framework.

Concentration was directed on one possible form of the indirect social cost which may result from a requirement by a regulatory body for supplemental information disclosure. The study demonstrates that the economic theory of deadweight welfare loss due to monopoly power to set price may be a useful tool in evaluating the indirect social cost of regulation.

The findings of this study suggest that if price elasticities can be estimated with reasonable accuracy, changes in the observed deadweight welfare loss that are related to increased information disclosure requirements imposed by regulatory bodies may be observed. Further, based on the results of this study, such changes are most likely to be significant in firms which are not in highly concentrated seller markets. Thus, the conclusion that may be drawn is that the economic theory pertaining to the loss of consumers' surplus due to a firm's monopoly power to set price may be a valuable tool in the search for a method of quantifying the indirect cost to society of regulatory body requirements for additional information disclosure.

Implications for Future Research

Future research could build on the foundation presented in this study. Less aggregated data than the consolidated data gleaned from the COMPUSTAT files might reveal more appropriate surrogates for the

economic values in the deadweight loss measurement model. The methodology could be extended to observe welfare losses of firms in service oriented industries. The Financial Accounting Standards Board requirement for current value and general price level adjusted data submission would permit a replication of this study. If price and cost information before and after a requirement for additional information disclosure could be obtained, the deadweight loss due to the requirement could possibly be quantified with the model developed in Chapter II. Perhaps the most important implication for future research is that this study has suggested an application of only one economic theory pertaining to the problem of observing and quantifying indirect costs. Other applications of this economic theory no doubt exist, and there may be other economic theories which can be applied to help resolve the problem addressed in this study.

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APPENDICES

APPENDIX A

LIST OF SAMPLE FIRMS

TABLE IV
 SAMPLE FIRMS LISTED BY INDUSTRY CODE NUMBER, COMPANY NUMBER
 AND COMPANY NAME

SIC Number	Company Number	Company Name
<u>Submitting Group:</u>		
2111*	24703	American Brands Inc.
2111*	532202	Liggett Group
2200	235773	Dan River Inc.
2400	97383	Boise Cascade Corp.
2400	962166	Weyerhauser Co.
2510	608030	Mohasco Corp.
2600	793453	St. Regis Paper Co.
2649	81437	Bemis Co.
2731	580645	McGraw-Hill Inc.
2800	150843	Celanese Corp.
2800	383883	Grace (W. R.) & Co.
2800	611662	Monsanto Co.
2800	709317	Pennwalt Corp.
2830	26609	American Home Products Corp.
2841*	194162	Coalgate-Palmolive Co.
2844	110097	Bristol-Myers Co.
2850	457659	Insilco Corp.
2850	824348	Sherwin-Williams Co.
2950	339711	Flintkote Co.
2950	361428	GAF Corp.
3000*	909160	Uniroyal Inc.
3140	585745	Melville Corp.
3221*	690768	Owens-Illinois Inc.
3241	23904	Amcord Inc.
3241	542290	Lone Star Industries
3270	372451	Genstar Ltd.
3310	17372	Allegheny Ludlum Inds.
3310	232525	Cyclops Corp.
3310	457470	Inland Steel Co.

TABLE IV (Continued)

SIC Number	Company Number	Company Name
3350	761406	Revere Copper & Brass Inc.
3390	171106	Chromalloy American Corp.
3429	270330	Easco Corp.
3449	150033	Ceco Corp.
3520	19645	Allis-Chambers Corp.
3533	444492	Hughes Tool Co.
3540	947015	Wean United Inc.
3550	291210	Emhart Corp.
3558	962898	Wheelabrator-Frye
3570*	628862	NCR Corp.
3570*	724479	Pitney-Bowes Inc.
3573*	586005	Memorex Corp.
3600	960402	Westinghouse Electric Corp.
3610	120655	Bunker Ramo Corp.
3610	227813	Crouse-Hinds Co.
3610	383492	Gould Inc.
3610	903422	UV Industries Inc.
3630*	810640	Scovill Inc.
3630*	829302	Singer Co.
3651*	749285	RCA Corp.
3714*	43339	Arvin Industries Inc.
3714*	99725	Borg-Warner Corp.
3714*	566472	Maremont Corp.
3714*	748359	Questor Corp.
3714*	872649	TRW Inc.
3720*	539821	Lockheed Corp.
3728	913017	United Technologies Corp.
3841	71892	Baxter Travenol Laboratories
3841	871140	Sybron Corp.
3861*	77851	Bell & Howell Co.

