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ELECTRICAL EQUIPMENT PURCHASING PATTERNS OF UTILITIES AND COMMERCIAL COMPANIES AS AFFECTED BY COLLUSION AMONG EQUIPMENT MANUFACTURERS: AN ASPECT OF RATE-BASE PADDING BY ELECTRICAL UTILITIES

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# ELECTRICAL EQUIPMENT PURCHASING PATTERNS OF UTILITIES AND COMMERCIAL COMPANIES AS AFFECTED BY COLLUSION AMONG EQUIPMENT MANUFACTURERS: AN ASPECT OF RATE-BASE PADDING BY ELECTRICAL UTILITIES

by

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TABLE OF CONTENTS

LIST OF TABLES

# LIST OF FIGURES

# CHAPTER I

# INTRODUCTION AND SUMMARY OF FINDINGS

## I-A Introduction

The Supreme Court stated in a landmark 1898 opinion that a regulated firm should be allowed to earn a fair return on fair value of the property used by it in the production of the services it provides. As this has evolved over time, it has meant that the regulators had to decide two quantitative values:

1) The rate base, which reflects the fair value of capital in use.

2) The allowed rate of return on that rate base.

To determine the "fair value" of capital is a major issue in regulatory proceedings. Until the 1940's this issue was the basis for repeated appeals of regulatory decisions by the courts. The courts ruled that a commission that undervalued a utility's assets was in effect confiscating part of that property.[1] Although no longer a constitutional question the ideal method of determining the fair value has not been found.

One way of calculating fair value is to use the original cost of the firm's assets and to subtract from them the subsequent depreciation. However, if inflation is present all assets evaluated by this method will have a low value. Another method is to use reproduction costs (what would it cost today to install the same equipment). This method circumvents the problem of inflation but it ignores the role of technology that often reduces the cost of similar equipment built years ago. In practice, most of the regulatory commissions use a combination of the two methods in order to assess the fair value of capital.[2]

After determining the rate base, the regulatory commissions decide what return to allow on it. In deciding the amount of return there is one central issue: what function profit serves in a regulated industry. Profit has two major functions:

> First, it must be set at a level which allows the regulated concern to attract sufficient new capital to satisfy consumer demands with an economically efficient plant. Second, profit performs an incentive function. To exploit its incentive potentialities, the regulators must set rates of return so as to reward efficiency and punish inefficiency.[3]

If the rate of return is less than the cost of capital, it will discourage utility investments. If, on the other hand, the regulatory commission allows a return greater than the cost of capital, utilities will have an incentive to increase their rate base. It is generally believed that in practice the regulators set the rate of return to be higher that the market rate of return on capital. For example, during the 1979-1973 period the common allowed rate of return was 12 percent after tax. This was a little higher that the average for the manufacturing sector of the economy, which was 10.8 percent. [4]

I-A-1 The Averch-Johnson Hypothesis

In a pathbreaking article in 1960 Harvey Averch and Leland Johnson examined the issue of overintensive substitution of capital for other factors of production by regulated firms.[5] They compared the capital labor ratio for both regulated and non-regulated firms and developed the theoretical basis, now known as the Averch-Johnson (A-J) hypothesis. It states that a rate of return regulation will cause the capital labor ratio utilized by the profit maximizing firm to be different from that which would result from unconstrained cost minimization. In other words, too much capital is hired relative to the amount of labor when a firm has a constraint that allows the return on capital to be greater than the market cost of capital. When this constraint is binding, the capital labor ratio is too high for efficiency in production. In a decade that followed other economists (A. Takayama, W.J. Baumol, A.K. Klevorick) have further refined the A-J hypothesis.

I-A-2 Rate Base Padding

The Averch-Johnsos hypothesis left the impression that a regulated firm has a tendency toward all forms of overcapitalization.[6] The fact is that regulated firls are capital intensive by the nature of their operation. For example, the electrical utility must meet the demand for electricity instantaneously, although the demand for electricity differs between peak hours (or seasons) and off-peak hours (or seasons). Utilities construct plants in order to satisfy the peak load, which means that at other times they operate below capacity with much of the capital being idle. In other words, "over-capitalization" exists in order to satisfy peak demand. What also appears to be an overintensive use of capital is that in some regulated industries, the firms insist on using technologically complex machinery, instead of using simpler equipment that requires more labor. However, the complex equipment has achieved impressive economies of scale. For example, in the production of electricity costs decline up to the plant size of 750,000 kilowatts, a capacity sufficient to serve 500,000 people.[7]

Other forms of overcapitalization make it possible for the regulated firm to take advantage of the regulatory process. The advantage is taken when the regulated firm pads the base with unnecessary capital and thus increases the allowed profit without increasing the services it provides. There are three types of such overintensive capital use:[8]

1) Gold Plating (the use of unnecessarily expensive material and design).

2) Maintaining excessive spare capacity.

3) Penetration into other markets at non-profitable prices in order to pad the base.

In order to examine these methods of overcapitalization, Prof. E. E. Zajac in 1970 (with additions in 1972) translated the A-J hypothesis into geometric form. [9] He found it surprising that little attention had been paid to the oldest issue of overintensive capital use, gold plating. This issue has been widely discussed verbally by those involved with the regulatory process, but it's economic analysis was absent from the literature. Prof. Zajac defined all unnecessarily expensive capital as non-productive capital. Then by using the geometric A-J model, he discovered that the regulated firm can in certain cases increase its profits by employing non-productive capital. The firm may find itself in a situation where additions of productive capital will reduce profits below the level that could be earned by padding the base. In that case padding the base by employing non-productive capital is more profitable.

I-A-3 Criticism of the Rate Base Padding Model

In the short run the regulated firm may not be able to obtain the amount of capital needed in order to operate at the point where maximum allowed profit is earned. Prof. Zajac acknowledges this since in his model the firm begins operating at a capital level below that required for allowed profit maximization. But when the firm operates at the capital level that earns less than the maximum allowed profit, Prof. Zajac argues that the firm should employ additional capital in order to achieve maximum allowed profit and it should not attempt to pad the base. Since the firm originally starts with the amount of capital which does not achieve maximum allowed profit, what guarantee is there that the regulated firm is able to employ the amount of capital that would bring maximum allowed profit in the short run? Suppose that the regulated firm is unable to employ the quantity of capital that will result in maximum allowed profit, but in the short run has enough resources to employ some additional capital. Actually, the firm has two strategies available to it:

1-It can employ additional capital

2- It can pad the base by using non-productive capital

Contrary to Prof. Zajac's findings, I will show that managers who choose between these two strategies will prefer to pad the base. Padding earns as much profit for the firm as employment of productive capital. Furthermore, it can be used to build lavish buildings, spacious offices etc.. This is an example of managers "satisficing", that is, seeking choices with respect to their several objectives. By padding the firm earns its allowed profit, and managers satisfy their non-profit objectives.

The short run expenditure that is meant to enlarge the rate base has a cumulative long run effect. Any non-productive capital acquired for padding purposes remains in the firm over its lifetime. What this means is that a firm that pads the base will increase its allowed profits not only this year but in the years to come as well, and the utility's customers will pay higher prices for services. Therefore, padding the base is a serious issue not only because it is an undesirable side of regulation but because it affects an individual's cost of living by increasing utility rates.

I-A-4 Objective of this Study

This study investigates the rate base padding issue. Specifically, it examines the possibility that utilities engage in that form of "gold plating", which includes the payment of unnecessarily high prices for equipment they purchase. The existence of this practice has been established by comparing the purchases of utilities with those of industrial firms, who operate free from the regulatory constraint. This study focuses on kinds of apparatus purchased by both types of buyers and this permits an analysis of which type of buyer paid higher prices. If it is found that the prices that utilities paid for their equipment were significantly higher than the prices paid by industrial firms, then that would support the thesis that utilities did in fact engage in this kind of rate base padding.

I-A-5 Time Frame

The time period selected for this study was 1957-1963 (1960 was not included because it was the transition year from before to after the conspiracy trial). The first three years represent the collusion period while the last three years represent the post-collusion period. Another reason why this time period was selected is that data compiled in the numerous court cases provided a basis for the analysis. By using the Freedom of Information Act I was able to obtain this data.

I-A-6 Chapter Descriptions

The organization of this study is as follows:

Chapter 2 describes the type of apparatus, pricing categories and the purchasing practices of the utilities and industrial firms. The equipment that will be used in the analysis consists of electrical apparatus of three types: transformers, switchgear-circuit breakers and industrial control devices. These are classified in the Census of Manufacturers as part of subgroup 36A, SIC four digit codes 3612, 3613 and 3622.

Chapter 3 describes the structural and behavioral characteristics of the market for electrical apparatus. The following factors are included: first, the size distribution of electrical apparatus market and the patterns of concentration. Second, the importance of mergers in the structure of the industry. Third, the effects of patents and barriers to entry. Fourth, the tradition of meetings among manufacturers that generally reduced price competition.

Chapter 4 examines the economic theory of price discrimination in the market for utility equipment. The A-J hypothesis is explained, since it is fundamental to the understanding of a firm that operates under a regulatory constraint. This is followed by Prof. Zajac's application of the A-J hypothesis which indicates that a regulated firm can find it profitable to buy equipment at a higher than market price (in order to pad the base). Then an addition to Prof. Zajac's work is introduced, by including the inability of a regulated firm to employ the capital necessary in order to operate at the maximum allowed profit. This is a short run phenomenon that can have a cumulative long run effect resulting in base padding that was previously thought as unlikely. Finally, the elasticity of demand is considered, as are other factors, that may explain price differentials between utilities and industrial firms.

Chapter 5 explains the actual prices paid for electrical apparatus in terms of the several factors that enter into the determination of these prices. The existence of the practice of price discrimination can be established only when these factors are taken into account. The factors are: the book or catalog price, the type of buyer, the position of particular manufacturers in the structure of prices, the effects of collusion and the general level of costs and prices for equipment in the year in question.

## I-B Summary of Findings

The unique aspects of rate base padding developed in this study are:

(1) The demonstration that rate base padding can take place under conditions where padding was previously thought unprofitable.

(2) The particular form of padding used, that results in the failure of utilities to pay lower prices for certain kinds of apparatus.

In addition, there are three other factors examined that enter into the determination of prices paid for electrical equipment:

(a) The position of particular manufacturers in the structure of prices and the visibility of transactions.

(b) The general level of costs and prices for equipment in the year in question.

(c) The effects of collusion on actual prices.

The study shows that, theoretically, padding the base is a short run possibility for any regulated firm. But before I examined the issue of "gold plating" I investigated other factors that might have contributed to utilities paying unnecessarily high prices for apparatus purchased. These other factors ( complexity of design, the size of contracts etc.) did not explain why utilities should have paid higher prices for the particular equipment examined in this study. Therefore, if utilities purchased apparatus at higher than necessary prices, this can be taken as a more probable inference that padding the base took place.

### I-B-1 Price Differences Between Utilities and Industrial Firms During and After the Collusion

Did utilities pay higher than necessary prices for the apparatus examined in this study? This question is best answered by examining separately the colusion period (1957-1959) and the post-collusion period (1961-1963).

The collusion period is characterized by large price differences between utilities and industrial firms. The utilities were found to have paid higher (actual) prices that average 15.3% above the industrial firm's prices for the same three year period. The dummy variable that measures the effect of collusion on prices is significant, meaning that the collusion contributed to higher prices. When collusion by sellers of equipment causes prices to be higher, it makes padding the base by buyers of equipment easier. Collusion and padding the rate base are complements: if the utilitiy desires to pad the base it will not object to higher prices for equipment it purchases. This is confirmed by the lack of aggressive bargaining by the utilities who possess a fair amount of monopsony power. Therefore, I conclude that for the 1957-1959 collusion period, padding the base cannot be ruled out.

The post-collusion period was characterized by a smaller difference in prices between utilities and industrial firms. The difference in price decreased from the begining of the period until it disappeared in 1963. For the three year period 1961-1963 the utilities paid 3.7% more than the industrial firms; hardly a significant difference. One can conclude that in the 1961-1963 period the utilities did not pad the base by paying higher prices for equipment they purchased.

Did padding the base through payments of high prices for equipment vanish with the end of the collusion in the industry? For the 1961-63 period the answer is yes. However, in order to answer this question properly, one would have to look at the years that followed 1963. For example from 1964 to 1968 the price level of electrical equipment was rising. Would this condition be an incentive to pad the base or did the treble damage suits that followed the collusion bring an end to price discrimination between the two types of buyers? Unfortunately, the data after 1963 was not available to me nor did the literature attempt to analyze these effects.

### I-B-2 Differences in Prices Among Manufacturers

The position of a particular manufacturer in the structure of prices enters into the determination of prices paid for electrical equipment. The manufacturers establish a book or catalog price which should have some variation among them. Since the other equipment manufacturers followed the lead of General Electric by setting their book price equal to GE's book prices, there was no variation. However, the manufacturers gave different discounts off book price and therefore, the actual price of an item varied from manufacturer to manufacturer. In this study Allis-Chalmers, the smallest of the three firms examined, gave the largest discount. Generally, the smaller firms are said to be price competitive with the components in which they specialize.

### I-B-3 Visibility of Transactions

Visibility of transactions can have an effect on the discount offered. In the electrical industry to give quantity discounts is customary, however, when prices are falling, a large transaction may receive small discounts because if a large discount were given, it would be interpreted by other manufacturers as a signal for further price reductions. Examination of the visibility of transaction issue shows that over the three year period 1961-1963, the more visible transactions received a 5% smaller discount. Unfortunately, for other years data were unavailable.

## I-B-4 General Trends, Broad Economic Factors and Unique Market Conditions

General trends and broad economic factors also enter into the determination of prices paid for electrical equipment. A variable was introduced in this study in order to capture these effects. Not surprisingly, it was significant for all six years suggesting that the general economic factors not captured in other variables had also an impact on prices of electrical equipment. Furthermore, the coefficients of this variable were negative, suggesting that the broad economic factors contributed to a decrease in actual prices, when compared to the base year 1957.

The electrical apparatus industry did not follow the average trends of the economy in the post-conspiracy (1961-65) period. Statistics concerning the economic activity point to a healthy economy for this period. Given a strong economy with no inflation, rapidly falling prices in one industry suggest that it has unique market conditions, which in fact, it did. The Philadelphia Electric Cases, the treble damage suits, the decrease in demand for the electrical apparatus and the increased presence of foreign manufacturers had a great effect on actual prices.

## I-B-5 The Effect of Collusion on Actual Prices

The breaking up of the collusive agreements among manufacturers in 1960 is probably the force most responsible for decreased prices in the electrical apparatus industry. It seems that for the first time in this century, the electrical apparatus industry was to experience price competition.

Regression analysis supports the hypothesis that collusion will keep prices at high and artificial levels. This was done by introducing a dummy variable that distinguished between the collusion and post collusion period.

# Footnotes

1 L. W. Weiss and A. D. Strickland, Regulation: A Case Approach (New York: McGraw-Hill, 1976), p. 16

2 Ibid., p. 16

3 F.M. Scherer, Industrial Market Structure and Economic Performance (Chigago: Rand McNally, 1970), p. 524

4 L.W. Weiss and A.D. Strickland, p. 17

5 H. Averch and L.L. Johnson, "Behavior of the Firm Under Regulatory Constraint", American Economic Review (December 1962), Vol. 52, No. 5, pp. 1053-1069

6 E.E. Zajac, "Note on "Gold Plating" or "Rate Base Padding"", The Bell Journal of Economics and Management Science (Spring 1972), Vol. 3, No. 1, p. 311

7 F.M. Scherer, p. 520

8 E.E. Zajac, p. 311

9 E.E. Zajac, "A Geometric Treatement of Averch-Johnson's Behavior of the Firm Model", American Economic Review, Vol. 60, No. 1 (March 1970), pp. 117-125

# CHAPTER II

# PRODUCT DESCRIPTION IN THE INDUSTRIAL CLASSIFICATION SYSTEM, TYPES OF BUYER AND PRICING PRACTICES

## II-A Introduction

This study examines the pricing behavior between manufacturers and buyers in the electrical apparatus market. The purpose of this Chapter is to describe the products, types of buyer and buying practices. The industry and products are described in detail using the framework of the standard industrial classification. The buyers are identified as two types: the utilities and the industrial firms, and throughout this paper they will be compared. The pricing practices are examined by establishing pricing categories and describing each category.

## II-B Electrical Equipment: The Industry in the Industrial Classification System

The electrical industry produces a large variety of products. The number of products seen infinite since even the simplest bulb is made in different sizes, voltage and for different applications. This study examines only certain products in the industry which will be identified below by using standard industrial classification codes.

The heavy electrical equipment is included in the Census of Manufacturers, as part of major group 36, Electrical Machinery.[1] This group consists of five subgroups:

36 A Electrical transmission, distribution and industrial apparatus.

36 B Household appliances

36 C Electric lighting and wiring equipment

36 D Communication equipment, including radio and TV accessories.

36 E Miscellaneous electrical machinery, equipment and supplies.

Subgroup 36 A, which includes the equipment that this study is concerned with, consists of eight four-digit industries:[2]

3611 Electric measuring instruments and test equipment.

3612 Power, distribution and specialty transformers.

3613 Switchgear and switchboard apparatus

3621 Motors and generators

3622 Industrial control

3623 Welding apparatus

3624 Carbon and graphite products

3629 Electrical industrial apparatus, not elsewhere classified.

In this study the above described category will often be referred to as the electrical apparatus industry, or the heavy electrical equipment industry. By this is meant all apparatus and equipment as described in the Census of Manufacturers, SIC Code 36 A.

This study will focus on transformers (SIC 3612), switchgear and switchboard apparatus (SIC 3613) and industrial control apparatus (SIC 3622). Transformers are devices that distribute electricity and change its voltage. Switchgear describes those devices that interrupt, control and regulate the electrical current. Industrial control apparatus is used for starting, stopping and controlling the speed of electrical motors or equipment that use electricity.

## II-C The Buyers of Electrical Apparatus

The dollar amount of the electrical apparatus sold is about equally divided between two kinds of buyers:[3]

A) Electrical Utility Companies

B) Industrial Companies

Below, both kinds of buyers are described.

### II-C-1 The Electrical Utilities

The electrical utilities produce and distribute electricity. The demand for electricity has to be met instantaneously. However, electricity can not be carried in inventory, which means that a utility must have excess capacity. Since it is not economical to build small plant additions, increases in capacity are made in large steps so that utilities can take advantage of the latest technological developments. If the equipment that the utility uses fails, the manufacturers are expected to provide quick repair or replacement. For this reason service becomes an important factor when utilities decide to purchase equipment.

Since utilities produce and distribute electricity, they purchase electrical apparatus for that purpose. They buy a variety of equipment, ranging from the largest generator to the smallest switch. In negotiating prices for large electrical apparatus at times a utility may have an advantage. Since plans for expansion are made years in advance, there is nothing to prevent a utility from waiting a year or two in order to get the best price.[4] By postponing purchases, pressure to lower prices is brought on manufacturers. Utilities also share information. They are not in competition with each other; their purchasing agents often meet and discuss market conditions, prices and contracts. The Edison Electric Institute regularly publishes information concerning the size of the backlog of manufacturers. This makes it easier for all buyers to select an advantageous time for their purchases.

The demand for electrical apparatus is inelastic in the long run.[5] However, in the short run the utilities have control over timing of their purchases, so that the short run elasticity of demand for electrical apparatus can vary. For example, during the "White Sale" the prices were lowered by 50% and the quantity purchased by utilities doubled.[6] I calculate the elasticity to be -2 for that period, since the percentage change in quantity over the percentage change in price is 100/50.

The utilities are very capital-intensive. However, direct operating and maintenance costs account for almost one half of the total cost; fuel is the largest single part. The remainder of the total costs consists of the cost of heavy electrical apparatus.[7] Since the cost of capital is such a large portion of the total cost, it would seem natural that a utility would not desire to pay inflated prices for the equipment it purchases.

II-C-2 Commercial or Industrial Buyers

There are many types of industrial or commercial buyers of electrical apparatus. Since this study examines transformers, switchgear and industrial control apparatus (a precise description of the equipment follows below), I would like to focus on the buyers that purchase these kinds of apparatus.

One type of industrial buyer is the electrical contractor. Contractors buy electrical equipment for installation in new construction or remodeling projects. They use all kinds of apparatus since they participate in simple and complex projects.

Another type of an industrial buyer is the manufacturer of machinery and industrial equipment. They purchase electrical components that are part of the products they produce. Switches, control devices and transformers are examples of what they purchase.

A small number of items that this study is concerned with are purchased by electrical repair shops. They need parts in order to perform services. Small transformers and industrial equipment that regulate the electric current are typical of things they buy.

The demand of the industrial buyers is highly sensitive to business conditions. When economic activity is on the increase, the demand will also rise. The reason is that this cyclical demand is closely related to new plant and equipment outlays. Also, it is a function of the availability and cost of credit. Since the major industrial purchaser is the construction industry, the quantity of houses built depends on the availability of mortgage money and other long term financing.

## II-D Channels of Distribution

The nature of the electrical apparatus and the types of companies that produce them determine the way the goods are distributed. Since the products range from small mass-produced items to large and complex products, several channels of distribution are needed. Marketing of the products requires selling and promotional activities, transportation, maintaining stocks at strategic locations and providing different financing arrangements. This too requires a variety of channels of distribution.

The electrical apparatus examined in this study is distributed in a fashion typical for the electrical apparatus in general.

### II-D-1 Direct Distribution

The simplest channel of distribution is when the manufacturer sells directly to the user. This is the most efficient channel for custom built equipment used in generating plants and industrial firms that have a special power-distribution problem.[8] The equipment is specially designed and it requires close working contact between the manufacturer and the buyer. A middleman would serve no purpose in handling such equipment.

Other common channels of distribution are the manufacturer's representatives and the electrical distributer.

II-D-2 Manufacturer's Representative

The manufacturer can not maintain a sales force everywhere, therefore in some parts of his market he will use an agent or a representative.

Agents sell apparatus based on agreements with several manufacturers. The understanding between the agent and the manufacturer include the sales area to be covered, lines to be handled, commissions to be paid, responsibility and authority. In the apparatus market agents typically have a high degree of technical competence which makes them valuable to the manufacturers. Agents usually handle several related lines which are sold to the same types of customers.

