THE ECONOMIC CONSEQUENCES OF
REGULATED MONOPOLY TAXATION

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By
Ivon William Ulrey, B.Sc., M.B.A.

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Approved by:

Ralph L. Dewey
Adviser
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CHAPTER I

INTRODUCTION

Economic theory does not provide, at present, a system that is capable of demonstrating the probable immediate and ultimate effects of taxes on regulated monopolies.\(^{(1)}\) The purpose of this study is to

\(^{(1)}\) The term will be defined fully later.

build a framework which will make it possible better to foresee the probable economic consequences of proposed tax changes in the regulated monopoly segment of the economy.

Stated more precisely, this study will set up a series of hypothetical models which appear to be representative of the great majority of regulated monopoly cases and attempt to show three things. The first is that established monopoly analysis does not fit privately owned and publicly regulated public service companies such as railroads, motor trucking firms, airlines, electric power companies, gas companies and other business activities often referred to as "natural" monopolies. The second is that a theory of monopoly taxation can be constructed on the basis of partial equilibrium analysis and can be used to give valuable insights into the probable economic consequences of any proposed course of action or of inaction. The third is that the partial equilibrium analysis developed in this study for the special cases presented by regulated monopolies can be used to help explain the economic consequences of the imposition of each of four general types of tax on public service corporations.
THE PROBLEM

The need for theoretical tools adequate to trace fully the effects of specific taxes on regulated monopolies is of great immediate importance. For example, state legislatures are now seeking ways to increase revenues so as to improve and extend their highway systems. They are considering the possibility that the trucking firms are not paying their fair share of the cost of building and maintaining the highways. The railroads are encouraging the growth of that point of view. The railroads contend that the motor carriers enjoy a favored position resulting from the provision and maintenance of public highway systems.

The motor trucking industry is spending unprecedented sums of money to convince the public and the legislators that they are already paying their fair share - or more - of the cost of building and maintaining that highway system. Although they want more and better highways - preferably freeways - they argue that higher taxes will jeopardize the development of the nation's most economical transportation system. The railroads answer this argument with the statement that not only is the railroad system in this country now highly efficient but that it would be even more economical if the railroads were in a position to compete for and get all the traffic that the railroads, at least, feel they are inherently best qualified to handle.

It seems safe to say that the arguments used by the railroads and the trucking companies are often based on inadequate information and are somewhat overstated. Nevertheless, the pressure being brought to
bear on the Congress may lead to significant changes in the regulatory provisions of the Interstate Commerce Commission. And the pressure being put on the state legislators may lead them to take action on the basis of attractively presented arguments rather than a knowledge of the probable economic consequences of such prospective action.

These are, therefore, vitally important issues, and they emphasize the fact that the most useful tool that could be placed at the disposal of the legislative bodies would be one that would indicate the probable economic consequences of the imposition of the proposed new taxes and revised regulations.

Congressmen and legislators have an opportunity to achieve through tax and regulatory laws any goals they choose. They can pass tax laws that will have great or slight effect on the profits of the firm. They can pass regulatory legislation that delegates to the regulatory bodies power to control activities of these firms in almost all respects. Together, these laws can place the privately owned and publicly regulated firm in whatever economic position the Congressmen and the legislators wish it to be. As yet, lawmakers have not taken full advantage of their opportunities. For example, although Congress has been studying and revising the national transportation policy for over sixty-five years, it is generally agreed that the present legislation does not adequately solve the problem. If Congress is to integrate its regulatory activities and bring tax policy into that integrated plan, economic analysis must make available tools to indicate the probable effects of each proposed action.
Some of the failure to integrate these activities may be attributed to the fact that students of each problem have in the past given undivided attention to their respective fields of specialization. Public finance students have their own complex problems to solve and they are tempted to dispose of regulatory problems in a single sentence by stating that the repercussions of regulated monopoly taxation are carefully controlled by the regulatory commissions. (1)


As will be seen later, students of regulatory problems commonly treat taxes as they treat any other item of expense. The courts seem to be well acquainted with the fact that rate making and taxation cannot be separately considered. (2) They, however, concern themselves with what has happened in the past as a result of the taxation and regulation of a particular firm. This review may very well call the attention of the legislative bodies to the past results of their laws and direct them to reconsider their policies, but such court decisions cannot provide adequate guidance in formulating new forward-looking policies.


Just before World War II, a considerable amount was written about the undesirable effects of regulatory taxation of the regulated monopolies. One writer argued that the purposes of taxation and regulation are different and that any attempt to make taxation supplementary
to regulation is likely to destroy the primary purpose of taxation — that is, the raising of revenue to finance the essential operations of government. (1) Another made a blanket charge that regulatory taxation constitutes "perversion, achieving improper and constitutionally prohibited objectives by subterfuge." (2) Still another writer stated that under rapidly changing conditions when regulation is inadequate, temporary taxes might become necessary and desirable. He went on to point out that "the fact must be recognized that the power of regulation and the power of taxation are not mutually exclusive." (3)

Despite the arguments used by those who oppose such taxation, regulated monopolies provide a source of much tax revenue for the governments at all levels, and as a practical matter, it is likely that heavy taxes will continue to be imposed on industries in this category.

MEANING OF TERMS IN THE TITLE

ECONOMIC CONSEQUENCES

In its broadest sense, the term "economic consequences" means the extent to which the imposition of a tax changes the income and expenses of individuals. (4) Under this definition the area of discussion


(3) Burkhead, Jesse V., op. cit., p. 390.

is not limited to the shifting of a tax from those who pay it to others but instead includes the effects of the tax on all members of society regardless of whether they pay it or not. (1)


The shifting of a tax is only one of the economic consequences of the imposition of that tax. (2) In fact, the repercussions are almost beyond identification and may influence the whole course of economic activity in much the same way that any price change may alter economic activity. This change, of course, may be either the result of deliberate planning or the unanticipated effect of the absence of a plan. Also, taxes paid by the taxpayer and utilized by the government result in a transfer of purchasing power and potentially in a change in the demand for goods and services. The consequences of a tax may be manifested through its payment, through the expenditure of the money, through its payment and non-expenditure, or any combination of the above actions. As a practical matter, the term "economic consequences" includes the effects on the level of employment, production, savings, investment, the aggregate national income and income distribution. These factors, in turn, affect the disposable income of persons and their choice as well as the volume of goods and services

(2) Mering, Otto Von, op. cit., 1942, p. 1
consumed. The extent of the changes in individual consumption and choices will also depend somewhat on the amount of existing unemployed resources. If resources are not fully employed, the effect may be to raise aggregate demand whereas, if employment is full, the effect may be to increase prices.

A statement of these tendencies must be carefully qualified to allow for economic dislocations created by sudden changes in demand in some segment of the economy.

The statements made already make it clear that even though a tax is imposed for the purpose of obtaining revenue, it will also be a regulatory tax to some extent. This means that in any branch of the business economy, a tax imposed to yield revenue is, to some extent, regulatory. Therefore, in the regulated branch of the economy particularly, a "tax change" is likely to create regulatory problems. By the same token, an order of the regulatory commission affecting the amount a regulated firm can charge for its service is very likely to create tax problems. The two activities are interrelated.

Studies dealing with the economic consequences of taxation of public service corporations must take into consideration the regulatory problems created and the possible solution to those problems. It is
not enough simply to state here that the tax will either be passed on to the consumer in the form of higher utility service rates or that the utility will have its profits reduced by the amount of the tax. It may be either, but it is more likely to be a combination of both. Tax problems, therefore, cannot be separated from regulatory problems.

TAXATION

This is not a study of the fundamental principles of taxation. Rather it is an analysis of the economic consequences developing from the imposition, the removal or the changing of specified types of taxes bearing on firms in the regulated public service industries. No attempt is made to answer the question of how utilities ought to be taxed or whether they ought to be taxed. And no effort is made to evaluate the present tax system or to suggest alternative ones. This study is only concerned with what will tend to happen in the nation's economic system when public service companies are taxed in certain ways. In fact, it is limited to a discussion of the economic consequences of four broad types of taxes. They are as follows:

1. A tax of a fixed amount.
2. A tax varying with the gross amount of service sold.
3. A tax varying with gross revenues or gross receipts.
4. A tax varying with net receipts or net income.

REGULATED MONOPOLY

The choice of the term "regulated monopoly" may be challenged because public utility and transportation firms are not absolute
monopolies, but the term was chosen despite its weaknesses because all other eligible terms seemed to be even less satisfactory. For example, if the term "public utility" had been chosen, it might not have brought to mind the transportation segment of regulated industry. As used here, the term refers to any and all privately owned public service firms that operate under the terms of a franchise, a certificate or permit, or some other agreement entered into between the firm and a governmental body. The words "regulated monopoly" refer to such firms as the privately owned and publicly regulated railroad, electric power, communication, gas, airline, motor truck, motor bus, and pipeline businesses.

The word "monopoly" does not have the same meaning as it has in the unregulated segments of the economy.\(^{(1)}\) It does not mean simply

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those firms that because of conditions of imperfect competition earn profits in excess of the minimum necessary for financial success. It is called a monopoly here because it does possess many of the characteristics of unregulated monopoly but differs in that its activities are in some ways restricted and in still other ways directed by representatives of the government. It is monopolistic in the sense that the firm is protected by the terms of its franchise against added
competition from the same type of utility. (1)

(1) Of course, competition exists in the sense that all businesses compete for the consumer's dollar. Competition may arise also through the need for and purchase of the factors of production.

Furthermore, the word monopoly, as used in unregulated industry, usually means a firm that is earning profits in excess of the minimum that would enable it to survive and prosper. In this study, one of the chief distinguishing features of the analysis is that any firm falling within the category described above will be studied. This analysis will, therefore, give careful attention to firms that are earning much less than the amount that would satisfy the unregulated firm. The regulated monopolies discussed here include the ones earning less than satisfactory returns on investment as well as those that are earning a satisfactory return or more. Less than satisfactory returns are often earned by regulated utilities for considerable periods of time. Despite this record, they often go on providing service to the public for many years. An unsatisfactory earnings' position may be due to tax policy, to regulatory policy, or to economic conditions, or to all three perhaps. Regardless of the reason, the fact that many such cases do exist makes it necessary to include in this study firms of this type as well as the more profitable ones.

Another reason for the choice of the term "regulated monopoly" is that the firms discussed in this study do enjoy a monopoly in the sense that they do not face unlimited competition with other firms for
the sale of the same service in exactly the same areas. There may be competitors but the number of them is restricted to some extent by the regulatory commission. As a result of its unique position - at least in some geographical areas and for some of its services - the regulated firm discussed here possesses many characteristics of monopoly.

PRESENT STATUS OF THE THEORY OF REGULATED MONOPOLY TAXATION

It may perhaps be said that there is no well-defined general theory of regulated monopoly taxation. (1) The literature on the subject

(1) Federal power projects, of course, potentially provide a basis for measuring the effects on demand and costs of relatively tax free operations. User costs, also, to the extent they are used simplify the tax problem.

of monopoly taxation treats unregulated monopoly taxation and not regulated monopoly taxation. There are several reasons for this. One is that in countries where such services are publicly owned and operated, the level of earnings has been so low that few if any taxes were paid - or even could be paid. On the other hand, where the regulated monopolies have been and still are privately owned, most of the attention has been given to protection, development and regulation rather than to taxation. Where taxes were imposed, the assumption was that the tax would be passed on to the consumer in the form of increased service rates. Where public regulation of privately owned firms was vigorous, the attitude of the public, businessmen, and regulatory bodies toward regulated monopoly taxation generally was that the economic consequences were carefully controlled. That
is, if taxes were imposed, the regulatory body would make provision for upward adjustments in the service rates charged by the firms and the taxes would be passed on to the consumer. If, on the other hand, profits were high, it was assumed that the service rates the firms were permitted to charge would be reduced and the profit would be restricted to a level that would protect the interests of the consumers.

In the United States, the taxation of regulated monopolies has developed generally in four phases. (1) These phases may be indicated as follows:

1. A period of subsidy.
2. A period of tax exemption.
3. A period of uniformity.
4. A period of integration and equalization.

The above periods have not coincided chronologically for all segments of regulated industry and have not been equally distinct. Nevertheless, the growing use of regulation in the third and fourth phases of the development of taxation was such as to move more or less concurrently. Consequently, earnings were often held down by regulation. Therefore, the net income tax problem in this business category

was made less acute. In fact, the development of regulation has been along lines that tend to hold service rates down where ever profits tend to rise and to increase service rates if profits fall to uneconomical levels. In other words, the development of regulation and taxation in about the same period has kept the level of taxable income generally so low relative to the unregulated segments of the business economy that not much concentrated attention has been paid in the past to regulated monopoly taxation. Regulated firms, however, pay many other types of taxes. Nevertheless, if added revenue was needed by the government and the taxing authorities decided to tax the public service firms, they generally did so on the assumption that the tax could and, if necessary, would be passed on to the consumer in the form of higher rates.\(^1\) The propriety of imposing taxes

\(^1\) Burkhed, Jesse V. *op. cit.*, p. 385.

... on public service corporations has been sharply debated,\(^2\) but the


... practice of taxing these firms continues at all levels of government. It seems safe to assume that they will be taxed in the future, and possibly even more heavily than in the past.
The literature on the taxation of public service corporations in foreign countries is extremely limited and out-of-date. Since the governments commonly own and operate the transportaion facilities and regulate the other branches of the public service industries, the earnings are quite low or are actually negative. Judging by the material available, the taxes paid by such firms are nominal. (1)


Even in this country, the literature on the subject of the economic consequences of taxation of regulated monopolies is not extensive. Some idea of the attitudes of writers and the restricted nature of material may be obtained from the following quotations:

One author writes as follows:

"....the question of incidence of all these various taxes is of little interest today where utility and railroad rates are subject to regulation. Incidence on the consumer is therefore possible only to the extent that the rate controlling authorities permit such taxes to be shifted." (2)

(2) Mering, Otto Von, op. cit., p. 239.

A student of tax and regulatory problems writes as follows:
"But in one field, that of the railroads and public utilities, this (incidence) has been taken care of; and we now have regulated incidence so far as regulatory bodies are able to make their policies effective. This means that in judicial theory, legislative bodies have been deprived of all authority to adopt any differentiated taxation of public utilities as compared with other fields of industry. There might conceivably be conditions under which legislative bodies might deem it wise to impose heavier taxes on the public utility field, or, on the other hand, to grant some degree of exemption to public utility industries. Either taxing policy would be completely neutralized by a regulatory policy which would automatically pass on both excess and exemption to consumers in the form of rates so adjusted to bring the final return back to where it was before. Under this theory, public utilities become merely conveyors of taxes from taxing authorities to consumers." (1)


Another author writes as follows about property taxes:

"The rates charged by each public utility are subject to government regulation. So long as demand for the goods produced or services rendered by a public utility is high enough and remains constant, its rates will be such as to make the investment of its stockholders yield a reasonable return." (2)


Another writer on public finance expresses himself as follows:

"In the last analysis, all taxes come out of the income or capital (actual or potential) of individuals." (3)


Another writer writes:

"Taxes paid by public utilities are a substantial portion of the total cost of the service and are taken into account by regulatory
authorities when fixing reasonable rates...."(1)


Still another writes this about regulated monopolies:

"Indeed, in the case of such (regulated) monopolies, it is ordinarily taken for granted that the tax will be added to the prices or rates fixed by the regulatory commission. Thus as most people are aware, the war tax on railroad passenger and freight traffic was so added to the regular charge."(2)


In a discussion of the shifting of a tax on gross revenues of a public utility, an economist writes:

"Economists have been wrong in so far as they have assumed that a tax on a monopoly cannot be shifted at all; right, however, when they contend that it could be shifted in small part only. Business men are all wrong in assuming that profits can be kept intact by simply passing the tax on to the consumer."(3)


One public utility executive writes as follows:

"...taxes on utilities are merely another item of utility operating expense."(4)


Still another person writes:

"Unless prevented from earning a fair return by economic or political causes which cannot be remedied by increased rates, substantially every tax levied against a public utility corporation is
passed along to the consumer in his bill for service."(1)


On the subject of tax burden on carriers the following statement was made not long ago:

"I have found no infallible method of measuring business tax burdens, and without a methodology, it is as impossible to measure past tax burdens as to predict future burdens."(2)


Taken together, the above quotations show clearly why it is quite accurate to say that there is not much discussion of the precise economic effects of the taxation of regulated monopolies. Almost the only point upon which there is agreement is that the tax and regulatory problems are intimately related. Current literature does not help much in the way of solving these problems. The only genuinely concrete ideas possessed by the writers have been that the tax problem is not a difficult one because it is simply a matter of the incidence of the tax and of changing the service rate the regulated firm may charge. These two points have been taken up, explained and settled in a matter of a sentence or two by writers in the past. Rarely has the subject received any careful attention.

The following chapters will attempt to clarify the problems that the interrelation of taxation and regulation create.
THE NEED FOR AN INTEGRATED PHILOSOPHY OF TAXATION AND REGULATION

It is easy indeed to conclude that inasmuch as the regulatory authorities have considerable control over the service rates charged by the firm, the economic repercussions of a tax will depend on what the regulatory commission does or does not do. This conclusion is true as far as it goes, of course, but it is not very helpful in formulating intelligent public policies.

One authoritative article on taxes says the following:

"Theories of incidence are thus the step-children of economic theory, and the reliability depends upon the accuracy with which the economist is able to understand, analyze and describe the character and functioning of the general economic system."(1)


That statement is the theme of this discussion - the theme applied to regulated monopolies. It is the goal of the present work to build an analytical system for identifying the economic effects on the "general economic system" of taxes on regulated monopolies. This analysis will differ from existing ones because this one is designed to fit the special cases of the regulated monopolies. It will be tailor-made for them.

With this analysis, it is hoped, the economic consequences of the imposition of four general types of taxes will become clearer. They should become sufficiently clear, at any rate, to provide new insights into the subject - insights in the sense that the economic consequences of the imposition of a tax can be anticipated.
to some extent before the actual imposition of the tax. (1)


This study may be criticized by those who argue that nothing genuinely significant can be accomplished without a clear philosophy of taxation and regulation. That point of view will not be debated. In fact, the writer largely shares that viewpoint. But there is one vitally important argument to be made in defense of a study like this one. It is this: such studies constitute a necessary preliminary to the development of a full-fledged philosophy of taxation. If this study makes certain tools available - even crude ones - that help prevent action that would have effects not contemplated by the legislators or Congressmen, something worthwhile has been done. And if the tools provided here actually help the legislative bodies to choose those taxes and those regulatory policies that will have the repercussions they wish, then the tax system is being brought into agreement with a philosophy they possess but which is not yet clearly formulated. Furthermore, this piecemeal approach may be the only genuinely useful one. Even if a valid basic philosophy could be agreed to, it is unlikely that the whole tax system could - as a practical matter - be changed all at once. It is much more likely to be done gradually.

THE METHOD OF INQUIRY

This study is the outgrowth of a conviction that neither the empirical nor the theoretical research work done in the past has made
much progress toward identifying the economic consequences of changes in taxes applicable to regulated monopoly. The status of such research is indicated in earlier sections of this chapter. Further work on the subject could be done by applying established statistical techniques to data available and it could be done by reexamining the theoretical literature and starting from that point. The second course of action was chosen for this study. It was chosen because it is felt that if analytical tools can be constructed from theoretical analysis and applied to hypothetical cases, some worthwhile conclusions may be reached. In other words, this study reexamines the theory of monopoly taxation, modifies and extends it to fit regulated monopolies where alteration is necessary and draws conclusions based on the theoretical analysis. This approach involves several assumptions regarding the nature of the industry. Also, it draws conclusions which can ultimately be tested by empirical research and provides techniques for testing the conclusions.