TABLE IV (Continued)

SIC Number	Company Number	Company Name
<u>Nonsubmitting Group:</u>		
2200	525030	Lehigh Valley Inds.
2300	946048	Wayne-Gossard Corp.
2510	549662	Ludlow Corp.
2649	698822	Papercraft Corp.
2721	127388	Cadence Ind. Group
2850	739732	Pratt & Lambert Inc.
3069	763121	Richardson Co.
3079	157186	Cetic Corp.
3499	370073	General Housewares
3662	208291	Conrac Corp.
3679	904790	Unimax Group Inc.
3699	443510	Hubbell (Harvey) Inc.-CL B
3911	859782	Sterndent Corp.

* These firms comprise the submitting subgroup with four firm concentration ratios of at least 50%.

APPENDIX B

CALCULATED VARIABLES

TABLE V
ESTIMATED WEIGHTED AVERAGE COST OF CAPITAL

Company Number	1975	1976	1977	1978
<u>Submitting Firms:</u>				
24703	.1323	.1343	.1312	.1440
532202	.1364	.1214	.1334	.1271
235773	.0718	.0550	.0530	.0554
97383	.1084	.1035	.1074	.1104
962166	.1031	.0965	.0979	.0973
608030	.0794	.0805	.0790	.0808
793453	.1046	.1069	.1021	.1067
81437	.1151	.1070	.1114	.1045
580645	.1209	.1225	.1261	.1281
150843	.0953	.0974	.0965	.0970
383883	.1080	.1010	.1026	.1072
611662	.1047	.1079	.1079	.1060
709317	.1023	.1043	.1041	.1071
26609	.1838	.1840	.1840	.1843
194162	.1522	.1546	.1549	.1419
110097	.1754	.1787	.1816	.1819
457659	.0808	.1068	.0953	.0944
824348	.1025	.1039	.0878	.0893
339711	.0952	.0978	.1062	.1077
361428	.1111	.1026	.1047	.1051
909160	.0578	.0559	.0579	.0669
585745	.1420	.1358	.1416	.1352
690768	.0806	.0852	.0836	.0809
23904	.0603	.0619	.0718	.0727
542290	.0674	.0711	.0698	.0728
372451	.0820	.0733	.0836	.0936
17372	.0897	.0817	.0668	.0767
232525	.0767	.1076	.0992	.0966
457470	.1007	.0817	.0865	.0750

TABLE V (Continued)

Company Number	1975	1976	1977	1978
761406	.0580	.0534	.0674	.0613
171106	.0896	.0952	.0915	.0968
270330	.1128	.1044	.0962	.1058
150033	.1122	.1087	.1116	.1132
19645	.0915	.0954	.0959	.0895
444492	.1683	.1732	.1761	.1619
947015	.0887	.0876	.0900	.0949
291210	.1521	.1443	.1536	.1594
962898	.1281	.1260	.1356	.1425
628862	.0928	.0973	.1068	.1194
724479	.1008	.1029	.1036	.1060
586005	.0564	.0787	.1119	.1184
960402	.1248	.1286	.1332	.1349
120665	.1063	.1260	.1090	.1171
227813	.1371	.1382	.1387	.1370
383492	.1146	.1154	.1224	.1187
903422	.0983	.1093	.0940	.1017
810640	.1095	.1131	.1174	.1003
829302	.0341	.0999	.1098	.1150
749285	.0910	.0954	.0928	.0960
43339	.1334	.1016	.1028	.1040
99725	.1263	.1324	.1297	.1287
566472	.1183	.1195	.0983	.1080
748369	.1163	.1151	.1038	.1231
872649	.1077	.1119	.1133	.1137
539821	.0493	.0746	.0771	.0895
913017	.0926	.1200	.1267	.1035
71892	.1087	.1045	.1096	.1136
871140	.1098	.1205	.1175	.1098
77851	.1644	.1295	.1295	.1231

TABLE V (Continued)