II-D-3 Electrical Distributers

In terms of value of the goods sold, the electrical distributer is more important than the manufacturer's agent. The reason for this is that he can sell items made by several manufacturers in a single order. This brings about an economy of marketing which the manufacturers cannot achieve. There are usually two kinds of electrical distributers. One is very general and carries all kinds of equipment and the other specializes in a particular kind of apparatus. Distributers who carry a broad line of apparatus sell primarily to electrical contractors and to industrial contractors that have their own maintenance department. The distributers that are specialized sell mostly to utilities and to firms that have power generating facilities.[9]

A distributer performs a wide range of service for both the manufacturer and the buyer. He carries an extensive inventory of items and therefore, his stock replaces the inventory that the manufacturers otherwise would have to carry themselves. Often the distributer's customers, who are small businesses or contractors, buy on credit. Since the manufacturers find it difficult to sell to them directly on a credit basis, the distributers by performing this service assist the manufacturer. Only under conditions of large sales volume is direct selling preferred to using electrical distributers.

For the buyers the distributer also provides a variety of services. He often gives technical advice and prepares quotations and layouts. He is in continuous contact with people who influence the buyers, such as consultants and engineers, so that he is well versed in the latest technology.

## II-E Pricing Categories

The contracts between manufacturers and buyers that are used in this study can be classified in several pricing categories. These categories are typical for the electric apparatus industry.

II-E-1 Book Price

Since the apparatus may have many features, it is possible to tailor an order to the exact requirements of the customer. A catalog is printed to make this unique information available to any purchaser. Such detail makes the catalog very large, The Westinghouse catalog for example, fills a six foot shelf. The catalog includes technical information concerning the application and performance of each added feature and its incremental price.

The cost of revising a catalog of that size is prohibitive, and this is why a book price was created. The book price is the catalog price subject to modification by a multiplier. When there is a change in price of the apparatus, a new multiplier is issued and this avoids the need to reprint the catalog.

II-E-2 Negotiated Price

Negotiated prices are used for custom designed equipment. A sales executive and a purchasing executive discuss the requirements, delivery and price of the apparatus and ultimately reach an agreement. A published (book) price may be the starting point for negotiations unless the product is very complex and therefore has no published price.

II-E-3 Bidding

For obvious reasons, the very large custom-built products are not cataloged and are not kept in inventory. They are complex apparatus with precise specifications. In cases like this, the buyer asks for competitive bids. The specifications are made available so that the manufacturers who can produce the product, can submit sealed bids. To prepare a bid is not an easy task. For example, a company might be asked to submit a bid involving 55 different items of data that would generally describe the product. The President of General Electric pointed out that:

> "when you put in a bid for a big machine, it merely means that you have agreed to meet the specifications as given by the customer. The negotiations begin following the bid. You may come out with an entirely different machine."[10]

Bids may be requested even when the buyer does not have complete specifications. For example, the buyer may have a product in mind that performs a specific function, however, he can not provide all the specifications for it. Therefore, he invites the manufacturers to provide the remaining specifications. The manufacturer may even provide a few options and then the buyer selects the most desired one. Wide ranges of prices are typical in this type of situation because of the different features of the products proposed by different suppliers.[11]

Usually the supplier with the lowest bid is awarded the project. In some cases, however, the low bid may be disqualified and the project can be awarded to a higher bidder. The reason for this is that the low bidder may be unfamiliar to the buyer or known for its lack of reliability. The delivery date or the credit arrangements may also influence the decision of who will be awarded the bid. Frequently, the customer will accept the bid from a supplier whose quotation offers more features even though the price is higher.

At times "rebidding" takes place. Before placing a bid for a project, the electrical contractor chooses the lowest quotations from his suppliers. He then adds to that what he intends to earn and in this way he composes his bid. Once the contractor is awarded the project, he contacts other suppliers <u>again</u> to see if he can get a lower quotation for the equipment he needs. This kind of bidding (rebidding) insures the lowest cost of equipment for the contractor.

II-E-4 Size of Orders

In the industry, orders of below $5,000 are regarded as small and most of such orders are taken straight from catalogues. In this study, however, orders of $ 25,000 or more are examined since the data for smaller orders was not available. In the sample of contracts that I obtained, it was impossible to tell whether an order was secured through catalogues, negotiations or by bidding. The larger the order, the greater is the chance that it was secured through negotiations or by bidding.

## II-F Standard Versus Custom-built Products

### II-F-1 Standard Units

The units produced by the manufacturers of electrical apparatus may be either standard or custom-built. The industry standardized many simpler products. Clear definition of quality standards and the reduction of arbitrary design have reduced installation and maintenance costs of electrical apparatus. The standard units are produced in large quantities and are kept in a shipping stock inventory for immediate delivery. They are often referred to as "off the shelf" products. However, standardized equipment can not be used for all purposes. Some projects require special specifications, design or degree of complexity. For this situation custom-built apparatus is needed.

### II-F-2 Standard Products Assembled From Standard Components

Some products are complex and have a large number of different features or characteristics. It would not be practical to stock a great variety of similar products that have a large number of small variations. Fortunately, some of these moderately complex products are made by combining various standard equipment.

> "For example, a distribution center for a commercial building may have space for thirty two (32) standard circuit breakers. Individual circuit breakers to fit this panel may be produced in a series of different ampere ratings. For such a product, the dealer stocks the breaker units and the distribution center separately and assembles the breakers into a panel in whatever combination of ratings the customer desires." [12]

II-F-3 System Built of Standard Units

This category consists of systems that may be composed of many different standard units. It is possible in such a system to incorporate products of different manufacturers.

II-F-4 Custom-built Products

These products are designed for a specific application. It is possible that some parts of this product are composed of standardized units. Since the product is specially designed for a certain purpose, it is considered a new product. The whole system could be designed so that one or more units are custom-built. This would be necessary if the performance specifications are high or when some products are not available as standard units.

## II-G Description of Products[13]

This study is limited to the examination of transformers, switchgear and industrial control apparatus (SIC codes 3612, 3613 and 3622). Therefore, the equipment involved in this study consists of the following specific electrical apparatus:

### II-G-1 Transformers (SIC 3612)

#### II-G-1-a Distribution Transformers

Transformers are electrical devices without continuously moving parts which, by electromagnetic induction transform electrical energy from one or more circuits to one or more other circuits at the same frequency, usually with changed values of voltage and current. Distribution transformers are those having a rating between 3 kva and 500 kva.

#### II-G-1-b Instrument Transformers

Instrument transformers are used in the measurement of voltage and current in the generation, transmission and distribution of electrical energy. The two basic types are potential transformers and current transformers. They are intended to reproduce in the secondary circuit (in a definite and known proportion suitable for utilization in measurement, control or protective devices), the voltage or current of the primary circuit, with the phase relations substantially preserved.

II-G-1-c Network Transformers

Network systems of electrical transmission and distribution are utilized to insure continuity of service. The network system is fed by by multiple primary feeders bringing current into the system. These primary feeders in turn supply a number of network transformers with electrical energy. The network transformer steps down the electrical energy received from its primary feeders to a voltage and current usable by the ultimate consumer. Network transformers are so engineered that if one of the feeders becomes faulty or goes out of action the network transformer still receives current and continues to supply power to the ultimate consumer.

The National Electric Manufacturing Association has established standard ratings for distribution, instrument and network transformers. Due to the standard rating and low captial requirements, entry into this market is relatively easy. As a result, one can find many small firms in this market who can specialize in a few kind of transformers. Since a local firm can offer a competitive price and personalized service, competition is keen.

The introduction of a new feature in a transformer gives only a temporary advantage to a manufacturer. The reason for this is that traditionally, the manufacturers that come out with new features made it easy for other manufacturers to obtain a licence. The ease of obtaining a licence makes present technology available to everyone.

Since the distribution and instrument transformers are standard items, and a necessary part of all circuits, the manufacturers are expected to keep a large number of them in stock. This reflects an understanding between the purchasers and the manufacturers that if an item is sold, getting a replacement is guaranteed.

II-G-1-d Power Transformers

Power transformers are used in the distribution and transmission of electrical energy to change the values of voltage and current between the points of generation and the points of distribution. They have a rating of above 500kva, and are specially differentiated from network transformers.

Power transformers are large and complex pieces of apparatus. Only a few manufacturers build them since large capital requirements and engineering know-how are substantial barriers to entry.

It requires about six months to build a power transformer. When the demand is high manufacturers tend to have a backlog of orders. When the demand is low, prices tend to be depressed as the manufacturers compete for the limited market. Because utilities plan their systems years in advance, they are able to take advantage of the periods when prices are low.

II-G-2 Switchgear (SIC 3613)

II-G-2-a Power Switchgear Assemblies

Power switchgear assemblies consist of switching and interrupting devices in combination with control, metering protection and regulating equipment, their associated interconnections and supporting structures. There are three principal kinds of power switchgear assemblies: 1. Metal-clad switchgear assemblies are manufactured for use indoors and outdoors, and include as component elements power circuit breakers rated from 2.5 to 13.8 kv. This type of assembly is commonly known in the industry as the "5 and 15 kv. metal-clad switchgear." 2. Drawout low-voltage metal-enclosed switchgear assemblies are manufactured for use indoor or outdoors and include as component elements air circuit breakers rated at 600 volts of less. 3. A unit substation consist primarily of one or more transformers connected and coordinated in design with one or more metal-clad or low voltage metal-enclosed switchgear assemblies or combinations. A primary unit substation has a low voltage rating 600 volts or less. Assemblies constructed for use aboard ships are not included here.

II-G-2-b Navy and Marine Switchgear

Navy and marine switchgear refers to power switchgear assemblies of 600 volts or below designed or constructed for use aboard ships. Its design and construction provide special resistance to shock, vibration and corrosion encountered in sea duty. When such equipment is destined for use aboard a military or naval vessel, it is known as "navy switchgear". When destined for use aboard merchant vessels, it is known as "marine switchgear".

II-G-2-c Circuit Breakers

Circuit breakers are used to protect electrical apparatus employed in the distribution of electrical energy. They interrupt electric circuits under normal and abnormal conditions. When utilized in land installations they are known as commercial breakers, and when modified for use aboard ship they are known as navy breakers.

II-G-3 Industrial Control Equipment (SIC 3622)

Industrial control equipment is used for starting, stopping protecting, accelerating, reversing and controlling the speed of electric motors and other apparatus utilizing electrical power. Such equipment also provides mechanical movement through the action of magnets and solemnoids. It does not apply to the equipment used to control motors or apparatus rated at more than 750 volts DC or 5,000 volts AC.

The switchgear and industrial control equipment are always parts of systems where electrical power is needed. The demand for these products is, therefore, related to the cyclical demand for capital equipment. When demand is high, buyers could wait up to two years for delivery. When the demand is low, the price competition among manufacturers intensifies.

The trend toward higher voltage requirements for these items requires investment in research. As a result, the advanced designs are patented and licences are given to other manufacturers. Many products are standardized so that here too small companies can compete by specializing in a narrow range of products.

Footnotes

1 U.S. Department of Commerce, Bureau of the Census, 1963 Census of Manufacturers (Washington D.C.: U.S. Government Printing Office, 1966) Vol. II, Major Groups 29-39, p. 36-1

2 Ibid., p. 36A-1

3 C. Walton and F.W. Cleveland Jr., Corporation on Trial: The Electrical Cases (Belmont, California: Wadsworth Publishing Company, INC., 1964) p. 21

4 Ibid., p. 23

5 Ibid., p. 28

6 Ralph G.M. Sultan, Pricing in the Electrical Oligopoly, Vol. I (Cambridge, Massachusetts: Harvard University Press, 1974), p. 62

7 Ibid., p. 19

8 Edwin Lewis, Marketing Electrical Apparatus and Supplies (New York: McGraw-Hill, 1961), p. 42

9 Ibid., p.43

10 Jules Beckman, The Economics of the Electrical Machinery Industry (New York: New York University Press, 1962), p. 130

11 Ibid., p. 124

12 Ibid., p. 120

13 The technical description of products is taken from Appendix A of C. Walton and F.W. Cleveland's Corporation on Trial: The Electrical Cases.

# CHAPTER III

# STRUCTURAL AND BEHAVIORAL CHARACTERISTICS OF THE MARKET FOR ELECTRICAL APPARATUS

## III-A Introduction

The electrical apparatus industry has all the characteristics of an oligopoly. A few large firms dominate the market although a large number of small firms coexist with them. From its infancy the industry exhibited the lack of price competition and often price leadership.

This chapter seeks to explain the structural and behavioral characteristics of the market for electrical apparatus. The four factors included in the analysis are:

1 - The size distribution of electrical equipment market with details about the number of manufacturers and patterns of concentration.

2 - The importance of mergers in the structure of the industry.

3 - The effects of patents and barriers to entry.

4 - The tradition of meetings among manufacturers which for some period of time resulted in a collusion and generally reduced price competition.

## III-B The Size Distribution of the Electrical Equipment Makers

### III-B-1 The Number of Manufacturers

The 1963 Census of Manufacturers reported that there were about 10,000 establishments that manufacture electrical equipment. Table 3-1 shows the number of manufacturing establishments in the two-digit industry SIC 36:

TABLE 3-1

NUMBER OF MANUFACTURING ESTABLISHMENTS (SIC GROUP 36)

| Year | |
|---|---|
| 1963 | 9,948 |
| 1958 | 8,086 |
| 1954 | 5,758 |

From Table 1-1, we can see that in the nine year period the number of manufacturing establishments doubled. One condition that economic theory requires in order for competition to strive, is a large number of firms. Although the number of establishments shown in Table 3-1 is large, the SIC group 36 covers a wide variety of products. Therefore, the number of firms that produce the specific kinds of electric apparatus examined in this study is much smaller. Table 3-2 shows the number of companies that produce transformers and industrial control equipment. The number of firms is still relatively large, however, the number of firms producing transformers and switchgear decreased over the observed time period.

Although the number of manufacturing firms is large, on average their relative size is small. However, two of them are among the largest corporations; General Electric Company and the Westinghouse Electric Corporation have been the two largest firms since the infancy of the apparatus industry.

The reason that the small firms could coexist with the two giants was that they specialized in one or few products. Historically, the large manufacturers did not adopt their production facilities to small order needs, thus leaving room for smaller firms.[4] Besides, the small firm gives: 1) prompt consideration to special problems, and 2) personalized attention. Business Week describes such firms as "electrical manufacturers who can supply everything you need, but who are competitive as can be with the components in which they

Table 3-2[2]

THE NUMBER OF COMPANIES PRODUCING TRANSFORMERS, SWITCHGEAR AND INDUSTRIAL CONTROL APPARATUS

| YEAR | TRANSFORMERS (SIC 3612) | SWITCHGEAR (SIC 3613) | IND. CONTROL (SIC 3622) |
|---|---|---|---|
| 1963 | 144 | 338 | 421 |
| 1958 | 157 | 339 | 205 |
| 1954 | 152 | NA[3] | NA |
| 1947 | 134 | NA | NA |

===========================================================

specialize.[5]

The coexistence of small and large firms in the electrical industry was well illustrated by a FTC study in 1950.[6] The study showed how many times a firm appeared on the top four list (according to sales) for every product group. There were 47 product groups (5 digit SIC) which means that there were 188 (47 x 4) spots into which a firm could place itself.

The Table 3.3 shows that many firms compete with the Big Two. Since neither General Electric nor Westinghouse appear in all of the 47 product groups, the small firms have an important place in some of these markets. Besides, the Big Two encountered a different group of competitors for each product group.

III-B-2 The Pattern of Concentration

The concentration ratios in the electrical industry are high relative to other industries. "Slightly more than one half of the electrical machinery industry had concentration ratios of 50% or higher, as compared with one out of four for all manufacturers."[7] Naturally, the concentration ratios vary from product to product. In Table 3-4, the concentration ratios of products with which this study is concerned are shown. There we see that all four firm

Table 3-3

DISTRIBUTION OF FREQUENCY OF APPEARANCE AMONG FOUR LEADING COMPANIES IN ELECTRICAL EQUIPMENT PRODUCT CLASS, 1950

| Company | Number of Times |
|---|---|
| General Electric | 36 |
| Westinghouse | 25 |
| RCA | 8 |
| General Motors | 7 |
| Allis-Chalmers | 7 |
| Western Electric | 6 |
| Avco | 4 |
| McGraw Electric | 4 |
| Sylvania | 4 |
| Nash-Kelvinator | 3 |
| Raytheon | 3 |
| Sunbeam | 3 |

The following companies appeared twice:

Essex Wire, Seeger-Refrigirator, Whirpool, Mallory (PR), Smith (AO), Motorola, Emerson Electric, Du Mont, Bendix Aviation, Jack and Heintz, General Precision and Square D.

Fiftyfour companies appeared once as a leading concern.

Source: Federal Trade Commission, Industrial Concentration and Production Diversification in the 1,000 Largest Manufacturing Companies, 1950, Washington, D.C., 1957, pp. 224-45.

Table 3-4

CONCENTRATION RATIOS OF 4 AND 8 LARGEST FIRMS [8]

| | Transformers (SIC 3612) | | Switchgear (SIC 3613) | | Ind. Control (SIC 3622) | |
|---|---|---|---|---|---|---|
| | 4 | 8 | 4 | 8 | 4 | 8 |
| 1963 | 68 | 79 | 51 | 65 | 56 | 69 |
| 1958 | 71 | 84 | NA* | NA | NA | NA |
| 1954 | 78 | 89 | NA | NA | NA | NA |

* Not available

concentration ratios are relatively high (above 50%). A brief history of mergers, ease of entry and the role of patents may explain these high concentration ratios.

## III-C The Importance of Mergers in the Structure of the Industry

The major mergers in the electrical industry took place by the end of the nineteenth century. These mergers resulted in General Electric and Westinghouse becoming the two dominant firms in the industry and no other firm being comparable in size to the two leaders. The primary objective of mergers was to secure patents and thus avoid conflict over them.[8] Probably the single most important merger was that of Edison General Electric and Thomas-Houston Co. in 1892.

Dr. R. Nelson, in an intensive study of merger activity between 1895 and 1907, found these results for the electrical machinery industry: In terms of the number of acquired firms as a percentage of the total number of firms in the industry, it ranked eight; in terms of capital involved, it ranked tenth; and, in terms of the percentage of capital involved, it ranked seventh.[9] Dr. Nelson's study suggests that in its most active period of mergers, the electrical machinery industry was not among the most active in this area.

Since the turn of the century, the two dominant firms have acquired other firms. The acquisitions took place at irregular intervals, most of them taking place in a decade after World War I. During the Great Depression and World War II, for obvious reasons, merging activity slowed down. After World War II mergers played no significant role in the growth of the two leading firms, but they played an important role in the growth of the smaller firms. For example, the Federal Pacific Electric Co. acquired 11 companies in the eight year period from 1952 to 1960. All of the acquired firms were, with one exception, small manufacturing plants or shops. The largest, Cornell Dublier Inc., was acquired in 1960, and had $ 18 million in assets. These mergers increased the assets of Federal Pacific Electric Co. from $ 15 million in 1952 to $ 73 million in 1960.[10] Similarly, I-T-E Circuit Breaker Co., merged with eight small firms in the period from 1953 to 1958. Its assets grew from $ 26 million in 1953 to $ 75 million in 1960.[11]

In conclusion, one could say that from the infancy of the industry until World War II, mergers helped the leading firms secure their position in the industry. After World War II, mergers among smaller firms lessened the dominance of General Electric and Westinghouse. Naturally, there are other causes, aside from mergers among smaller firms, that contributed to the decrease in dominance of the two leading firms. Below, the other causes are explained.

## III-D Patents and Barriers to Entry

### III-D-1 Patents

One would expect that in an industry that produces complex products, patents might have played a significant role in establishing and maintaining market shares. As mentioned before, many mergers took place to combine important patents. Where mergers were not used to accomplish this, patent pools were arranged.

Patent pools are agreements among competitors to share patent rights. In 1897, for example, G.E. and Westinghouse abandoned about 300 patent suits pending between them. [12] They created a joint committee, The Board of Patent Control, which allowed the two companies to share their patents and sue other companies who tried to copy patents without a licence. A side benefit from patent pooling was the ability to divide the market shares by agreement. These market sharing agreements seemed to reduce the incentive to cut prices.

Although the G.E.-Westinghouse patent pool was disbanded by the courts, other patent pools were created. In 1926 the U.S. Supreme Court upheld General Electric's various licensing and market sharing agreements. Furthermore, it stated that a patent-holding firm legally could control the selling price for its inventions even when the product was manufactured by others. [13]

A typical example of patent pooling that influenced prices was a patent agreement in 1937 for circuit breakers. In the G.E. and Kelman Electric agreement, in addition to patent sharing, price setting was provided for. Confessions during the Philadelphia Electrical Cases revealed that, in their patent negotiations, electric equipment manufacturers were more interested in price maintainance than in future royalties. [14]

During World War II, in the face of the increasing threat of antitrust action by the government, patent pooling ceased to exist. G.E. and Westinghouse dissolved all of their patent pooling agreements. After World War II the firms in the electrical machinery industry generally made their patents available to other companies. [15] For example, licenses for electrical apparatus can be had for royalties or in exchange for other licenses. The charges for the licenses have been reasonable, and have been granted freely.

Since it became easy to obtain licenses, patents no longer play the critical role that they played at the turn of the century.

III-D-2 Barriers to Entry

The high degree of concentration is not due to a small total number of firms, with new competition effectively banned by the existing firms in the industry. However, since there are two large firms among many small ones, it would not be correct to describe the electrical machinery industry as purely competitive. In order to observe the ease of (or barriers to) entry, it would be best to divide the industry into two markets : The market for simple standardized products and the market for complex apparatus.

The market for simple standardized products has been characterized from the very begining by ease of entry and good opportunity for growth of small firms. In the eleven years from 1947 to 1958 the number of establishments in the electrical machinery industry (SIC 36) grew from 3,970 to 7,066. For the same time period the number of establishments with less than 20 employees grew from 1,817 to 3,699 or 103.6 %.[17] In contrast, the number of establishments for all manufacturing ( with less than 20 employees) grew from 240,802 to 298,077 or 23.8 %.[18] This shows that the number of small establishments, which typically produce simple equipment, grew faster in the electric machinery industry than in all manufacturing, suggesting that an ease of entry exists.