Chapter II, therefore, attempts to identify the characteristics of regulated monopoly that distinguish it from unregulated monopoly. These peculiarities provide a basis for setting up assumptions and for proceeding with the analysis.

Chapter III seeks a logical starting point for the analysis. It strives to identify the most likely relationship of the firm's output to its most economical rate of production. Conventional analysis assumes that a monopoly tends to operate at a rate much below the low cost rate of production. This assumption is not valid for the
regulated monopoly. Furthermore, established monopoly theory assumes a monopoly to be a monopoly-profit making monopoly. This, too, is not always true for the regulated monopoly.

Established analyses make no mention of the possibility that the monopoly may very well alter its capacity so as to meet as closely as possible the demand made on it for its service. Is this because such adjustments are impossible or is it because established theory has overlooked this factor? These questions are not answered clearly in the literature. Also, does the regulated monopoly tend to set output at the point where marginal revenue is equal to marginal cost, or is it likely that this relationship is not so significant in the analysis of repercussions of revenue and cost changes on the regulated monopoly? Fundamentally, Chapter III builds an equilibrium concept and makes use of it as a point of departure for the analysis of the economic consequences of the imposition of taxes on regulated firms.

The main body of the analysis, Chapters IV, V and VI, utilizes the assumptions set forth in Chapter II and the equilibrium analysis of Chapter III. Each of the four basic types of tax is taken up and an analysis made on the basis of the new assumptions and the new equilibrium theory. The four types include: 1) lump sum taxes, 2) taxes per dollar of revenue, 3) taxes per unit of service sold, and 4) net income taxes.

Each tax is discussed in terms of its effects on the consumer of the service provided by the monopoly, on the monopoly itself, and to
some extent on the general public. The economic consequences are ex­
examined in terms of the short run as well as the long run. This analy­
sis is applied to each of three hypothetical firms used to illustrate
the most likely situations in a mixed enterprise system such as the
one in the United States. Such firms include one that is making a
profit in excess of a necessary minimum, a second that is making
barely enough to attract the capital necessary for efficient opera­
tion and a third that is not collecting enough in revenue to cover all
its expenses and yield a return adequate to attract equity capital.
The discussion takes into account the possibility that the firms may
or may not be operating at the rate of production that would result
in the maximum profit or the least loss. The problems created by
changes in demand over a period of time and changes in costs due to
changes in the scale of operations are also taken into consideration.

The final chapter VII summarizes the findings and sets forth the
implications contained in the study for public policy making.
CHAPTER II

PECULIAR CHARACTERISTICS AFFECTING THE ECONOMIC CONSEQUENCES OF TAXATION OF REGULATED MONOPOLIES

Regulated monopolies are not monopolies in the usual sense. They have some of the characteristics of the monopoly firm and some of the competitive firm, but the only important characteristics they have in common with both are that usually they are privately owned businesses, seek to make profits, and compete in the open market with other businesses for the factors of production needed in their operations.

Such firms are not free to set the price they charge for the service they sell. Neither are they free to decide how much of their service they will sell. The price they may charge is directly influenced by the regulatory body set up by law to protect the interests of the public. This restriction in turn indirectly controls the quantity of the service the firm sells because the firm is obligated by the terms of its franchise to serve all who ask for service at the rate set, provided, of course, the applicant meets the qualifications required by the franchise. These two characteristics alone take the regulated monopoly out of the broad category of monopoly.

Public service firms are not competitive because they are protected against competition by the terms of the franchise—protected, that is, against added competition from another firm offering to supply the same service. They are not protected, however, against competitors who offer to supply a substitute service, and in this sense they are competitive.
There are many other peculiarities that distinguish the regulated monopoly from other monopolies and competitive firms and all of them affect the economic consequences of taxation of these unique business organizations. Many of these factors will be discussed in other sections of this chapter.

**LEGALLY INTENDED CONSEQUENCES OF TAXES**

Although the imposition or removal of a tax on a regulated monopoly changes the profits of the firm - or its losses - by the amount of the tax if no action is taken by the regulatory body, the attitude of the courts and the regulatory bodies is usually that the taxes must be taken into account when service rates are established.

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(1) This is true provided demand does not change.


This means, of course, that the tax will be reflected in the price the consumer pays for each unit of the service he buys. Although it is not accurate to say that this is always true, it usually is. The chief exceptions are the income tax which some commissions hold is meant to be
a tax on the firm, the federal capital stock tax and


the state excess dividends tax (2) which are sometimes treated as a


tax on the investor and not on the firm. (3) Despite these and other


exceptions, as a general rule Congressmen, legislators and regulatory commissions expect increased taxes to be passed on to the consumer in the form of higher service rates. (4) The expected results may not


occur, however, for many reasons. (5)

(5) Troxel, Emery, op. cit., p. 104.

The tax change may or may not be reflected in earnings - or losses - because of the wide variation in the time it takes the firm to get action by the regulatory body or by reason of changes in the general level of economic activity or because the price being charged by the firm prior to a tax increase may already be the price
maximizes profits. In the latter case, any increase in price will reduce those profits. (1)

(1) Burkhead, op. cit., p. 390

Regulated monopolies are protected against confiscation of property for public use without just compensation and without due process of law, of course, by the fifth and fourteenth amendments to the Constitution. (2)


Other factors that may delay or effectively prohibit price increases are the threat of government purchase or competition from government facilities providing the same service or private facilities providing a substitute service. (3)

(3) Troxel, Emery. op. cit., p. 106

An example of an attempt to establish by law the economic effects of the imposition of a tax is the federal energy tax placed on electricity during the 1930's. In the Revenue Act of 1932, a tax of 3% was placed on the price of each unit of electricity sold for residential and commercial use. The tax was shown as a separate item on the consumer's bill and was collected from the consumers by the electric utility company. A year later this was changed and the Revenue Act of 1933 required the utility to pay the tax. The tax was no longer added to the amounts the consumers paid. The purpose of this change
was to alter the economic consequences of the tax. Apparently, the Congress felt that the shift was clear and that the consequences were quite different under the two laws.

DEMAND

There are many reasons why certain businesses are considered to be "affected with the public interest" and are regulated by the public. One economic reason is that the demand for the product is often highly inelastic. That is, the quantity of the good that the public will buy will not change much even though the price charged for each unit of the good is changed suddenly. If unregulated, businessmen operating under these conditions would be able to take advantage of an opportunity to charge high prices and enjoy maximum profits. Although producers of a substitute service might compete to some extent for the available business and thereby guarantee at least certain classes of consumers reasonable prices, this would not assure all consumers reasonable prices. It would not protect consumers within the range where the demand is highly inelastic due to the imperfectness of the substitute. Also, even where competition is effective, it is quite likely that the stronger firm will sooner or later drive its smaller competitors out of business, or as an alternative, the competitors will conspire against the consumer, divide up the market and proceed to charge excessive prices for the service.

Whatever the outcome, society has learned from experience that the consumer is in a weak position and has chosen to take action to protect him and obtain for him the benefits of large scale production in those industries where such benefits are highly significant. This economic development may be described as the substitution of the hands of the government for the invisible hand of *laissez faire* private competition. Potentially, the benefits to be derived from this substitution are significant. Taxation plus government regulation offer an opportunity to benefit all members of society. The extent of the benefits depends, however, to some degree on the level of understanding of the degree of elasticity of demand.

In most instances, it is quite likely that the regulated monopoly could not raise its prices very much for all its services in all areas it serves. In some areas or for some classes of its service, the consumer would turn to a substitute rather than pay more for the product. In other cases, the consumer may not have any alternative available to him and must be protected. Actually instead of the demand for the service being highly inelastic over a rather wide range of prices, it is likely that the inelasticity is restricted to a rather narrow range. In other words, the demand curve for the regulated monopoly is probably kinked.

Each type of business activity included in the category of "regulated monopoly" usually has some geographical areas where it has very little competition or some class or classes of consumers that cannot serve themselves or find another source of supply. In
In any case, the number of and instances where the public service firm enjoys a monopoly are sufficiently high to justify public regulation. These demand characteristics create complicated tax problems. Some of those problems may be illustrated best by an example. Suppose a tax is imposed on an electric power company. This company, it will be assumed, sells electric energy to residential, commercial and industrial consumers and perhaps to municipalities for resale. Under those circumstances, the service rate charged residential consumers is probably well below the maximum rate these consumers would pay rather than use a substitute or go without the service altogether. In other words, the utility could, if permitted to do so, charge considerably higher rates and not lose much business in this category. The same is probably true for commercial consumers but to a lesser extent. The same is not true for the industrial or municipal consumers. Neither of them will pay more than it would cost to manufacture the power. The highest rate they are willing to pay might be even less than this because they might threaten to pool resources and build a plant adequate to serve them both. The mere threat by either or by both jointly to build a generating station would convince the electric power company that it must keep the charge it makes for industrial

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and municipal uses at quite low levels. (1)

(1) This situation creates a problem of discriminatory pricing. Actually, the monopolist will tend to discriminate as between classes of buyers when elasticity of demand is not uniform. Higher rates will tend to be charged in markets where demand is relatively inelastic.

The sharply different degrees of elasticity of demand for the service of the firm is highly significant for several reasons. If a tax is imposed on the electric utility and the regulatory commission authorizes a compensating increase in rates such a service rate increase is likely to affect largely the residential consumers and to a smaller extent the commercial consumers. Rates to the industrial and municipal consumers probably will not be increased. This is particularly true of the municipal consumer because the tax imposed on the electric company might very well be one a municipal plant would not need to pay. It may be concluded then that the tax will be passed on to certain consumers, but that the increase will be distributed on a highly selective basis. In this instance, the tax will be passed on, but it will not be passed on to all the consumers. From this it may be concluded that a large part of the tax will ordinarily be reflected in higher electric bills for the residential and commercial consumers — the ones the regulatory body may be most anxious to protect against higher rates.

As a second example, suppose that a railroad and a motor carrier are competing vigorously for all classes of traffic except one. In this particular case, the railroad has the advantage because its cost of handling this one type of traffic is lower than it is for the motor
carriers. Perhaps the traffic is a low-rate, long-haul, high volume commodity. Now suppose that the state or local tax authorities increase the tax on real estate of all businesses. The railroads have extensive real estate holdings. The motor trucking firms have very little. If the increased tax causes the regulatory commission to authorize the railroad to increase its rates - and perhaps the motor trucking firms also, but to a smaller extent - the railroad is likely to request an increase on the one class of traffic that is not competitive with the trucks. The net result will be that this service rate increase by the railroad will reduce its service rate advantage - or perhaps eliminate it - and the railroad suddenly becomes vulnerable to competition and loss of traffic to the motor carrier. The significant point is that the tax is not passed on to all consumers but is, instead, passed on to only one class of consumers.

The purpose of these illustrations is to show that the Congressmen, legislators and commissioners ought to take into account the demand function when they consider proposed tax legislation. There is some evidence to show, however, that many regulatory commissions often do not. One student of public utility economics writes as follows:

"Buyer response to price changes, usually expressed graphically by a downward-sloping demand curve, is an accepted fact among economists, but the regulators of public utility firms rarely give attention to it as reasonable earnings are determined. These commissions do not trouble themselves with studies of market demand schedules."(1)

The same writer goes on to say that out of ninety decisions by utility commissions, in only two cases was buyer response to price changes taken into consideration. This criticism may not be made of all regulatory commissions however. The Interstate Commerce Commission, for example, pays close attention to the elasticity of demand because Section 15a of the ICC Act as Amended requires the Commission to take into consideration in rate cases the "effects of rates on the movement of traffic."

Another writer discussed the importance of elasticity of demand on the distributive effect of the excise tax as follows:

"The implication, often not intended, which results from this type of analysis is that the greater part of the burden falls on the consumer and that the profit of the seller is either affected slightly or not at all."(1)


This same author cites several cases to show how eminent economists concentrate their attention upon the price of the good before and after the tax. Little or nothing is done to identify the extent of the repercussions on the consumer, the producer and the public. The two examples cited above show what abstract deduction can do toward giving a more comprehensive explanation of the economic effects of a tax even when only one factor - elasticity of demand - is recognized as an important factor. The urgent need now is for some data that will show the degree of elasticity of demand for the services of regulated monopoly firms. If that data were available, it might be possible to show rather accurately what the effects of the imposition of a
tax are likely to be in a given situation.

Speculation about the degree of elasticity of demand is interesting because it is possible to reach many rather surprising conclusions. Suppose, for example, that the demand in a particular situation is highly inelastic. Under such circumstances the imposition of a tax will not affect much the volume of sales of the firm. If the sales are not much affected then it seems safe to conclude that when the commissions ignore the demand function in considering service rates adjustments, they may not be greatly injuring the regulated firm. On the other hand, if it is assumed that the demand is rather elastic, the conclusions reached must be that the firm will suffer financially. By means of these illustrations it becomes clear that the degree of elasticity of demand is a highly significant factor and that it ought to be taken into consideration in all service rate adjustment cases.

The discussion of demand so far has been limited to the short-run period. Even more complicated problems arise in the long run. Suppose, for example, that the tax money collected from the railroad and motor carrier is used by the government to improve the roads of the state. This road improvement may very well so improve the highways that the motor carriers can afford to haul the low grade traffic for less cost per unit of traffic and do it with less lapse of time between the point of origin and destination. The tax money collected from the motor carriers and from the railroads may be used to reduce - or actually eliminate - the advantage the railroad possesses over the
motor carrier. In economic terms, the tax money collected from all industry may be used in such a way as to reduce the costs and to increase the demand (1) for the service offered by the motor carriers.


In such a case, the increased tax may actually increase the profits of the motor carriers rather than reduce them. In an actual instance, this effect may not be readily apparent. The increased volume of business done by the motor carriers may very well be attributed to increased general business whereas the traffic increase may be due to the swifter and more economical service the motor carrier is now able to offer. (1)

(1) Similar repercussions arise in connection with subsidies.

COSTS

Peculiarities involving the changes in costs of production of regulated monopolies also play an important role in determining the economic consequences of taxation upon such firms. Regardless of the effect on unit costs of a change in the volume of production, cost changes are potentially important and must always be taken into consideration. The importance of this factor may be demonstrated in several ways. One is in the changes in unit costs that arise due to the operation of a particular plant at different rates. These changes occur as the rate of production varies even though the capacity of the plant does not change. Another is in changes in costs that arise
due to different scales of operation. These cost changes take into account the effect on unit costs of different sizes of plants and combinations of sizes of plants. Still other changes in unit costs of production take place as a result of technological improvements and reflect the unit cost changes over time. The last type are often referred to as historical cost changes and accompany a growth in the market for the service.

Changes of each of the three types referred to above can be presented graphically. In dealing with cases of the first type - those where unit costs change due to the operation of a given plant at different rates - the unit costs of production are assumed to be different for each quantity of service the particular plant is capable of producing. In this instance it is assumed that the plant has only one rate of output where the cost of production per unit is lowest. If the plant operates at either a higher or lower rate of production, the cost of production per unit is higher. Described in graphic terms, a curve joining all the points representing all possible alternative rates of production and the corresponding unit costs of production would start from a rather high position on the graph for low rates of production and decline as production rates increase to a point where the unit costs would be lowest. For still higher rates of output, unit costs of production would rise again until the maximum rate of output is reached. A great deal of use is made of this U-shaped cost curve. It is particularly helpful in regulated monopoly cost analysis and will be used extensively in this study.
The changes in unit costs of production that arise due to different scales of operation may also be represented by a U-shaped cost curve. This curve is used to illustrate the unit cost of production of any and all quantities at a given instant of time even though the different quantities are assumed to be produced in plants with different capacities. Each point on the curve represents the unit cost of production in a plant - or in a combination of plants - that could produce the given quantity for the lowest cost per unit of production. (Hereafter, this curve will be referred to as the scale unit cost curve.)

Changes in unit costs of production that take place over time as a result of technological improvements may be illustrated either by a single curve or by a series of U-shaped curves. If the changes are represented by a single line and the unit costs have declined as output increased over the years, the curve slopes downward to the right. If unit costs remained constant or increased, the curve takes the shape of a horizontal line or slopes upward to the right as output rises over time.

Historical unit costs may be represented by a series of curves, however, where each individual curve represents a particular plant capable of producing one or a number of quantities of service. Each curve represents also the costs of production of various quantities of service at a particular time or under earlier long run
conditions. To construct the "long run" curve, each plant unit

cost curve is extended until it intersects the plant curve nearest to
it and so on until there is one scalloped curve made up of segments
of a series of plant curves. This scalloped curve is often referred
to as a long run cost curve. Sometimes this envelope curve is
"smoothed out." The "smoothed out" curve has some value for economic
analysis but is not completely satisfactory for this analysis. For
this study, an entirely different concept of historical costs is
needed. Here, it is necessary to know what technological changes have
taken place over a period of time for the production of each of all
possible quantities of service. This concept is illustrated in
Figure 1 on page 38.

Figure 1 shows the hypothetical chronological records of changes
in unit production costs for several possible quantities of service.
Other curves could be added for other quantities. (Hereafter, these
curves will be referred to as historical unit cost curves.) The con­
cepts illustrated by these curves are important for this reason.
Whereas the scale unit cost curve shows what will be the unit cost of
producing most cheaply any quantity of service it is possible to pro­
duce at a given time and place, this curve alone will not always serve
adequately a regulatory commission that must decide how much to adjust
the service rate of a firm if a certain tax is imposed. It is inad­
quate because the scale unit cost curve does not take into account

(1) Chamberlin, Edward. The Theory of Monopolistic Competition, Cam­
the technological changes in unit costs reflected in the historical unit cost curve. Inasmuch as they must be taken into account, this can be done only if the past record of technological changes is known and if unit costs of producing each possible quantity of service are known. Of course, it may be argued that the tax and regulatory commissions ought not to anticipate technological changes, and there is considerable reason to agree with that argument. Nevertheless, the tax commission may want to know the trend of unit costs in the past and the rate of change. This would be significant information if the commission were considering a service rate change not entirely because of the change in taxes but because it is, in fact, reviewing a case it has not studied for many months or several years. The period under review may be a period during which technological changes reduced unit costs of production for any and all quantities of service. Under those circumstances, technological changes do become pertinent in taxation policy and also in determining a "just and reasonable" service rate when a rate adjustment problem arises as a result of a change in taxes.

Each of the three cost concepts described above will be used extensively from this point on. The purpose of describing them here is to set up a terminology and to establish a background for identifying several points of departure for the discussion contained in the following chapters. One simple example of how these concepts will be used is illustrated in Figure 2 on page 40. This figure combines a demand curve (AR) and a plant unit cost curve (AC) as well as a service
Figure 2

REVENUES AND COSTS PER UNIT OF PRODUCTION

[Graph showing revenues and costs per unit of production with axes labeled 'Quantity of Production' and 'Revenues and Costs per Unit.']
rate line (SR). The service rate line is included to show the price established by the regulatory commission. The significant point to note here is that the unit cost of production for the quantity of service demanded is just equal to the price the regulatory body established. (1) At this rate of production the firm is able to enjoy

(1) The firm is not operating at the rate where marginal revenue is equal to marginal cost - or at the point where it could maximize its profits.


financial stability provided - and as long as - the demand (AR) and the costs (AC) do not change. This figure shows that with the demand, service rate, and costs as illustrated the firm can survive financially. That is to say, the firm can meet all its expenses out of revenue and pay dividends that are adequate to satisfy those who own the equity securities of the firm and to attract new capital if needed.

Suppose now that the service rate is increased to the level indicated by the broken horizontal line (SR1). The unit cost curve is assumed to remain unchanged. The effect is to change the profit position of the firm because after the service rate increase the firm will deliver the quantity of service indicated by the point where the new service rate line (SR1) and the demand line (AR) intersect. This is a smaller amount and at this new lower rate of production, the unit costs or production are higher, but not as much higher as the new service rate. The result is that the firm has revenue from this volume of business that is more than enough to cover all expenses
including dividends. The firm thereby enjoys a larger profit - a profit in excess of the minimum necessary for financial stability.