Company Number	1975	1976	1977	1978
<u>Nonsubmitting Group:</u>				
525030	.0079	.0472	.0489	.0681
946048	.1026	.0923	.0965	.1044
549662	.0853	.0846	.0823	.0748
698822	.1106	.1096	.1135	.1193
127388	.0711	.0722	.0766	.0748
739732	.1300	.1194	.1218	.1219
763121	.0605	.0648	.0610	.0648
157186	.1237	.1207	.1280	.1147
370073	.1191	.1169	.1169	.1008
208291	.1087	.1051	.1119	.0997
904790	.0833	.0863	.0703	.0812
443510	.1482	.1478	.1516	.1509
859782	.1537	.1554	.1198	.1302

TABLE VI
ESTIMATED PRICE ELASTICITIES OF DEMAND

Company Number	1975	1976	1977	1978
<u>Submitting Group:</u>				
24703	4.12	4.08	4.09	4.29
532202	3.42	3.18	3.35	3.13
235773	16.11	7.61	8.03	7.49
97383	9.55	7.59	6.91	6.99
962166	5.23	4.97	5.39	4.79
608030	5.02	4.85	5.07	5.13
793453	7.87	8.16	7.40	7.66
81437	7.68	6.78	6.67	6.36
580645	2.43	2.39	2.32	2.30
150843	5.37	5.27	5.25	4.90
383883	4.23	4.37	4.18	4.05
611662	4.31	4.34	4.54	4.81
709317	3.50	3.34	3.44	3.64
26609	2.39	2.39	2.37	2.36
194162	2.90	3.13	3.29	3.24
110097	1.87	1.93	1.93	1.95
457659	3.87	3.73	3.30	3.39
824348	3.49	3.65	3.96	3.89
339711	9.68	9.41	8.62	6.69
361428	4.38	4.66	4.70	4.51
909160	5.05	5.24	5.43	5.99
585745	2.70	2.73	2.76	2.74
690768	7.41	7.28	8.67	7.79
23904	5.30	5.24	4.66	4.75
542290	5.22	5.06	5.13	5.14
372451	5.18	4.77	5.31	4.93
17372	10.36	9.95	9.55	6.46
232525	15.64	12.67	16.33	11.91

TABLE VI (Continued)

Company Number	1975	1976	1977	1978
457470	10.60	10.09	13.37	9.72
761406	24.21	13.80	13.14	9.41
171106	4.40	4.43	4.55	4.41
270330	6.73	7.26	6.91	6.82
150033	7.09	9.83	11.88	9.36
19645	7.59	6.23	5.68	5.43
444492	5.19	6.02	5.73	4.36
947105	12.36	14.53	9.11	10.33
291210	5.51	3.71	3.86	3.93
962898	6.34	6.04	5.48	5.58
628862	2.73	2.74	2.36	2.20
724479	1.56	1.62	1.54	1.54
586005	2.07	2.19	2.42	2.62
960402	9.07	8.69	9.44	9.04
120655	8.40	6.23	5.54	4.67
227813	3.20	3.12	3.08	3.06
383492	5.33	4.17	4.05	4.01
903422	6.15	5.95	5.20	6.70
810640	5.04	4.46	4.36	4.02
829302	2.79	3.09	3.17	3.29
749285	5.18	4.76	4.37	4.33
43339	14.06	5.71	5.85	6.55
99725	9.40	7.23	6.79	6.73
566472	3.68	3.50	3.45	3.59
748359	4.98	4.39	4.24	4.40
872649	4.78	4.50	4.48	4.50
539821	9.76	10.00	9.48	10.08
913017	4.33	4.55	4.41	4.19
71892	3.15	2.90	2.95	2.96
871140	3.48	3.35	3.16	3.12
77851	5.77	4.43	4.25	4.00

TABLE VI (Continued)

Company Number	1975	1976	1977	1978
<u>Nonsubmitting Group:</u>				
525030	6.66	6.98	6.19	6.24
946048	5.26	5.26	6.25	6.12
549662	10.00	7.38	6.57	7.60
698822	3.13	3.20	3.16	3.16
127388	2.56	2.32	2.37	2.08
739732	3.73	3.47	3.60	3.51
763121	6.68	5.49	4.95	5.05
157186	5.46	4.66	4.86	5.06
370073	3.92	3.44	3.56	3.69
208291	6.67	5.75	5.81	9.41
904790	3.96	3.67	2.98	2.95
443510	4.23	4.08	4.01	4.23
859782	7.20	11.79	6.28	7.55