The market for complex apparatus production requires large plants and large capital investments. A high degree of technical know-how is required, and only a few firms possess this knowledge. Changes in technology are rapid and therefore, substantial research programs have to be maintained. For example, all of these requirements are needed in the production of heavy generators, large distribution transformers and for some of the switchgear apparatus. Therefore, the entry into the complex apparatus market is difficult and one would expect high concentratio ratios.

## III-E The Tradition of Meeting Among Manufacturers

In 1922 the Electric Power Club, the Electrical Manufacturers Club and the Associated Manufacturers of Electrical Suppliers merged and became known as the National Electrical Manufacturers' Association, or NEMA. The purpose of NEMA was to improve the manufacturing, reliability and standardization of electrical apparatus. Each manufacturer of a particular item would send representatives to meetings where market statistics, standardization of products, dimensions and ratings were discussed. Naturally, as Adam Smith would have predicted, prices were also discussed. There would be official meetings which all the representatives would attend and then there would be unofficial meetings where prices would be agreed upon. It is obvious that the establishment of the trade association further reduced price competition.

The onset of the depression of the 1930's was to cause a serious reduction in price competition. To help the economy in general, the National Industrial Recovery Act was instituted, which sought to moderate the rigor of competition by establishing codes of fair competition. Violators of these codes were prosecuted by the Federal Trade Commission. For example, in the electrical industry, the following were unfair trade practices according to NIRA; selling below list price (list prices had to be filed with Nema, since NEMA took up the task of NIRA's code enforcement), giving excessive discounts, granting preferred terms of payment, giving secret rebates, offering warranties against price decline, etc.. [19]

In 1935, the U.S. Supreme Court ruled that the National Industrial Recovery Act (NIRA) was unconstitutional. However, in the 1930's meetings to discuss prices were common in the electrical industry and many managers were told that this was the way things were done. [20] During World War II prices were administered by the government.

## III-E-1 Collusion

After World War II managers were warned by company officers throughout the industry to stop meeting with their competitors. For example, G.E. instructed its managers in January 1948 and again in April of 1950 that they must obey the antitrust laws. [21] All managers had to sign a statement indicating that they would comply with those laws. During the Philadelphia Electric Cases some managers testified that the antitrust statement was issued for public relations purposes and that top management wanted the meetings among competitors to continue.

The meetings among competitors continued to take place, even in the depressed years, after 1950. However, the success they had in discouraging competition was limited. In the depressed markets of this period there was a tendency to cheat and to lower prices in order to win orders. The best example of this is the White Sale that took place in 1955 when prices were reduced by 50% to 60%. White Sale is a term used within the industry which indicates that a significant amount of price cutting has taken place.

Due to the recession during the last half of 1953, and throughout 1954, there was a relatively low demand for electrical apparatus. Electrical World reported that the year 1954 saw a buyers' market for the first time in years. It also forecast that for 1955 the orders for generating equipment were expected to decline. As a result of these expectations, manufacturers of electrical apparatus reduced prices drastically to secure future orders. These large cuts in prices did in fact secure more orders than in the two previous years.

Beginning in the summer of 1955, and throughout 1966, meetings were held to prevent another White Sale. A system of pricing by memorandum was adopted. An unsigned memorandum was circulated to the five major companies in the industry listing new jobs and book prices. If there were disagreements on job descriptions or book prices, each participant could circulate a countermemorandum.[22] The memorandum system increased prices and kept them at the new high level until the summer of 1957.

In 1957 cheating on agreements began again, partly because some companies felt that they deserved a larger market share. Prices fell in all markets and decreases of up to 60% were registered in the switchgear market. To remedy the situation, a high level conference was scheduled at the NEMA meeting in Atlantic City. There the markets were divided (see Appendix) in a way that gave the smaller firms larger market shares. However, by 1959, the Atlantic City agreements were no longer being followed. Prices fell again and the investigation by the Department of Justice into the industry discouraged further meetings.

The investigation of a possible conspiracy among electrical manufacturers began in Knoxville, Tennessee. A newspaperman, Julian Granger, working for the Knoxville News-Sentinel, wrote a series of articles about the TVA which appeared in May, 1959. In his articles he showed that, for many years, the TVA had received identical bids for its projects. When he interviewed the TVA managers they complained that the prices for equipment had been increasing at a much faster rate than the general price level.

At this time TVA was accepting bids for equipment to be used on the Colbert Steam plant. A typical bid, for example, was one for transformers. Westinghouse was awarded the bid at $ 96,760 and Allis-Chalmers, G.E. and Pennsylvania Transformer quoted identical prices of $ 112,712. [23] Julian Granger wondered how, under a system of ostensively secret bids, could three companies bid a price identical to the penny?

At about the same time, the TVA was in the process of doing something on its own about the high prices of electrical apparatus. In 1958 the TVA had asked for bids on turbine generators for its Colbert plant. G.E. and Westinghouse offered bids of about $ 17 million. The TVA decided that the price was too high and therefore, it invited a British firm, C.A. Parsons & Co., Ltd., to bid. Their bid was $ 12,095,800, significantly lower than the bids of the U.S. firms. In February, 1959, the TVA announced that the project was awarded to Parsons & Co.. G.E. and Westinghouse protested the award claiming that such award would be detrimental to the national security.

The invitation to foreign competition by the TVA and the articles written by Julian Granger received national attention. Senator Kefauver of Tennessee started an investigation based on notion that identical bids were common in the electrical industry. The evidence of identical bids was not hard to find.

Based on the findings of the Kefauver Subcommittee, the U.S.

government proceeded with a series of criminal law suits in the United States District Court for the Eastern District of Pennsylvania. In all, 20 law suits were brought against the electrical apparatus producers of which 17 were filed in Philadelphia between February 16, 1960 and October 20, 1960 (see Appendix). These law suits came to be known as the Philadelphia Electrical Cases. [24] The law suit filed in Philadelphia on June 22, 1960, Criminal No. 20399 is an example of one of those cases. Taken from it is a partial list of charges brought against Westinghouse, Allis-Chalmers, Federal Pacific and G.E. :

INDICTMENT [25]

The Government charges:

> 14. Begining at least as early as 1958 and continuing thereafter at least to September 23, 1959, the defendants together with the co-conspirators and other persons to the grand jurors unknown, engaged in a combination and conspiracy in unreasonable restraint of the aforesaid interstate trade and commerce in power switchgear assemblies, in violation of Section 1 of the Act of Congress of July 2, 1890, entitled "An act to protect trade and commerce against unlawful restraints and monopolies" as amended (c. 647,26 Stat. 209, 15 U.S.C. Sec.1) commonly known as the Sherman Act.
>
> 15. The aforesaid combination and conspiracy consisted of a continuing agreement, understanding, and concert of action among the defendants, the co-conspirators and other persons to the grand jurors unknown the substantial terms of which were:
>
> (a) To fix and maintain prices, terms and conditions for the sale of power switchgear assemblies;

(b) To allocate among themselves the business of supplying power switchgear assemblies to Federal, State and local governmental agencies;

(c) To submit noncompetitive collusive and rigged bids for supplying power switchgear assemblies to electric utility companies, Federal State and local governmental agencies, private industrial corporations and contractors throughout the United Stated;

(d) To refrain from selling certain types of power switchgear assemblies or components thereof to other manufacturers of electrical equipment

VI. EFFECTS [26]

17. The effects of the aforsaid combination and conspiracy have been that:

(a) Prices of power swithgear assemblies throughout the United States have been raised, fixed and maintained at high and artificial levels;

(b) Price competition in the sale of power switchgear assemblies throughout the United States has been restrained, suppressed and eliminated;

(c) Purchasers of power switchgear assemblies throughout the United States have been deprived of the benefits of free competition in the purchase of these products;

(d) Public agencies engaged in the generation transmission or distribution of electricity have been denied the right to receive competitive sealed bids, as required by law, and have been forced to pay high, artificially-fixed prices for power switchgear assemblies.

The defendants pleaded guilty.

III-E-2 The Absence of Price Competition

From the infancy of the industry until the Philadelphia Electrical Cases in 1960, the electrical industry has been characterized by the absence of price competition. At first, mergers ended rivalry among competitors. Then, patents and patent-pools were used to limit price competition. Later, the meetings through NEMA and the establishments of the NIRA were the means for limiting competition. During the World War II prices were administered by the government and immediately after the war, the times when price competition took place were more the exception than the rule.

Although the meetings of the electrical equipment producers continued in the 1950's, price competition broke out when the market for equipment fell off. While the conspirators made attempts to divide the market, the inducement to cheat was very strong when demand decreased. Cheating began the price war, known as the "White Sale" (from 1954 to January 1955). When price wars of this magnitude take place, they create a greater incentive for the manufacturers to police the market and to enforce the illegal agreements among themselves.

The prices of the electrical apparatus rose significantly in the 1950's. Table 3-5 compares the price increases of all commodities with those of electrical apparatus. The comparison could be misleading because the electrical equipment price indices do not take full account of the effects of technology and the efficiency of design. Given the rapid evolution of product designs and technology, the cost of producing electricity steadily declined from 1914 to 1950. This suggests that the usual price indices may have understated the growth in equipment prices. However, even allowing for quality improvement in the 1947-1958 period, electrical machinery prices grew by 33 % more than prices in general, as shown in Table 3-5.

Table 3-5 [27]

COMPARISON OF THE PRICE INDEX FOR ALL COMMODITIES AND ELECTRICAL MACHINERY (1947-49 = 100)

| Year | All Commodities | Elec. Machinery |
|---|---|---|
| 1950 | 103 | 106 |
| 1952 | 112 | 120 |
| 1955 | 111 | 128 |
| 1956 | 114 | 138 |
| 1957 | 118 | 149 |
| 1958 | 119 | 152 |

Footnotes

1 U.S. Department of Commerce, Bureau of the Census, 1963 Census of Manufacturers (Washington D.C.: U.S. Government Printing Office, 1966), Vol. II, Major Groups 29-39, p. 36-3

2 Ibid., p. 368-8

3 Not available. In 1958 from a single industry SIC 3616 two industries were formed: SIC 3613 and SIC 3622.

4 Howard F. Bennett, Precision Power (New York: Appelton-Century Crofts Inc., 1959) p.297

5 Business Week, Nov. 28, 1959, p.95

6 Jules Backman, The Economics of Electrical Machinery Industry (New York: New York University Press, 1962), p. 63

7 Jesse J. Friedman, Concentration in American Industry (Report of the Subcommittee on Antitrust and Monopoly to the Committee on the Judiciary, U.S. Senate, persuant to Sen. Res. 57, Washington D.C., 1957), p.12

8 U.S. Department of Commerce, Bureau of the Census, 1963 Census of Manufacturers (Washington D.C.: U.S. Government Printing office, 1966), Summary and Statistics, Vol. I, p. 11-34

9 Ralph Nelson, Merger Movements in American Industry, 1895-1956 (Princeton, N.J.: National Bureau of Economic Research, 1959) pp.171-172

10 Moody's Investors Services, Inc., Moody's Industrial Manual, June 1965 (New York: Robert H. Messner), p. 876

11 Ibid., p.1483

12 Ralph G.M. Sultan, Pricing in the Electrical Oligopoly, Vol I (Cambridge, Massachusetts: Harvard University Press, 1974), p. 26

13 Ibid., p. 27

14 Ibid., pp. 26-27

15 Jules Backman, The Economics of the Electrical Machinery Industry (New York: New York University Press, 1962), p. 107

16 Ibid., p. 108

17 Ibid., p. 75

18 Ibid., p. 75

19 Ralph G.M. Sultan, p. 29

20 Ibid., pp. 31-33

21 Ibid., p. 34

22 Ibid., p. 42

23 J.G. Fuller, The Gentlemen Conspirators ( New York: Grove Press Inc., 1962), p. 9

24 C. Walton and F.W. Cleveland Jr., Corporations on Trial: The Electrical Cases (Belmont, California: Wadsworth Publishing Company, Inc., 1964) p. 34

25 Ibid., p. x

26 Ibid., p. xiv

27 Ibid., p. 30

# CHAPTER IV

# ECONOMIC THEORY OF PRICE DISCRIMINATION IN THE MARKET FOR UTILITY FQUIPMENT

## IV-A The Averch-Johnson Hypothesis

The imposition of artificial constraints on a decision process that would otherwise be optimal will certainly lead to no improvement in outcome and will generally make things worse. This is what H Averch and L.L. Johnson had in mind when they developed a theory of the monopoly firm seeking to maximize profit, but subject to a constraint on its rate of return. The conclusion of their path-breaking article was, under the assumptions described below, that rate of return regulation will cause the capital labor ratio utilized by the profit maximizing firm to be different from that which would result from unconstrained cost minimization.[1]

They started by defining what is meant by rate of return regulation: after the firm subtracts its operating expenses from gross revenues, the remaining net revenue should be just sufficient to compensate the firm for its investment in plant and equipment.[2] The A-J model is shown below with refinements made since its introduction in 1962[3]:

K = The amount of capital in dollar units

L = The number of labor-man years

w = The market wage of labor

r = The market cost of capital

A utility company is bound by a constraint on its profits:

1) $$\frac{Q \cdot P(Q) - wL}{K} = r + \alpha$$

where $r + \alpha$ is the allowed rate of return and $\alpha$ ($\alpha > 0$) is a premium. Equation 1 can be rewritten in the implicit form:

2) $$Q \cdot P(Q) - wL - (r + \alpha)K = 0 .$$

Now the utility has to maximize its profits subject to equation 2 as a regulatory constraint. Thus, the Lagrangian function is:

3) $$\lambda = Q \cdot P(Q) - wL - rK - \lambda[Q \cdot P(Q) - wL - (r + \alpha)K],$$

where $\lambda$ is an undetermined multiplier. If $\lambda = 0$, then the regulatory constraint is not binding. Therefore, the firm behaves like a monopolist If $\lambda = 1$, then equation 3 reduces itself to:

$\lambda = \alpha K$

which implies that every dollar of capital employed will add to profits $\alpha$ dollars. This suggests that infinite amounts of capital will be hired. Since the values 0 and 1 for $\lambda$ do not make any sense, the value of $\lambda$ must be $0 < \lambda < 1$.

The first order conditions require that I differentiate equation 3 with respect to K, L, and $\lambda$ :

5) $$\frac{\partial \lambda}{\partial K} = R_k - r - \lambda R_k + \lambda ( r + \alpha ) = (1 - \lambda) R_k - (1 - \lambda) r + \lambda \alpha = 0$$

6) $$\frac{\partial \lambda}{\partial L} = R_L - w - \lambda R_L + \lambda w = (1 - \lambda) R_L - (1 - \lambda) w = 0$$

7) $$\frac{\partial \lambda}{\partial \lambda} = R - wL - ( r + \alpha ) K = 0$$

where R is total revenue, $R_k$ is the marginal revenue product of capital and $R_L$ is the marginal revenue produce of labor.

Rearranging equation 6 one gets:

8) $$R_L = w.$$

The marginal revenue product of labor is equal to the wage, as is in any profit-maximizing monopoly. Rearranging equation 7 it follows:

9) $$R_k = r - \frac{\lambda\alpha}{1-\lambda} \qquad \left( 0<\lambda<1,\ \alpha>0,\ \frac{\lambda\alpha}{1-\lambda}>0 \right)$$

By dividing equation 8 by equation 9 one gets:

10) $$\frac{R_k}{R_L} = \frac{r}{w} - \frac{\lambda\alpha}{(1-\lambda)w} \ .$$

Without regulation equation 10 would be:

11) $$\frac{R_k}{R_L} = \frac{r}{w} \ .$$

Equation 9 indicated that capital is hired until its marginal revenue product falls below the market cost of capital. The term $\frac{\lambda\alpha}{1-\lambda}$ can be called the distortion factor, since it measures the amount by which the ratio of $R_k$ to $R_L$ (and hence the ratio of the marginal physical product of capital to the marginal physical product of labor) is prevented from coming to equality with $\frac{r}{w}$, as efficiency in production requires (equation 11).

The combination of equations 8 and 9 shows that too much capital is hired relative to the amount of labor when a regulated firm has a constraint that allows the return on capital to be greater than the market cost of capital. When this constraint is binding, the capital labor ratio is too high for efficiency in production.

## IV-B Rate Base Padding

The Averch-Johnson hypothesis pointed out that overintensive substitution of capital for other production factors takes place when regulation is present and when the allowed rate of return is greater than the market cost of capital. However, suprisingly little attention was paid to a much older issue, of possible overintensive use of capital unrelated to the substitution process among different factors of production. This has been described by some as "gold plating" and by others as " rate base padding ".[4]

Such overintensive use of capital may occur in three forms:[5]

1 - "Gold plating". This means that the regulated firm uses unnecessarily expensive material and design. Using non-productive capital and paying a higher than competitive price for equipment belongs to the same category.

2 - Maintaining excessive capacity.

3 - Penetration into other markets at non-profitable prices in order

to pad the rate base.

"Gold plating" and "rate base padding" have been discussed orally by those involved with regulation since the begining of economic analysis of utility regulation. However, in 1970 Prof. Zajac noticed that the economic analysis of "gold plating" seemed to be absent from written economic literature. Prof. Zajac proceeded to develop the theoretical analysis of the rate base padding.

In the Rate Base Padding Model. developed by Prof. Zajac, the production function depends only on capital:

$$Q = Q(K)$$

The firm's net income (gross revenue minus operating expenses) is equal to:

$$Y = y(K).$$

If r is the cost of capital, the firm's profits then are:

12) $\pi = \pi(K) = y(K) - rK$

Equation 12 could represent the profit function of any firm. As the quantity of capital increases, profits will rise up to a point beyond which they will decrease. The reason for the increase and then decrease in profits is twofold. First, the additions of capital will increase costs. Second, additions of capital will increase output however, prices may have to be lowered in order to sell the increased output. If demand is inelastic, an increase in output will reduce total revenue which reduces profits. Utilities are an example of firms that face an inelastic demand. For these two reaseons equation 12 is shown in Figure 4.2 as a curve concave to the horizontal axis. This curve is often referred to as the profit-possibilities curve (boundary) or simply as profit hill.

We now have to introduce the regulatory constraint. Depreciation is neglected and K is simply the firm's rate base. Therefore, the regulatory constraint will be:

13) $y = sK$

where s is the "fair" rate of return. From equations 12 and 13 we get

14) $= (s - r)K$

In Figure 4.2 equation 14 is shown as a line with the slope s-r. I will refer to it as a constraint line.

What Prof. Zajac has done so far is to cleverly present the A-J hypothesis in graphical form. Figure 4.1 is an example of that and Figure 4.2 is a two dimensional version of the same.

It is very important to understand that the profits, a regulated firm earns, are a function of both equations 12 and 14. These two equations are like two forces that are not necessarily pulling in the same direction. In order to observe these two forces at work, let us observe Figure 4.2 to the right of point B. Along the profit hill, as the quantity of capital increases, profits are decreasing. Along the constraint line, as the quantity of capital increases, profits are increasing. These two forces meet at point B, where the regulated firm earnes the maximum profit while satisfying the regilatory constraint; it earns the maximum allowed profit.

Now, let us consider the case of the rate base padding. For simplicity, we assume that the firm acquires a quantity of non-productive capital K*. Non-productive capital will enter both equations 12 and 14. From 12 we get

15) $\Pi = \Pi(K,K^*) = y(K) - r(K+K^*)$

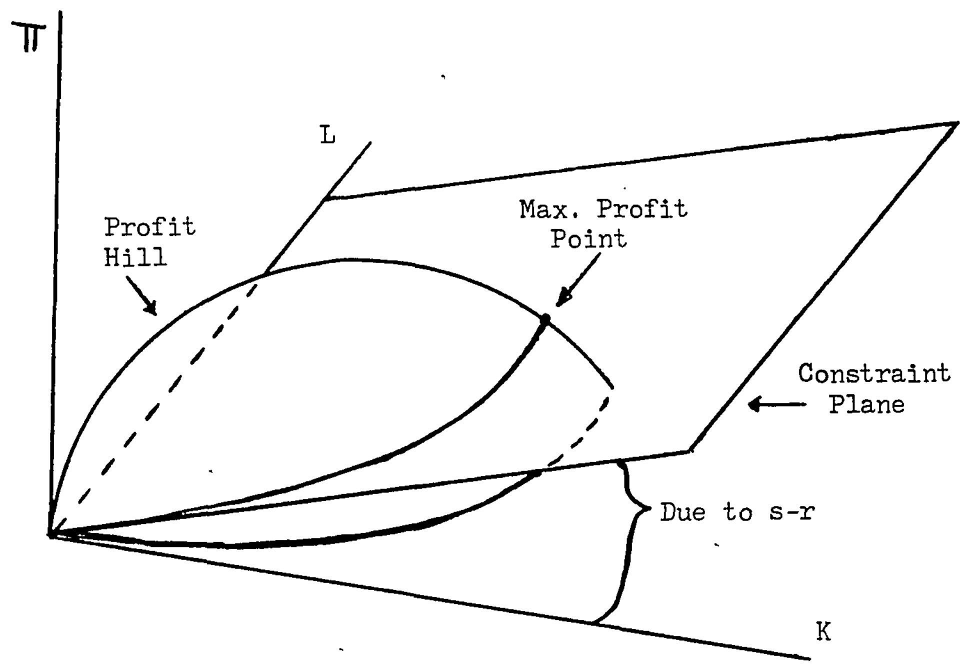
and from 14 the regulatory constraint becomes

16) $\Pi = \Pi(K,K^*) = (s-r)(K+K^*)$

Non-productive capital enters equation 15 only as a cost and it makes no contribution to income. Therefore, padding decreases profits at a faster rate than if productive capital was used instead. This will change the slope of the profit-possibilities curve at the point

Figure 4.1

GRAPHICAL ILLUSTRATION OF THE REGULATORY CONSTRAINT

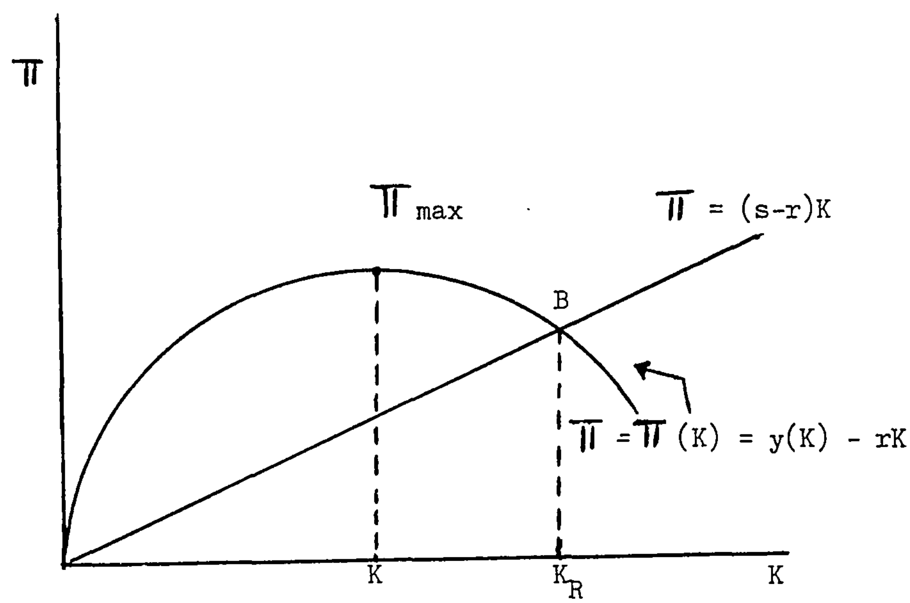



Profits of the firm could be shown as $\pi$ = PQ - rK - wL. This can be visualized as a smooth hill in a space defined by three axis: $\pi$, K, and L. Regulation imposes a constraint on the firm so that it can not operate ao the top of the hill. The constraint is $\frac{PQ-wK}{K} = s$ where s > r. This could be rearanged:

PQ - wL = sk. By substituting for PQ we get $\pi$ = (s-r)K. The last equation can be visualized as a plane that is hinged on the L axis and swung upward from the K, L plane by s-r. Maximum profits will occur ar the intersection of the constraint plane with the profit hill.