Next imagine the cost curve not to be the shape shown on the diagram but to be more nearly "V" shaped. Under those circumstances, an increase in the service rate will cause a smaller increase in profit - assuming no change in the demand curve - and perhaps no increase at all. In fact, if the cost curve were quite "V" shaped, the firm might not make a profit but instead suffer a loss. Because the range of output within which the firm operates efficiently is very narrow, an increase in service rate would not benefit the firm. Financially, the increase would injure it.

This discussion certainly has not mentioned all the possible combinations of demand and cost curves. But the two possibilities explained here do indicate the importance of the shape of the cost curve and its relation to the demand curve. The vitally important fact to be noted so far is that the imposition of a tax will change the location and perhaps the shape of the cost curve or the demand curve depending on how the tax change is shown.(1)


An example of how a knowledge of the shape of the cost curves helps to explain the economic effects of the imposition of a tax is illustrated in Figure 3 on page 43. In this case, two cost curves are shown. One represents a hypothetical trucking firm and the other
Figure 3

REVENUES AND COSTS PER UNIT OF TRAFFIC

MOTOR FREIGHT CARRIER

RAILROAD

Revenues and Costs per Unit

Quantity of Traffic

Quantity of Traffic
a hypothetical railroad.

The trucking industry is made up of many small operators with almost infinitely divisible transport units competing vigorously among themselves and with the railroads and airlines for certain types of traffic. Under these circumstances, it would seem logical to expect the plant cost curve for a motor carrier to be quite V shaped rather than open U shaped. It is very likely that a plant curve for a motor carrier is V shaped, but such a curve is not used in this illustration for the following reason. Even though the volume of traffic a motor carrier can handle with its trucks is probably rather inflexible as of a given instant of time, it is also a fact that if the motor trucking firm needs more capacity or finds it has excess capacity it can alter its capacity to meet either change within perhaps a few hours. It can buy or sell trucks and trailers or it can lease a truck from or to another firm on very short notice. Therefore, instead of representing the cost curve for the motor carrier as a V-shaped curve, it is shown as something approaching a horizontal line. The analysis that can be made with this line seems to be much more logical under the circumstance described than it would be with a V-shaped curve. Also, it realistically reflects the fact that most costs of the motor carriers vary in almost direct proportion to the volume of traffic and that even though capacity limits are narrow for a given firm these limits can be shifted in a short space of time by means of capacity adjustments.
The use of the "flat" cost curve may be challenged because it assumes each and every motor carrier can quickly sell motor trucks and trailers whereas if all firms simultaneously found themselves with surplus equipment there would be no market for the surplus. This might be true, yet trucks are highly mobile and can be diverted from one geographical area to another or perhaps from one country to another in a short space of time.

The other cost curve is the plant cost curve of a railroad. Since a railroad cannot change its capacity in a short period, the unit cost curve for this firm has a different shape and slope.

Suppose the relative position of the two curves to be as shown on Figure 5. It can be demonstrated that the conditions present here could lead either to stability or instability. Suppose, for example, that the railroad is doing enough business to enable it to operate at the low point on its cost curve. Under those circumstances, the railroad enjoys a satisfactory profit even though its service rate is below the minimum the truck operator can charge and maintain financial stability. If the truck carrier has traffic enough at higher rates to keep it busy and yield it a profit, this relationship may continue indefinitely.

On the other hand, suppose that the railroad does not have traffic enough to enable it to operate at its low cost rate. Under these circumstances, it will have an incentive to draw some of the traffic away from the motor carrier. It can do this by establishing low rates for the traffic the motor carrier is handling. If permitted
to do so, it may even cut rates below those necessary to cover all costs of handling this traffic. The truck carrier may retaliate by lowering its rates.

Under these circumstances a rate cutting war may break out. Is it possible to determine what the outcome will be? The answer is hard to give, but several highly significant points can be made here that will lay the foundation for a discussion of this problem in later chapters. The out-of-pocket costs(1) of handling traffic for the trucking firm and the railroad are quite different. For this illustration, suppose the out-of-pocket cost for the trucking firm is ninety per cent of total cost and for the railroad is sixty per cent of total cost.(2) If these cost relationships exist, the trucking

(1) Out-of-pocket may be defined as marginal costs or as the expenses the carrier would not have had to meet if it had not transported the additional unit of traffic.


firm cannot reduce its rate very much without impairing its financial condition severely. In fact, if the trucking firm were so anxious to get added traffic that it actually did reduce its rate below the out-of-pocket cost of handling the traffic, the railroad might actually use the motor carrier to haul its traffic because such a shift of traffic to the motor carrier would drive it even more rapidly to financial disaster. If the motor carrier stops short of reducing rates below its out-of-pocket costs, the out-of-pocket costs of sixty per
percent of a lower total unit cost enjoyed by the railroad gives the railroad a tremendous advantage when the lowest figure the motor carrier can intelligently use is ninety per cent of a higher total unit cost. In an all-out war the trucking firm would be at a sharp disadvantage, even if its total unit cost of handling traffic were less than the total cost per unit of traffic handled by the railroad.

The significance of this illustration for a taxation study is that any tax that does not raise the out-of-pocket costs per unit of service provided by both the motor carrier and the railroad by the same amount will change the competitive relationship of the two firms. A change in the real estate tax rate would not affect out-of-pocket costs but is another example of a case where the competitive relationship would change. If the service rates were not raised for either the motor carrier or the railroad, the net revenue would be reduced more for one carrier than for the other. If the service rates were adjusted upward by a flat amount per unit of service sold, then the repercussion would not be the same for both carriers because changes in the volume of traffic would result in different changes in aggregate revenue. Service rate adjustments must be made with a full knowledge of these facts, or the results will not be fair to both carriers; indeed, in the example described, the real estate tax could result in perpetuating the high cost agency - the motor carriers - and create an uneconomic national transpor-
The previous illustration assumes a given demand and given plant unit costs. This is a relatively simple example. Imagine now that the tax imposed is one that applies to electric utilities. What will be its effect on an individual firm? First, let it be assumed that the demand for electricity is not perfectly inelastic. Suppose next that the imposition of the tax necessitates an increase in service rate. The immediate effect will be to reduce the quantity of service demanded. This, in turn, will cause the utility to produce less electricity. If the firm was producing at its low cost rate of production before the tax and the rate adjustment, it will produce at a lower rate and at higher unit costs after the rate increase. In this case the regulatory body must take two factors into account. One is the reduced volume of sales and the other is the higher unit cost of production.

Conventional analysis usually stops here. It simply states that the service rate probably will be increased. The analysis should proceed further. For example, if the electric utility described above finds its capacity is too large for the quantity of service being purchased from it, it may know that a smaller plant operating at its low cost point can produce the quantity of service being demanded of it after the tax for less cost per unit than the present plant operating at less than its low cost rate. The firm may then reduce capacity and thereby keep down its unit cost of
production. (1) The net effect will still be for the unit costs of

(1) It must be kept in mind that the reduction in capacity of the existing plant may not reduce unit costs to the level indicated by the scale unit cost curve because the scale unit cost curve reflects unit costs in the firm that can produce a particular quantity of service most economically. This may represent unit costs in an all-new plant.

production to rise somewhat because of reduced production but the extent of the increase in unit costs will be determined by the shape of a modified scale unit cost curve and not by that of the plant unit cost curve. As a result, the service rate adjustment made by the regulatory body must be based upon the modified scale unit cost curve and not on the plant cost curve. The necessary service rate adjustment may be much less than would be indicated by the plant cost curve. This explanation may be challenged for the reason that it usually takes considerable time to make adjustments in plant capacity. The significance of this time lag varies widely in different industries.

Even though it always takes time to adjust capacity, it takes much more time in some branches of regulated industry than in others. In the case of railroads, the adjustment may take years whereas in the case of motor trucks it may not take more than a single month. (1)

(1) Proposed rulings by the Interstate Commerce Commission may adversely affect this flexibility by prohibiting trip-leasing and making the minimum leasing period thirty days.

The important fact is that the time period required by regulated monopolies to make adjustment in capacity varies widely. Therefore, the capacity adjustment problem becomes a highly significant one,
especially where two regulated monopolies with different adjustment periods are in competition with each other in certain areas or for certain classes of service. The plant unit cost curve may be quite useful for some analysis, but when it is necessary to work out abstractly the probable repercussions of a tax on two regulated monopolies, it is necessary to take into account also the period of time required for adjustments in capacity. Economic theory does not adequately integrate this factor into the system of monopoly analysis.

So far this discussion has demonstrated the effect on unit costs of changes in rates of output within a plant - assuming no lapse of time - and the effect on unit costs of changes in rates of output - assuming output to be in the most economical plant or combination of plants with little lapse of time. There is still a third factor for the regulatory body to take into consideration if the service rate adjustment does not take place immediately following a tax increase. If the service rate adjustment should be delayed several months or a few years, the commission will no doubt wish to take this delay into account and make allowance for any technological changes that have taken place in the industry. Perhaps the cost of production has declined generally for all possible quantities of production. If it has, this factor can be measured to some extent by the historical unit cost curves and consideration given to it on the basis of the direction and rate of change.

OTHER PROBLEMS

It has been stated already that each of these cost concepts will
be developed further. For that reason, the remainder of the present chapter will be devoted to the examination of certain other cost factors that bear upon the discussion of the consequences of taxation of regulated monopolies. The data available to the tax and regulatory authorities are accounting data. Therefore, questions concerning the accuracy and uniformity of the records and reporting are significant. In some branches of the regulated monopoly segment of the economy, the records are kept in accordance with a uniform system of accounts. Under these circumstances, the reports filed with the tax and regulatory commissions are generally complete and accurate. For other branches, the firms are required to file quite simple reports, and they do not give the data necessary for exhaustive economic analysis.

Beyond this basic weakness, there is the problem of getting the division of revenue and expenses that the economist would like to have to work with. Whereas the accountant is interested in a breakdown of expenditures which will enable him to keep the records in accordance with established accounting practice, the economist likes to get expenditures divided among capital, constant and variable costs.

Accelerated write-offs and depreciation allowance adjustments are two post-war problems that make it difficult for the economic researcher to get the data he needs. (1) Whereas the economist seeks

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a measure of the "real" costs or total costs of providing the service, the accountant does not need them. In other words, the accounting records kept by firms do not cover all costs of providing a service. The costs of government subsidies for example, are involved in a study of real costs, and these are not available, or are not available in a form that enables a researcher to determine the amount of a subsidy enjoyed by a particular firm or to measure the effect of a change in the subsidy.

A situation that may confront the Interstate Commerce Commission in the near future provides an example of the difficulties described above. If proposed legislation is passed by Congress, the Commission may find it difficult to determine whether or not the carriers are earning the return on investment to which they are entitled by law. The Interstate Commerce Act, as amended, requires the Commission to take into consideration in rate-making cases, "among other factors," the effect of rates on traffic of the carrier or carriers, of public need for adequate and efficient railway transportation at lowest cost consistent with furnishing service, and of need of revenues sufficient to enable carriers under honest, economical and efficient management to provide such service. (1) The railroads are urging

(1) Interstate Commerce Act, as amended, Section 15 (a) 2.

Congress to change this provision and to remove the portion of the law requiring the Commission to pay attention to the effect of rates on the volume of traffic and to substitute clauses requiring the Commission to consider, among other factors, certain new objectives
which are designed to maintain sound credit and attract equity capital. (1) Commissioner Spawn of the Interstate Commerce Commission

(1) Senate Bill S. 1461.

has called attention to the fact that the bill does not state whether interim rate increases that may be authorized under the proposed amendment should enable all, a majority, an average, a few or only one carrier to attract equity capital. (2)

(2) Testimony before the Senate Interstate Commerce Committee on Senate Bill S. 1641, May 15, 1953.

Of course this provision may not become law, but whether it does or not, it shows how the Commission is always faced with the problem of authorizing service rates at levels that will be fair and reasonable to the public as well as to the carriers. If a particular general service rate increase is large, some carriers may earn high profits while other firms are merely able to survive financially. With a lower rate, however, some firms would fail. What, then, should the Commission do?

The carriers have argued that the Interstate Commerce Act entitled all of them to a fair return. The Commission has not agreed and has not authorized service rates that have permitted every carrier to earn a fair return on its investment. The proposed new amendment might, however, make it mandatory for the Commission to authorize rates designed to preserve the financial status of each and every carrier. This would create a very difficult regulatory problem. The problem may be explained this way. Suppose it is
assumed that a carrier with one million dollars in assets has outstanding only common stock and the amount of such common stock is one million dollars. If the Commission should decide that a six per cent return on investment is a fair return, the carrier is entitled to sixty thousand dollars in earnings after deduction of all expenses. The Commission must then authorize service rates designed to yield these earnings. The carrier is in a position to pay six per cent in dividends on the common stock.

Suppose, on the other hand, that the carrier has outstanding five hundred thousand dollars in three per cent bonds, two hundred and fifty thousand dollars in four per cent preferred stock and two hundred and fifty thousand dollars in common stock. In this case, the earnings available for payment to common stock holders would amount to a fourteen per cent return instead of six per cent. The difficult problem the Commission has to solve is whether or not the capitalization of the carrier is a factor that must be taken into consideration in authorizing service rates. If the Commission retains its policy of setting rates designed to permit carriers generally to earn a reasonable return on invested capital, capitalization is not a factor. If, on the other hand, the Commission either assumes responsibility or is made responsible by law for authorizing service rates that will permit each carrier to attract capital, it has a very difficult problem to solve.

This illustration is grossly over simplified and portrays a problem that is largely regulatory, but it may arise because taxes
create it. The effects of World War II federal taxes on return on investment of regulated monopolies with different capitalization were studied recently and the following conclusion was reached:

"The taxes cannot be viewed as intended to put relatively great burden on consumers with slight benefit to stockholders, merely for the sake of tax collection. Consequently, the regulatory authorities should modify their standard of a "fair return," especially to stockholders on whom the taxes impinge." (1)


**SUMMARY**

This chapter has shown why certain of the assumptions made for conventional monopoly theory cannot be made for regulated monopoly theory. The discussion has revolved about the fact that a regulated monopoly is neither a monopoly nor a competitor. In fact, none of the conventional classifications applies to the "regulated monopoly." As a result, the chapter has shown that any analysis of regulated monopoly must begin with a clear statement of the assumptions. Thereafter, a logical deductive analysis must be made to fit the special circumstances.

Fortunately, the inability of a single set of assumptions to fit all cases does not make regulated monopoly analysis quite as complicated as it might seem. It is simplified immensely because the price or service rate a regulated firm may charge is known. Therefore, when a tax is imposed on such a firm the immediate effect of that tax is to reduce profits by the amount of the tax or to increase losses by the same amount. This statement does not need
to be qualified except to state that the firm is assumed to be genuinely regulated insofar as its price and services are concerned and that the quality of the product or the service cannot or will not be altered.

Therefore, if the regulatory body authorizes the firm to increase - or decrease - its service rates, the old and new prices are known exactly and without delay. This simplifies the researcher's job immensely. This does not imply that the problem suddenly becomes an easy one to solve. It does mean, however, that one factor is partially removed from the list of unknowns. (1) As a result of

(1) Public service firms do often sell some of their service to industrial or other businesses and under those circumstances, the opportunity for promotional pricing is much greater.

This, instead of examining the repercussions of taxes on regulated firms in terms of demand, cost and price, the primary variables are demand and cost. The problem then becomes one of studying what will happen if the service rate is changed from one level to another. This is much simpler than the unregulated monopoly analysis which must recognize the economic effects of demand, costs and price.

The next chapter deals with the probable relationships between demand and cost under regulated monopoly conditions. It seeks a logical point of departure for a discussion of the repercussions that may be expected from the imposition of each of four classes of taxes.
CHAPTER III
MONOPOLY EQUILIBRIUM

This chapter has three objectives. One is to restate the
conventional explanation of monopoly equilibrium as it applies to un-
regulated monopolies operating in a mixed private enterprise system. (1)

(1) Cournot, Austin. Researches into the Mathematical Principles of
the Theory of Wealth. New York: The Macmillan Company, 1927,
Chapter 5.
Garver, Raymond. "The Effect of Taxation on a Monopolist." American
Robinson, Joan. The Economics of Imperfect Competition. London:
Macmillan and Company Limited, 1933, pp. 47-60.
Harrod, R. F. "Doctrines of Imperfect Competition," Quarterly Journal
of Economics, 48 (1933-34), pp. 460-464.
Samuelson, Paul A. Foundations of Economic Analysis. Cambridge:
Wiles, P. "Empirical Research and Marginal Analysis." Economic

The second is to point out some of the important reasons why the
established explanations of monopoly equilibrium do not fit regulated
monopoly situations. And the third is to create models to illustrate
regulated monopoly equilibrium.

UNREGULATED MONOPOLY EQUILIBRIUM

Figure 4 on page 58 illustrates the usual explanation of monopo-
ly equilibrium. It shows that if the demand curves and cost curves
are as portrayed and the firm is free to adjust output and price in
any way it wishes so as to maximize its profits, it will set price
and adjust output to the amounts dictated by the point where marginal
revenue and marginal cost are equal. The statement that the firm
will adjust output to this rate is made on the assumption, of course, that the firm wishes to maximize its profits and knows how to do so. (1) Although in actual instances the last assumption may or may not be true, it is reasonable to expect each firm to take those steps that will tend to maximize its profits. While there may temporarily be reasons for not setting output and price precisely at the points indicated, it seems reasonable to assume that the unregulated monopoly will usually move in that direction as rapidly as expedient. (2)

Among others, Alfred Marshall, Austin Cournot, and Joan Robinson studied the problem of monopoly equilibrium and concluded that a monopoly always tends to set output and price at the point where marginal cost and marginal revenue are equal. Each of them stated or implied that the tendencies assumed above exist and that the primary goal of the monopoly is to make as much profit as possible under the circumstances. Their explanation cannot be utilized for the regulated monopoly for the reason that the assumptions made for unregulated firms are not uniformly applicable to regulated monopoly situations.


Triffin, Robert, op. cit., p. 148.
Therefore, the conclusions reached are not adequate for studies of the taxation of regulated monopolies.

SHORT RUN REGULATED MONOPOLY EQUILIBRIUM

The assumptions that the monopoly is free to adjust output and price when and as it wishes are not valid for the regulated monopoly. The regulated monopoly is obligated to serve all who ask for service and to do so at rates established by the appropriate regulatory body. The public utility, therefore, is not free to maximize monopoly profits.

If, for example, Figure 4 is used to illustrate a regulated monopoly and the established service rate is as shown by the horizontal line designated by the letters SR, the utility will deliver the quantity of service indicated by the intersection of the demand curve (AR) and the service rate line (SR). With production costs as shown by the curve (AC), the firm will collect in revenue only enough to cover its costs.\(^{(1)}\) The restrictions under which a utility operates become clear. The same utility would, if free to do so, restrict output to the rate where marginal revenue and marginal cost are equal and enjoy revenue substantially in excess of its total costs.

\(^{(1)}\) The adjustment of capacity to match quantity demanded would automatically eliminate the problem of excess capacity and marginal pricing. If the plant operates at its low cost rate, and has revenues just equal to expenses, marginal cost pricing problems do not arise unless of course some consumers are charged rates in excess of total average unit cost in order to subsidize other consumers who may then pay rates that are less than the total average unit cost of providing the service they buy. The capacity adjustment concept leads logically to total cost pricing and the abandonment of marginal cost pricing.
In order to show more fully the rigid restrictions under which the utility company operates, Figure 5 on page 62 has been constructed. It shows how the utility is affected by the regulation of the price it may charge and by its obligation to serve all who ask for service. (1)

(1) The utility is obligated to provide service for all who request it under the franchise it possesses and who are willing to pay the rates prescribed by the regulatory commission.