TABLE VII
OBSERVED WELFARE LOSSES - PRICE ELASTICITY UNITY

Company Number	1975	1976	1977	1978
<u>Submitting Group:</u>				
24703	75.613	75.721	76.893	73.797
532202	28.955	33.696	32.395	35.769
235773	0.779	4.062	3.453	3.904
97383	7.988	15.850	21.512	21.703
962166	44.330	54.996	50.149	68.179
608030	11.100	12.533	11.271	11.177
793453	11.256	11.653	16.179	16.151
81437	4.583	6.265	6.341	6.893
580645	45.471	48.732	54.310	59.180
150843	32.952	36.174	37.389	44.894
383883	98.485	89.610	100.860	108.118
611662	97.750	107.088	98.888	89.467
709317	29.135	32.864	31.260	28.671
26609	196.921	203.784	212.174	226.240
194162	170.524	169.575	157.806	169.403
110097	261.515	252.045	260.192	264.411
457659	11.087	13.118	16.262	16.081
824348	35.674	33.796	29.320	30.831
339711	2.323	2.617	3.507	6.727
361428	25.076	23.083	18.921	21.553
909160	42.907	39.822	38.895	31.484
585745	62.414	77.621	86.092	95.838
690768	20.691	22.943	16.364	21.164
23904	2.952	3.441	5.191	5.242
542290	11.228	13.277	14.505	17.053
372451	13.439	18.455	14.931	16.332
17372	3.687	4.244	4.881	12.901
232525	0.988	1.665	1.083	2.266

TABLE VII (Continued)

Company Number	1975	1976	1977	1978
457406	9.380	11.905	6.665	14.166
761406	0.326	1.238	1.537	3.174
171106	20.394	22.549	24.326	29.684
270330	2.244	2.052	2.538	2.815
150033	2.576	1.214	0.842	1.608
19645	12.542	18.478	21.127	24.626
444492	6.469	5.003	6.088	14.329
947015	0.977	0.530	1.033	0.722
291210	5.846	38.010	35.738	35.897
962898	4.133	5.103	7.129	8.263
628862	144.680	145.323	201.597	222.178
724479	94.462	96.584	112.822	123.696
586005	30.721	33.912	34.016	38.018
960402	35.506	38.423	30.612	33.619
120655	2.046	3.850	4.928	7.242
227813	10.199	12.012	13.328	14.317
383492	13.616	33.283	43.893	48.043
903422	5.643	6.907	9.616	5.521
810640	8.710	14.170	15.708	19.288
829302	132.118	105.407	101.055	94.260
749285	89.049	111.240	136.774	144.903
43339	0.860	5.799	5.962	4.690
99725	9.280	16.852	19.566	21.184
566472	10.811	11.955	11.852	10.849
748369	8.191	10.764	11.602	9.227
872649	56.671	68.280	72.131	77.027
539821	17.783	15.129	16.680	14.146
913017	103.272	118.139	126.448	147.101
71892	28.4116	38.2497	43.0902	47.3595
871140	23.0266	24.3069	26.0473	26.1119
77851	5.9868	10.5502	12.1021	14.6300

TABLE VII (Continued)

Company Number	1975	1976	1977	1978
<u>Nonsubmitting Group:</u>				
525030	1.1735	1.1600	1.5543	1.4933
946048	0.8971	1.1115	0.8343	0.8495
549662	0.9044	1.9504	2.2198	1.0311
698822	4.0045	3.1080	3.3173	3.3536
127388	6.7458	7.9207	7.9949	10.4241
739732	2.5216	3.0841	2.8174	2.9001
763121	1.3680	2.1875	2.7425	2.6925
157186	0.5898	0.8790	0.8085	0.8302
370073	1.7601	2.1631	2.1219	1.8378
208291	1.0170	1.7411	1.7543	0.6012
904790	1.3699	1.7779	3.3352	3.5491
443510	4.8121	5.4645	5.8349	6.0050
859782	1.0548	0.4481	1.8801	1.5298