Figure 4.2

GRAPHICAL ILLUSTRATION OF THE REGULATORY CONSTRAINT REDUCED TO TWO DIMENSIONS $\pi$ , K




$K_\pi$ = Quantity of capital needed to maximize profits when no constraint exists.

$K_R$ = Quantity of capital employed that maximizes profits when the regulatory constraint is binding.

$\pi = \pi(K)$. indicates that profits are a function of productive capital.

$\pi = (s-r)K$ is the regulatory constraint.

where non-productive capital was introduced. This is shown in Figure 4.3 there the heavy solid curve changes its slope at point C.

In equation 16 additions of non-productive capital increase profits. The constraint line retains the same slope and therefore, profits increase in proportion to the increases in non-productive capital.

Padding introduces one more variable in our two equation system. Along the profit-possibilities curve padding will reduce profits and along the constraint line padding will increase profits. These two equations point out that there is a cost and a benefit associated with padding. We wish to determine the circumstances in which padding the base serves to increase profits, and under what circumstances it serves to decrease profits. Presumably, the firm will choose to pad the base in a manner which serves to increase profits.

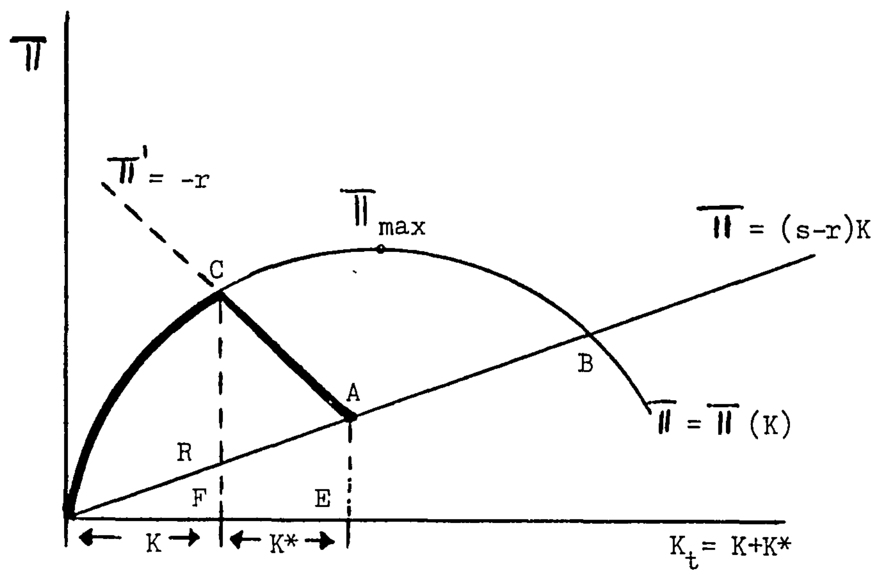
IV-B-1 The Case when Padding is not Desirable [6]

Assume that a regulated firm uses a combination of K (productive capital) and K* (non-productive capital) as indicated in Figure 4.3 . In other words, the firm uses K amount of capital and then it pads the base by adding K* in order to satisfy the regulatory constraint.

How will padding affect profits in this case ? From equation 15, we can deduce that padding will decrease profits at a rate of $\Pi' = -r$.

Figure 4.3

THE CASE WHEN PADDING IS NOT DESIRABLE




The firm's profits are represented by a heavy solid curve are a function of total capital $K_t = K+K*$, where K stands for productive capital and K* stands for padding or non-productive capital (as shown by equation 15). The thinner curve represents profit as a function of K only.

The firm pads the base to the right of C by an amount K*, until it satisfies the regulatory constraint (point A). Padding reduces profits by rK*, which is represented by a straight line $\pi = -rK$ starting at point C. At the same time, the amount of profits that the firm is allowed to keep increases from FR to EA.

In Figure 4.3, we can see this as a change in direction of the heavy solid curve at point C, where the non productive capital was introduced. Profits fall from point C to point A by an amount rK*. However, equation 16 states that padding will increase profits. This can be seen as a movement from point R to point A on the constraint line. In order to see the total effect of padding on profits, one should compare profits before and after padding took place. Before padding profits were CF, however the utility was allowed to keep only RF. With padding the firm earns and keeps AE. Since AE is larger than RF, the total effect of padding was to increase profits for the regulated firm.

Prof. Zajac points out that in this situation padding is <u>not desirable</u>. The reason for this is that point A is below point B. Therefore, the firm should hire productive capital until it reaches point B where it would earn higher profits.

IV-B-2 The Case when Padding is Desirable[7]

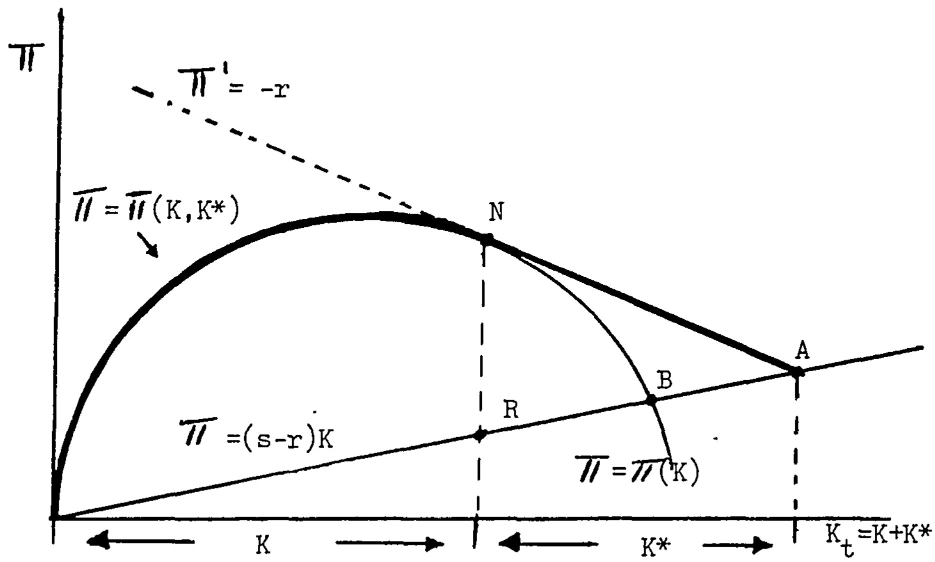
Before I examine under what condition padding is desirable in Prof. Zajac's model. it would be interesting to know at what point does the regulated firm maximize income. Rearranging equation 12 we get

$$y(K) = \pi(K) + rK$$

$$y' = \pi' + r$$

Figure 4.4

THE CASE WHEN PADDING IS PROFITABLE




Starting at point N, due to padding, the heavy solid curve becomes a straight line with the slope of -r. As long as the constraint line $\pi = (s-r)K$ is below N padding is profitable. The best the regulated firm could do by employing productive capital is to reach point B. By padding, point A is attainable which is clearly outside of th the profit possibilities curve that is a function of productive capital. In this case padding is desirable.

As in Figure 4.3 the heavy solid curve/line is a function of productive and non-productive capital.

When $\pi'$ = -r, then y' = 0. In Figure 4.4 income is maximized at point N, since it is there that the slope of the profit-possibilities curve is equal to -r.

When the intersection of the constraint line with the profit-possibilities curve takes place to the right of point N, padding is desirable. Figure 4.4 illustrates this case. The regulated firm could operate at point B, where it seems that profits are maximized. In fact, the firm should hire productive capital until it reaches point N and then pad the base in order to satisfy the regulatory constraint. This is a much better solution. Let us examine the effects of padding in this case. Padding decreases profits because of its cost by -rK* which is shown starting at point N and going to point A in a straight line. It also increases profits due to the regulatory constraint from R to A. The total effects is that profits are much higher at A than at R, where padding began. But profits at point A are also higher that at point B! In fact, point A is outside the profit-possibilities curve and therefore, this is a perfect example of where padding is desirable.

If the constraint line would intersect the profit-possibilities curve to the left of N, the best the firm could do would be to operate at point B and hire productive capital only. The situation is the same as the one illustrated in Figure 4.3.

Prof. Zajac's work can be summarized as follows:

1 - He cleverly translated the Averch-Johnson hypothesis into graphical form. By doing so he pointed out that there are two forces that affect profits for a regulated firm. The first, is that every firm (whether regulated or not) has a profit-possibilities boundary associated with the increase in the quantity of capital. As the quantity of capital increases, a point is reached beyond which profits will start decreasing. The decrease in profits, as the quantity of capital increases, is not only due to increasing costs of production. Utilities face an inelastic demand and as output is increased, as capital is added, total revenue will fall and thus profits will decrease. This is why the profit-possibilities curve is concave to the horizontal axis. The second, is the regulatory constraint. As capital increases, the regulators allow a proportional increase in profits. These two forces determine how much capital a regulated firm will employ. When compared to a non-regulated firm a utility will be more capital intensive. This is exactly what H. Averch and L. Johnson found.

2 - The graphical form of Prof. Zajac's presentation allows examination of the issue of rate base padding. Padding the base lessens the profit-possibilities boundary and at the same time it increases the rate base. He found that padding is profitable only when the constraint line is below the income maximizing point (for example, point N in Figure 4.4). At other times padding is not desirable; it is better to use productive capital instead.

## IV-C Capital Measured in Terms of Price

The theoretical base of this study is the Averch-Johnson hypothesis and Prof. E. Zajac's rate base padding model. Both suggest, that in analyzing the quantity of capital employed, a regulated monopolist will be more likely to engage in an over-intensive use of capital, than will a non-regulated firm.

The A-J effect could be measured by comparing the operation of a regulated firm with one that has no regulatory constraint. This would require the knowledge of the production process and of each capital item for both types of firm. It is extremely difficult to obtain such technical information. Therefore, lacking data on the physical capital used, only value data which reflect the combined effects of price and quantity were used in analysis.

In the Zajac model the firms pad the base by adding quantities of (non-productive) capital. Being required to measure capital in terms of dollar value instead of quantity thus limits the analysis as it seeks to identify rate base padding. As will be shown below, this problem is not capable of empirical resolution, though analysis of the content of the equipment sales contracts suggest that a significant part of the difference in dollar value are attributable to differences in price.

For this reason the use of market values instead of quantities is appropriate to the case of padding the base by paying higher than market price for capital. For example, two firms buy identical transformers, but one firm pays 10% more for it. If we would measure padding the base in physical units, since both firms bought one unit, by comparing the firms no difference would be revealed. If we measure padding by using prices, it is obvious that one firm padded the base by 10%.

## IV-D Rate Base Padding in the Electrical Cases

This study examines theoretically the issue of rate base padding and at the same time it investigates whether rate base padding took place in the period 1957-1963. Since part of this period was characterized by a collusion among the electrical manufacturers, the following question needs to be answered: Is there any relationship between the collusion among the electrical manufacturers and the utilities' desire to pad the base? It is obvious that a utility that desires to pad the base will accept higher prices for equipment it purchases from the manufacturers. Sometimes this is referred to as the "co-conspiracy" hypothesis; the manufacturers raise prices by collusion, while the utilities accept these prices with little resistance, as they are able to pass on the higher prices through the enlargement of the dollar value of the rate base.

One of the smaller electrical manufacturers, the Allen-Bradley Company, used rate base padding as part of its defense in the case of Atlantic City Electric v. General Electric.[8] Allen-Bradley Company charged that it was a victim of a joint conspiracy that involved the larger manufacturers in combination with their utility customers. It was argued, using the Cleveland Electric Illuminating Company as an example, that the generating equipment market value of $ 19.7 million was carried on the books at $ 27.9 million. For that utility as a whole, equipment with an aggregate market value of $ 400 million was carried on its books for rate making purposes at a value of $ 600 million. In addition to this example, many historical ties between the large manufacturers and their utility customers were cited, indicating that they formed a "club" that smaller manufacturers were prevented from joining. The many technical and social gatherings of utility and manufacturers' officers provided ample opportunity to meet and agree on keeping smaller manufacturers out. Generally, the attorneys for Allen-Bradley argued, the utilities made it known that they were not concerned with high prices but rather with "uniformly administered prices" in order that no single utility would be given preferential treatement.[9]

The "co-conspiracy" hypothesis was not accepted by the courts.

Its failure was not the lack of evidence, but the desire of the courts not to introduce "rate-base" considerations into the electrical cases, contending that to do so would "convert the litigation into a rate hearing".[10]

The court's refusal to examine the rate base padding issue did not prevent the regulatory agencies from doing so. For example, while applying for a rate increase Houston Lighting and Power Company was not allowed by the local regulatory agency to use its reproduction cost study. The study was dismissed because the prices used in it were conspiratorially fixed according to the utility's own allegations in its treble damage suit. Furthermore, the regulatory bodies encouraged the utilities to pursue the treble damage suits, while not forgetting that padding the base could have taken place. The Florida Railroad and Public Utilities Commission on February 13, 1961 addressed a directive to all privately-owned electric utilities:

> As a result of recent conviction of a number of electrical equipment manufacturers of violations of the Sherman Anti-Trust Act, it appears that there is a strong probability that the privately-owned electric utilities in Florida will be entitled to substantial refunds from the convicted companies from which they have purchased equipment.

> It follows that if these violations of the Anti-Trust Law have resulted in the over-pricing of electrical equipment... then the investment of the utilities may also be correspondingly... reflected in the rates charged the public by those utilities. [11]

It is clear that the electrical utilities and not the industrial firms were the target of the manufacturers' conspiracy. Out of 1,880 damage suits only a few were brought by non-electrical utilities. Charles A. Bane wrote in 1973:

> Electric utilities were not the only claimants: El Paso Natural Gas Company and three associated natural gas pipeline companies filed in ten product lines; American Sugar Refining Company sued in three product lines, as did the AT&T and Bell related companies. Several foreign purchasers brought actions too. [12]

Of these non-electrical suits, only the one brought by the American Sugar Refining Company was brought by a non-regulated industrial firm. It seems that the industrial firms did not feel that they were overcharged as much as the utilities.

Although the courts did not examine the co-conspiracy hypothesis, the fact that utilities accepted the increase in prices suggests that they did not feel that they would be damaged by the conspiracy.

## IV-E Criticism of the Rate Base Padding Model

The length of the run should be included in any discussion about the rate base padding, as the examples below will illustrate, because the regulated firm may use different strategies in the short run than it would in the long run. Prof. Zajac did not examine the effects of the length of the run in his model. He assumed that the regulated firm would operate at the maximum allowed profit. However, in the short run a utility can not always operate at the point of maximum allowed profit due to fixity of capital. In that case, padding is a choice that may be the most profitable one.

### IV-E-1 Apparent Indifference to Padding

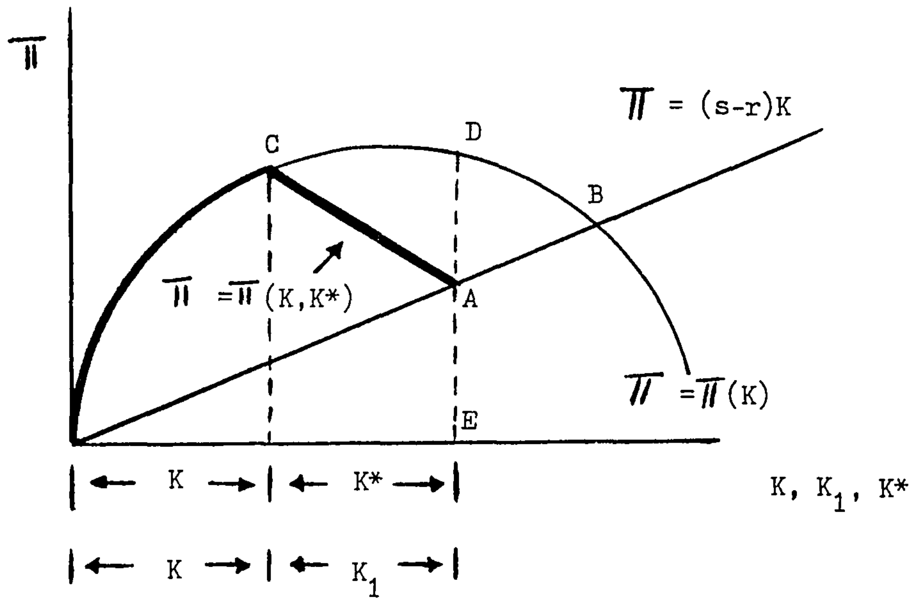
Although the regulated firm should operate at a point where the allowed profits are maximized (point B in Figure 4.5), this may not always be possible. Suppose that as a short run phenomenon the firm is unable to hire enough capital in order to operate at the maximum allowed profit. The firm starts with K amount of capital and then two strategies are open to it: either pad the base by an amount $K^*$ or employ $K_1$ of productive capital where $K^*=K_1$. The two choices can be stated as

1) $K + K^*$ , or

2) $K + K_1$

Figure 4.5

APPARENT INDIFFERENCE TO PADDING IN A SHORT RUN




The regulated firm starts with K amount of capital In the short run, due to scarce resources, it can not operate at point B. However, it has two choices: K+K*, if it pads the base by K*, or $K+K_1$ if it adds productive capital $K_1$. In terms of dollar spent in purchasing additional capital $K_1 = K^*$.

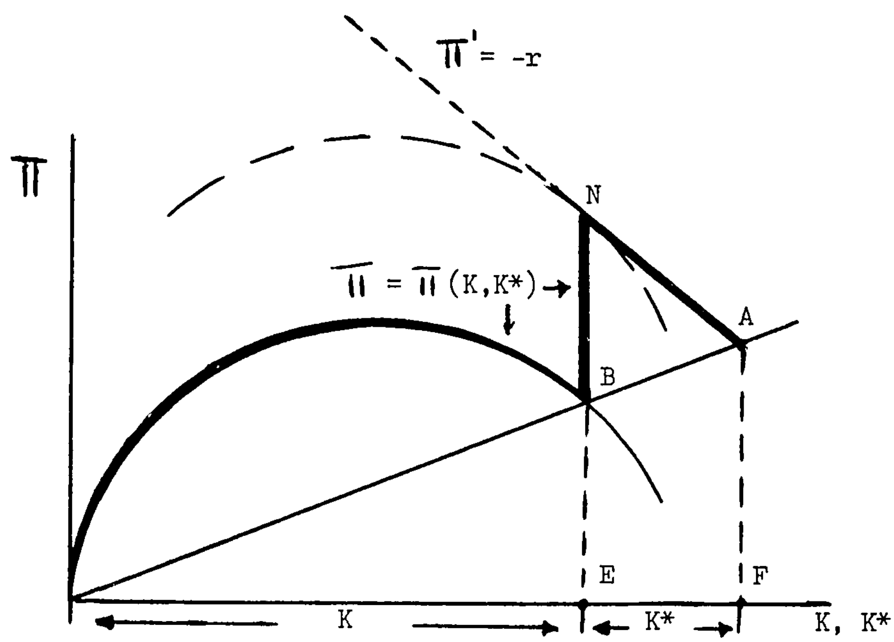
as shown in Figure 4.5 . The first choice results in AE amount of profit after padding took place. The second choice earns DE in profits, but the firm is allowed to keep only AE, the same amount as if it was padding the base! It seems that the firm should be indifferent between these two choices since they earn the same amount of profit. But managers who may have to choose between these two alternatives in fact may prefer padding. Padding earns as much profit as productive capital could, and it can be used at the same time to build lavish buildings, spacious offices etc. This is an example of managers "satisficing"; that is, seeking choices with respect to their several objectives. By padding they earn the allowed profit, but also satisfy other non-profit objectives.[13]

IV-E-2 Shifts of the Profit-possibilities Curve and the Constraint Line

Prof. Zajac showed that padding can take place, but did not specify the particular means by which padding is accomplished. Suppose that due to a change in market conditions or regulatory policy a utility is earning a higher than allowed profit rate. The utility could pad the base e.g., by buying extra spare parts, or by accelerating construction in order to lower the profit rate to the allowed amount. For example, let us assume that the regulatory commission approves higher electric rates. The higher electric rates shift the profit-possibilities hill as indicated in Figure 4.6 . The utility employs originally K amount of capital. After the increase in the electric rates the utility pads the base by adding K* amount of non-productive capital and thus

Figure 4.6

A SHIFT IN THE PROFIT-POSSIBILITIES CURVE




The regulated firm operated at point B using K amount of productive capital. A shift in the profit-possibilities curve creates a situation where padding increases profits.