In Figure 5, the lines SRI, SR2, and SR3 represent three possible alternative rates that might be established by the regulatory body. The average revenue, average cost and marginal cost lines are identical to those shown in Figure 4. The key points to keep in mind are that the utility cannot, without the permission of regulatory commission, adjust output or alter price.

If the service rate is assumed to be SRI, and the demand to be as shown by the line AR, the quantity demanded by the consumers will be the amount indicated by the point where the average revenue (AR) and service (SRI) lines cross. Although this service rate permits the utility to collect revenue in excess of total costs, the excess is still less than the amount the utility could earn if it were free to restrict output and raise price to the quantity indicated by the intersection of the marginal revenue and marginal cost lines. Also, although the utility will operate at a rate below the low cost point, it will not operate as far below the low cost point as it would if it were free to make adjustments to maximize its profits. This is a significant difference.
REVENUES AND COSTS PER UNIT OF PRODUCTION
If the service rate is assumed to be SR2, the quantity of service that will be demanded will be greater and the utility will operate at a higher rate of production. In this case it will operate at the rate where its unit cost of production is lowest. And, in addition, its revenue will be just sufficient to cover all costs, including a "normal profit." (This is the same situation as that illustrated in Figure 4.)

The final possibility is for the service rate to be at SR3. This will necessitate a production rate above that at which unit costs of production are lowest and will impair further the firm's financial position with each unit sold. This situation illustrates a particularly unfortunate case because of the fact that even though the firm, when operating at its low cost rate, would be unable to collect enough in revenue to cover costs, it must deliver to its customers aggregate service that exceeds the amount it can produce most economically. It must produce at a rate in excess of the low cost rate and actually dissipate its assets rapidly. This special case will be used later to demonstrate how important it is to know whether, in a given category of regulated industry, the conditions are likely to be such that the firms will be called on to deliver services in excess of, equal to, or less than the amounts where unit costs are at a minimum. It is easy to understand how this situation may arise and exist temporarily. The important fact demonstrated later is that uneconomical situations such as this may continue indefinitely.
The conclusion that must be drawn from the above explanation is that some of the assumptions made in conventional text-book analysis are not applicable to regulated monopoly and that the differences are highly significant. Whereas the unregulated monopoly always tends toward a rate of output and a price indicated by the intersection of the marginal revenue and marginal cost curves, the regulated monopoly has no such tendency. The price it can charge is determined by the appropriate public regulatory commission, and the output is determined by the consumers' demand for the service at the established rate. The concept of equilibrium in the latter case is thus quite different from the equilibrium concept for the unregulated monopoly.

Also, whereas the usual analysis describes the unregulated monopoly as one that always operates at less than its low cost rate, the regulated monopoly may operate at any point within its range of output. It may, under some circumstances, operate at less than the low cost point but under other circumstances it may operate at the low cost point or beyond it. In each case, the firm may be in equilibrium and operate there for an indefinite period.

By way of conclusion, it must be made clear that Figure 5 shows only three of an infinite number of possible combinations of revenue and cost curves. Not only may the regulated monopoly be called upon to produce at any rate within its capacity, but the regulated firm must continue to produce at those rates even though the quantity of service it must deliver may be such that the revenue collected is not sufficient to cover total costs of production.
The question of whether the conventional explanation of economic equilibrium is a short-run or long-run concept has not as yet, been raised. Actually, the curves used in Figures 4 and 5 are the usual timeless concepts. The curves in all the figures used so far represent a set of conditions as of a given time and place. They illustrate the short-run analysis. The average revenue line is defined as the line representing a schedule of alternative quantities that will be demanded at all possible prices at a given time and place. The points along the marginal revenue, average cost and marginal cost curves are also defined as representing alternative conditions at a given time and place.

The conclusion reached by way of the short-run analysis is that the regulated monopoly equilibrium is a dictated equilibrium inasmuch as the regulatory commission determines what service rate the firm may charge\(^{(1)}\) and the public determines what quantity of service the firm must produce. The firm has no direct and unrestricted control over either price or output in the usual sense. Stated in graphic terminology, the output is determined by the intersection of the average revenue and the service rate curves; not by the intersection of the marginal revenue and marginal cost curves. The outcome may be to yield the firm a profit in excess of the minimum necessary to prosper financially or it may be less than that. The amount the firm

\(^{(1)}\) The degree of control exercised over service rates is not uniform throughout the regulated segment of the economy. In all instances, the firm has some latitude but even so the restrictions are either actually or potentially quite comprehensive.
earns depends on many factors, including those of public regulation and taxation.

Probably the most significant point developed above is that the regulated monopoly may operate at a rate below, at or above that where unit costs of production are lowest. Contrast this with the explanation given of the unregulated monopoly. In that case the operating rate is explained to be below (to the left of) the low cost point. Furthermore, the conventional analysis always shows the monopoly to be one that is earning a monopoly profit - a profit in excess of the minimum it must have to endure financially on a year-in-year-out basis. Neither of these conditions are uniformly applicable to the regulated monopoly.

The above paragraphs have explained some of the important reasons for stating that conventional monopoly analysis does not make adequate provision for all possible equilibrium positions of "regulated" monopolies. In fact the usual equilibrium analysis does not apply to most regulated monopoly situations. If applicable at all, conventional theory fits only the occasional special case.

**LONG RUN REGULATED MONOPOLY EQUILIBRIUM**

By way of transition from a discussion of short-run analysis to one of long-run analysis, it may be helpful to restate the basic reason why existing monopoly theory does not provide a foundation for a discussion of regulated monopoly taxation. Regulated monopoly firms do not enjoy the freedoms that the unregulated monopoly firms do. The unregulated firm is free at any and all times to alter out-
put and price in any way it sees fit so as to maximize its profit with the plant it has. A utility firm, on the other hand is not free to adjust its price or its output. No price adjustments can be made without the prior approval of the appropriate public regulatory body even though the utility may be operating at a rate either above or below the most profitable one. The only adjustment the regulated firm can make is a capacity adjustment. That is, it may adjust capacity to the quantity demanded of it by the consumers. Beyond that it cannot go. It is not free to make short-run output or price adjustments. (1)

(1) Firms may use promotional rates but if the firm has its capacity adjusted to match exactly the quantity demanded discriminatory pricing would tend to disappear - at least in the marginal cost pricing sense. Service rate schedules would tend to reflect full cost pricing.

The remainder of this chapter will be devoted to the construction of a set of models that illustrate the equilibrium positions toward which public service corporations tend, in the long-run, in a mixed private enterprise economy. With these theoretical tools available it will be possible to proceed to an examination of the economic consequences of the taxation of public service corporations.

Figure 6 on page 68 illustrates the long-run concept of regulated monopoly equilibrium for profit-making, marginal and loss-suffering firms. For each of the plant unit cost curves, it will be noted that the low point on the average unit cost curve coincides with the rate of output indicated by the point where the average revenue and service rate lines cross. This common point illustrates the relation-
Figure 6

REVENUES AND COSTS PER UNIT OF PRODUCTION

[Graph showing revenues and costs per unit of production with labels AC3 (Plant 3), AC2 (Plant 2), AC1 (Plant 1), MC3, MC2, MC1]
ship between revenue and cost curves toward which regulated monopo-
  lities will tend in the long-run. And they will act promptly to
  reach this point so that each will be doing the best it can - profit-
  wise - under the circumstances. The firm illustrated as Plant 1 will
  maximize its profits with this plant. The firm represented as Plant
  2 will neither enjoy a monopoly profit nor suffer a loss. It will
  just be able to survive financially.

  The Plant 3 unit cost curve portrays the loss-suffering firm.
  This firm is not breaking even in the economic sense. That is, it is
  not collecting enough revenue to cover all costs including payment
  of minimum adequate dividends to stockholders. The firm may, however,
  show a profit in the accounting sense and may actually pay income
  taxes. For this discussion, however, the firm represented as Plant
  3 will be considered to be a loss-suffering firm. It will, neverthe-
  less, be treated as representative of many operating utilities and
  will be given the same consideration in the discussions that follow
  as the profit-making and marginal monopolies.

  Attention is called here to an assumption made in connection
  with all the curves on Figure 6. This assumption is that each
  utility represented has been able to adjust its capacity to the amount
  the consumers chose to demand at the established rate. This may or
  may not be true and for that reason a full discussion will be made
  later of monopoly equilibrium when the character of the production
  process is such that this neat and precise adjustment of capacity
  to quantity demanded cannot be made. For those cases, however, where
capacity can be adjusted to fit exactly the quantity demanded, the curves on Figure 6 are applicable.

Figure 7 on page 71 represents another set of common circumstances. In this case, it is assumed that the lowest possible unit cost of production is the same in any one of a rather wide range of plant sizes or capacities. It is assumed that the unit costs of production do not change as plant capacities change. It assumes that there are no economies resulting from the use of larger numbers of the units of one or more factors of production in conjunction with larger numbers of the units of the other factors of production. (1)


Although it might be argued that under such circumstances, the number of plants would increase and the result would be a constant cost situation, in the regulated industry the plant size may be increased instead. The conclusion to be drawn from this illustration is that, in the long-run, a regulated monopoly, when operating under conditions where capacity can be adjusted to meet exactly the quantity of its services demanded, will be in equilibrium when it is operating at its low cost point. Under these circumstances, equilibrium is always where the utility is operating at its lowest unit cost; any other rate is only a temporary one - a short-run equilibrium.

The comments made regarding the conditions illustrated in Figure 7 are equally valid when the service rate is either above or below the level shown. It is true, however, that if the service rate is
above the level shown on Figure 7, the utility will be enjoying a profit in excess of the minimum necessary to enable the firm to survive indefinitely, and if the service rate is below that shown on the graph, the monopoly will not be able to cover all costs, including a satisfactory return on investment.

From Figure 7 it may be concluded that conventional monopoly equilibrium does not provide for cases such as these. In this study, utilities that fit the circumstances described here will always be assumed in the long run to be operating at their respective low cost rates, regardless of whether they are enjoying above normal, normal or below normal profits.

Figure 8 on page 73 is in some respects similar to Figure 7. It contains curves illustrating three plants, each with different plant capacities. Each also has identical unit costs of production when operating at its respective low cost point. These cases differ, however, from those shown earlier in that it is assumed that the capacities cannot be adjusted to fit exactly every possible quantity demanded. Here it is assumed that for any quantity between the quantity at which the smallest plant (Plant 1) operates at its low cost point and the quantity at which the largest plant (Plant 3) operates at its low cost point, only one alternative plant (Plant 2) with costs as shown is possible. For some quantities it (Plant 2) would have costs lower than those of either Plant 1 or Plant 3. In other words, any quantity between the low cost point for Plant 3 can be produced for less by either Plants 1, 2 or 3 than by any other plant that might
Quantity of Production

Revenues and Costs per Unit of Production

Figure 3

Revenues and Costs per Unit

Plants 1, 2, and 3

AP1, AR1, AR3

MC1

MC2

MC3

MO2

MO1

MO3

Plants (1), (2), (3)
be constructed to produce the quantities described.

If the quantity demanded is assumed to be where the average revenue line two (AR2) and the service rate (SR) line cross, the unit cost of production for that quantity will be the lowest in Plant 2 with the average cost curve shown as (AC2) and will be so when Plant 2 is operating at its lowest cost point.

If, on the other hand, the quantity demanded is taken to be where the average revenue line three (AR3) and the service rate line cross, the unit cost of production of that quantity will be higher because the most economical means of producing that quantity will also be in Plant 2 but at a point beyond the lowest point on the cost curve. A third possibility is that the quantity demanded will be where the average revenue line one (AR1) and the service rate line cross. In this case, the most economical means of producing the quantity will be in Plant 2 when it is operating at a rate below its low cost point. An infinite number of other quantities may be assumed to be demanded. The explanation made already indicates how it is possible to determine what the unit cost will be in any case.

In conclusion, this diagram demonstrates how regulated monopoly equilibrium can occur at a rate of production that is either less than, equal to, or greater than the rates where the unit cost of production is lowest.

Other diagrams could be drawn to illustrate the possible monopoly equilibrium points for monopoly profit making monopolies and for loss-suffering monopolies. In these cases also, if the assumptions made
earlier regarding the plants shown in Figure 8 are retained, it could be shown that equilibrium for the firms need not be reached at some rate less than the low cost point as described by conventional theory. Equilibrium may be reached there, but it may also be reached at rates equal to the optimum or beyond it. It seems safe to assume that equilibrium is no more likely to occur at some point below the lowest cost point than it is at any of an infinite number of points beyond it. One other conclusion likewise appears clear: If the firm is not operating at its low cost point to produce the quantity being demanded of it, there are two possible explanations. One is that the firm has not had time to alter its capacity (i.e., this is a short-run equilibrium situation), and the other is that the firm for practical reasons cannot adjust its capacity.

Figure 9 on page 76 is included here to consolidate some of the concepts that have been set forth separately in Figures 4 through 8 and to bring the illustrations nearer to actual conditions in regulated industries. In this figure, Plant 1 is relatively small, and even when operating at its low cost point has a higher unit cost of production than Plant 2. Plant 2 is considerably larger and has lower unit costs of production when operating at its most efficient rate.

Taken together then and under the conditions existing at a given time and at a given place, the unit cost of producing the particular utility service in smaller quantities is higher than the cost of producing it in larger quantities. Attention is called again to the fact that this figure and all the others have represented unit costs of
production for different quantities at a given time and place. No consideration has been given and none of the figures is intended to show any of the possible effects of technological improvements upon costs over time. That is another problem.

Plant 3 is a large plant and has higher unit costs than Plant 2 has when it is operating at its low cost point of production. This plant is included to illustrate the fact that in the utility industry, plants may become so large that they are uneconomical.

If it is assumed that capacities can be adjusted to fit exactly the quantity demanded, then for long-run analysis each of the plants (1, 2, and 3) would always be shown to be operating at its low cost point. In the short-run, of course, they might not.

Figure 10 on page 78 is identical to Figure 9 in so far as the cost curves are concerned. The revenue lines for Plants 1 and 3, however, are different. The revenue lines have been changed so as to illustrate that the firms may actually operate at rates below, equal to or above the low cost points if the plant capacities cannot be adjusted to produce exactly the quantity demanded when operating at the low cost point.

In the case of Plant 1, the quantity demanded at the established service rate is considerably below the amount the firm can produce most economically. Therefore Plant 1 will operate at less than its low cost point.

Plant 2 is shown to be operating at its most economical rate, but this neat and precise ideal situation might be destroyed if the
regulatory body were either to raise or lower the service rate. If the service rate were raised, the plant would instantly sell less than enough to utilize its capacity to the point where unit costs are minimized, assuming some elasticity of demand of course. If the service rate were lowered, the plant would operate at a rate beyond its low cost point, at least temporarily.

Whether or not the capacity would be adjusted to fit exactly the quantity demanded would depend on whether or not such adjustment were possible as a practical matter.

With demand (AR3) as shown, Plant 3 in Figure 10 is being called on to operate beyond its low cost point. Under the circumstances assumed to exist, this situation might very well prevail for an indefinite period of time. As long as it continues to prevail, of course, revenue from the service sold will not cover costs.

**SUMMARY**

Figure 11 on page 80 is designed to bring together in one graph examples of the possible demand, service rate and cost curve relationships illustrated in Figures 4 through 10. Although it must be recognized that under actual conditions the number of possible alternative combinations of demand, service rate and cost curves is infinite, in any given industry five or less might cover all possible combinations and even if there were more, those shown here are representative of the other possibilities.

Each of the five curves is assumed to represent one plant capable of producing any quantity within a considerable range of outputs. The
five plants, taken together, represent the alternatives by which a rather wide range of quantities can be produced. In other words, the five plants shown may be used to represent a case where these plants are the only ones that can be constructed to produce most economically any of the quantities between the low cost point of the smallest plant and the low cost point of the largest plant.

Figure 11 illustrates a condition where the character of the industry is such that plants cannot be constructed to produce every possible quantity when operating at the low point on their cost curves but can be built in rather large increments to supply any quantity demanded even though a plant may not be operating at the low cost point when delivering certain quantities. (1)

(1) In cases where the capacity can be adjusted to meet exactly the quantity demanded, it may be assumed for the purposes of long-run analysis that at any given time and place the firm will be operating at its low cost point and producing the service at the lowest possible unit cost under the circumstances.

Attention is called to the fact that as the capacity increases from that represented by the smallest plant to those shown in the next three larger sizes, unit costs tend to decline. Beyond the fourth, however, average unit costs begin to rise again. In general, then, as the plants increase in size, unit costs decline up to a point. Beyond some point, however, as capacity rises unit costs
This condition may actually arise despite the fact that the utility company might consider building a second plant rather than enlarge the first one. Although the construction of a second plant may, under some circumstances, be the best solution to the problem, under other circumstances it may not be. For example, it may be necessary to operate a rather large plant in order to benefit from any substantial economies of scale, and when one large plant becomes so large that to enlarge it further would raise unit costs, it may still be more economical to increase its size a little more than to build a small one to supplement the output of the large one. In this case, to build a small plant to augment the output of the big plant might result in higher average unit costs of total production in both plants than the unit costs of production in the enlarged single plant.

Therefore, in order to identify the lowest cost at which a given output can be produced, it is simply necessary to find the lowest point on any one of the five cost curves corresponding to the particular output sought. All possible outputs are shown by the heavy scalloped curve which is a curve made up of portions of all five curves.

Assuming the costs of production to be as represented by this heavy line, it is easy to understand how production may take place in any one of the five hypothetical plants and to see how the output may be at a rate below, equal to, or above the low cost point. The critical factors will be the demand and the service rate. If the demand and service rate lines cross at a point which dictates a rate of production that can be most economically produced in a plant when it is operating at less than its low cost point, this will be the equilibrium rate at which the plant will be operated, perhaps indefinitely, or until demand, costs, or the service rate change. If, on the other
hand, the quantity demanded is an amount that can be most economical-ly produced by operating beyond the low cost point in some one plant, that will become the equilibrium rate. The third possibility is that the demand line and service rate line will intersect at the low point on the average cost line. Under those circumstances, plant capacity will fit exactly the demand, and equilibrium will occur at the plant's most economical rate of production.

The illustrations and explanations in this chapter have been used to show why established monopoly equilibrium theory is not satisfactory for use as a point of departure for a discussion of regulated monopoly taxation. They have also been used to show the possible equilibrium relationships among demand, service rate and cost that may exist at any time a tax is imposed upon a utility.

The conclusion reached is that equilibrium for a regulated monopoly may occur when the plant is being operated at a rate in excess of, equal to or less than the low cost point of production. These equilibrium positions may represent either short run or long run situations. They may occur when the utility is making an attractive profit, just enough to meet all expenses or less than enough to pay all expenses. In the first case the firm will prosper financially; in the second, it will have no serious financial difficulties; and in the third case, it will fail--at least ultimately.

The illustrations in this chapter will be used in succeeding chapters as a point of departure for a discussion of the possible economic consequences of the imposition of taxes on regulated monopoly firms.
APPENDIX A TO CHAPTER III
SOME COMMENTS ABOUT UNREGULATED AND REGULATED MONOPOLY THEORY

The critical examination of monopoly theory made in Chapter III raises several questions about the adequacy of unregulated monopoly theory. For example, why does monopoly theory assume that equilibrium occurs at an operating rate below (to the left of) the low cost point? Also, is a monopoly always able to produce a given quantity of service for less cost per unit in a large plant operating at less than the low cost rate than it can in a smaller plant operating at the low cost rate or beyond?

While it is clearly not correct to say that it is never cheaper to produce a given quantity in a large plant operating at a rate that is lower than its lowest cost rate than in a smaller plant operating at optimum or beyond, neither does it appear correct to assume that this is always so or - for that matter - that it usually is. Unless the unit cost of production declines rather sharply as plant capacity rises, it appears that the monopolist is quite likely to find it more profitable to build a plant - or to adjust the capacity of an existing plant - to produce the exact quantity demanded when operating at the low cost rate than any other size than to operate at a rate below the low cost rate with a plant possessing excess capacity.