TABLE VIII
OBSERVED WELFARE LOSSES - PRICE ELASTICITIES ESTIMATED

Company Number	1975	1976	1977	1978
<u>Submitting Group:</u>				
24703	311.691	309.247	314.253	316.635
532202	98.928	107.039	108.392	111.927
235773	12.551	30.899	27.742	29.224
97333	76.310	120.305	148.741	151.774
962166	231.663	273.086	270.390	326.886
608030	55.765	60.842	57.189	57.315
793453	88.598	95.114	119.767	123.792
81437	35.206	42.467	42.322	43.871
580645	110.440	116.563	126.076	136.316
150843	176.931	190.540	196.272	219.807
383883	416.874	391.343	422.021	438.409
611662	420.899	464.955	449.190	430.367
709317	101.968	109.893	107.659	104.388
26609	471.579	487.979	503.001	534.619
194162	493.853	530.569	518.572	548.926
110097	488.857	486.502	503.212	516.978
457659	42.949	48.965	53.748	54.466
824348	124.347	123.328	116.145	120.004
339711	22.483	24.617	30.248	45.014
361428	109.963	107.576	89.001	97.228
909160	216.640	208.756	211.183	188.497
585745	168.362	212.293	237.361	262.829
690768	153.354	167.015	141.813	164.820
23904	15.661	18.020	24.208	24.887
542290	58.590	67.177	74.487	87.636
372451	69.561	88.036	79.349	80.571
17372	38.212	42.230	46.608	83.369
232525	15.458	21.094	17.684	26.989

TABLE VIII (Continued)

Company Number	1975	1976	1977	1978
457470	99.415	111.923	89.090	137.766
761406	7.891	17.080	20.196	29.856
171106	89.833	99.956	110.725	130.781
270330	15.105	14.909	17.543	19.200
150033	18.260	11.939	9.996	15.047
19645	95.097	115.203	120.113	133.801
444492	33.549	30.114	34.904	62.430
947015	12.077	7.702	9.414	7.455
291210	32.230	140.995	137.966	141.200
962898	26.200	30.836	39.069	46.084
628862	395.803	398.606	475.140	489.131
724479	147.543	156.903	174.246	190.507
586005	63.680	74.331	82.460	99.655
960402	323.023	334.099	288.862	303.981
120655	17.194	24.000	27.326	33.832
227813	32.615	37.480	40.996	43.758
383492	72.536	138.857	177.680	192.505
903422	34.720	41.108	50.025	37.017
810640	43.926	63.221	68.497	77.570
829302	368.937	325.447	320.216	309.852
749285	461.789	529.358	597.673	628.119
43339	12.099	33.100	34.910	30.760
99725	87.205	121.808	132.876	142.566
566472	39.759	41.917	40.882	38.904
748359	40.804	47.288	49.188	40.576
872649	270.678	307.485	323.349	346.893
539821	173.542	151.350	158.064	142.601
913017	447.472	537.156	558.302	616.582
71892	89.517	110.999	127.120	140.063
871140	80.134	81.381	82.238	81.518
77851	34.545	46.709	51.400	58.523

TABLE VIII (Continued)

Company Number	1975	1976	1977	1978
<u>Nonsubmitting Group:</u>				
525030	7.821	8.102	9.615	9.321
946048	4.724	5.843	5.214	5.198
549662	9.053	14.392	14.584	7.833
698822	12.519	9.953	10.491	10.585
127388	17.243	18.399	18.951	21.661
739732	9.409	10.689	10.146	10.191
763121	9.137	12.002	13.568	13.596
157186	3.219	4.098	3.929	4.205
370073	6.904	7.441	7.545	6.791
208291	6.781	10.019	10.192	5.659
904790	5.421	6.533	9.954	10.480
443510	20.345	22.309	23.384	25.384
859782	7.597	5.283	11.810	11.548

APPENDIX C

COMPUTATIONAL PROCEDURES

Repeated Measures Unequal Group Sizes, Unweighted Means Solution

AB Summary Table						AB' Summary Table					
	b_1	b_2	b_3	b_4	Totals		b_1	b_2	b_3	b_4	Totals
a_1	G_{11}	G_{12}	G_{13}	G_{14}	A_1		\bar{G}_{11}	\bar{G}_{12}	\bar{G}_{13}	\bar{G}_{14}	A'_1
a_2	G_{21}	G_{22}	G_{23}	G_{24}	A_2		\bar{G}_{21}	\bar{G}_{22}	\bar{G}_{23}	\bar{G}_{24}	A'_2
Totals	B_1	B_2	B_3	B_4	G		B'_1	B'_2	B'_3	B'_4	G'