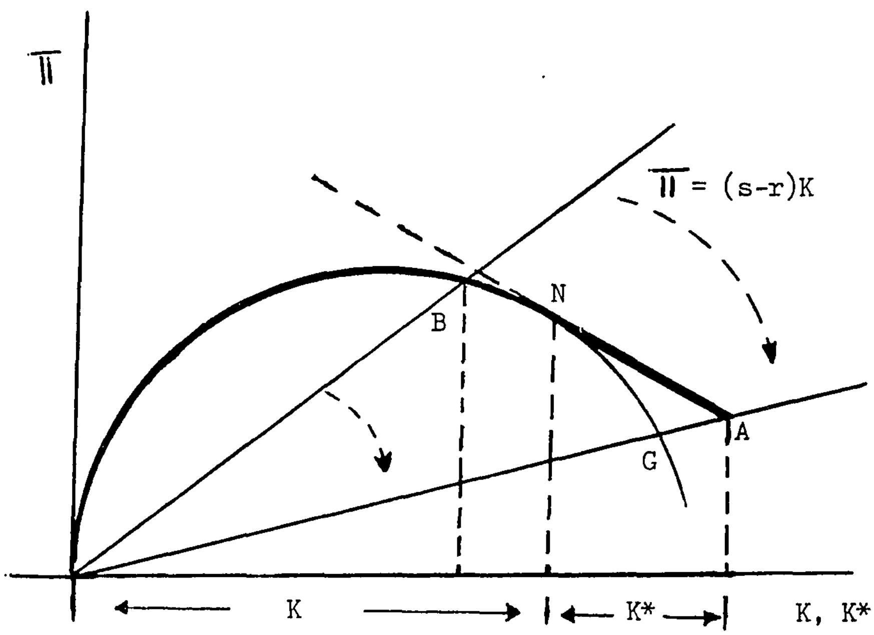
satisfies the regulatory constraint. In Figure 4.6 before padding took place the firm would earn BE in profits. However, due to padding the allowed profits are increased to AF. Here too, padding is desirable.

Ommited from the literature on rate base padding is the fact that padding and the employment of productive capital are choices which are not perfect substitutes. Capital projects take a long time to complete since planning and complex construction may be necessary. To pad is a choice that could be reached at any instant of time. For example, in Figure 4.6 as the profit hill shifted upwards, padding became necessary. Changes in market conditions that affect profit-possibilities thus may create a situation where padding is desirable. Therefore, padding is a choice which is always available as a strategy tool. In the short run one could not say that padding and productive capital projects are substitutes, only padding is possible.

Changes in the rate of return on capital and in the allowed return by the regulators will affect the need to pad. These changes affect the regulatory constraint directly and can be shown as changes in the slope of the constraint line. For example, the constraint line may shift upwards due to an increase in the allowed return on capital This changes the intersection of the profit-possibilities curve with the constraint line from right to left of point N. By this kind of shift, the regulated firm that was padding the base will no longer have an incentive to do so. If the constraint line shifts from left to right of point N, the utility that did not pad the base would have

Figure 4.7

A SHIFT IN THE CONSTRAINT LINE




A regulated firm operated at point B by using productive capital only. If the constraint line shifts clockwise, as indicated in the Figure above, the firm will employ productive capital until it reaches point N (where income is maximized) and then pads the base until it satisfies the regulatory constraint (point A).

an opportunity to do so. For example, in Figure 4.7, the constraint line shifted to the right of point N. The regulated firm can now hire productive capital until it reaches point N (where income is maximized) and then it pads the base until it satisfies the regulatory constraint (point A).

IV-E-3 Conclusion

Padding the base is a choice that every regulated firm encounters but it is not always the best strategy. Since the begining of utility regulation, padding the base has been suspected. Prof. Zajac, in a pathbreaking article, showed that under certain conditions a regulated firm can increase its profits by padding. I have presented three situations in addition to the ones described by Prof. Zajac, that in the short run may induce the utility to pad the base. The first points out that a firm may not be able to employ the optimal amount of capital due to short run fixity of capital. In that case, if the firm wishes to increase profits it has two choices: to use additional capital or to pad the base with non-productive capital. The firm may be indifferent to either choice but this indifference could be apparent. The firm's manager may prefer to pad the base because padding in addition to earning the allowed profit, satisfies other non-profit objectives. The second, due to changes in market conditions the profit-possibilities hill could shift. Such shifts can create conditions under which padding is desirable. The third, changes in the return of capital or changes in regulations will shift the constraint line which may create conditions where padding is likely.

In the long run, padding the base is a strategy that a regulated firm should not in principle consider. However, viewed as a short run phenomenon when the opportunities to pad develop, managers consider them as a part of ongoing strategy. The regulated firm's raison d'etre is to provide a service to its customers and therefore, long run plans concentrate on the quality and quantity of service to be provided and on how to pad the base. However, the accumulation of short run padding has a long run result.

## IV-F The Elasticity of Demand

Examination of the elasticity of demand for electrical apparatus may shed some light on the purchasing behavior of the industrial firms and utilities. For these two types of buyers of electrical apparatus the relative difference in the elasticity of demand is not known. However, we do know that the demand for all electrical apparatus is inelastic.[14] In order to analyze the difference in elasticity of demand between the two types of buyers, I will examine two demands for capital :

1) Linear demand

2) Demand that has constant elasticity

The demand for capital is $K = K(\pi)$, where $\pi$ is the shadow price of capital and $\pi = r - s$. where r is the cost of capital and s is a distortion factor. For an industrial firm s=0 and for a utility $0 < s < r$.

IV-F-1 Linear Demand for Capital

If $K = b_o - b\pi = b_o - b(r - s)$, then the price elasticity of demand for capital would be:

$$e = - \frac{dK}{dr}\frac{r}{K} \qquad \text{or}$$

$$e = b\,\frac{r}{K}\,.$$

Subscript 1 will indicate industrial firms and subscript 2 will indicate utilities. Then, the elasticity for industrial firms is

$$e_1 = b\,\frac{r}{K_1}\,,$$

and for regulated firms

$$e_2 = b\,\frac{r}{K_2}\,.$$

Since the A-J hypothesis shows that the utility would employ capital past the point where its marginal revenue product equals the market cost of capital, I can say that

$$K_2 > K_1 ,$$

therefore,

$$e_2 < e_1 .$$

We arrive at the same result through the ratio of elasticities

$$\frac{e_2}{e_1} = \frac{K_1}{K_2} = \frac{b - br}{b - br - bs} < 1 ,$$

therefore,

$$e_2 < e_1 .$$

IV-F-2 Constant Elasticity of Demand for Capital

Suppose that the demand function for capital is of the constant elasticity form

$$\ln K = b - b \ln \pi$$

$$\ln K = b - b \ln(r - s) .$$

Then, the elasticity of demand is

$$e = -\frac{\partial \ln K}{\partial \ln r} = \frac{\partial \ln K}{\partial \ln K(r-s)} \frac{\partial \ln(r-s)}{\partial \ln r} = b \frac{\partial \ln(r-s)}{\partial \ln r}$$

$$e = b \frac{\partial \ln(r-s)}{\partial (r-s)} \frac{\partial (r-s)}{\partial r} \frac{\partial r}{\partial \ln r}$$

$$e = b \cdot \frac{1}{r-s} \cdot 1 \cdot r$$

$$e = b \frac{r}{r-s} \quad .$$

If again the subscripts 1 and 2 are used to indicate industrial firms and utilities respectively then

$e_1 = b$ is the elasticity for the industrial firms ( $s = 0$) and

$e_2 = b \frac{r}{r-s}$ is the elasticity for utilities.

The ratio of the two elasticities is

$$\frac{e_2}{e_1} = \frac{r}{r-s} \text{, therefore,}$$

$$e_2 > e_1 \ .$$

The above results indicate that the utilities have a smaller elasticity of demand for capital when the demand is linear ( constant slope). They have a larger elasticity of demand when the demand curve has a constant elasticity with respect to r. If neither the slope or the elasticity are constant, the result is ambiguous. These different results do not help in determining which one of the two, utilities or industrial firms, will pay a higher price for the capital they purchase. What I conclude is only that the two types of buyers pay different prices.

## IV-G Do Utilities Engage in Rate Base Padding ?

A utility is allowed to earn a predetermined amount of profits. The amount is determined by the regulators and it is a function of the size of the rate base and the allowed rate of return. In turn, the size of the rate base depends upon the size of the capital stock. The larger the capital stock, the larger the rate base and therefore, the larger the permitted profits. The utility, if it desires to increase the allowed profits, can increase it's rate base in two ways, as pointed out by Prof. Zajac. One was is to increase the base by adding productive capital, the other is to increase the base by adding non-productive capital.

I would like to clarify the meaning of rate base padding, which will also explain further the distinction between productive and non-productive capital. Prof. Zajac defined padding as an overintensive use of capital unrelated to the substitution process among different factors of production. Such overintensive use of capital, as explained in section IV-B, can have three forms:

1) Gold plating

2) Maintaining excessive capacity

3) Penetration into other markets at non-profitable prices.

In this study I will examine only the first form of overintensive use of capital: "Gold plating". In this case padding the base is defined as purchases of capital that are unnecessarily expensive. For example, if a utility purchases capital at a price which is 15% higher than the market price, the extra 15% could be viewed as an unnecessary expense. This can be interpreted as padding the base by 15%. Let us assume that the utility purchased $115 million in equipment and it paid 15% above the market price. In Prof. Zajac's terminology the utility purchased $100 million of productive capital and it padded the base by $15 million of non-productive capital. The term non-productive capital means the amount of capital that is not necessary for production. Therefore, payments for capital that are above the market price are viewed as additions of non-productive capital.

In order to find out if the utilities are paying unnecessarily high prices for their capital, I must compare their purchases with those of industrial firms. Therefore, I will empirically examine the proposition that the regulated firms are paying higher prices for similar equipment than industrial firms. If in fact higher prices are paid by the utilities, then "gold plating" as a way of padding the base exists.

An important question could be raised: why do utilities choose to pursue policies which do not lead to lower costs of capital ? Are they intentionally padding the base or do they pay higher prices for some other reason.

IV-G-1 Reasons for High Prices of Equipment Other than Base Padding

As mentioned, there may be factors, aside from base padding, that explain why utilities pay higher prices than industrial firms. If some of these factors can explain the higher prices, then padding the base may not be an important phenomenon. For example, higher prices can be caused by complex specifications, small order sizes, visibility of bids, and the lack of aggresive bargaining.

One possible explanation for the high prices is that product specification could be more elaborate and varied for the utilities.[15] This is probably true for the large generators since the utilities use the most complex ones. For the equipment that I examined in this study, chances of that being the case are small, since similar apparatus is used for both utilities and industrial firms. However, one should keep in mind the fact that complicated specifications (and therefore more expensive equipment) could be a way of padding the base.

In the electrical apparatus industry the larger the size of the transaction the larger the discount it will receive.[16] Utilities would be expected to pay higher prices if they were requesting mostly small orders, but this is not the case. The frequency distribution of transactions for utilities and industrial firms are very similar. Therefore, if utilities are paying a higher price for transactions when compared to industrial firms, it is not due to smaller order size.

Manufacturers give different discounts on transactions based on transaction visibility.[17] A transaction is visible if everyone in the industry knows that it took place. For example, a large order in an open public bid is very visible. The manufacturers prefer to give low discounts to visible bids and higher discounts to less visible bids, during a period of falling prices. When prices are falling, visible transactions receiving large discounts can trigger further donward pressure on prices by manufacturers. However, throughout the industry only a small percentage of orders are visible. It is incorrect to assume that utilities' orders are more visible and therefore, they pay higher prices than industrial firms for that reason.

Unfortunately, from the data in this study I could not determine which orders were visible and which were not.

Utilities could pay higher prices and in this way pad the base because they do not bargain aggressively.[18] When negotiating prices with manufacturers, they do not bargain as aggressively as industrial firms. Some utilities use consulting services which help in price negotiation and thus receive larger discounts. The number of utilities that use " outside help" is small and most prefer to negotiate directly with manufacturers. What lessens the aggressive bargaining is that the utilities have to depend on reliable equipment. Since the utilities meet the demand for electricity instantly, the reliability of equipment is vital to their operation. Therefore, they depend on reliable suppliers or "the old boy network" and avoid suppliers that could provide the equipment at lower cost. Many engineers, who compose the specification requirements of equipment for the utilities, insist on particular products made by specific manufacturers. They favor products and manufacturers that were reliable in the past. Utilities and their engineers, by favoring the manufacturers that they are accustomed to, ignore the search for lower prices from other manufacturers. They often pay higher prices for the same quality, which can be interpreted as padding the base.

Do regulated firms engage in rate base padding? This study concentrates on padding the base that results from purchases of capital that are unnecessarily expensive. Regulated firms have a reputation of not bargaining aggressively and therefore, they often pay a higher than market price for equipment. Paying higher than market prices can be interpreted as a desire to pad the base, since other explanations like rigid specifications or size of orders are not satisfactory. If regulated firms pay a higher than market price for capital, it is very likely that they are padding the base.

# Footnotes

[1] H. Averch and L.L. Johnson, "Behavior of the Firm Under Regulatory Constraint", American Economic Review (December 1962), Vol. 52, No. 5. pp. 1053-1069

[2] Ibid., pp. 1055-1056

[3] The Averch-Johnson model presented in this study received some additions and clarifications by the following:

A. Takayama, "Behavior of the Firm Under Regulatory Constraint", American Economic Review (June 1969), Vol. 59, No.3, pp. 255-260

W.J. Baumol and A.K. Klevorick, "Input Choices and the Rate-of-Return Regulation: An Overview of the Discussion", The Bell Journal of Economics and Management Science (Autum 1970), Vol. 1. No. 1, pp. 129-142

E.E. Baily and J.C. Malone, "Resource Allocation and the Regulated Firm", The Bell Journal of Economics and Management Science (Spring 1970). Vol. 1, No. 1, pp. 129-142

F.M. Scherer, Industrial Market Structure and Economic Performance (Chicago: Rand McNally, 1970), pp. 551-555

[4] E.E. Zajac, "Note on Gold Plating or Rate Base Padding", The Bell Journal of Economics and Management Science (Spring 1972), Vol. 3, No. 1, pp. 311-315

[5] Ibid., p. 311

[6] Ibid., p. 313

[7] Ibid., p. 312

[8] Ralph G.M. Sultan, Pricing in the Electrical Oligopoly, Vol. I (Cambridge, Massachusetts: Harward University Press, 1974), p. 107

[9] Ibid., p. 107

[10] Ibid., p.108

[11] Charles A. Bane, The Electrical Equipment Conspiracies (New York: Federal Legal Publications, Inc., 1973), pp. 70-71

[12] Ibid. pp. 80-81

[13] F.M. Scherer, p. 31

[14] C. Walton and F. Cleveland Jr., Corporations on Trial: The Electric Cases (Belmont, California: Wadsworth Publishing, 1974), p. 28

[15] Ralph G. M. Sultan, p. 258

[16] Ibid., p. 248

[17] Ibid., p. 249

[18] Ibid., p. 267

# CHAPTER V

# ANALYSIS OF THE DETERMINANTS OF PRICES IN PRE AND POST TRIAL YEARS

## V-A The Several Factors that Affect Actual Price

This chapter seeks to explain the actual prices paid for equipment in terms of the several factors that enter into determination of these prices. The factors that are included in this analysis are the book or catalog price, the type of buyer, the position of particular manufacturers in the structure of prices, the effects of collusion and the general level of costs and prices for equipment in the year in question. The existance of price difference between types of buyer, which might indicate the practice of price discrimination, can be established only when the effects of such other factors that determine actual prices have been taken into account.

## V-B Book Price

The book price is a published price usually indicated in price catalogues or price lists, and it is known to all interested parties.

A manufacturer sets the book price knowing that this price will be a starting point of any price negotiations. When transaction prices are regressed on book prices the coefficient should be less than one, since the actual price is almost always lower that the book price. This coefficient thus provides a measure of the discount from the book price.

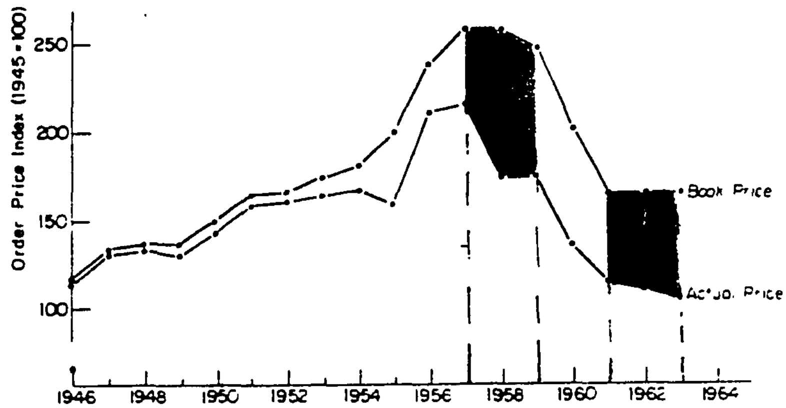
If during the collusion (1957-1959) and the post-collusion (1961-1963) periods the book prices were unchanged, I would expect that the actual prices would be lower in the post-collusion period. The reason for this expectation is that after the courts uncovered and punished the collusion, more competition should have been forthcoming which would lead to lower actual prices. It is also possible that an increase in price competition would reduce both book and actual prices.

Figures 5.1 and 5.2 show that the book and actual prices decreased after 1957 in the (1) circuit breaker and switchgear and (2) power transformer markets respectively. From Figure 5.1 I have calculated that between 1957 and 1963 book prices decreased by 38% and actual prices by 53%. Similarily, from Figure 5.2 I calculated that for the same time time period book prices decreased by 44% and actual prices by 41%. Therefore, both book and actual prices decreased from the pre-trial to the post-trial periods.

In Table 5-1 I compare the actual prices as percentages of

Figure 5.1

SWITCHGEAR AND CIRCUIT BREAKERS ESTIMATED PRICE INDEX



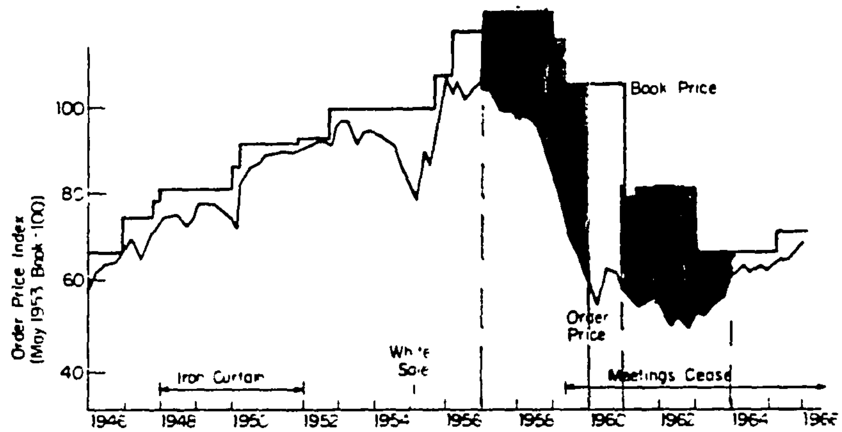

Order price = Actual price

Shaded areas indicate the periods examined in this study

Source: R. Sultan, p. 44

Figure 5.2

POWER TRANSFORMER PRICES FROM 1946 TO 1966




Order price = Actual price

Shaded areas indicate the periods examined in this study

Source: R. Sultan, p. 51

Table 5-1

ACTUAL PRICES AS PERCENTAGES OF BOOK PRICES 1957-1963

| Year | Switchgear and Circuit Breakers* | Power Transformers** | Electrical Apparatus*** | |
|---|---|---|---|---|
| | | | Utilities | Industrial |
| 1957 | 81 | 81 | 99 | 80 |
| 1958 | 63 | 75 | 67 | 62 |
| 1959 | 70 | 54 | 86 | 69 |
| 1961 | 72 | 61 | 78 | 59 |
| 1962 | 69 | 73 | 67 | 64 |
| 1963 | 66 | 91 | 61 | 64 |

*Calculated from Figure 5.1
**Calculated from Figure 5.2
***These are the book price coefficients taken from Table 5-2. The coefficients approximate the actual prices as percentages of book prices. Furthermore, the electrical apparatus includes only the apparatus used in this study.

book prices for the two types of products with the annual regression results of electrical apparatus shown in Table 5-2. We know from Figures 5.1 and 5.2 that book and actual prices had fallen, however, it would appear that the actual prices fell more sharply than book prices. The coefficients of book price, in Table 5-1, illustrate the decline in actual prices by the type of buyer: for the utility buyers actual prices decreased from 99% to 61% of book price and for industrial buyers actual prices decreased from 80% to 64% of book price. This means that in addition to the decrease in prices, larger discounts off book prices were given. However, for circuit-breakers, switchgear and power transformers, actual prices did not decrease uniformly as a percentage of book prices. In 1958, for example, a small price war broke out among the manufacturers which caused prices to fall rapidly. In 1963, power transformers book prices reached their lowest level since WW II and probably as a result of that, the actual prices were a higher percentage of book price.

One can conclude that the competition that developed after the Electrical Cases had two effects. First, it led to a reduction in book prices. Second, the discounts of actual prices from book prices increased.

## V-C Price Differences by Type of Buyer

The two principal types of buyers of the electrical apparatus examined in this paper are industrial firms and electric utilities. These two types of buyers could pay different prices for the same or similar products. The reasons for the price differences are:

1 - Rate base padding by utility buyers. A utility can pad the base in order to maximize profits, that is, pay a higher than market price for equipment. Industrial buyers, on the other hand, operate in competitive markets and are thus unable to pay prices above cost.

2 - Since the industry is characterized by a few large suppliers, collusive oligopoly pricing could result in price discrimination. This should be definitely expected in the 1957-1959 period that was characterized by complex price-rigging schemes.

3 - The manufacturers could perceive that the demand for apparatus for the two types of buyers is different. Unfortunately, the respective elasticities of demand are not available to me, nor did this issue appear in the literature concerning the industry.

Having divided the sample data into two groups, regression analysis was used to identify the absence or presence of price differences. The actual values were measured on the vertical axis and the book values on the horizontal axis of a chart, and separate least square regressions were calculated for the two groups. If one of the regression lines is higher than the other, it means that along it the actual payments by that group of buyers are greater relative to bool value than for buyers described by the other regression line. Since, as argued above, the utilities might be expected to pay higher prices for equipment than commercial and industrial buyers, I would expect the regression line for the utilities to be higher. If the slopes of the two regressions are different, it means that the suppliers of equipment impose different discount policied between the two groups, i.e. they price discriminate.