In the figures used in Chapter III, it will be recalled that the relationship among demand, service rate and cost toward which all

regulated firms tend is one where the service rate and average revenue lines cross and where the firm has adjusted capacity to meet demand when it is operating at the low cost point. If this relationship is the most desirable one for the regulated firm, it would seem to be wise for the unregulated monopoly to try to adjust its capacity so as to produce the quantity demanded at the lowest unit cost? Monopoly theory assumes there is always a low cost rate - or perhaps range - of operations for any plant and that there is one best size of plant for a given output. Under the circumstances, then, there seems to be a solid basis for concluding that an unregulated monopoly will tend to adjust capacity to a rate that will be no greater than the quantity the consumers demand at the price the monopoly decides to charge for its product. In fact, it seems likely that the tendency described above is universal among monopolies, not among regulated monopolies only.

Motor carriers, bus companies and airlines utilize relatively small units of durable capital goods and can adjust capacity rather closely and promptly to the quantity of service demanded of them. For example, if a motor carrier finds that it needs slightly more capacity, it can either exchange one or more of its trailers for a larger one or, if necessary, purchase another tractor-trailer combination. Similar adjustments can be made by unregulated firms selling a differentiated product. In many instances, the trucking firm acquires the additional capacity by means of a short term contract or lease with another carrier for the additional equipment. Bus companies and airlines
follow much the same practice. Gas and electric public service companies, too, tend to adjust capacity to demand, but require more time to complete those adjustments. In these instances, it seems logical to assume that management understands the potential benefits of adjusting capacity to demand. Furthermore, contrary to the explanation usually given, it is possible for an electric company to install and utilize a combination of power production equipment with various rated capacities to produce almost exactly the electric energy demanded of it by its consumers. If excess capacity exists, it is very likely because the firm has deliberately over-expanded to meet anticipated near future demand. Gas companies, too, can utilize storage tanks, various pipe sizes and pressures so as to fit almost perfectly the plant capacity to the demand.

It seems logical to conclude, then, that the usual analysis of monopolies and the assumption of almost perpetual excess capacity is unrealistic in many industries. The explanation ought, instead, to point out the opportunity for many monopoly firms to adjust capacity rather closely to demand and to emphasize that such adjustment is probably made promptly wherever it is possible to do.

Also, it seems logical to assume that any monopoly firm - either regulated or unregulated - attempts to adjust capacity to meet the quantity demanded of it most of the time and then operates at a rate in excess of the low cost rate during periods of emergency. It seems quite possible that the regulated monopolies were generally operating considerably beyond the low cost rate of operations during World War
II. Many were unable to expand capacity even though they may have wanted to do so. Others did not do so because they felt the business volume would decline to amounts approaching pre-war levels after the war.

Therefore, rather than assume that regulated firms adjust capacity so as to equal demand at peak business periods, it seems more sensible and likely that firms adjust capacity to meet the quantity demanded the greater part of the time and take care of demand in excess of that quantity by operating in excess of the low cost rate on the unit cost curve. This would seem further to weaken the established theory that monopolies tend always to operate at a rate below the low cost point. Although it might be argued that it is physically impossible for a utility to produce much beyond the low cost rate and therefore to handle the emergency periods, this argument would not be universally applicable and is perhaps untrue in a significant portion of the cases.

Another unrealistic feature of monopoly theory is that a monopoly is always represented as a profit making monopoly - that is, a firm making a profit in excess of the minimum necessary to attract capital when and if needed for expansion. Does the established monopoly theory assume that if the monopoly is only earning a "normal" profit it really is not a monopoly but is instead a competitive firm? This certainly does not seem to be the case. It appears that established monopoly theory either has not made clear its assumptions or the theory is not generally adequate.
Perhaps the failure to pay more attention to the above factors in regulated monopoly literature has been due to the inability of railroads to make the neat and precise adjustments suggested above and to the abundance of material written about "economies of mass production" in terms of steam railroad companies. (1)

Chapter III lays the foundation for determining the economic consequences of the imposition of a tax by showing the revenue and cost relationships that may exist for a regulated monopoly firm at the time the tax is imposed. This chapter will build on that foundation.

With a knowledge of the characteristics of the industry and of the alternative equilibrium positions of a firm, some useful conclusions can be reached about the effects on the firm and the public of the imposition of a lump sum tax. These conclusions include indications of the service rate adjustments the regulatory body may be called upon to make under a variety of circumstances.

THE EFFECTS OF THE TAX WHERE EQUILIBRIUM OCCURS AT THE LOW COST RATE OF PRODUCTION

Figure 12 on page 90 illustrates a hypothetical situation where equilibrium for the regulated firm occurs at the low cost rate of production. That is, the quantity demanded at the established price is equal to the quantity the firm can produce when it is operating at its low cost point on the cost curve. This diagram has been especially designed to illustrate a regulated firm that is in equilibrium when operating at its low cost rate of production. Such a situation may arise under actual conditions either because of a short-run coincidence or as a result of a long-run adjustment of capacity to quantity demanded. The reasons are not particularly important here. The vital point is that the firm illustrated is in equilibrium and
Figure 12

REVENUES AND COSTS PER UNIT OF PRODUCTION

[Graph showing revenues and costs per unit of production with curves for AC, AR, MR, SR1, SR2, and MC.]
cannot improve its profit as long as the positions of the service rate, the demand and the costs of production are what they are.

The solid lines represent the cost and revenue curves. The lower broken curve labeled SRAT1 represents the net service rate the firm would collect if a lump sum tax were imposed. The curve declines sharply as it moves to the left because the portion of the total rate that is taken by taxes is higher for a low rate of production than it is for a high rate. In other words, as the rate of production falls, the portion of the service rate absorbed by the tax increases.

An examination of the relationship between the net service rate (SRAT1) line and the average cost (AC) line shows clearly how the firm is forced into a sub-marginal position the instant the tax is imposed. Unless the regulatory body takes action to raise the service rate, the firm will fail to collect revenue sufficient to cover all costs including a "normal" profit. The amount by which the revenues of the firm are reduced is the exact amount of the tax.

It is easy to see how the positions of the regulated monopoly, on the one hand, and the unregulated monopoly, on the other, differ by observing the effects of the tax on profits of the regulated monopoly and the effect of the same tax on an identical unregulated firm which had previously adjusted its output and price to maximize its profit.

If the cost curves, the average revenue and marginal revenue lines of Figure 12 are used to represent the unregulated firm, the effect of the lump sum tax would be to reduce the monopoly profit
by the amount of the tax. This would be true because before the imposition of the tax, the firm would operate at a rate dictated by the intersection of the marginal revenue and marginal cost curves. After the tax, it would operate at the same rate because marginal revenue and marginal cost are not affected. Thus, it would be unable to benefit by raising its price (service rate). In this case the effect of the tax is to reduce the firm's monopoly profit. It cannot avoid these consequences.

In the case of the regulated firm, however, the effect of the tax on profits will be the same except for the fact that the regulated firm may be able, if permitted to do so, to raise its service rate and regain its profit position. This will be possible if the firm, prior to the imposition of the tax, was charging a rate substantially below the one at which it might have maximized its profits. The regulated firm, therefore, will very likely appeal to the regulatory commission for permission to raise its service rates. If a rate increase is authorized by the commission, the regulated firm may earn profits equal to or even greater than those it was earning prior to the imposition of the tax. This restoration of profits is possible, of course, only if the service rate increase does not destroy the market for the service.

If conditions are as illustrated in Figure 12 the service rate increase will reduce the quantity of service demanded and will, in fact, bring production nearer to the level chosen by the unregulated firm in order to maximize profits. If the service rate were raised far enough - to the point where marginal revenue and mar-
original cost are equal - the regulated firm and the unregulated firm would reach the same position relative to profits and production.

Attention is called to the fact that the assumptions made - or implied - in connection with this discussion of the effects of the tax on the regulated firm differ greatly from those for the unregulated firm. Whereas the regulated monopoly was assumed to possess the capacity it did and to operate at the rate it did either because it had adjusted capacity to meet exactly the quantity demanded or was accidentally operating at the low cost rate of production, the unregulated firm was assumed to be operating at the rate it did simply because that rate is the rate where marginal revenue and marginal cost are equal. In other words, the regulated firm had the capacity it did because it had adjusted capacity to meet the quantity demanded - the only adjustment it could make - whereas the unregulated firm was operating at less than its low cost rate in order to maximize its profits - the point where marginal revenue and marginal cost are equal. This is highly significant and adds evidence to the assertion made earlier that conventional monopoly theory does not fit the regulated monopoly situation.

For this discussion it is assumed that the regulated monopoly shown in Figure 12 had made capacity adjustments to enable it to meet the demand and that it was able to make adjustments permitting it to produce the exact quantity demanded at the established service rate and to do so at the lowest unit cost. It is considered to be in economic equilibrium.
The conclusions that may be drawn under these circumstances are that if a lump sum tax is imposed on a regulated utility such as the one illustrated in Figure 12, the revenues of the firm will be reduced by an amount exactly equal to the amount of the tax. Until the regulatory body gives the firm permission to raise its service rate it bears the full burden of the tax. If demand - as illustrated by the demand curve - and the costs of production do not change, the firm would ultimately suffer disastrous financial hardship.\(^{(1)}\)

\(^{(1)}\) Factors that may intensify or relieve these hardships will be discussed at the end of the chapter.

It is likely, however, that the firm will ask the regulatory body for permission to raise the service rate. If the request is denied the firm will have its profits reduced by the amount of the tax. If, on the other hand, the regulatory body gives the firm permission to increase its service rates, the economic consequences will depend on several factors. The best way, perhaps, to indicate the outcome is to examine the effects of a tax increase in each of several hypothetical cases.

Suppose, for example, that the regulatory body authorizes a service rate increase equal to the total amount of the tax divided by the quantity of service produced. Under these circumstances, the profits of the firm will be reduced and the firm will be in a poorer position - revenue and cost-wise - despite the upward adjustment in service rate. The reasons for the impairment of the earnings of the firm are these. Although the service rate will rise from the SR1 position to the SR2 position, the net service rate will be as
indicated by SRAT2. The demand curve (AR), however, shows that if the service rate is raised from SR1 to SR2, the quantity demanded by the customers will decline to that indicated by the intersection of the AR and SR2 lines.

If the quantity demanded declines, the firm will produce at a lower rate and when the plant is operated at a lower rate, the unit costs of production will be higher. The firm will then be adversely affected in two ways. One is that the quantity demanded and sold will decline, thereby reducing the net service rate due to the lower quantity sold. The other is that the firm will be operating at less than the lowest cost rate and will have higher unit costs of production. Taken together, these factors will cause the profits to decline even though the service rate was increased by an amount that might, at first, appear to be adequate to restore profit to the pre-tax level.

Although these short-run effects of the tax on the firm are clear, there are several other factors to be considered. One is the effect of the service rate increase on the consumer. Another is the possibility that the firm may be able to take steps, over a period of time, that will relieve the adverse repercussions of the tax. In the first case it is clear that the consuming public does not have much opportunity to avoid paying the higher price for the service it buys. It can - as the demand curve shows it will - reduce the quantity of service it buys but since the demand is quite inelastic the reduction will not be large. As a result, the smaller quantity, purchased at the higher price, will actually cost more
total dollars than the larger quantity purchased before the service rate increase. The consuming public, therefore, pays more dollars for less service and must make budget adjustments accordingly. This may cause alterations in other purchases, savings or investment and even perhaps indirectly cause reductions in employment, wage rates and the general plane of living. Whether or not these changes actually take place will depend on many factors, some of which have been discussed in Chapter II and others of which will be considered in Chapter VII.

Although it has already been shown clearly what the immediate consequences of the imposition of a lump sum tax are likely to be on profits of the firm, it must be borne in mind that the firm will seek other ways to minimize the adverse effect of tax. In this connection it may be possible to reduce plant capacity and thereby reduce unit costs of production. Clearly, if the production rate is reduced from the quantity dictated by the intersection of the AR and SR1 lines to that dictated by the intersection of the AR and SR2 lines, the cost per unit in the existing plant will be higher when operating at the lower rate. It may be that the firm cannot do better than this, but it is also possible that if the capacity of the firm is reduced, the new smaller plant, when operating at its low cost rate, will be able to produce the smaller quantity now demanded at less cost per unit than the larger plant can.

If the smaller plant can produce this quantity for lower unit costs, the firm will take steps promptly to reduce capacity and partially offset the adverse effects on profits of the imposition of the
tax. Whether the new cost per unit will be as low as that of the larger plant operating at its low cost point will depend on whether or not the industry is subject to economies of mass production and other factors. If it is subject to such economies, a reduction of capacity will only partly offset the adverse effects - costwise - of the smaller volume of sales.

In terms of the "plant unit cost curve" and the "scale unit cost curve" explained in Chapter II, the firm may find it wise to reduce the capacity of the plant it possesses. After adjusting its capacity, the new smaller plant will operate at its low cost rate when it produces the new lower quantity of service demanded and thereby produce the service for less cost per unit than in the larger plant. Although the "scale unit cost curve" previously described shows the unit cost of producing each of a wide range of quantities in a number of alternative plants it reflects for each quantity the unit costs which would occur in a plant or plants designed and built to produce precisely those quantities. In the case being discussed here the circumstances are different. In this case a large plant is being altered to produce the smaller quantity. It is a compromise adjustment and it is probable that the modified plant will be unable to produce the new lower quantity of service for a unit cost as low as that at which it would be possible to produce the quantity in a completely new plant. Therefore, in order to make an estimate of the long run economic consequences of the imposition of the tax both the "scale unit cost curve" and "historical unit cost curve" must be taken into consideration along with the "plant unit cost curve." This makes
the problem of determining the probable economic consequences of im-
position of a lump sum tax a difficult one. Its answer depends on
the effect on unit costs of modifying a large plant to produce a
smaller quantity rather than on the cost of producing the smaller
quantity in a plant built explicitly to produce that quantity. None
of the cost curves described in Chapter II can be used directly to
give an answer to this question.

But this is a long run adjustment. In the short run the effects
of the tax on the firm will depend largely on the relationship of
the revenue curves to the cost curves, the amount of the tax, the
degree of elasticity of demand, and the shape of the cost curve.
With the service rate changes as shown in Figure 12, if the demand
is elastic and the firm has a rather narrow range within which it
can operate economically, the adverse effects of the tax - at
least in the short run - would be severe. If, on the other hand,
demand is rather inelastic and the possible range of efficient output rather wide, the financial status of the firm would be injured
less severely by the tax. Nevertheless it would be injured if the
revenue prior to the imposition of the tax were just sufficient to
cover costs.

Similar figures could be drawn for firms that were unable to
cover costs and for others that were more than able to do so. The
analysis would be carried out in the same way. In the first case,
losses would be increased and in the second, profits would be reduced.
The extent to which losses would be increased or profits reduced
would depend on the factors described in the above illustration.
Figure 12 illustrates a very simple practical example. The conclusions reached are significant and useful, yet this example represents only one of an infinite number of possible situations. For that reason, Figures 13, 14, and 15 have been constructed to provide additional illustrations. In Figure 13 on page 100 the regulated firm is already operating at less than the lowest cost rate and is making a profit in excess of the minimum it would accept and on which it could prosper. This firm may be operating at the restricted rate either because it would be impossible to construct a plant to provide the exact quantity demanded at a lower unit cost or because the adjustment of capacity to demand has not yet been completed. The important fact is that if a lump sum tax is imposed upon this firm, the probable consequences will be quite different from those shown for the firm in Figure 12. In this case the firm is already operating at a rate considerably below the low cost point and at a rate where unit costs of production are notably higher than they would be if the firm were producing a greater output. As a result, even though when the tax is first imposed, the monopoly profit will be reduced by the exact amount of the tax, if the firm is authorized to increase its service rate the resulting reduction in quantity demanded may be accompanied by a sharp increase in unit costs and the firm may suffer a severe reduction in monopoly profit or even its complete eradication.

This statement may be verified by referring to Figure 13 which
Figure 13

REVENUES AND COSTS PER UNIT OF PRODUCTION
shows that if the service rate (SR1) is raised to the position of (SR2), the quantity demanded will be reduced to such an extent that the net service rate (SRAT2) will exceed by only a small amount the unit cost of production of the reduced quantity. In fact, if the demand were slightly more elastic or the cost curve slightly more V-shaped, or both, the firm might not be able to collect enough revenue - net after the tax - to cover expenses. Therefore, even though this firm, like that in Figure 12 will suffer from the imposition of the tax by an initial profit reduction of an amount exactly equal to the tax, the effects of a rate adjustment are different. In this case, any service rate adjustment that the regulatory commission may authorize - no matter how large or small - will not restore to the firm its original profit position. If conditions are as illustrated in Figure 13, the commission is unable to do so. In this case the firm is bound to suffer. Whether in other cases a firm will suffer or benefit depends on the relationship among the same factors as those stated in connection with the explanation of Figure 12.

Figure 14 on page 102 illustrates how a firm may benefit if, after the imposition of the tax, a higher service rate is authorized. In this case, the demand is rather inelastic whereas demand for the service offered by the firm shown in Figure 13 was elastic. Also, the slope of the cost curve in Figure 13 was much steeper at the point of output. As a result of these two variations, an increase in service rate per unit by an amount equal to the tax per unit leaves this firm in a position where the difference between the net service rate
Figure 14

REVENUES AND COSTS PER UNIT OF PRODUCTION
and the unit cost of production is smaller than it was before the tax but considerably greater than it was after the imposition of the tax and before the upward adjustment in the service rate. The point to bear in mind is that under the circumstances assumed for Figures 13 and 14, even though both firms will initially suffer a reduction in monopoly profit by exactly the amount of the tax, the ultimate repercussions may be to increase, leave unchanged or reduce profits.

It is quite likely that the firm upon which increased taxes have been imposed will apply to the regulatory body at once for an upward service rate adjustment. This application may lead to an investigation of profits, and the regulatory body may decide not to authorize the firm to raise rates. In such a case the profits of the firm are reduced by the amount of the tax. If, on the other hand, the regulatory commission believes the profit earned by the utility before the tax was fair and reasonable and wishes to authorize action that will return the carrier to its original profit position, it may be difficult or even impossible to do so.

In Figure 13, if the service rate is raised from SR1 to SR2 the unit costs will rise by an even greater amount by reason of a reduction in output. Under these circumstances it is impossible for the commission to restore to the company its original level of profits. In fact, the firm will be better off to absorb the tax and not ask for a service rate increase. In Figure 14, if the regulatory body authorizes a service rate increase equal to the tax, the profit position will be only partially restored.
Figures 13 and 14 emphasize how it is that sometimes the profit positions of the firms cannot be restored and how profits may, in fact, be eradicated. It is important to recognize from these illustrations that the consequences of a tax cannot be forecast unless all the pertinent facts are known. Under certain circumstances, taxes designed to bring in revenue may destroy the taxpayer rather than place on him a part of the costs of government. Illustrations like those developed here show how misleading it is to declare that the consequences of taxes depend on the action of the regulatory body. In some cases, the regulatory body is almost helpless, and even though the commission authorizes service rate increases to offset the effect on profit of higher taxes, the service rate increase, if put into effect, may or may not restore profits. It may instead reduce them to an even lower level.

Before attempting to summarize the economic consequences of Figures 12, 13, and 14, one more case must be considered. Figure 15 on page 105 shows a firm that is operating at a rate in excess of its low cost rate. Once again, this situation may be the result of a temporary condition or of the fact that it is a practical impossibility to build a plant that can produce the quantity demanded when operating at its low cost rate and do so at a lower unit cost than in the plant shown. In either case, the problem created for the regulatory body by the imposition of a lump sum tax is quite different from that created in the case of Figures 12, 13 and 14 discussed above.