Computations:

- | | |
|-------------------------------|---------------------------|
| 1. G^2/Nq | 1'. G'^2/pq |
| 2. $\Sigma \Sigma x^2$ | |
| 3. $\Sigma (A_i^2/n_{iq})$ | 3'. $(\Sigma A_i'^2)/q$ |
| 4. $(\Sigma B_j^2)/N$ | 4'. $(\Sigma B_j'^2)/p$ |
| 5. $\Sigma [(AB_{ij})^2/n_i]$ | 5'. $\Sigma (AB'_{ij})^2$ |
| 6. $(\Sigma P_m^2)/q$ | |

Harmonic Mean:

$$\bar{n}_h = p / \Sigma (1/n_i)$$

Analysis of Variance

<u>Source</u>	<u>df</u>	<u>SS</u>
<u>Between Firms:</u>	<u>N-1</u>	
A	p-1	$\bar{n}_h(3' - 1')$
Subjects within group	(N-p)	6-3
<u>Within Firms:</u>	<u>N(q-1)</u>	
B	q-1	$\bar{n}_h(4' - 1')$
AB	(p-1)(q-1)	$\bar{n}_h(5' - 3' - 4' + 1')$
B_x subjects within group	(N-p)(q-1)	(2 - 5 - 6 + 3)

Source: B. J. Winer. Statistical Principles in Experimental Design.
2nd Edition. New York: McGraw-Hill, 1971, p. 602.

APPENDIX D

ANALYSIS OF VARIANCES -

A PRIORI TESTS

Analysis of Variance

Two Group DWLAD Measurement
Unweighted Means Solution

Source	df	SS	MS	F
<u>Between Firms:</u>	<u>71</u>			
A	1	87157.838	87157.838	8.818*
Subjects within groups	70	691841.310	9883.447	
<u>Within Firms:</u>	<u>216</u>			
B	3	339.553	113.184	.418
AB	3	10.712	3.571	.013
B _x subjects within groups	210	56814.220	270.544	

$$*F_{.95}(1,70) = 3.99$$

$$F_{.95}(3,210) = 2.64$$

Analysis of Variance
Two Group ELAD Measurement
Unweighted Means Solution

Source	df	SS	MS	F
<u>Between Firms:</u>	<u>71</u>			
A	1	909536.907	909536.907	11.281*
Subjects within groups	70	5643989.04	80628.415	
<u>Within Firms:</u>	<u>216</u>			
B	3	5608.772	1869.591	5.526**
AB	3	4815.522	1605.174	4.744**
B _x subjects within group	210	71042.723	338.299	

$$*F_{.95}(3,210) = 2.64$$

$$**F_{.95}(1,70) = 3.99$$

APPENDIX E

ANALYSIS OF VARIANCES -

A POSTERIORI TESTS

Analysis of Variance

Submitting Subgroup I
(CR4 < 50%)

Source	df	SS	MS	F
Between Firms:	40	3462547.104	86563.678	
Within Firms:	123	62865.815	511.104	
Year	3	21607.971	7202.657	20.949*
Residual	120	41257.844	343.815	

$$*F_{.95}(3,120) = 2.68$$

Analysis of Variance

Submitting Subgroup
(CR4 > 50%)

Source	df	SS	MS	F
Between Firms:	17	1938916.308	114053.901	
Within Firms	54	36858.476	682.564	
Treatment	3	8296.174	2765.391	4.938*
Residual	51	28563.295	560.045	

$$*F_{.95}(3,51) = 4.21$$

Analysis of Variance

Nonsubmitting Group

Source	df	SS	MS	F
Between Firms	12	1315.847	109.654	
Within Firms	39	147.531	3.783	
Treatments	3	36.134	12.045	3.893*
Residual	36	111.396	3.094	

$$*F_{.95}(3,36) = 2.872$$

2
VITA

Helen Malcolm Traugh

Candidate for the Degree of

Doctor of Philosophy

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