The most likely pattern to be found is one where the regressions differ in both intercept and slope. If one regression line has both, a greater slope and a greater intercept, then the highest priced group of buyers is unambiguously identified. However, if the two regression lines intersect then there would be no blear cut price discrimination. It would simply mean that for some range of book values the utilities paid higher prices, and for some other range of book value they paid lower actual prices than the industrial firms.

To compare the two regressions the method developed by Prof. D. Gujarati using dummy variables has been used. First, only one regression needs to be run because individual regressions can be easily deduced from it. Second, both coefficients (intercept and slope) can be directly tested for significance. Third, the data for utilities and industrial transactions are pooled, thus increasing the number of degrees of freedom and therefore the relative precision of the estimated parameters.

The regression equation using pooled data and dummy variables following the Gujarati method is as follows:

$$ACT = \alpha_0 + \alpha_1 D_i + \beta_1 BOOK + \beta_2 (D_i \ BOOK) + u_i$$

where,

ACT = Actual price

BOOK= Book price

$D_i$ = 1, for utilities

$D_i$ = 0, for industrial firms

$u_i$ = Sample residual.

When $D_i$= 1 the regression equation describes utilities and it becomes

$$ACT = \alpha_0 + \alpha_1 + \beta_1 BOOK + \beta_2 BOOK,$$

and when $D_i = 0$, the regression equation describes the industrial firms:

$$ACT = \alpha_0 + \beta_1 BOOK.$$

$\alpha_1$ is the differential intercept, and $\beta_2$ is the differential slope coefficient. The differential slope coefficient indicates by how much the slope of the utilities function differs from the slope of the industrial firms function.

The regressions in Table 5-2 were designed to establish the probability of price differences by the manufacturers of the electrical apparatus in sales to utilities and industrial firms. All, the slope coefficients and the slope dummy coefficients are statistically significant. Some of the dummy intercept coefficients are not significant, however, given the significance of the difference in the slope coefficients, the finding does not invalidate the difference between regression lines. All intercept dummy coefficients (even those with a negative sign) fall outside the area of observation and serve no useful purpose. To faciliate the analysis individual regressions were deduced by substituting values of 0 and 1 for the dummy variables. The individual regressions are shown in Table 5-3 where for every year there are two regressions equations: one for industrial firms and one for utilities.

Table 5-2

ANNUAL REGRESSIONS UTILIZING DUMMY VARIABLES TO DISTINGUISH BETWEEN UTILITIES AND INDUSTRIAL FIRMS

$R^2 \geqslant .94$

| Year | |
|---|---|
| 1957 | $ACT = 45.73 - 75.78D_i^* + 0.80BOOK^* + 0.19D_iBOOK^*$ |
| 1958 | $ACT = 54.70 + 6.87D_i + 0.62BOOK^* + 0.05D_iBOOK^*$ |
| 1959 | $ACT = 80.42 - 59.34D_i + 0.69BOOK^* + 0.17D_iBOOK^*$ |
| 1961 | $ACT = 93.12 - 129.20D_i^* + 0.59BOOK^* + 0.19D_iBOOK^*$ |
| 1962 | $ACT = 29.68 - 9.85D_i + 0.64BOOK^* + 0.03D_iBOOK^*$ |
| 1963 | $ACT = 8.94 - 37.59D_i + 0.64BOOK^* - 0.03D_iBOOK^*$ |

All values are in hundreds of dollars.

ACT= Actual price

Book = Book price

$D_i$ = 0 for industrial firms

$D_i$ = 1 for utilities

* Significant, at the 5% level of statistical significance.

Table 5-3

ANNUAL REGRESSIONS BY TYPE OF BUYER DEDUCED FROM TABLE 5-2

| Year | Industrial Firms | Utilities |
|---|---|---|
| 1957 | ACT = 45.73 + 0.80BOOK | ACT = -30.25 + 0.99BOOK |
| 1958 | ACT = 54.70 + 0.62BOOK | ACT = 61.67 + 0.67BOOK |
| 1959 | ACT = 80.42 + 0.69BOOK | ACT = 21.08 + 0.86BOOK |
| 1961 | ACT = 93.12 + 0.59BOOK | ACT = -36.07 + 0.78BOOK |
| 1962 | ACT = 29.68 + 0.64BOOK | ACT = 19.83 + 0.67BOOK |
| 1963 | ACT = 8.94 + 0.64BOOK | ACT = -29.45 + 0.61BOOK |

Graphically the two regression equations can be represented by two lines in a system of coordinates where actual prices are plotted on the vertical axis and book prices are ploted on the horizontal axis. The area that matters is to the right of the book value of $25,000, since this number represents the smallest transaction in my data. An intersection of regression lines to the left of book value of $25,000 would have no importance since it is outside the area of observation (see Figure 5.3). If the intersection takes place to the right of book value of $25,000, it would mean that for some range of book values utilities paid higher actual prices and for other range of book values the industrial firms paid higher actual prices. Table 5-4 shows book prices where the intersections of all regressions took place.

For the years 1957-1959, the period of collusion in the industry the annual regression functions indicate the existence of price differences: the utilities' regression functions are above the functions for the industrial firms. This implies that utilities not only paid a different price, but also a higher price. The fact that the regressions for years 1957 and 1959 intersect at relatively low value does not seriously detract from overall finding of higher prices charged to utilities.

The regression analysis for the years 1961-1963, the post-collusion period, indicates the presence of smaller and diminishing price differences as compared to the collusion period. The

Figure 5.3

A GRAPHICAL EXAMPLE OF THE TWO REGRESSION LINES

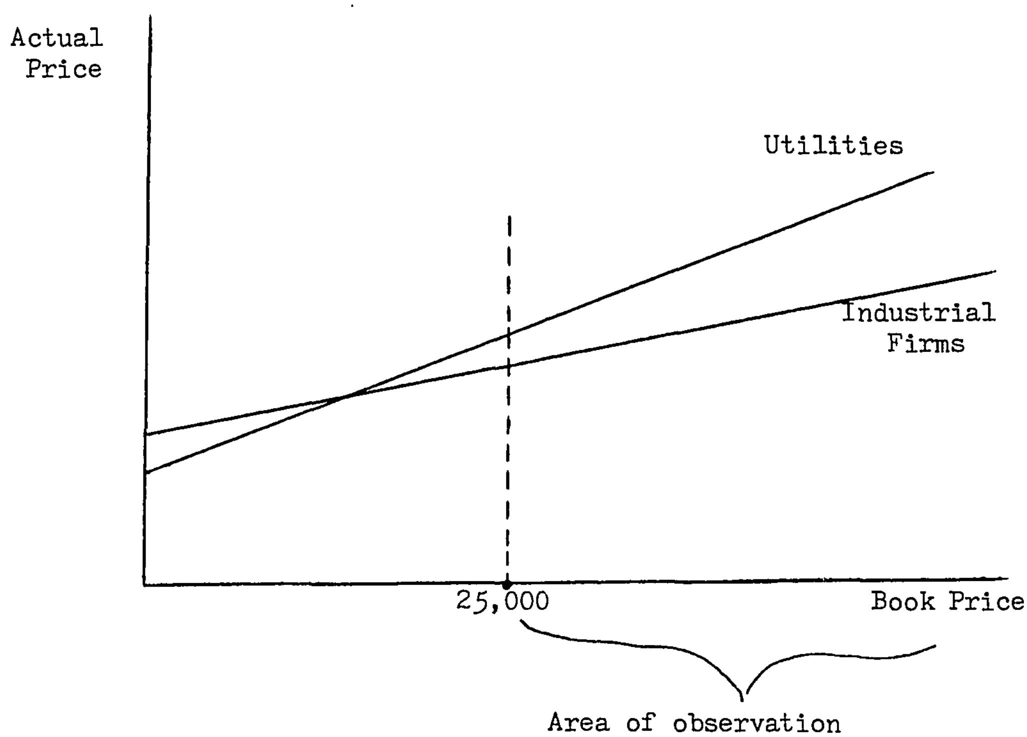


Table 5-4

BOOK PRICES AT WHICH THE INTERSECTION OF ANNUAL REGRESSION EQUATIONS TAKES PLACE

| YEAR | BELOW 25,000 | ABOVE 25,000 |
|---|---|---|
| 1957 | 20,494 | |
| 1958 | No intersection* | |
| 1959 | 24,700 | |
| 1961 | | 67,900 |
| 1962 | | 32,800 |
| 1963 | | 125,600 |

* The intersection would take place someplace in the thire quadrant

regression functions intersect well within the area of observation which means that in part of the range of book prices the utilities paid higher actual prices and in part of the range they paid lower actual prices. For 1961 and 1962 the intersection takes place near the book value of $25,000 (note that the transaction range in the sample were from $25,000 to $728,000). This means that the regression line for the utilities is above the regression line for the industrial firms for most of the range, which is another way of saying that utilities characteristically had paid higher actual prices. For 1963, the intersection lies deep in the area of observation and therefore it is not obvious who paid higher actual prices.

Other measurements, further clarify the decrease in price differences between utilities and industrial firms. In order to measure this difference, I calculated the actual prices that both paid at the mean book price as shown in Table 5-5. Table 5-5 indicates that book prices increased from 1957-1959 to 1961-1963. If we look at the three year means, the book prices increased from $100,800 per transaction to $103,000 per transaction. During the same period average actual prices for both utilities and industrial firms fell. However, there are differences in actual prices. To illustrate the difference in actual prices I composed Table 5-6. It shows by what percentage utilities paid higher actual prices, when compared to industrial firms, calculated at the mean book price. The results indicate that for the three collusion years (1957-1959) utility buyers paid fron 8.2% to 25.3% more than industrial buyers. However, after the Philadelphia Electrical

Table 5-5

ACTUAL PRICES FOR UTILITIES AND INDUSTRIAL FIRMS CALCULATED AT THE MEAN BOOK PRICE ANNUALY*

| YEAR | | MEAN BOOK PRICE | | ACTUAL PRICE | | |
|---|---|---|---|---|---|---|
| | | | | UTILITIES | | INDUSTRIAL |
| 1957 | | 95.4 | | 91.4 | | 80.8 |
| 1958 | 100.8** | 111.9 | 85.4** | 81 | 74.2** | 74.8 |
| 1959 | | 95.1 | | 83.8 | | 66.9 |
| 1961 | | 92.2 | | 68.3 | | 63.6 |
| 1962 | 103** | 109.4 | 71.2** | 75.1 | 68.7** | 72.9 |
| 1963 | | 107.4 | | 70.1 | | 69.6 |

* The mean book price was calculated from all book prices (utilities and industrial firms. If we segregate the data into two groups, utilities and industrial firms, their respective mean book price would have been different.

** The mean of a three year period

Table 5-6

HIGHER ACTUAL PRICES PAID BY THE UTILITIES, EXPRESSED IN PERCENTAGES AND CALCULATED AT THE MEAN BOOK PRICE

| YEAR | PERCENTAGE |
|---|---|
| 1957 | 13.1 |
| 1958 | 8.2 |
| 1959 | 25.3 |
| 1961 | 7.3 |
| 1962 | 3.0 |
| 1963 | 0.7 |

Cases, the difference decreased to 7.3% in 1961 and it further decreased to 3% in 1962. In 1963 the difference hardly existed; it was only 0.7%.

## V-D Price Differences Among Manufacturers

During the period examined in this study (1957-1963), the book prices of Westinghouse, General Electric and Allis-Chalmers were virtually identical.[2] This is a result of price leadership which is often found in oligopolies. Price leadership was suspected in the electrical apparatus industry for a long time and it was confirmed by testimony of managers in the Philadelphia Electrical Cases. Managers of Westinghouse and Allis-Chalmers testified that until 1963 they copied the General Electric book price outright.[3] In this industry the book prices were not rigid; they showed some response to market conditions as illustrated in Figures 5.1 and 5.2. However, book prices were always higher than the actual prices.

Although the book prices were uniform, the manufacturers of electrical apparatus gave discounts off book price. The amount of discount varied with the kind of product and its complexity, the size of transaction and its visibility. In addition, the composition of transactions may vary among firms. It may seem that one firm gives a larger discount, say on a $30,000 dollar transaction, where actually this transaction consists of items that traditionally get larger discounts. On the other hand another firm may give smaller discount on a transaction of the same value, because the components in it are discounted less. Unfortunately, the composition of transactions is unknown to me.

If the composition of transactions and the book prices were identical among different manufacturers, regressing book prices on the manufacturere dummy variables would result in the dummy coefficients not being significant. When the regression was run (Table 5-7) the dummy coefficients were significant. Since we know that the book prices were identical, the significant dummy coefficients indicate that the composition of transactions probably differed among manufacturers. Table 5-7 can be interpreted as showing that for the 1957-59 period the General Electric's and Westinghouse's composition of transactions are statistically different from those of Allis-Chalmers. The same can be said for the 1961-63 period where General Electric's composition of transactions can be interpreted to be different from those of Westinghouse and Allis-Chalmers.

In Table 5-8 average discounts off book price were calculated from 1373 transactions distributed over a period of six years. From

Table 5-7

THE DIFFERENCE IN BOOK TRANSACTION PRICES AMONG MANUFACTURERS FOR THE PERIODS 1957-1959 and 1961-1963

1957-1959

$R^2 = 0.41$ N = 451

$$\text{BOOK} = 1437 - \underset{(103)^*}{922\text{GE}} - \underset{(44)^*}{755\text{WE}}$$

Average Book price = 1008 = $ 100,800

---

1961-1963

$R^2 = 0.19$ N = 922

$$\text{BOOK} = 1173 - \underset{(24)^*}{434\text{GE}} + 24\text{WE}$$

Average Book price = 1030 = $ 103,000

---

BOOK = Book price
GE = Generak Electric dummy
WE = Westinghouse dummy

Coefficients of all dummy variables are expressed in hundreds of dollars dollars.

* Significant, at the 5% level of statistical significance (F-test)

Table 5-8

AVERAGE DISCOUNT GIVEN IN PERCENTAGES BY DIFFERENT FIRMS FROM 1957-63

| YEAR | W | GE | AC |
|---|---|---|---|
| 1963 | 29 | 30 | 39 |
| 1962 | 28 | 34 | 33 |
| 1961 | 19 | 26 | 33 |
| 1959 | 17 | 30 | 33 |
| 1958 | 21 | 24 | 34 |
| 1957 | 30 | 32 | 26 |

Three year averages

| YEARS | W | GE | AC |
|---|---|---|---|
| 1961-63 | 25.3 | 30 | 35 |
| 1957-59 | 22.7 | 28.7 | 31 |

W= Westinghouse

GE= General Electric

AC= Allis-Chalmers

Table 5-8 we can see that the three firms gave different discounts every year. This is not surprising since actual prices reflect market conditions and the fact that some price competition exists among manufacturers. The same table shows that Allis-Chalmers gave the largest discounts. It is expected that a firm that has a smaller portion of the market assumes a more aggressive posture. If we look at the three year averages and compare the collusion and post-collusion periods, we see that the discounts have increased by a small amount. Even if the discount remained the same actual prices would fall, since book prices have fallen significantly.

Visibility of a transaction can have an effect on the discount given to it. A larger discount given to a larger transaction is common in this industry, however if the transaction is visible, it is possible that a larger transaction receives a smaller discount. The visibility of a transaction is a factor only during a period of falling prices and therefore, the 1961-1963 period examined in this study falls into this category. R.G. Sultan explaines:

> Visibility of information about prices quoted on large jobs was of double concern to the manufacturers. Low prices on very large, visible jobs could lead to embarrassing confrontations with smaller customers who paid higher prices. More important, low bidding on a very large and prominent job might well be construed by other suppliers as a general signal heralding another lowering of the already sinking price level.
>
> ....since the larger items were more prominent in the market place, they were discounted with

> caution.... Thus, in obscure and out-of-the-way procurement situations competitors would be more likely to indulge in deep price-discounting. [4]

During the period of rising prices (1965-68 for example), transaction visibility played no role in determining the amount of discount.[5] Therefore, one can conclude that in the electrical apparatus oligopoly, price leadership is exhibited during increase in the price level. As the price level rises, if one firm increases its prices, others follow. However, when prices are falling, by giving smaller discounts to visible transactions, in effect the oligopoly polices itself against rapid declines in price.

I was able to examine the transaction visibility issue for the 1961-1963 period. The transactions that are more visible are those for which many manufacturers compete. The transactions that are less visible are those involving only a single manufacturer. Table 5-9 was composed from price charts ( known in the industry as measles charts) that show discounts given by different manufacturers when compared to Westinghouse's book price. Since the book prices were the same for all manufacturers, the discounts given represent the price policy when two or more manufacturers competed for the same project. Table 5-9 compares the average discount among manufacturers for three year period. First, the discounts are different from manufacturer to manufacturer. Second, Allis-Chalmers has given the largest discount (except for 1963). Third, when Table 5-9 is compared to Table 5-8 we see that manufacturers give smaller dis-

Table 5-9

AVERAGE DISCOUNT GIVEN BY DIFFERENT FIRMS WHEN COMPARED TO WESTINGHOUSE'S BOOK PRICE, IN PERCENTAGES 1961-1963

| Year | W | GE | AC |
|---|---|---|---|
| 1963 | 27.8 | 28.4 | 26.8 |
| 1962 | 24.2 | 26.4 | 26.7 |
| 1961 | 14.8 | 18.8 | 20.5 |

W = Westinghouse

GE = General Electric

AC = Allis-Chalmers

Table 5-10

AVERAGE DISCOUNT GIVEN BY WESTINGHOUSE DEPENDING ON THE NUMBER OF COMPETITORS FOR THE SAME PROJECT

| Year | Westinghouse in competition with one or more firms | Westinghouse alone |
|---|---|---|
| 1963 | 27.8 | 32.3 |
| 1962 | 24.2 | 28.9 |
| 1961 | 14.8 | 20 |

counts when they compete for the same projects. This supports the notion that visibility of the bid (transaction) will affect the discount given. This is further confirmed in Table 5-10 where Westinghouse' discounts are shown according to the number of competitors participating in a bid or negotiation. A smaller discount was given when more competitors were participating in the bidding process.

In the electrical apparatus industry manufacturers have charged different prices for the same kind of equipment. In all industries it is customary to give discounts on large orders and vary the discount according to the type of product. However, in the electrical apparatus industry there is an anomaly. The larger the number of manufacturers competing for the same project, the lower the discount during a period of falling prices. The reason given in the literature for such behavior is that the manufacturers want to prevent a price war. The lack of price competition for decades, as described in Chapter III, and the "white sale" price war led firms not only to avoid price wars, but also to conspire to fix prices.

## V-E General Price and Cost Level Trends and Broad Economic Factors Affecting Actual Price

The actual price at which sales are made in any given year depends on such general economic factors as the stages of the business cycle, the trend of costs and prices in general and on market conditions unique to the industry. Some of these factors have been described in Chapter III. However, in order to capture the effects of general conditions a variable that measures yearly effects on actual prices was introduced in the analysis. This variable captures all effects other than those explained by other variables. Furthermore, by observing all yearly effects some trends could be deduced. For example, were prices rising or falling during the observed period? At what rate were they changing?

In Table 5-11 dummy variables were introduced into the regression function to capture the effects of broad economic factors on actual prices for various years. Since my sample is drawn from a six year period, only five year-dummies are needed to avoid over-specification. D58, D59, D61, D62 and D63 are dummies for the respective years 1958, 1959, 1961, 1962 and 1963. Note that the year-dummy coefficients are expressed in hundreds of dollars and they represent the average change in actual prices, when compared to the 1957 level of actual prices.

Table 5-11

EFFECTS OF DIFFERENT MANUFACTURERS, BROAD ECONOMIC FACTORS AND TYPE OF BUYER ON ACTUAL TRANSACTION PRICES (1957-1963)

$R^2 = 0.94$

$$ACT = 132 + 0.68\ BOOK + 43\ DUM + 56\ DWE + 43\ DAC - 174\ D58 - 81\ D59 - 149\ D61 - 212\ D62 - 216\ D63$$

| VARIABLES | F TEST | VARIABLES | F TEST |
|---|---|---|---|
| BOOK | 23929.2 | D63 | 187.5 |
| DUM | 16.7 | D62 | 173.5 |
| DWE | 24.6 | D61 | 92.1 |
| DAC | 17.2 | D59 | 19.1 |
| | | D58 | 98.3 |

All variables are significant at the 5% level of statistical sifnificance (F-test).

DWE and DAC are the manufacturers' dummies.

D58 through D63 are the year dummies.

DUM is the regulated (1)/ industrial (0) firm dummy

The units for all coefficients,except for BOOK, are in hundreds of dollars.

Mean BOOK price = 1 019 or $ 101,900

Table 5-11 shows that the effects of general trends amd market conditions unique to the industry was to decrease actual prices in comparison with the year 1957, since all year-dummy coefficients have a negative sign. In Figure 5.4 these coefficients were plotted against time in order to illustrate their relative change. Out of the six years examined in this study, 1958 experienced the biggest slowdown of the economy (percentage change in the real GNP was -0.2 and unemployment reached 6.8%, up 2.5% from 1957). It is not surprising that the biggest one-year drop in actual prices took place in 1958. Figure 5.4 indicates that in 1959 the effects of broad economic factors was to increase prices to a level above 1958 but still below 1957 prices. After that year, the broad economic factors contributed to a decrease of actual prices, until they leveled off between 1962 and 1963 (note that 1960 was not included in this study).

After 1960 the apparatus industry did not follow the average trends of the economy. The year-dummies indicate falling prices, although the economic statistics concerning the 1961-1963 period suggest that the economy was strong. In Table 5-12 we can see that for this period there was a healthy increase in the real GNP, minimal increases in the price level (WPI averaged -0.1 and CPI averaged 1.1 for the three year period) and a relatively low unemployment. This would suggest that the apparatus industry did not follow the average trends of the economy. The court cases that exposed the conspiracy made many buyers price conscious. Some buyers, who felt that they were overcharged in the past, proceeded with treble damage suits.