As in the other three cases, the immediate effect of the tax is to reduce the net service rate and to reduce total net revenue by
Figure 15

REVENUES AND COSTS PER UNIT OF PRODUCTION

Revenues and Costs per Unit

Quantity of Production

AC

SR2

SRAT2

SR1

SRAT1

MR

AR
the amount of the tax. The immediate result is to reduce revenue to a sum which is insufficient to cover all expenses. But the effect upon profits of an increase in service rate from $SR1$ to $SR2$ is striking. In this case, the service rate increase causes a reduction in the quantity demanded, but it also permits the firm to operate at a rate nearer to its low cost rate. Consequently with a service rate increase equal to the tax, this firm will actually enjoy a larger monopoly profit than it had prior to the imposition of the tax even though a smaller quantity of service is sold.

The four figures taken together illustrate many practical everyday cases. They show clearly how difficult it is to anticipate the repercussion of a tax on a utility and that the conventional statement made concerning unregulated monopoly firms that a lump sum tax will reduce the profits of a monopoly by the amount of the tax is not at all adequate for regulated monopolies. Such a tax will reduce the profits of the regulated firms by the amount of the tax unless the regulatory commission authorizes the firm to increase its service rate. But if a service rate increase is authorized the effect on profits will be determined by many factors. Under some circumstances, the profits may be restored to pre-tax levels or even increased beyond that level. In other cases, even though the regulatory body may authorize a service rate increase the effect on profit will be negligible. Under still other circumstances, the tax may reduce profits or create a loss despite the best efforts of the commission to prevent these results.
SUMMARY

Before summarizing, perhaps it would be worthwhile to restate and develop further the assumptions made so far in this chapter. In the first place, it was assumed that each firm was in a position of at least short-run economic equilibrium at the time the tax was imposed (or increased). If no further adjustment of capacity was possible the firm's position was also one of long-run equilibrium. In either case, it was assumed that the demand, costs and service rate were as shown and that the monopoly was operating as economically as possible. It assumed that the firm had pushed its advertising to the point where any added revenue derived from further advertising would be less than the added cost. The diagrams also assumed that the regulatory body had, after careful study, authorized a service rate at the level shown. Given these conditions, the regulated firm had made all the adjustments it could - including, in the case of long-run equilibrium, adjustments in capacity - to maximize its profits.

Although profit maximization may be challenged as being unrealistic, a strong argument can be put up to defend the making of this assumption here. It is that the service rates of the regulated firm are subject to constant review by the regulatory body and that the public generally considers the service rate set to be "acceptable" under the circumstances. In this case then, it seems safe to assume that the utility will use the rate set by the commission as the minimum as well as maximum and attempt to maximize its profits with the service rate it is authorized to use. It does not seem likely
that the firm will lose prestige or needs to fear that it may create unfriendly relations with the public by its efforts. In fact, it would probably gain nothing - either in the short-run or long-run - by charging service rates below the authorized maximum.

Of course it can be argued that since the utility company enjoys a monopoly in at least part of the area it serves or for some classes of consumers it supplies, there will be no incentive for it to attempt continually to reduce costs. This may be true, but, on the other hand, if the company has learned from experience that the service rate is not likely to be changed for a considerable period, that set of circumstances may create a strong incentive for the firm to increase its monopoly profit by reducing costs. Its incentive to do this depends in large measure on the relationship between the commission and the firm and on whether or not the utility expects the regulatory commission to reduce the service rate and wipe out any monopoly profit it gains by reducing costs.

Moreover, it is important to recognize that not many of the regulated monopolies are truly unlimited monopolies. In a large part of the regulated monopoly branch of the economy the services provided by a regulated firm have imperfect substitutes whose costs are not much different from the rates for the firm's own service. Perhaps it would be more accurate to say that the services provided by most regulated monopolies today are differentiated services rather than monopoly services. The accuracy of this classification is of little importance for this study. The purpose of the present work is to show that if certain firms are subjected to public control and the
charges those firms can make for their services are regulated, the extent of the economic consequences of taxation under such circumstances need to be understood by the legislators and the regulatory commissions.

So far it has been shown that the effect of a lump sum tax on a regulated monopoly may be either to reduce profits, leave profits unchanged or raise them, depending on the action of the regulatory body and on the relationships among demand, service rate and costs. It has also been shown that in some cases the regulated firm is able to adjust capacity to equal exactly the quantity of service demanded and minimize the effect of higher taxes on unit costs of production. In other cases this adjustment is not possible. Whether or not it is possible to make the adjustments, the repercussions cannot be foretold unless several important facts and relationships are known.

By now, it is evident that it is misleading and an oversimplification to state that the effects of a tax imposed on a regulated firm are regulated. The seriousness of this oversimplification depends on the circumstances. In fact, in some cases the adverse effect on profits of the imposition of a lump sum tax on a regulated monopoly may be great despite the best efforts of the commission to offset those effects by increased service rates. Also, any tax - no matter how small - will reduce the profit or increase the losses of the firm unless the service rate is increased. And even if it is increased, under some circumstances, profits may not be restored to a satisfactory level.
Furthermore, the statement often made that taxes must be passed on to the consumer may be quite inaccurate if that statement is interpreted to mean that rates must be increased by an amount equal to the tax on a per unit basis. In Figure 15, it is demonstrated that a very modest increase in a service rate may be sufficient to restore profits to the pre-tax level. In this illustration if the service rate is increased by an amount equal to the tax on a per unit basis, the profits of the firm would actually rise to a level above the level enjoyed before the tax. The burden upon a regulated monopoly of taxes collected from the monopoly may be further altered by the use the government makes of the revenue so collected. For example, if the tax money is used in such a way that a large part or all of it either increases demand for the utility's service or reduces its cost or production, the burden of the tax on the utility may be very light or perhaps negligible.
This chapter discusses the economic consequences of taxes based on gross revenue and on the number of units of service sold. The equilibrium analysis of Chapter III will be used as a point of departure and the effects of the two taxes will be discussed in terms of both unregulated and regulated monopoly firms.

The Effects of the Taxes When Production Is at the Plant's Low Cost Rate

Figure 16 on page 112 shows the usual revenue, cost and service rate lines. It also shows several broken (or dashed) lines. Of the latter, the diagonal evenly spaced broken lines running parallel to the average revenue and marginal revenue lines represent the net average and net marginal revenue lines for the unregulated monopoly after the imposition of a tax of 0.5 per unit sold. The diagonal unevenly spaced broken lines represent the net average and net marginal revenue lines after imposition of a tax of about 9 per cent on gross revenue of the unregulated monopoly. These tax rates were chosen because they are rather modest and because each yields the same aggregate tax revenue when the firm's output is where marginal revenue equals marginal cost - the rate which conventional equilibrium analysis assumes the firm will set. The statement that tax revenue is the same for each of the two taxes can be confirmed by observing that the net average revenue lines cross at the same rate of output as that dictated by the crossing of the marginal revenue and marginal cost lines.
Figure 16

REVENUES AND COSTS PER UNIT OF PRODUCTION

![Graph showing revenues and costs per unit of production.](image-url)
The lower evenly broken horizontal line represents the level of the net service rate for the regulated monopoly after the imposition of a tax of 0.5 unit or of a tax on gross revenue at a rate of about 16.7 per cent. This line is labelled SRAT1. The upper evenly broken horizontal line represents the adjusted service rate after an increase by an amount equal to the amount of the tax.

The concave line labelled UE connects points on the grid that have the same quantitative value. That is, any point on this line will have a numerical value of twenty-one if any quantity measured on the vertical scale is multiplied by the corresponding quantity on the horizontal scale. This line makes it possible to determine visually whether the demand and cost curves are elastic or inelastic. For example, the UE line passes through the point of intersection of the AR and AC lines. The UE line has a slope at the point of intersection of the three lines that is steeper than the AC line but less steep than the AR line. This relationship among the lines demonstrates that the AR line is quite inelastic whereas the AC line is rather elastic. In other words, it can be verified by observation that if the service rate is increased to a figure above the level where the three lines intersect, the total revenue received from the smaller quantity of service sold will be greater than it would be for the larger quantity. It can also be seen at a glance that if the firm's output is reduced, the total cost of the smaller quantity will be less than for the larger quantity. The UE line, therefore, makes it easy to determine the effects of a change in service rate on the revenues and the costs of the firm illustrated. (This line
is included in several figures that follow in order to facilitate visual comparisons.)

These lines make it possible to draw several general conclusions regarding the economic consequences of the imposition of each of the taxes on the unregulated and on the regulated monopoly. Although numerical calculations can be made to show exactly the effects of each on output, prices and profits, this is not done here because the results would show the outcome under only one particular set of circumstances. The purpose of this chapter is not to examine minutely any specific case but rather to show the significance of relationships and changes in relationships among the various factors involved.

When a percentage tax on gross revenues or a tax per unit is assessed on the unregulated monopoly firm, the lines on Figure 16 show clearly that the monopoly will suffer least - profitwise - if it reduces its output and raises its price. This is true, however, to a different degree if the tax is a percentage tax on gross revenues than if it is a tax per unit of output. In the case shown in Figure 16, the reduction in output and the increase in price will be greater in the case of the per unit tax than in that of the percentage of gross revenue tax. The extent of the reduction in output and increase in price is indicated by comparing the point where the marginal revenue and marginal cost lines cross with the point where the marginal cost line crosses the net marginal revenue lines applicable in each case. The fact demonstrated here is that if either tax is imposed, the unregulated monopoly will reduce its output to a point even farther to the left of the low cost rate of production.
and raise its price. It will do so in order to minimize the reduction in profits caused by the imposition of the taxes. According to the conventional explanation of the repercussions of these taxes, the tax in each case increases the marginal costs of the firm. Due to this increase, the intersection of the marginal revenue and the new higher marginal cost lines dictates a higher price and a lower rate of output. The conventional analysis then proceeds to explain that the ultimate effects of the tax increases are to pass some of the tax on to the consumer in the form of higher prices and to cause the firm to absorb some of the tax through a reduction in profits. (1) This is


correct for unregulated monopoly analysis but inadequate for the analysis of regulated monopoly.

THE EFFECTS OF THE TAXES ON UNREGULATED AND REGULATED MONOPOLY FIRMS CONTRASTED

Although the observations made above provide opportunities to discuss the economic consequences of each of these taxes on unregula-
ted monopoly firms and to examine certain exceptions to the broad generalizations just stated, the purposes of this chapter are merely to identify the literature on that subject and to determine whether or not it is applicable to a regulated monopoly. The analysis already presented shows that established monopoly theory does not fit the regulated monopoly.

The reasons why it does not fit have been examined in detail in Chapters III and IV. They may be summarized as follows:

1) The regulated firm may or may not be earning profits in excess of those needed to attract capital and maintain financial stability.

2) The regulated firm ordinarily cannot adjust its service rates as it wishes - except, of course, with the permission of the regulatory commission.

3) Due to its limited freedom to change service rate, the regulated firm cannot alter output. It must serve all who request service and do so at the established rate.

4) The regulated monopoly does not tend always to operate at a rate below the rate where its unit costs are lowest. It may operate there, but it strives to make adjustments that will enable it to operate at a rate where it produces the quantity of service demanded for the lowest possible unit cost.

5) If the regulated firm is not operating at the low cost rate of production, it is failing to do so either because it has not had time to make the appropriate adjustments or because it is impossible to adjust its plant to produce the quantity demanded of it
at a lower unit cost. In other words, it is always assumed in this discussion that equilibrium occurs when the plant possesses such a capacity that its output, when operating at the lowest cost rate, just provides the quantity of service demanded. If this relationship between quantity demanded and plant capacity does not exist this is the result either of a change in quantity demanded to which the firm is in the process of adjusting capacity or, to the fact that the firm is unable to make adjustments in its plant so it can produce the quantity demanded for less cost per unit of service than in the existing one.

If the capacity of the firm cannot be adjusted to meet the quantity demanded at its lowest cost, the firm may have an incentive either to encourage or to discourage sales in order to bring the quantity demanded into equality with the rate dictated by the point where the service rate line and the marginal cost line intersect. It has this incentive because at that rate the firm would maximize its profits - or, in the case of the loss suffering firm, minimize its losses. Although the assumption was made earlier that the regulated firm has utilized advertising to the extent it can profitably do so to increase sales, if sales exceed the amount where the service rate and marginal cost lines cross, the firm may very well want to discourage sales. In this case, the firm might discontinue advertising. This would tend to reduce sales and to reduce costs of production at the same time.

However, the firm might find such action unwise if it had reasonable expectations that continued advertising plus the effect of
other favorable factors upon the growth of sales might soon raise the quantity demanded to a volume that would make it worthwhile to increase capacity. Furthermore, a larger plant might benefit from decreasing costs and enjoy more favorable earnings. This factor, then, may make it unwise for a utility to attempt to restrict output to the point where the service rate is equal to the marginal cost. Such action may enlarge short run earnings but may, at the same time, postpone the time when it becomes possible for the firm to enlarge its capacity and benefit from both a larger volume of sales and a lower cost per unit of production. In most cases, it seems very unlikely that the utility will discourage sales because even if there are no economies of scale possible, a larger plant operating at its low cost point may very well be able to produce the service for less than a smaller plant operating at some rate other than its low cost rate. Of course, these cost characteristics may not apply to the industry and if not to the industry, then perhaps not to the particular firm. Each case must be considered individually. Such analysis does show clearly, however, how unlikely it is that the regulated firm will seek to operate at the rate where marginal revenue is equal to marginal cost.

Whereas the unregulated monopoly reacts to the imposition of the taxes by reducing output and increasing price, the regulated monopoly is not free to make such adjustments - at least until the regulatory body authorizes an increase in rates. There is this important point to be made, however. If the unregulated firm increases its service rates, the best it can do is to recover only partly its original
profit position. Despite its best efforts, its profits will be re-
duced somewhat - assuming, of course, that demand is not perfectly
inelastic. The regulated firm, on the other hand, was not charging
a service rate that would maximize its profits prior to the imposi-
tion of the tax because it was prevented from doing so by regu-
lation. Under such circumstances, if the regulatory commission sees
fit to do so it can authorize a service rate increase that will
enable the regulated firm to regain its profit position or perhaps
even to exceed it, unless of course, such a large rate increase
would drive business to imperfect competitors or destroy business
altogether. The significant new fact indicated here, then, is that
under the conditions most likely to prevail, the regulated firm can,
if authorized to do so, raise its services rates by an amount suf-
ficient to restore its profits to the level earned before the im-
position of the tax. The unregulated monopoly cannot achieve a com-
parable adjustment even though it is free to adjust output and ser-
vice rates as it sees fit.

As described above, whereas the unregulated monopoly reacts to
the imposition of the taxes by reducing output and increasing its
charges, the regulated firm cannot make either of these adjustments -
at least until the regulatory commission authorizes an increase. It
is required to serve all who request service provided they meet the
requirements set forth in the franchise or certificate. The differ-
ences described are illustrated in Figure 16.

Figure 16 shows clearly that if a tax of 0.5 per unit is imposed
on the regulated monopoly, the service rate will be reduced from the
SRI position to the SRAT1 position. If the tax were a percentage of gross revenue of about 16.7 per cent, the service rate would likewise be reduced from SRI to SRAT1. The gross amount of the tax collected would change as output changed but the percentage of gross revenue would not. Also the 0.5 per unit tax and the 16.7 per cent rate on gross revenue yield the same total tax revenue when the firm operates at the point where average revenue and average unit cost are equal. This is the rate at which the regulated firm illustrated in Figure 16 will operate when in equilibrium.

Figure 16 shows only one of an infinite number of possible situations that might be set up to represent regulated monopoly firms. In this particular illustration, when the tax is based on the number of units of service sold or on a percentage of gross revenues, its effect on the service rate is to reduce it to the SRAT1 position. The rate paid by the consumer remains unchanged but the net amount retained by the utility out of collections after deduction of the tax is represented by the SRAT1 line. The instantaneous effect is to reduce net revenue collections of the utility to such an extent that it cannot pay all its expenses including a normal profit. In other words, it must absorb the full amount of the tax and, inasmuch as the revenue of the firm before the tax was just sufficient to pay expenses, it has less than enough by an amount equal to the tax. The short-run effect is to push the firm from a marginal position into a sub-marginal one. If and until the regulatory body authorizes the utility to increase its rates, the utility suffers by the full amount of the tax, and if no relief is granted, it will ultimately be
forced into financial difficulty. So far, therefore, the statement sometimes made that the extent of the incidence on the consumer is determined by the rate-controlling authorities is correct. (1)


It is misleading, however, to stop with that statement. An examination must be made of the economic consequences of the tax if and when the regulatory body does authorize some upward adjustment in the service rate. If, for example, the rate-controlling authorities permit the utility to raise its rate by an amount equal to the tax, the consumer must pay the higher rate, but several other changes take place also. At the higher rate, less of the service will be purchased. And the extent of the reduction will depend on the degree of elasticity of demand. In this case, some persons will be priced out of the market - or perhaps turn to another less satisfactory service. And consumers who buy the smaller quantity of the service will actually pay a greater aggregate amount for the smaller volume of service than they paid for the larger quantity delivered before the imposition of the tax. Others will use less of the service. Therefore, the utility will sell less of its service and, of course, produce less. The reduction in output may very well increase the production costs per unit. If this happens, the effects of the tax go far beyond those implied on the statement that the incidence on the consumer depends on the rate controlling body. (2)

(2) See Appendix A to Chapter V for a discussion of the economic effects of various taxes measured in terms of consumers' surplus.
Further examination of Figure 16 will reveal that the utility will not, under the circumstances most likely to occur, regain its marginal position even if the rate authorities permit it to raise its rates by an amount equal to the tax. It would regain its former position only if demand were perfectly inelastic or if the unit costs of production did not rise as output declined, or both. Neither of these conditions is likely to exist. Therefore, the extent of the injury to the utility depends on the change in the amount of service demanded as a result of the higher service rate and on the effect on unit costs of reducing output below the quantity for which the plant was designed. The injury could be measured numerically by multiplying the negative difference between the net service rate and the unit cost of production by the new reduced rate of production.

If the regulatory body wishes to give the utility an opportunity to preserve its financial stability, it may agree to allow the utility to raise its service rate even more. Under circumstances like those indicated in Figure 16, an increase in the service rate by an amount considerably in excess of the amount of the tax would be required to yield a net rate sufficient to again produce revenue enough to cover all expenses including a minimum profit. This is because an increase in service rate reduces the quantity demanded and a reduction in the quantity demanded results in an increase in unit cost of production.

In the short run the effects of the tax are as described. In the long run, however, the financial position of the firm after the
imposition of the tax may or may not be as poor as indicated. Of course, if the demand is rather elastic and unit costs rise notably when the utility operates at less than the rate at which it was operating before the tax, it will suffer severely. But it may be that the utility, if given enough time, can reduce its capacity. In the new, smaller plant it may be able to produce the smaller quantity of service for less than it can in the existing plant. The alert monopoly will, of course, make this capacity adjustment as quickly as possible if it can do so. If it does, the primary injury will be reduced to the extent that such adjustment is possible.

Of course, if demand for the output of this industry is expanding gradually the quantity demanded may not decrease as much over time as it has been assumed to do. This too, would reduce the adverse effects on the profits of the utility. But such a possibility is not considered here because demand is not likely to change suddenly.