Figure 5-4

Graphical Illustration of Regression Coefficients From Table 5-10

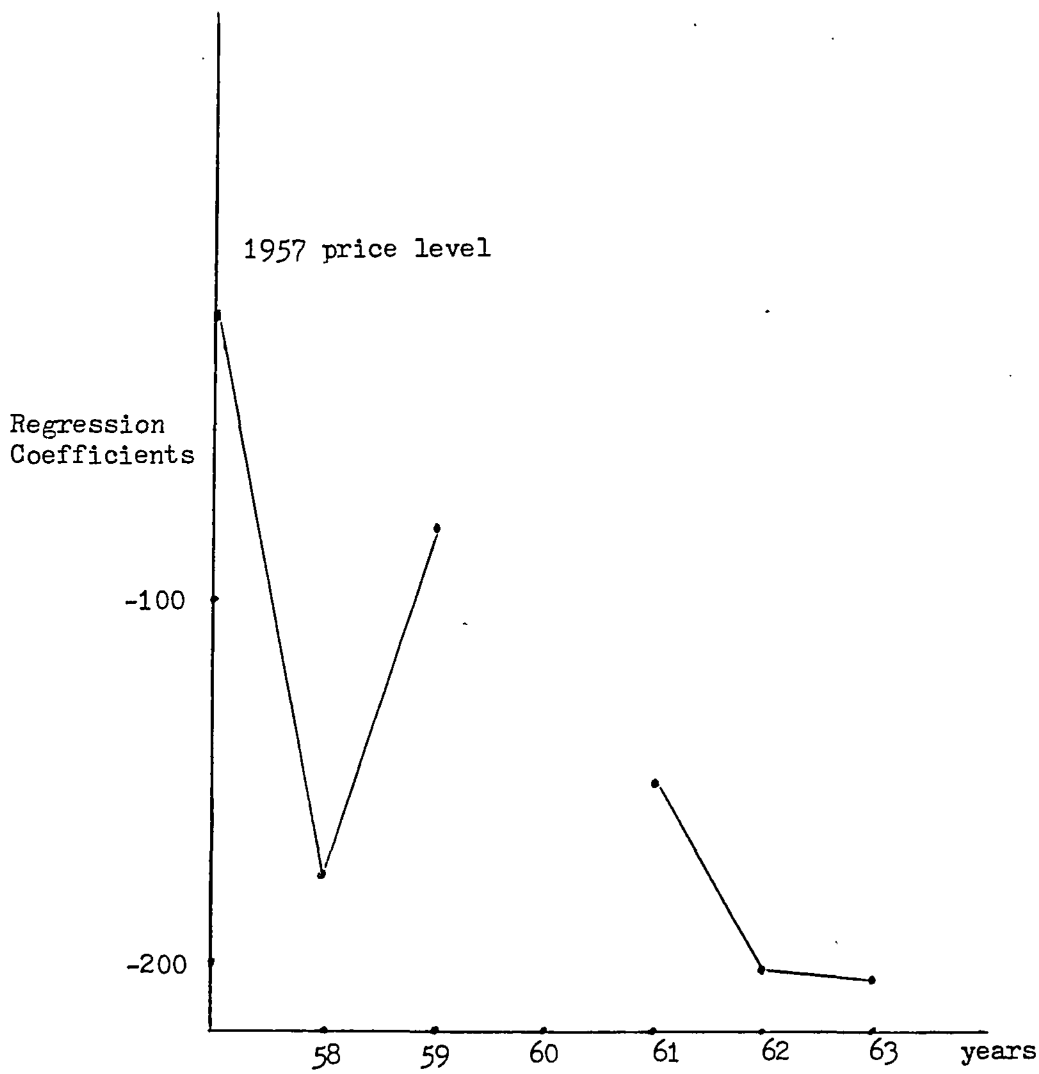


Table 5-12 [7]

STATISTICS CONCERNING THE NATIONAL ECONOMY

| Year | Percentage change in: | | | |
|---|---|---|---|---|
| | Real GNP | Unemployment | WPI* | CPI* |
| 1957 | 1.8 | 4.3 | 2.8 | 3.3 |
| 1958 | -0.2 | 6.8 | 1.4 | 2.7 |
| 1959 | 6.0 | 5.5 | 0.2 | 0.8 |
| 1960 | 2.3 | 5.5 | 0.1 | 1.6 |
| 1961 | 2.5 | 6.7 | -0.4 | 1.1 |
| 1962 | 5.8 | 5.5 | 0.3 | 1.2 |
| 1963 | 4.0 | 5.7 | -0.3 | 1.3 |

* For WPI(Wholesale Price Index) and CPI(Consumer Price Index) the base years are 1957-59 = 100.

At the same time, the demand for electricity was forcasted to grow at a new, slower rate.[6] This decreased the demand for apparatus, which in turn caused the cancellation or postponments of deliveries for orders already placed. The decrease in demand resulted in a decline of factory utilization to almost 50% of capacity, accompanied by layoffs of workers. In addition, foreign manufacturers who were seldom invited to participate in the bidding process, entered the domestic market which further reduced prices due to more competition. Indeed, the apparatus industry did not follow the average trends of the economy.

## V-F The Effects of Collusion on Transaction Prices

In this chapter I have said much about the collusion in the apparatus industry and its effects. Finally, I will formally examine the hypothesis that the absence of collusion has decreased actual prices in the apparatus industry.

In most industries when collusion takes place, it effects prices. Such was the case with the electrical apparatus industry from 1957 to 1959. Since my data covers that period of time, I proceeded to measure the separate effects of collusion on utilities and industrial firms. In order to clearly separate the effects of collusion, two regressions were run; one for utilities and one for industrial firms. They are shown in Table 5-13.

In both regressions the collusion dummy is statistically significant. The negative sign indicates a decrease in actual prices going from the collusion period (1957-1959) to the post-collusion period (1961-1963). The collusion coefficient for the utilities (-152) is larger in absolute value than for industrial firms (-92), suggesting that the decrease in the utilities' actual prices was larger in the post-collusion period. This confirms the finding that in the 1961-1963 period actual price difference between the utilities and industrial firms were decreasing. Since the utilities' prices were higher during the collusion period, they had to decrease more in order to be at the similar level after the collusion.

Table 5.13

THE EFFECT OF COLLUSION ON ACTUAL PRICES FOR UTILITIES AND INDUSTRIAL FIRMS (1957-1959, 1961-1963)

$R^2$ 0.93

Industrial firms

$$ACT = 141 + \underset{(19756)^*}{0.64}\ BOOK - \underset{(26)^*}{53}\ GE + 5\ WE - \underset{(101)^*}{92}\ DCL$$

Utilities

$$ACT = 80 + \underset{(5430)^*}{0.73}\ BOOK + 16\ GE + \underset{(2.6)^*}{46}\ WE - \underset{(36)^*}{156}\ DCL$$

GE = General Electric

WE = Westinghouse

DCL (collusion dummy) = 1 if 1961-1963, 0 if 1957-1959

The units for all coefficients, except for BOOK, are in hundreds of dollars.

Mean BOOK price for the six year period = $ 101,900

* Significant, at the 5% level of statistical significance(F test).

Footnotes

1 Damodar Gujarati, Basic Econometrics (New York: McGrae-Hill, 1978) pp. 295-298

2 Edwin H. Lewis, Marketing Electrical Apparatus and Supplies (New York: McGraw-Hill, 1961), p. 171

3 Testimony of officials from Allis-Chalmers and Westinghouse co confirm this fact.

4 Ralph G.M. Sultan, Pricing in the Electrical Oligopoly, Vol. I (Cambridge: Harvard University Press, 1974), p. 213

5 Ibid., p. 249

6 Ibid., p. 249

7 U.S. Bureau of the Census, Statistical Abstracts of the United States, 1964 (Washington D.C.: U.S. Government Printing Office, 1964) pp. 216, 317, 351, 356

# APPENDIX

## A-Sources and Characteristics of the Data

### A-1 Sources

The sources of the data used in this study are exhibits presented in the various court cases fied at the U.S. District Court for the District of Pennsylvania from 2/16/60 to 10/20/60 and known as the Philadelphia Electric Cases. The specific case numbers are:

| | |
|---|---|
| Criminal No. | 20235 |
| - " - | 20348 |
| - " - | 20361 |
| - " - | 20398 |
| - " - | 20399 |

In the Table A-1 a detailed list of defendants is shown for each case.

In addition to the Philadelphia Electric cases the following cases were also sources of information:

Atlantic City Electric v. General Electric
Civil Action 4258 (S.D.N.Y., 1963)

Philadelphia Electric v. Westinghouse
Civil Action 30015, Trade Cases(71, 1231)
( E.D. Pa., 1964)

It probably would have been impossible to have obtained the exhibits from these cases had it not been for the Freedom of Information Act. On Nov. 29, 1979 my attorney informed the Attorney General of the United States, Benjamen Civilatti, of my request for data via the Freedom of Information Act. The access to court documents was granted and the data were sent to me by Leo Neshkes, control officer of the Antitrust Division of the U.S. Department of Justice, on January 17, 1980. The data I received are photo-copies of various documents and exhibits from the requested court cases. The documents and exhibits were provided to me in their entirety.

TABLE A-1[1]

# THE PHILADELPHIA ELECTRICAL CASES

| Case | Corporate Defendants |
| --- | --- |
| No 20235*<br>Oil Circuit Breakers<br>February 16, 1960 | General Electric Company<br>Allis-Chalmers Manufacturing Company<br>Federal Pacific Electric Company<br>I-T-E Circuit Breaker Company<br>Westinghouse Electric Corporation |
| No 20236<br>Low-Voltage-Power Circuit Breakers<br>February 16, 1960 | I-T-E Circuit Breaker Company<br>General Electric Company<br>Westinghouse Electric Corporation |
| No 20238<br>Insulators<br>February 17, 1960 | Ohio Brass Company<br>General Electric Company<br>Lapp Insulator Company, Inc<br>The Porcelain Insulator Corporation<br>I-T-E Circuit Breaker Company<br>A B Chance Company<br>McGraw-Edison Company<br>H. K Porter Company, Inc. |
| No 20239<br>Lightning Arresters<br>February 17, 1960 | McGraw-Edison Company<br>General Electric Company<br>Hubbard and Company<br>Joslyn Mfg and Supply Co<br>Ohio Brass Company<br>H K Porter Company, Inc<br>Westinghouse Electric Corporation |
| No 20240<br>Open-Fuse Cutouts<br>February 17, 1960 | A B Chance Company<br>General Electric Company<br>Hubbard and Company<br>I-T-E Circuit Breaker Company<br>Joslyn Mfg and Supply Co<br>McGraw-Edison Company<br>Southern States Equipment Corporation<br>Westinghouse Electric Corporation |
| No 20241<br>Bushings<br>February 17, 1960 | Lapp Insulator Company, Inc.<br>General Electric Company<br>Ohio Brass Company<br>Westinghouse Electric Corporation |
| No 20348*<br>Power Switching Equipment<br>May 19, 1960 | Federal Pacific Electric Company<br>General Electric Company<br>I-T-E Circuit Breaker Company<br>Joslyn Mfg and Supply Co<br>H K Porter Company, Inc<br>Schwager-Wood Corporation<br>Southern States Equipment Corporation<br>Westinghouse Electric Corporation |
| No 20349<br>Isolated Phase Bus<br>May 19, 1960 | H. K. Porter Company, Inc.<br>General Electric Company<br>I-T-E Circuit Breaker Company<br>Westinghouse Electric Corporation |
| No 20350<br>Navy and Marine Switchgear<br>May 19, 1960 | I-T-E Circuit Breaker Company<br>General Electric Company<br>Westinghouse Electric Company |
| No 20361*<br>Power Transformers<br>May 25, 1960 | Westinghouse Electric Corporation<br>Allis-Chalmers Manufacturing Company<br>General Electric Company<br>McGraw-Edison Company<br>Moloney Electric Company<br>Wagner Electric Corporation |

TABLE A-1 (CONTINUATION)

| | |
|---|---|
| No. 20362<br>Distribution Transformers<br>May 25, 1960 | General Electric Company<br>Allis-Chalmers Manufacturing Company<br>Kuhlman Electric Company<br>McGraw-Edison Company<br>Moloney Electric Company<br>Wagner Electric Corporation<br>Westinghouse Electric Corporation |
| No. 20363<br>Network Transformers<br>May 25, 1960 | McGraw-Edison Company<br>Allis-Chalmers Manufacturing Company<br>General Electric Company<br>Moloney Electric Company<br>Wagner Electric Corporation<br>Westinghouse Electric Corporation |
| No. 20364<br>Instrument Transformers<br>May 25, 1960 | Allis-Chalmers Manufacturing Company<br>General Electric Company<br>Westinghouse Electric Corporation |
| No. 20398*<br>Industrial Control Equipment<br>June 22, 1960 | Allen-Bradley Company<br>The Clark Controller Company<br>Cutler-Hammer, Inc.<br>General Electric Company<br>Square D Company<br>Westinghouse Electric Corporation |
| No. 20399*<br>Power Switchgear Assemblies<br>June 22, 1960<br>(Superseded 20234) | Westinghouse Electric Corporation<br>Allis-Chalmers Manufacturing Company<br>Federal Pacific Electric Company<br>General Electric Company<br>I-T-E Circuit Breaker Company |
| No. 20400<br>Low-Voltage Distribution Equipment<br>June 23, 1960 | Cutler-Hammer, Inc.<br>Federal Pacific Electric Company<br>General Electric Company<br>I-T-E Circuit Breaker Company<br>Square D Company<br>Westinghouse Electric Corporation |
| No. 20401*<br>Turbine-Generator Units<br>June 29, 1960 | General Electric Company<br>Allis-Chalmers Manufacturing Company<br>Westinghouse Electric Corporation |
| No. 20402*<br>Condensers<br>June 29, 1960 | Foster Wheeler Corporation<br>Allis-Chalmers Manufacturing Company<br>Carrier Corporation<br>Ingersoll-Rand Company<br>Westinghouse Electric Corporation<br>C. H. Wheeler Manufacturing Company<br>Worthington Corporation |
| No. 20488<br>Power Capacitors<br>September 15, 1960 | Cornell-Dubilier Electric Corporation<br>McGraw-Edison Company<br>General Electric Company<br>Ohio Brass Company<br>Sangamo Electric Company<br>Westinghouse Electric Corporation |
| No. 20508<br>Watthour Meters<br>October 20, 1960 | Sangamo Electric Company<br>General Electric Company<br>Westinghouse Electric Corporation |

******This was one of the seven most serious cases in which the government opposed pleas of* nolo contendere.

A-2 What Data were Available

As mentioned earlier, the market for electrical apparatus is divided between two types of buyers: utilities and industrial firms. While only utilities purchase generating and heavy distribution equipment, both types of buyers buy moderate and light distributing equipment. The data used in this analysis relates to equipment common to both types of buyers.

All the data in this study relate to large contracts, which the electrical industry classifies as any contract above $25,000. Data on small contracts were not available for all companies. Furthermore, it was the industry practice that no discounts were given for small contracts; there was no difference between book and actual proce.

The data originates from the switchgear, transformer and industrial control departments of four companies: General Electric, Westinghouse, Allis-Chalmers and I-T-E. In some cases the transaction data contain specific descriptions and include information on single items such as low voltage metal-enclosed switchgear or instrument transformers. For the other cases it is not possible to tell which specific product is involved in a given transaction. In general, the transaction data did not reveal which specific equipment was involved, i.e. whether it was switchgear, transformer or industrial control equipment.

The following information was available from the several court eases:

1- Monthly history of large orders ($25,000 or more) for the years from 1957 thr ough 1963. This includes dollar amount of the order, the name of the seller, the name of the purchaser and the percentage off book price.

2- Price charts showing the amount of discount given by all manufacturers as compared to Westinghouse's book price.

3- Yearly reports on operatbons and forecasts from 1955 through 1961.

The data consists of records of transactions between the manufacturers and buyers. Every transaction shows the book value (which is the published price) and the actual value (which is the price actually charged to the buyer). Furthermore, the name of the manufacturer and the buyer is given for every transaction.

Data were available for years: 1957, 1958, 1959, 1960, 1961, 1962 and 1963. Since in 1960 the court cases were taking place, the pricing policies of the manufacturers would reflect neither the conspiracy nor the post-conspiracy conditions. Therefore, I omitted the data for 1960.

The dollar value of all transactions in my sample for the year 1958 is $13,536,000. This is about 0.6% of the total value of products (switchgear, transformers and industrial control apparatus SIC codes: 3612, 3613 and 3622) shipped by all manufacturing establishments.[2] Similarly, the dollar value of all transactions in my sample for year 1963 is $20,447,000, which is approximately 0.8% of the total value of products shipped by all manufacturing establishments.[3]

Table A-2 shows the number of transactions that were available to me. The total number of transactions that I was able to obtain is 1373. Of these 453 represent purchases by utilities and 942 represent purchases by industrial firms. If the data are divided according to manufacturers, General Electric, Westinghouse, Allis-Chalmers and I-T-E are represented by 529, 497,281 and 66 transactions respectively.

In Figure A.1 the annual frequency distribution of actual transaction prices is shown. This distribution describes accurately <u>any</u> of the six years examined in this study. The reason for this is that the distribution of transaction prices changed very little from year to year. If the data is divided between utilities and industrial firms, the frequency distributions for both resemble Figure A.1. The uniformity of distribution thus permits a comparison between the two kinds of buyers.

TABLE A-2

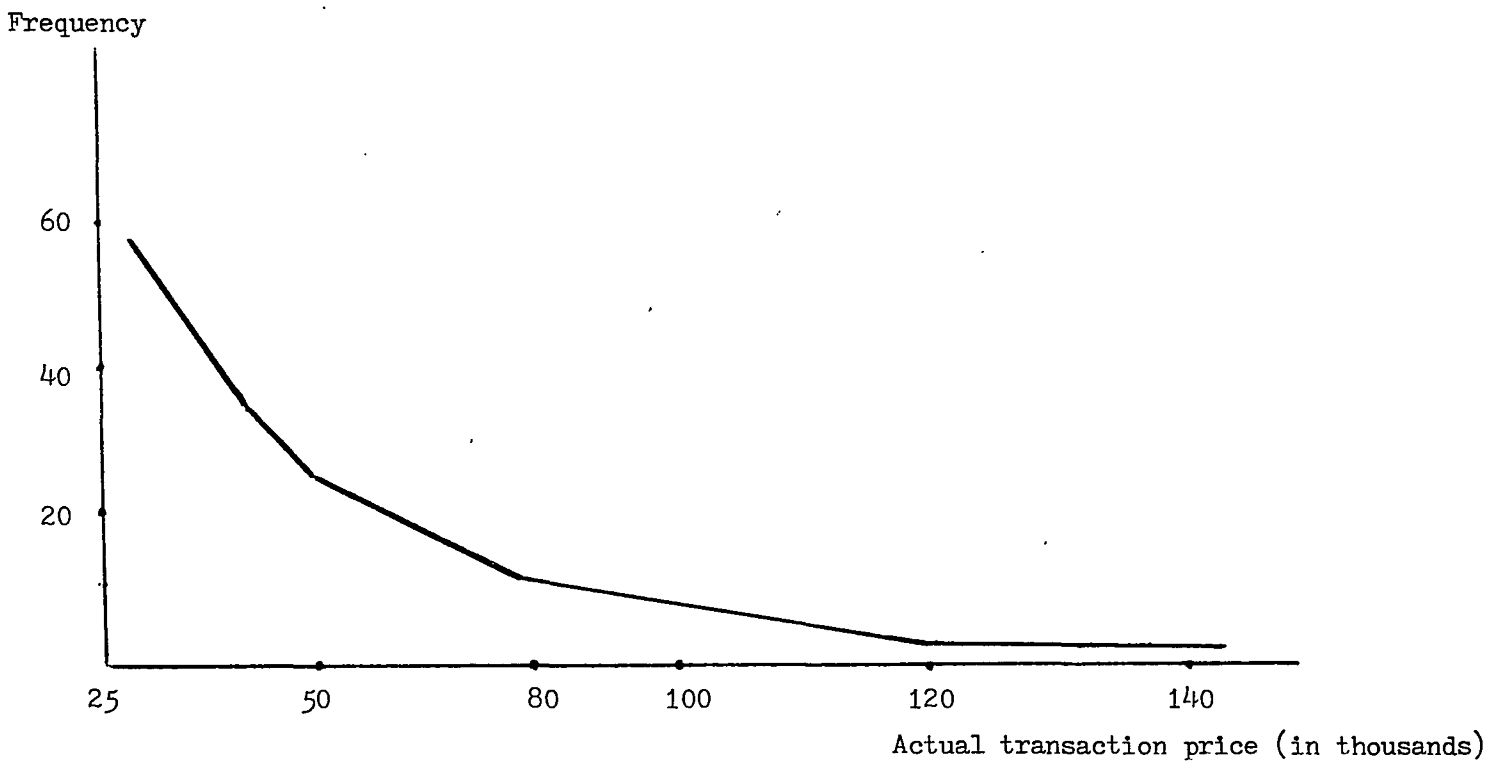
THE NUMBER OF TRANSACTIONS AVAILABLE BY YEAR ( 1957-1963 ), MANUFACTURER AND BUYER

| | INDUSTRIAL FIRMS | | | | | | UTILITIES | | | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | '57 | '58 | '59 | '61 | '62 | '63 | '57 | '58 | '59 | '61 | '62 | '63 | |
| GENERAL ELECTRIC | 25 | 28 | 31 | 95 | 91 | 73 | 26 | 24 | 30 | 37 | 36 | 33 | 529 |
| WESTINGHOUSE | 33 | 37 | 33 | 77 | 80 | 82 | 21 | 25 | 25 | 29 | 27 | 31 | 497 |
| ALLIS-CHALMERS | 19 | 28 | 21 | 42 | 44 | 37 | 9 | 9 | 7 | 21 | 19 | 25 | 281 |
| I-T-E | 5 | 11 | 7 | 14 | 19 | 10 | NA | NA | NA | NA | NA | NA* | 66 |
| | 82 | 104 | 92 | 228 | 234 | 202 | 53 | 58 | 62 | 87 | 82 | 89 | 1373 |

* Not available

Figure A.1

THE FREQUENCY DISTRIBUTION OF ACTUAL TRANSACTION PRICES FOR A TYPICAL YEAR



This study measures the difference in transaction prices between industrial firms and utilities, and although their frequency distributions are very similar, still the importance of the very large transactions (over 100,000) has to be mentioned. One would expect that the utilities have many very large transactions and therefore, their frequency distribution should be skewed to the right when compared to the frequency distribution of industrial firms. If this was the case, comparing the average transaction price between utilities and industrial firms would result in the utilities having the larger one. But in my sample the utilities did not have a skewed distribution. In order to illustrate this further I listed ten largest actual price transactions from the total sample (all years) for both industrial firms and utilities in Table A-3. From Table A-3 we can see that the utilities do not have the highest transactions. In fact, when the ten transactions are added for both kind of buyers, the sums are almost identical! Indeed, even the right tails of the frequency distributions for the two types of buyers are very similar.

If the frequency distributions were not similar, it would be difficult to assume that there is composition similarity of transactions between the two buyers. Then one could say that the utilities paid a higher price because their transactions consisted of more components. With equal distribution and large samples it is not unreasonable to assume that the average transactions would be similar in composition regardless of the type of buyer. The reason why the

TABLE A-3

THE TEN HIGHEST ACTUAL TRANSACTION PRICES FOR EACH TYPE OF BUYER
1957-1963 (in 000's)

| UTILITIES | INDUSTRIAL FIRMS |
|---|---|
| 629 | 728 |
| 591 | 505 |
| 541 | 473 |
| 497 | 431 |
| 440 | 425 |
| 427 | 416 |
| 389 | 414 |
| 366 | 410 |
| 346 | 380 |
| 336 | 377 |
| 4,562 | 4,559 |

utilities paid higher prices over most of the period covered in this study is that they paid a higher actual price <u>per book price</u> for the whole range of transactions, i.e. they were given a smaller discount by the manufacturers of electrical apparatus.

A-3 The Data: What was Done with Them

The first step was to remove all transactions between the manufacturers and buyers which were neither utilities of industrial firms. The omitted group consisted primarily of government (various departments) and schools. The reason for dropping government and school transactions is that they can neither be classified as utilities nor as industrial firms. Furthermore, the pricing policy of the manufacturers toward the government and schools could be different.

With the help of the names of all utilities in the United States, I could easily identify transactions between manufacturers and utilities. What remained were transactions between the manufacturers and the industrial firms.

I then arranged the data so that a regression analysis could be performed. In Chapter V the arrangement of the data and the regression analysis are described in detail.

## B-Collusion in the Switchgear and Circuit Breaker Markets

As explained in Chapter 3, meetings among manufacturers started in 1922 with the creation of N.E.M.A.. The reason producers of switchgear and circuit-breakers began meeting is that their engineers had been reaching different decisions in interpreting customer's specifications. It was felt that the best way to achieve uniformity was through discussion.[4] Naturally, the discussion of specifications often led to a discussion of prices and sometimes of market shares for sealed bids. This was common in the circuit-breaker market until 1953.

Between 1953 and January 1955 competition increased. Producers gave large discounts to customers and the market share agreements were violated. For example, in January 1955 General Electric offered a bid which was 45 percent off book price on a combined order of switchgear and transformers to Ebasco Services,[5] where a typical discount varied between 10 and 20 percent. The increase in competition created a desire among the manufacturers to meet more often. General Electric, Westinghouse, Allis-Chalmers and I.T.E. wanted to discuss every transaction. This required that meetings be held for different levels of management. As a result of this, there were more meetings taking place and a precise system was established ("phase of the Moon") that would determine each producer's position on sealed-bids.[6]

From 1956 to 1959 the collusion among manufacturers was at its peak. 1958 however, was the exception, since due to falling prices, competition intensified and some cheating on the agreements took place. To stabilize the situation, a high level conference was organized during a NEMA meeting in Atlantic City in 1958. The only way for the large companies to keep market shares stable was to give in to smaller companies.[7] In Table A-4 the market shares are indicated for before and after 1958. In 1959, again in the face of slipping prices, the manufacturers did not keep their agreements. That year the Department of Justice started to investigate the industry and the meetings among producers ended.

TABLE A-4

SWITCHGEAR AND CIRCUIT BREAKERS SEALED-BID
MARKET ALLOCATION BY COMPANY BEFORE AND AFTER 1958

| | CIRCUIT BREAKERS | | SWITCHGEAR | |
|---|---|---|---|---|
| | Before | After | Before | After |
| General Electric | 45 | 38.8 | 42 | 39 |
| Westinghouse | 35 | 31.1 | 38 | 35 |
| Federal Pacific | 10 | 15.9 | 0 | 7 |
| Allis-Chalmers | 10 | 10 | 11 | 8 |
| I-T-E | 0 | 4 | 9 | 11 |

Source: R. Sultan, pp. 42-43

## C- Collusion in the Transformer Market

The conspiracy to fix prices started probably in the 1930's with modest success. After WW II, from 1948-1952 (known as the Iron Curtain period in the industry), no meetings took place. There was no downward pressure on prices and transformers were sold at close to book prices.

In 1952 meetings continued and grew into separate working-level and high-level groups. At these meetings book and quoted (actual) prices were discussed, with the intention to allocate contracts to different manufacturers.

The White Sale had an effect on the transformer market just as it did for most of the apparatus market. To avoid another White Sale, meetings were intensified and sealed bids were allocated to the quotas shown in Table A-5.

The collusion among manufacturers worked well during the 1956-1959 period. The exception being 1958, when falling market prices made it tempting to cheat on agreements. However, technology seems to have dealt a serious blow to the conspiratorial meetings.

In order to improve its competitive position, General Electric created a black-box concept. This was a new design that incorporated standardized components via a computer. Instead of making the announcement in 1960, General Electric sped up its program and announced it in 1959. Since the competirors were not ready to produce such a device, they were furious. This event and the knowledge of the Federal investigation stopped all the conspiratorial meetings.[8]

Table A-5

COMPARISON OF AGREED QUOTA AND MARKET SHARES IN SEALED-BID SEGMENT

OF THE LARGE POWER TRANSFORMER MARKET

1955 - 1959

| | Quota | *Actual Share of Orders* | | | | |
|---|---|---|---|---|---|---|
| A. Total Sealed Bid Market | | 1955 | 1956 | 1957 | 1958 | 1959 |
| General Electric | 30% | 18.4% | 32.9% | 26.1% | 23.4% | 16.9% |
| Westinghouse | 30 | 26.5 | 14.0 | 19.0 | 29.4 | 26.5 |
| Allis-Chalmers | 15 | 3.6 | 5.0 | 4.4 | 6.6 | 16.8 |
| Maloney | 9 | 7.9 | 8.1 | 9.9 | 7.8 | 8.1 |
| Pennsylvania | 8 | 10.2 | 8.1 | 3.1 | 10.5 | 7.2 |
| Wagner | } 8 | 1.6 | 2.2 | 7.0 | 3.6 | 2.6 |
| Other Domestic | | — | 0.4 | 1.0 | 2.5 | 0.4 |
| Foreign | 0 | 31.6 | 29.3 | 29.5 | 16.2 | 21.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Dollar Volume (millions) | — | $21.6 | $23.8 | $23.5 | $17.4 | $22.9 |

Source: R.G. Sultan, p. 53

## D- The Extent of the Overcharge

One way to measure the difference in prices paid to manufacturers by the utilities and industrial firms is to calculate the area under the regression lines. The area can be measured by a process of integration, having the lowest and highest book transaction price as the lower and upper limits. The area under the "curve" can be expressed in percentage terms. For example, in Figure A.2, area B can be expressed in percentage of area C. This can be calculated by dividing area B by area C. If the two regression lines intersect, finding the area between them and expressing it in percentage terms is more complex. In this case, as shown in Figure A.3, the percentage by which the area under the regulated firms curve can be measured as follows:

$$\frac{\text{area(B)} - \text{area(A)}}{\text{area(C)}}$$

The differential in the areas under the regression lines indicates that one type of buyer has paid higher prices for its equipment. This differential could be called a welfare loss to consumers (if utilities paid a higher price which could be shifted to the consumers via base padding) due to price discrimination by the suppliers of electrical apparatus.

Figure A.2

AREA UNDER THE REGRESSION LINES

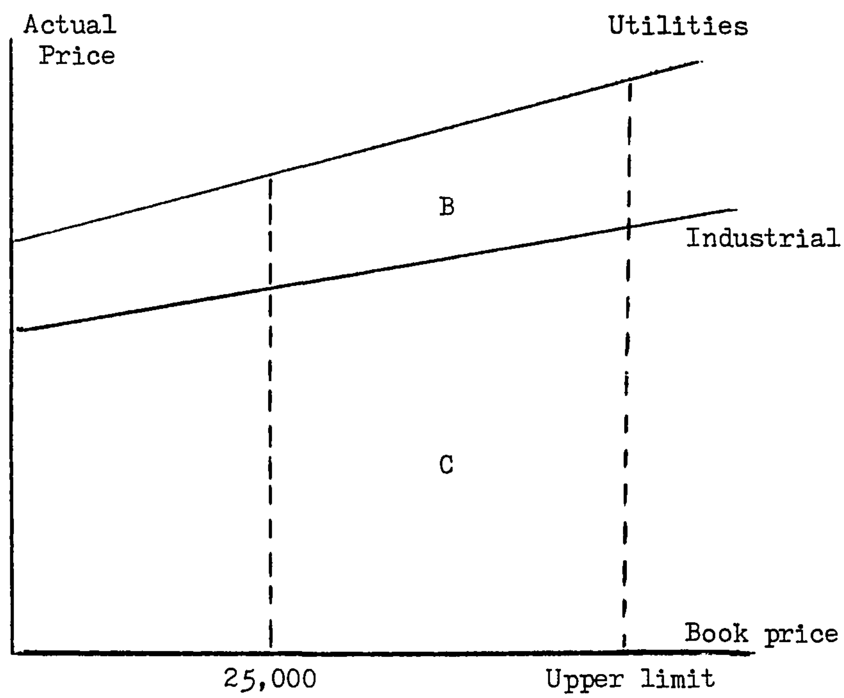


Figure A.3

AREA UNDER THE REGRESSION LINES WHEN INTERSECTION TAKES PLACE

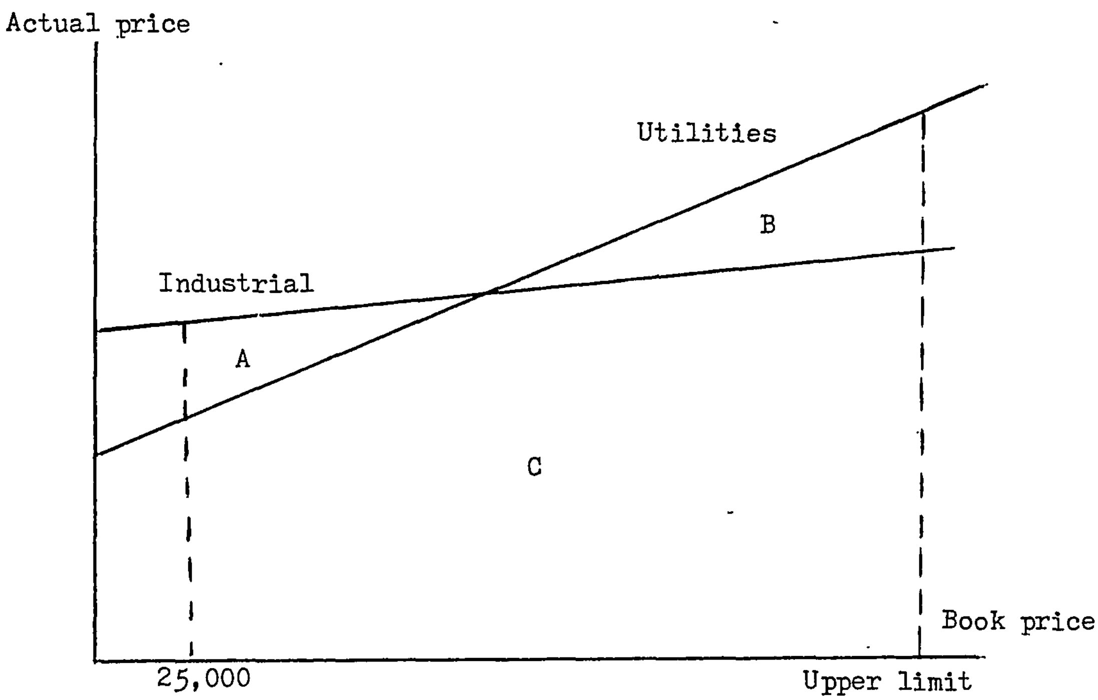


Table A-6 shows that for five out of six years the area under the utilities' curve was larger. These results go hand in hand with my previous findings which is that utilities received a smaller discount during the conspiracy period (1957-59) and a similar discount by 1963.

The statistics concerning the cost of the conspiracy have not been compiled and one can only try to estimate them based on limited information. In 1964, General Electric estimated its damage payments at $160 million.[9] In the same year Westinghouse announced that it will set aside $110 million for claim settlements arising from the Philadelphia Electrical Cases.[10] After that the manufacturers said nothing more about damage payments. Some people believe that from $6 billion to 7 billion in litigation sales volume, about 10 percent was paid in damages.[11] This could be somewhat higher than the actual dollar amount of the settlement. For example, American Electric Power (a utility) received approximately 4-5 percent of its purchase in settlement. From the Table A-7, I calculated that for the TVA, the mean of its settlements was approximately 8 percent of purchases. It is likely that on average 5-8 percent was paid in damages which translates to $300-560 million although the actual evidence is sketchy.

Table A-6

AMOUNT BY WHICH THE AREA UNDER THE UTILITIES' REGRESSION LINE IS GREATER THAN THE AREA UNDER THE INDUSTRIAL REGRESSION LINE EXPRESSED IN PERCENTAGES BY YEAR

| Year | % | Three year mean |
|---|---|---|
| 1957 | 19.1 | |
| 1958 | 9.9 | 20.6 |
| 1959 | 32.8 | |
| | | |
| 1961 | 3.4 | |
| 1962 | 2.4 | 2.7 |
| 1963 | -3.1 | |

Table A-7

TVA ANTITRUST SETTLEMENTS

| Company | TVA Purchases[a] (Thousands of Dollars) | Antitrust Settlement (Thousands of Dollars) | Settlement as Percent of Purchases |
|---|---|---|---|
| General Electric[b] | 60,032.0 | 6,470.0 | 10.8 |
| Westinghouse | 14,114.1 | 430.0 | 3.0 |
| Allis-Chalmers[c] | 2,672.7 | 65.3 | 2.4 |
| I-T-E | 381.5 | 32.9 | 8.8 |
| Federal Pacific | 924.1 | 8.2 | 0 9 |
| McGraw-Edison | 999.0 | 41.0 | 4.1 |
| Wagner | 1,555.9 | 56.0 | 3.6 |
| Southern States | 226.9 | 10.9 | 4.8 |
| Lapp Insulator | 250.2 | 7.1 | 2.9 |
| Ohio Brass | 144.7 | 4.7 | 3.3 |
| Joslyn | 137.7 | 13.7 | 9.9 |
| Moloney | 2,169.2 | 46.2 | 2.1 |
| H.K. Porter | 529.2 | 21.5 | 4.0 |
| Schwager Wood | 136.4 | 8.2 | 6.0 |
| Porcelain Insulator Co. | 177.9 | | |
| A.B. Chance | 80.9 | | |
| Memco | 21.7 | | |
| USCO | 43.3 | | |

[a] Over indictment period for respective products, as follows.
1956–1960 for power transformers
1951–1960 for oil circuit breakers
1958–1959 for power switch gear assembly

[b] GE Turbine Generators 12.6% of $48,612,000 = $6,152,077
GE "Other" 2.5% of $12,111,960 = $ 311,933
Fees $ 5,990

GE Total $6,470,000

[c] Allis-Chalmers settlement was based on total purchases of $2,505,185. Settlement was 2.6% on this basis.

Source: R.G. Sultan, p. 112

# Footnotes

[1] Clarence C. Walton and Frederick W. Cleveland, Corporation on Trial: The Electric Cases (Belmont, California: Wadsworth Publishing Company, Inc., 1964), pp. 35-37

[2] 1958 Census of Manufacturers, Vol. II, Industry Statistics Part 2, Major Groups 29 to 39 (Washington D.C.: Government Printing Office, 1961), p.36A-17

[3] 1963 Census of Manufacturers, Vol. II, Industry Statistics Part 2, Major Groups 29 to 39 and 19 (Washington D.C.: Government Printing Office, 1966), p. 36A-22

[4] Ralph G.M. Sultan, Pricing in the Electrical Oligopoly, Vol. I (Cambridge, Massachusetts: Harvard University Press, 1974), p. 38

[5] Ibid., p.40

[6] Ibid., p. 39

[7] Ibid., p. 48

[8] Ibid., p. 50

[9] Ibid., p. 123

[10] Ibid., p. 123

[11] Ibid., p. 123

# BIBLIOGRAPHY

## Books


Backman, Jules, The Economics of the Electrical Machinery Industry (Nwe York: New York University press, 1962)

Bane, Charles A., The Electrical Equipment Conspiracies (New York Federal Legal Publications, 1973)

Fuller, John C., The Gentlemen Conspirators (New York: Grove Press, Inc., 1962)

Gleaser, Martin G., Public Utilities in American Capitalism (New York: The Macmillan Company, 1957)

Goldschmid, H.J., H.M. Mann and J.F. Weston, Industrial Concentration: The New Learning (Boston: Little, Brown and Co., 1974)

Gujarati, Damodar, Basic Econometrics (New York: McGraw-Hill Book Co., 1978)

Hellman, Richard, Government Competition in Electric Utility Industry (New York: Preager Publishers, 1972)

Herling, John, The Great Price Conspiracy (Washington: Robert B. Luce, Inc., 1962)

Kwoka, J., Market Share Concentration and Competition in Manufacturing Industries (Washington D.C.: Federal Trade Commission, 1978)

Lewis, Edwin H., Marketing Electrical Apparatus and Supplies (New York: McGraw-Hill Book Company, Inc., 1961)

MacAvoy, Paul W., The Regulated Industries and the Economy (New York: W.W. Norton & Company, 1979)

MacAvoy, Paul W., ed., The Crisis of Regulatory Commissions (New York: W.W. Norton & Company, 1970)

Nelson, Ralph L., Merger Movements in American Industry 1895-1956 (Princeton: Princeton University Press, 1959)

Sultan, Ralph G.M., Pricing in the Electrical Oligopoly, Vol. I (Cambridge, Massachusetts: Harvard University Press, 1974)

Sherer, F.M., Industrial Market Structure and Economic Performance (Chicago: Rand McNally College Publishing Company, 1970)

Walton, Clarence C., and Frederic W. Cleveland, Jr., Corporation on Trial: The Electric Cases (Belmont, California: Wadsworth Publishing Company, Inc., 1964)

Weiss, Leonard W., and Allyn D. Strickland, Regulation: A Case Approach (New York: McGraw-Hill Book Company, 1976)

Williamson, O.E., The Economics of Discretionary Behavior: Managerial Objectives in a Theory of the Firm ( Englewood Cliffs, New Jersey: Prentice Hall, 1964)

## Articles

Atkinson, A.B., and L. Waverman, "Resource Allocation and the Regulated Firm: Comment", Bell Journal of Economics and Management Science (Spring 1973), Vol. 4, pp. 283-287

Averch, H., and Johnson, L.L., "Behavior of the Firm Under Regulatory Constraint", American Economic Review, (Dec. 1962), pp. 1053-69

Baumol, W.J., and A.K. Klevorick, "Input Choices and Rate-of-Return Regulation: An Overview of the Discussion", Bell Journal of Economics and Management Science (Autum 1970) Vol. 1, pp. 162-190

Bower, R.S., "Rising Capital Cost versus Regulatory Constraint", Public Utilities Fortnightly (March 4, 1965), pp. 31-33

Corey, Gordon R., "The Averch and Johnson Proposition: An Analysis", Bell Journal of Economics and Management Science (Spring 1971), Vol. 2, pp. 358-373

Courville, Leon, "Overcapitalization in Regulated Industries: The Electric Utility Case", Bell Journal of Economics and Management Science (Spring 1974), Vol. 5, pp. 322-337

Coleman, Roger, "The Effects of Lagged Regulation in an A-J Model", Bell Journal of Economics and Management Science (Spring 1971) Vol. 2, pp. 22-38

Emery, David E. "Regulated Utilities and Equipment Manufacturer Conspiracies in the Electric Power Industry", Bell Journal of Economics and Management Science (Spring 1973), Vol. 4. pp. 322-327

Gale, B., " Market Share and Rate of Return", *Review of Economics and Statistics* (November 1972) Vol. 54, pp. 412-423

Harrison, J.L., "The Lost Profits Measure of Damage in Price-Enhancement Cases", Minnesota Law Review, (April 1980) Vol. 64, pp. 751-788

Johnson, Leland L., "Behavior of the Firm Under Regulatory Constraint: A Reassessment", *American Economic Review* (May 1973), Vol. 63, pp. 90-97

Kofaglis, Milton Z., "Output of the Restrained Firm", *American Economic Review* (Sept. 1969), Vol. 59, pp. 553-559

Miller, Merton H., and Franco Modigliani, "Some Estimates of the Cost of Capital to the Electric Utility Industry 1954-1957", *American Economic Review* (June 1966), Vol. 56, pp 333-391

Myers, Stewart C., "A Simple Model of Firm Behavior Under Regulation and Uncertainty", *Bell Journal of Economics and Management Science* (Spring 1973), Vol. 4, pp. 304-315

Rosoff, Peter, "The Application of Traditional Theory to a Regulated Firm", *Business Economics* (Jan. 1969) Vol. 14, pp. 77-81

Solomom, E., "Alternative Rate-of-Return Concepts and Their Implications for Utility Regulation", *Bell Journal of Economics and Management Science* (Spring 1970), Vol. 1, No. 1, pp. 65-81

Stain, Jerome L. and George H. Borts, "Behavior of the Firm Under Regulatory Constraint" *American Economic Review* (Dec. 1972), Vol. 2, pp. 3-21

Stigler, George J. and Claire Friedland, "What can Regulators Regulate? The Case of Electricity", *Journal of Law and Economics* (Oct. 1962), pp. 1-16

Takayama, Akira, "Behavior of the Firm Under Regulatory Constraint", *American Economic Review* (June, 1969), Vol. 59, pp. 255-260

Westfield, Fred M., "Regulation and Conspiracy", *American Economic Review* (June 1965), Vol. 55, pp. 424-423

Zajac, Edward E., "A Geometric Treatement of Averch-Johnson's Behavior of the Firm Model", *American Economic Review* (March 1970), Vol. 60, pp. 117-125

Zajac, E.E., "Note on Gold Plating or Rate Base Padding", *The Bell Journal of Economics and Management Science* (Spring 1972), Vol. 3, No. 1, pp. 311-315