Several conclusions may be drawn from the foregoing discussion of Figure 16. In the first place, the consumers will very likely feel the effect of the tax in terms of a higher service rate. The service rate will probably increase at least by the amount of tax and perhaps more. In the second place, inasmuch as the service supplied by the firm is one for which there is no substitute at a comparable price and one which is relatively inexpensive and considered to be essential for comfortable living, the consumers are not likely to reduce consumption greatly even though the service rate is increased. It is likely that the consumers will use
moderately less of the service but even so, the total dollar cost of the reduced quantity purchased will be higher than the total amount paid for the larger quantity of service before the tax increase. The net effect is that the purchasing power of the consumers will be reduced. Unless the tax money is used in such a way as to return the purchasing power to the community, savings, employment, and wages may be adversely affected. The adverse effect may, of course, be so small as to be negligible. What actually does happen will depend on the changes of many factors, of which the tax is only one.

If, on the other hand, the commission does not permit the firm to increase its service rate by an amount sufficient to offset the effects of the tax, the utility will suffer financially and, in the long run, fail unless other beneficial changes take place to aid the earnings position of the firm.

From the point of view of the utility, the significant fact is that a tax imposed on a monopoly that is not enjoying a profit in excess of the minimum on which it can survive may destroy it. To avoid this ultimate repercussion, the tax authorities need to understand the factors described above before they impose a per unit or a gross revenue tax on regulated monopolies. In those branches of the regulated segment of the economy where the firms are already in a precarious financial position and have demands for their output that are more or less elastic, taxes may actually lead to the destruction of the firms. This may happen even though the regulatory commission does all it can to assist the firm. This is particularly true in
industries that are generally contracting because technological changes have resulted in shifts to other newer industries. The same destructive effects, of course, may result from subsidy programs.

THE EFFECTS OF TAXES WHEN THE PLANT'S RATE OF PRODUCTION IS LESS THAN THE LOW COST RATE

Figure 17 on page 126 presents another example of regulated monopoly. In this case, the firm has the capacity to produce much more than the quantity being demanded by the consumers at the established service rate. This excess capacity may exist because there has been a recent change in demand, service rate, or cost of production or a combination of these factors. Or it may be because a plant of the size shown can produce the quantity of service demanded at less cost per unit than any alternative plant. In any event, the relationships shown here between capacity and demand are the best possible under the circumstances. In this example, however, the firm is collecting in revenue from service sold more than the minimum needed to cover all costs, including a minimum profit. It is earning a profit in excess of the minimum necessary for financial stability.

Under the circumstances shown, if a tax of 0.5 per unit or of 16.7 per cent of gross revenue is imposed, the immediate effect will be to reduce the net service rate to SRAT1 and to almost eradicate the margin of profit above the minimum necessary for financial security. The firm will have its excess of revenue over expenses reduced by the full amount of the tax, but that reduction will still leave somewhat more revenue than necessary to enable the firm to survive for an infinite period. This reduction may put the firm in a position where
Figure 17

REVENUES AND COSTS PER UNIT OF PRODUCTION

[Diagram showing revenues and costs per unit of production with labels UE, SR2, SR1, SRAT2, SRAT1, AC, and AR.]
it earns something less than the amount it considers to be a satisfactory return on capital invested but it can, nevertheless, survive indefinitely.

If the regulatory body should decide to authorize this firm to raise its rates by the amount of the tax per unit, the results would be quite different from those portrayed in Figure 16. In this case, the service rate would rise to SR2 and the quantity demanded would fall to the amount indicated by the point where the SR2 and AR lines intersect. The net service rate would be as indicated by SR1 (SRAT2). The result would be that the new net service rate would exceed the higher unit cost of production by a substantial margin whereas in Figure 16 it was shown that a comparable service rate would ultimately result in the destruction of the firm. Although the aggregate excess in Figure 17 would be held down by the fact that the number of units sold at the new higher service rate would be smaller than before, the firm still would earn attractive profits after the service rate adjustments to compensate for the tax were made.

As a result of these adjustments, the consumers would be obliged to pay a higher service rate and to get along with less service. In fact, inasmuch as the demand is rather inelastic at this new higher service rate, the consumers would actually pay a larger aggregate amount for the smaller quantity of service than they paid for the larger quantity purchased before the imposition of the tax and before the service rate adjustment.

From this there follows one vitally important additional point which is overlooked in the conventional analysis. If the utility is
unable to make any downward adjustment in its capacity by reason of the reduced quantity demanded, the conclusion stated above is applicable for an indefinite period. If, on the other hand, the firm is able to reduce its capacity and to produce the quantity now required at a lower unit cost than in the existing plant, it will act instantly to make that adjustment, unless of course it anticipates an increase in demand reasonably soon. If the firm can alter capacity and thereby reduce unit costs of production, it might very well be that the unit costs would be so much lower in the new plant operating at or near its low cost rate that the profits of the firm would rise to a level equal to or above what they were before the tax was imposed. This possible course of action by the utility suggests that it might be worthwhile for the regulatory body to review the relation of unit costs and service rate after such capacity adjustments are completed. Such an investigation may reveal that the service rate may be reduced somewhat and still not embarrass the utility financially.

This possibility raises certain problems. If the rate controlling body raises rates to take care of increased taxes and makes the upward adjustment on the basis of current production costs, the ensuing change in quantity demanded may substantially alter the volume of production and, in turn, alter the costs of production. The repercussions on costs may then make the revised service rate something less than satisfactory and may make a further service rate adjustment
This situation leads, logically, to the conclusion that the regula-
tory body must take into account the effect on costs of a reduc-
tion in the rate of production and must authorize a rate increase
that will be fair and reasonable on the basis of what the costs of
production will be after the adjustment in capacity has been completed
rather than on the basis of the costs of production in the existing
plant. Of course if the cost of production does not change as capa-
city changes, the difficulties described here do not arise. A less
satisfactory way for the commission to deal with the problem is to
make as many service rate adjustments as may be necessary to establish
ultimately a fair and reasonable rate. This discussion of the possi-
bility for several service rate adjustments has not as yet
taken into account the possibility of growth or contraction of demand
during the period over which capacity adjustments are assumed to be
made.

Certainly a distinction between expanding and contracting indus-
tries should be sharply drawn. If demand is expanding, then perhaps
there will be no necessity for a downward adjustment in capacity. If,
on the other hand, demand is contracting the service rate adjustment
problems may be made even more difficult. It seems quite clear that
the attractive earnings record of the electric power utilities has
been due to market growth and technological improvements. Firms in
this branch of the regulated segment of the economy have prospered despite higher taxes and sharply higher labor and material costs. The railroads, on the other hand, have not generally expanded traffic-wise and have not shown any notable technological improvements, except perhaps for the expanded use of the diesel locomotive. Higher taxes, together with the effect of subsidies to competitors, and higher labor and material costs have restricted their earning power.

The foregoing illustrations and discussions have shown that the possible relationships among the pertinent factors involved are so great in number that both the tax commission and the regulatory body must be continually alert. The tax commission ought to know in advance when the effect of a tax increase will be to destroy the taxpayer. The regulatory body must watch continually for any change in demand and any capacity adjustment the firm may make to reduce its costs and raise its monopoly earning power. Furthermore, the tax commission must not assume that all regulated monopolies are profit-making ones. Neither can it assume that any tax can be absorbed or passed on to the consumer. Although either of the above assumptions may be true in any particular instance, it is equally possible they may not be.

To assume that the utility can absorb the tax carries with it the implied assumption that the regulatory body has not done its job well. This may or may not be true. To assume that the monopoly can act as a tax collector and that any tax that cannot be absorbed can be passed on to consumers in the form of higher service rates also
may or may not be true. The regulatory body may not agree to an increase in service rate, and even if it should, it may be that the quantity demanded at the higher rate may fall so sharply that the consumers suffer and the utility faces financial disaster. Once more this discussion leads logically to the conclusion that the tax and regulatory problems are inevitably interrelated and that the two cannot be separated.

THE EFFECTS OF TAXES WHEN THE PLANT'S RATE OF PRODUCTION IS GREATER THAN THE LOW COST RATE

Figure 18 on page 132 shows still another example of regulated monopoly. In this case the firm is operating at a rate in excess of the low cost point and is, despite this fact, enjoying a profit in excess of the minimum it would probably accept if it could not get more. This case opens up a number of possibilities. One is that the firm may be operating beyond the low cost point because demand has risen recently and it has not had time to enlarge its capacity. Another possibility is that the demand represented by AR is a demand that the firm enjoys for only a short period each year - at least for less than one-half the time. In such a case, the utility may have decided that it is better, profit-wise, to operate in excess of the low cost rate during the temporary period and then operate at (or near) the low cost rate the greater share of the time. A third possibility is that the plant size illustrated is as close as it is possible to approach the quantity demanded. To enlarge the plant would mean that unused plant capacity would exist part or all the time and the unit cost of production for the quantity demanded would
Figure 18

REVENUES AND COSTS PER UNIT OF PRODUCTION

[Diagram showing the relationship between quantities of production and revenues per unit with various lines representing costs and revenues.]
be higher in the larger plant operating at less than its low cost rate than in the existing plant operating above the low cost rate. In any event, the firm illustrated is in equilibrium, and it is possible to make some broad general statements about the consequences of the imposition of a per unit or a percentage of gross revenue tax on a firm in this situation.

As has been shown in each of the previous cases, the imposition of a per unit or a percentage tax on gross revenues reduces the income of the firm instantly by reason of a reduction of its effective service rate from the service rate shown by line SRI to some lower level such as the one labelled SRAT1. In the case of the firm shown in Figure 18, the immediate effect of a tax of 0.5 per unit or about 16.7 per cent of gross revenue would be to absorb the monopoly profit the firm is enjoying and even more. In other words, the net service rate illustrated by the line SRAT1 would be so low that the firm could not meet all expenses, including a minimum profit. The revenue would fall below the total expenses by an amount equal to the negative difference between average unit cost and net service rate multiplied by the quantity demanded by the consumers at the service rate set by the regulatory body.

If this situation arose, the utility would instantly petition the rate controlling authorities for permission to raise the service rate. If the regulatory authorities denied the petition, the utility's financial status would be impaired because the net service rate would be forced below the average unit cost. If the regulatory body allows the utility to increase its service rate by an amount equal to the
tax, the utility will not only regain its original monopoly profit making position but exceed that position. It will enjoy this bonanza for two reasons. One is that the demand is quite inelastic and even though the service rate is increased, the quantity demanded will not decline greatly. The other is that, at the lower production rate, the firm will operate more efficiently and will be able to produce each unit of its service for a lower cost. Together these characteristics will cause the firm to be better off - profitwise - after the imposition of the tax and the adjustment of the service rate than it was before.

Figures 16, 17, and 18 have been used to illustrate a marginal monopoly operating at the low cost rate, a monopoly-profit making monopoly operating at less than the low cost rate and a monopoly-profit making monopoly operating beyond the low cost rate. One further figure will be necessary to illustrate clearly the importance of the elasticity of demand and of the degree to which the monopoly firm is able to adjust capacity to meet the quantity demanded when the plant is operating at its low cost rate.

THE EFFECTS OF TAXES WHEN THE PLANT IS OPERATING AT ITS LOW COST RATE AND EARNING MORE THAN A MINIMUM PROFIT

Figure 19 on page 135 shows a monopoly-profit making utility that is operating at its low cost rate. In other words, its capacity is adjusted to provide the quantity of its service demanded at the established rate and to do so at its low cost production rate. Also, its low cost of production per unit is considerably below the service rate established by the regulatory authorities and, as a result,
Figure 19

REVENUES AND COSTS PER UNIT OF PRODUCTION

Revenues and Costs per Unit

Quantity of Production

0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10
the aggregate revenue exceeds total costs by a rather substantial sum.

Under circumstances such as these, the tax authorities may see fit to impose a tax of 0.5 per unit or of about 16.7 per cent of gross revenues. If such a tax is imposed, the effective service rate will decline to the level shown by the broken line labelled as SRAT1. If no further changes are made, the monopoly will have taken from it an amount just equal to the profit it is enjoying in excess of the minimum it probably would need to preserve its financial stability. Under such circumstances the utility would probably petition the regulatory body for permission to increase its service rate. In the event the petition is denied, the utility has no alternative to absorbing the tax. If, however, the rate controlling commission authorizes it to raise its service rate by an amount equal to the tax, the repercussions cannot be described as passing the tax on to the consumers or as returning the utility to its original monopoly-profit making position. If the demand is anything less than perfectly inelastic, the consumers will buy or utilize less service. In fact, the consumers will actually pay more for the smaller aggregate service than they did for the larger total. The utility, on the other hand, will collect a higher service rate, but after deduction of the tax from the collections, will be worse off than before the tax because it will sell a smaller quantity of its service at the new higher service rate. The final result is that the firm operates at a lower rate of production and has higher unit costs. Thus the utility's earnings decline. The amount by which they decline
depends, of course, both on the degree of elasticity of demand and on the extent to which unit costs of production rise as a result of operating at the reduced rate of production.

This explanation does not cover all possibilities by any means. An examination of Figure 19 will show that if the service rate were raised by twice the amount of the tax to SR3, the net service rate would be as indicated by the line SR2 and the wide margin between the net service rate and the corresponding average unit cost of production would be enough so that even though the output would decline and unit costs would rise, the monopoly profit would very likely be greater than before the tax was imposed.

Such a service rate increase might be impractical, however, because the consumers might turn to a less satisfactory substitute. This is quite likely in the regulated monopoly field, and it would, of course, be reflected in the revenue lines. In the graphic illustrations included here, no attempt has been made to indicate or make allowance for substitute services. Certainly an increase in service rate by an amount equal to twice the amount of the tax would not be a very satisfactory exchange for tax revenue equal to only about one-half the service rate increase. And even if the service rate were not increased by an amount equal to twice the tax, an increase that would restore the utility to its original profit position might require a service rate increase by an amount substantially greater than the tax. Furthermore, the consumers would enjoy fewer units of the service. The service rate increase of an amount greater than the tax would certainly be necessary to restore the firm to its
original earnings position unless the utility could make a benemicial capacity adjustment. If, after such downward adjustment, it was able to produce in the smaller plant at a unit cost no greater than the unit cost of the higher output in the larger plant before the tax, the utility would be in precisely the same profit position after the upward adjustment in service rate by an amount equal to the tax, it was before the imposition of the tax. Although this adjustment may be possible in some cases, in many other cases it may not be. In any event, the possibility presents a difficult problem for both the tax authorities and the rate controlling body.

SUMMARY

In order to bring together the points made so far in this chapter, another figure is needed. It must combine all the possibilities set forth in Figures 16, 17, 18 and 19. Inasmuch as Figure 11 in Chapter III on page illustrates all the alternative situations, it is possible to summarize this chapter by referring to that diagram. That diagram shows that it is possible for a regulated monopoly to be in equilibrium at rates of output that are either below the low cost rate of production, equal to that rate or above it. If equilibrium occurs at a rate equal to the rate that would be indicated by the intersection of the conventional diagonal marginal revenue curve and the marginal cost curve, it is probably a coincidence. For equilibrium to occur at some other rate is much more likely. The best relationship among the AR, SR and AC lines is, of course, where the intersection of the AR and SR lines indicates a quantity just
equal to the low cost point on the AC curve. Under these circum-
stances the consumer is in a position to buy service for the lowest
rate possible under the circumstances and the firm is in the best
possible position to supply the quantity of the service demanded
at minimum rates and enjoy, at the same time, income to cover all
expenses, including a "satisfactory" profit. If equilibrium does
not occur at the rate described, it is probably either because the
firm is unable to make capacity adjustments to reach this equilibrium
or because the firm is in the process of making the appropriate ad-
justments and has not yet completed them. Of course, there may be
other reasons, some of which were discussed in connection with the
illustrations used in this chapter.

For the regulated firm, per unit taxes and taxes imposed on the
basis of a percentage of gross revenue will, in every instance, reduce
the profit or increase the loss by the full amount of the tax in the
short run. None of the newly imposed tax can be passed on to the con-
sumer unless the regulatory body authorizes an increase in the service
rate the utility may charge. If an upward adjustment in service rate
is authorized, the repercussions may vary widely, depending on the cir-
cumstances. A nominal upward adjustment in service rate may enable
the utility to regain its monopoly-profit making position. Under
other circumstances, an upward service rate adjustment by more than
the amount of the tax may not succeed in restoring the utility to a
profit position equal to what it enjoyed prior to the imposition of
the tax. The final outcome depends on the relationship among the
various revenue and cost curves. Each case presents a special
problem and has a different solution. In general, however, the usual explanation of the effect of taxes on monopoly firms does not apply to the regulated firm. The differences are so great that established monopoly taxation theory is almost worthless in a discussion of regulated monopoly taxation.
Consumer surplus analysis is often used to show how a consumer may benefit from a reduction in the price of a commodity he buys. J. R. Hicks\(^{(1)}\) used the illustration of a decrease in the price of oranges from two d. to one d. and a concurrent increase from six oranges purchased at two d. to ten oranges at one d. The result of this price decrease, says Hicks, is such that even if the consumer's income falls six  d. at the same time the price declines, he can be no worse off than before the price decrease and is perhaps better off because with the lower relative price for oranges the consumer will tend to substitute oranges for other commodities and so be better off in terms of consumers' surplus. This is all that is necessary, says Hicks, to demonstrate that "a tax on commodities lays a greater burden on consumers than an income tax. If the price of oranges falls from two d. to one d. as the result of a reduction in taxation, then (assuming constant costs) the reduction in tax receipts from our particular consumer is six d. If this is taken from him by an income tax, he is still better off and the government no worse off."

\(^{(2)}\) Hicks, J. R. op. cit., p. 41

This analysis has been criticized\(^{(3)}\) because it assumes that the

marginal utility of money to the individual purchaser of the commodity is the same regardless of the change in relative prices. It is true that this may not be the case but if this qualification is taken into consideration, and it is recognized that the analysis also assumes constant costs, the illustration used by Hicks shows clearly the possible benefits of substituting an income tax for a commodity tax or of imposing an income tax to obtain additional revenue for the government rather than a tax on gross revenues or on each unit of goods or services sold.

The same illustration can be expanded to show that if oranges can be more cheaply produced in large than in small quantities, the potential benefits of the use of the income tax rather than the commodity taxes are even greater. For example, if the consumer buys more oranges after the price reduction than before - even though the dollar saving from the price reduction are taken from him through an income tax - each orange in the larger quantity will cost him less as a result of the lower unit costs of production and he will be better off, at least if prices fell to reflect lower production costs. Of course, the reallocation of the consumers' income for the purchase of more oranges means that he will buy less of other things and if the "other things" of which he buys a smaller quantity are also produced under decreasing cost conditions, there may be no net gain. If, on the other hand, the "other things" of which he now purchases a smaller quantity are produced at increasing costs
or constant costs then the consumer genuinely benefits from the price reduction of oranges - at least in the sense that he has more total goods after the price reduction than before it.

This analysis may or may not be useful and significant in the regulated industries because in some branches of the regulated industries there is evidence of conditions leading to substantial economies of scale while in others there are few or no such economies to be enjoyed. The fact that firms in different branches of regulated industries may be potentially highly competitive and be subject to different degrees of change in unit costs as a result of economies of scale make the consumers' surplus analysis well worth applying. (1)

CHAPTER VI

NET INCOME TAXES

This chapter examines the economic consequences of the imposition of net income taxes on unregulated and regulated monopoly firms. The first portion of the chapter considers whether the income tax should be treated as an element of expense or as a deduction from profit for the regulated firm. The remaining portion discusses the effect of the income tax on the unregulated and on the regulated monopoly under several different equilibrium circumstances.

It might seem that income taxes - taxes on profits - would not apply to regulated utilities simply because service rates are regulated. This, however, is not the case. Regulated firms are legally entitled to earn a fair or standard (1) profit and generally do earn this amount or more when economic conditions are good. When they earn a profit, it is subject to the tax. In fact, from the point of view of the income tax administrator, any sum the utility has left after paying all expenses is considered to be a profit and is subject to the income tax. This is true even though the residual sum may be insufficient to yield the investors a fair return on their money. The bare fact that a profit is earned makes the firm subject to an income tax.

The regulated monopoly firm may or may not be earning a satisfactory return on investment prior to imposition of the tax. Its

failure to do so may be due to regulation or it may be due to conditions over which the regulatory body has no control. Several of these factors are illustrated and discussed later in this chapter.

At this point it should be emphasized that there are two ways for the regulatory commission to treat the taxes on income of monopolies. One way is to include the income tax as an expense. (1) This method makes the profit figure an amount to which the common stockholder is entitled and an amount that may be used to determine whether the firm is or is not making a minimum profit. The other is to calculate and show profits before the deduction of income taxes. (2) In this case, income taxes must be deducted from profits before the profit available to the stockholder is known. Either method is satisfactory provided the proper adjustments are made before making comparisons with the earnings of other industries and firms. (3) It certainly is not legitimate to compare the profits of utilities that have been permitted to include income taxes in expenses with an unregulated firm that reports profits before the deduction of income taxes.

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Regulatory commissions have not adopted a uniform method of handling income taxes and the researcher must be constantly alert to the absence of uniformity. Inasmuch as the present chapter is concerned with the economic consequences of taxes, it is necessary for the purpose of this analysis to choose one method of handling income taxes. In this study, income taxes will not be treated as an expense. Profits will be considered to be profits after all taxes have been deducted except income taxes. In this way, profit figures are comparable to figures for unregulated monopoly firms.

The average cost curves shown in the illustrations in this chapter contain all expenses including all taxes except income taxes. The curves may be thought of as representing either an unregulated or a regulated firm. This makes it much easier to carry out the analysis of monopoly income taxation. The average cost curves contain provision for a fair or standard return on investment equal to that which competitive firms with comparable risks would earn or - as it is sometimes stated - a return sufficient to enable the firm to attract capital when it needs capital.

Income taxes are excluded from costs for two other important reasons. First, it would make the illustrations much more complicated if they were not, and secondly they should be handled as nearly as possible as they are for the unregulated firm. Otherwise, the whole analysis becomes distorted and confusing. Therefore, the average unit cost curves shown on the graphic illustrations that follow
include all expenses and all taxes except income taxes. (1)

(1) Some commissions do not allow certain other taxes to be included as expenses, but this is probably the exception rather than the rule.

In each of the illustrative figures used in Chapters 3, 4, and 5 where average revenue is equal to or greater than average cost at the established rate of output, the firm is assumed to be making a profit. In those cases where the average revenue is equal to average cost, the profit is assumed to be the minimum acceptable. In cases where average revenue exceeds average cost, the difference is assumed to be profit in excess of an acceptable minimum. The profit in both cases is profit that is subject to the income tax. That is, this tax applies to the "minimum profit" included in the average cost curve as well as to any profit made in excess of that amount.

Although it may be argued that it is the function of the regulatory body to fix service rates at levels that will yield only enough revenue to cover all expenses, including a minimum profit, this argument seems to imply that the utility ought not to have to pay an income tax. That is a false implication. This "minimum profit" is the amount of profit to which the common stockholders are entitled and the purpose of the income tax is to take from the firm a part of any amount the firm earns in excess of the amount needed to cover all expenses. The effect of the income tax is to reduce the amount of earnings to which the common stockholders are entitled. Furthermore, this profit figure is a part of what is usually referred to as a "fair return." In other words, a fair return includes both profit
and the amount needed to cover fixed charges. Although the regulatory commission is directed by law to permit the utility to earn a fair return and therefore all utilities are entitled to such a return, they are not always able to earn it. The significant point is, however, that whenever the utility does earn a profit, that sum becomes subject to the income tax and the firm will have to pay it. The same is true of the unregulated firm.

Although commissions recognize that the "fair return" to which the utility is entitled may be calculated either before or after the deduction of income taxes and that those figures may be compared with the corresponding return earned by firms in unregulated industries, the fact that the income tax is meant to be a tax on a residual seems to make it more logical and certainly much easier to set service rates on the basis of costs before rather than after the inclusion of income taxes. This method permits the commission and the utility to calculate profits in the same way that they are calculated by firms in the industries with which the utilities are often compared. This approach simplifies the regulatory job and places the regulated monopoly in a position similar to all other firms that must pay the income tax.

If the income tax is treated as an expense item, then a change in the income tax rate may necessitate an immediate change in service rates. Whether the tax increase does, in fact, call for a rate adjustment depends on the attitude of the regulatory commission. If the commission concludes that the increased tax will reduce the firm's residual profit to a point below a fair and reasonable level,
it may authorize an increase in service rates. If, on the other hand, the commission feels that the repercussions on the utility are no greater than those on other unregulated firms, it may not grant an increase in the service rate. Either attitude is a distinct possibility. It must be borne in mind, however, that the regulated firm is not as free to take advantage of good economic conditions and high earnings as are the unregulated firms, and if a commission does not permit the utility's earnings to rise as economic conditions improve, then those earnings may need to be protected during periods of heavy income taxes or unfavorable economic conditions, or both. These earnings are protected, of course, to some extent by the franchise or other contract and by the Fifth and Fourteenth Amendments to the Constitution. The concluding point is, then, that even though the income tax imposed on the utility is imposed on all economic activity as well, this is not always reason enough for concluding that the utility is not justified in asking for an upward adjustment in its service rate.

If the utility is permitted to charge service rates that yield it a return before income taxes comparable to that earned by unregulated firms facing equal risks, then a change in income tax rates is likely to result in the equitable treatment of both the unregulated and the regulated firms, provided - of course - that both the regulated and unregulated firms are subject to identical tax rates and other provisions.
THE EFFECTS OF THE TAX WHEN THE PLANT IS OPERATING AT ITS LOW COST RATE OF PRODUCTION

Figure 20 on page 150 illustrates a regulated monopoly that earns a minimum satisfactory profit as long as it operates at its low cost rate of production and sells its output at the established service rate. In other words, a regulated monopoly that has a demand curve and cost curves as shown on Figure 20 will collect in revenue only enough to cover expenses - including a fair return on investment before payment of income taxes.

This same illustration shows how an unregulated firm can enjoy a substantial monopoly profit - a profit in excess of a necessary minimum - if it knows how to take advantage of its opportunities, restricts its output to the rate where marginal revenue is equal to marginal cost and raises price to the maximum it can charge for the smaller number of units produced.

This figure has been constructed to illustrate and contrast the possible repercussions of taxes on regulated and unregulated firms. If only the conventional average revenue, marginal revenue, average cost and marginal cost curves are considered, it is clear from the explanation made in earlier chapters that the unregulated firm tends to set output at the rate where the marginal revenue and marginal cost lines cross. This rate yields the firm its maximum profit. If the illustration is used to describe the effect of net income taxes on this firm, the conventional explanation will proceed by stating that inasmuch as net income is maximized where marginal revenue is equal to marginal cost, the firm is unable to benefit by altering
output and so must absorb the tax.\(^1\)


The explanation may go on to state that if the tax is a tax applicable only to some business activities in which investments are made, then the monopolist's profit will be reduced by the amount of the tax. It may explain also that the firm will proceed to do business unaltered unless the tax drives the profits to such a low level that the investors can invest their money elsewhere and earn a higher return. In that case, the conventional analysis states that the monopoly will discontinue operations promptly or ultimately will find it impossible to borrow capital when needed and will fail financially. If, on the other hand, the income tax is considered to be a general tax - a tax applicable to all business activities - the discussion will become more involved and the conclusion reached may be that ultimately the tax may cause either higher or lower prices\(^1\) or


Figure 20 contains certain lines that have not as yet been referred to. These lines are included to illustrate the effect on average and marginal revenue of a 20 per cent net income tax if the tax is treated as though it were a reduction of revenue rather than as an increase in cost. The tax is shown as a reduction of average revenue and marginal revenue simply because the taxes discussed earlier have been treated in that manner. Therefore, it seems logically consistent to continue using this analysis. Furthermore, the monopolist may very well think of the income tax as a reduction in revenue rather than an increase in cost. A tax, in fact, reduces the aggregate revenue the monopolist has available to meet operating expenses, pay for borrowed capital and reinvest.

If the income tax is calculated as a reduction of revenue, the net revenue will be as shown by the two dashed lines that run generally along the average revenue and marginal revenue lines. Attention is called to the fact that the net average revenue line does not rejoin the original average revenue line at the point where the average revenue line and average cost lines cross. It does not rejoin the solid average revenue line until it has reached a point considerably beyond the point where the firm is considered to be earning a normal or minimum profit. The failure of the net average revenue line to rejoin the solid line at the point described is due to the fact that the net income tax of 20 per cent must be applied to the "normal" profit contained in the average cost figures as well as to the profit in excess of this normal. Net income is, after all, the amount of revenue remaining after payment of all operating expenses and fixed
costs. Income taxes, therefore, apply to the normal profit included in the average cost figures as well as to any excess.

This illustration confirms the usual explanation that the monopolist cannot alter output so as to be better off profit-wise. In other words, it is better for him to have a taxable profit and pay part of it in taxes than to have no profit at all. Also, it is better to have a big profit before taxes and pay 20 per cent of it in taxes than to have a small profit and pay 20 per cent of that in taxes. The extent to which the firm is less well off - profitwise - depends on the tax rate and the exemption if any. These statements are illustrated on Figure 20 by the fact that the net marginal revenue line rejoins the gross marginal revenue in such a manner that the intersection of the marginal cost and marginal revenue curves takes place at the same point as that of the gross marginal revenue and marginal cost curves.

Figure 20 supports graphically the statements made in taxation literature that the imposition of an income tax on an unregulated monopoly will not cause the monopoly to alter either output or price. This assumes, of course, that the monopoly knows how to and does take advantage of every opportunity to maximize profits. (1)


Although the possible long run economic consequences are widespread, it is enough to observe at this point that the unregulated monopoly is enjoying a profit in excess of the minimum on which it would prosper. Therefore, it is not likely to make any attempt to
shift to another activity just because an income tax somewhat reduces the profit it has been earning in excess of the minimum.

The above explanation and tentative conclusions do not apply, however, if the monopoly shown on Figure 20 is used to illustrate a regulated monopoly rather than an unregulated one. In this case the service rate is just high enough to yield a minimum profit before the imposition of the tax. If demand were either higher or lower or if costs were higher, or both, the regulated monopoly would not be able to survive financially - at least in the long run. If it is assumed, however, that the firm illustrated in Figure 20 is in equilibrium, then it is accurate to state that before the imposition of the tax this regulated monopoly would collect in revenue enough to meet all its expenses including the necessary minimum return on investment. In this case the imposition of an income tax will reduce profits to a point below the minimum, and the firm will face immediate financial hardship and ultimate financial disaster.

The broken curves that run more or less along the horizontal service rate line represent the net service rate or net average revenue (NAR) and the net marginal revenue (NMR) for the regulated firm. The net average revenue curve is the one that has a concave shape and stays below the service rate line at all points. The net marginal revenue curve, on the other hand, falls below the solid (gross) service rate line at the rate of production where the firm begins to earn something toward the minimum necessary profit. As output is increased, the net marginal revenue curve declines. Ultimately, the curve does turn upward as output approaches the low cost production
rate and finally joins the average revenue, average cost and service rate lines at a common point.

From this it may be concluded, that even though the imposition of an income tax on minimum profits is treated as a reduction of revenue, the rate of output established as the equilibrium rate before the imposition of the tax remains the rate at which the firm will have the maximum net revenue or minimum loss after the tax. Whether the profit is large or small or the loss small or large depends on the size of the tax. The initial conclusion that must be reached from this illustration is the same as that reached in each of the previous chapters when a tax is imposed on a regulated monopoly. The utility must bear the full amount of the tax. The consumers are not affected. The ultimate outcome, however, depends on a large number of factors. These must now be discussed.

As soon as a regulated firm operating under the conditions shown on Figure 20 learns of the income tax, it will seek permission from the rate controlling authorities to increase its service rates. This application for higher rates will raise many questions, and the outcome will depend on various factors. If the public authorities feel that the utility is entitled to a return equal to the one it was enjoying before the imposition of the tax, it may authorize a service rate increase. If, on the other hand, it considers the new lower return to be adequate because all other firms - unregulated and regulated - must also pay the income tax, the commission may deny the utility a rate increase.
If the commission refuses to allow the utility to raise its service rates, it will have its profits reduced or eradicated, or it may suffer a loss. If, however, the commission agrees that the utility is entitled to higher rates, and a return on investment equal to that enjoyed before the tax, the problem that arises is how much of a rate increase is necessary to enable it to regain that position. Inasmuch as the tax is a percentage of net income, the increased service rate must be studied in conjunction with the demand curve and the effect of a lower rate of output on the unit costs of production.

The demand curve shows that if the service rate is increased, the quantity demanded will decline. Although the demand curve is inelastic and the total revenue collected from the consumers will rise despite the decreased total sales, the unit cost of production will also rise. In this case then, any service rate increase will result in the public paying more total dollars for the reduced quantity of service than it did for the larger quantity. From the point of view of the public this is a distinct impairment of purchasing power. If it were not for the fact that the share of the average family's budget that goes for utility services is relatively small, there would be strong opposition to the increased rate. This fact, together with the rather complacent attitude ordinarily taken by the public because the rate controlling authorities are presumed to protect the consumer's interest, accounts, in large part, for the absence of vigorous public opposition to most utility rate increases. This attitude is less common in cases where transportation service rates
are involved. Shippers are usually keenly conscious of their trans- portation costs and oppose increased rates.

Figure 20 shows clearly that an increase in the service rate will reduce the quantity of service demanded. It shows also that a lower rate of output will cause unit costs of production to rise. The outcome may be summarized as follows. The consumers must pay a higher service rate. Furthermore, due to the inelastic nature of the demand, the aggregate amount the consumers must pay for the smaller quantity of service will be higher than the aggregate amount they paid for the larger quantity of service at the lower rate.

The firm, on the other hand, is also affected by reason of the reduced rate of production and the higher unit costs at that rate. If unit costs were not higher at lower rates of production, of course, the regulatory authorities could raise the service rate only enough to increase the total collections of the firm by the amount of the tax and stop. This would make the utility a tax collector, and the repercussions of the tax would fall entirely on the consumer. Under these circumstances, the utility would not have its profits impaired because the amounts shown along the average unit cost curve are average cost figures which will yield the firm a necessary minimum profit if the average revenue for the quantity demanded is at least equal to it. This is true regardless of the rate of production. The final observation to be made about Figure 20 is, then, that under circumstances where costs of production are higher at lower rates of output, both the
consumer and the utility are adversely affected by the tax.\(^{(1)}\)


To determine how much the consumer and the utility are affected by the tax, the relationships among the various revenue and cost curves and the shape and slope of each of these curves must be known. This much can be stated without qualification. As long as the demand is not perfectly inelastic but has less than unitary elasticity, any increase in service rate will increase the aggregate amount consumers must pay for their utility service even though they utilize somewhat less of it. This fact certainly leaves the consumers less well off both in terms of their consumption of utility services and in terms of their purchasing power.\(^{(2)}\)

\(^{(2)}\) See Appendix A to Chapter V for a discussion of the economic effects of various taxes measured in terms of consumers' surplus.

Of course, the increased revenue collected by the utility from the consumers will be wholly or in part passed on to the government which in turn provides the public with some services or performs some functions. These services or functions may compensate the consumers in whole or in part for the sacrifice made by them. The exact net benefit or net loss to the public cannot be determined exactly, but its repercussions can be identified in a general way. To observe that a higher service rate will cause the consumers to pay more for less service is highly significant even though the statement does not tell exactly how much more.
The utility's earnings are reduced by the tax because its sales decline and its unit costs of production are higher at the lower rate of output. If production costs are as shown on Figure 20, they will certainly rise. Furthermore, even if the utility acted as promptly as possible to adjust capacity downward to meet the lower volume of sales, the unit costs might or might not be lower than those in the larger plant operating at a rate below its low cost rate. The extent of the repercussions on the utility will depend on several factors. They may be summarized as follows. In the short run, if the average cost curve is such that a moderate reduction in the rate of output increases sharply the unit costs of production, the adverse effect on the firm will be substantial. If, on the other hand, the average cost curve is quite "flat" around the low cost rate of production, a moderate reduction in sales might have very little effect on the profits of the utility.

In the long run, if the firm makes an adjustment in capacity and if it can do so without an increase in unit costs of production, profits will not be adversely affected except during the period of capacity adjustment. The ability or inability of the firm to make this capacity adjustment is vitally important. It is, in fact, one of the most important concepts in the discussion of utility taxation. If the utility can make this capacity adjustment and do it without raising the unit costs of production, the utility makes a perfect tax collector. Almost all the burden of the tax falls on the consumers who must pay the higher service rate and who will consume the smaller quantity of service. The increased amount paid by them is only the
amount of the tax and no more. The firm is also in an equally good position to change capacity promptly if demand arises. This situation probably does not exist in most branches of regulated industry, but it may not be far from the situation in the trucking and bus line segment. Empirical research is urgently needed in this area because the degree to which these industries, and others too, benefit from the economies of large scale production will indicate the action that tax authorities and regulatory bodies should take when a tax is imposed.

Up to this point in this analysis, it has been assumed that the demand did not change. For the purposes of short-run analysis, this restriction has not distorted the conclusions reached. In long-run analysis, however, it leads to conclusions that are likely to be less useful in a dynamic economy. In the preceding paragraph, for instance, the summary statements considered the possibility of reducing capacity to meet the lower quantity demanded at the increased service rate. As a matter of fact, a utility may choose not to reduce capacity under those circumstances even though it might appear wise to do so. This may be an industry in which demand is gradually growing. Rather than take steps to reduce capacity to meet a temporary reduction in demand, the firm may absorb temporarily whatever adverse effects it may suffer from the tax and be in a position to produce enough service to meet the demand it may expect in the future. This problem opens up an entirely new field of investigation. It is this whether the firm will act to reduce capacity as a result of the re-
duction in service demanded will depend on the time it takes to make such an adjustment. If the anticipated growth in demand is quite slow and the capacity adjustment can be completed quickly, the utility is likely to be keenly conscious of the beneficial effect on profits of swift and accurate capacity adjustments to meet changes in demand. It is likely to make these changes. If, on the other hand, the growth in demand is significant and steady and the time and cost involved in adjusting capacity is considerable, the firm is likely to seek permission to increase its service rate but not alter its capacity. If its request for a rate increase is granted but the amount of the increase is not enough to cover increased costs resulting from the smaller output, it is likely to absorb any short run repercussions so as to benefit from the advantage of having the required productive capacity when the demand has risen so that the quantity demanded again equals the firm's capacity.

It is impossible to say categorically that utilities will or will not adjust their capacities by reason of a change in taxes. Nevertheless, the situation illustrated on Figure 20 seems to indicate it would be eminently worthwhile for tax authorities and regulatory bodies to bear in mind that some segments of regulated industry are probably quite flexible - capacitywise - while others are not. The trucking firms are probably flexible whereas the railroads, electric and gas utilities are not. An understanding of these facts and the degree to which they apply would aid immensely in the formulation of tax and regulatory policy.
THE EFFECT OF THE TAX WHEN THE PLANT IS OPERATING AT A PRODUCTION RATE BELOW ITS LOW COST RATE

Figure 20 was designed to facilitate the discussion of the taxation of a regulated monopoly that was, before the imposition of the tax, earning a minimum or standard profit when it was operating at its low cost rate of production. This firm possessed, it will be recalled, the exact capacity needed to produce the quantity demanded most economically. In other words, its capacity was such that its low cost rate of production was exactly equal to the quantity of service demanded at the established service rate. The firm was in equilibrium in the sense that equilibrium was described in Chapter 3.

Figure 21 on page 163 illustrates a different set of circumstances. In this case the firm is making a profit in excess of the necessary minimum. Furthermore, its capacity does not exactly match the quantity demanded at the established service rate. Its low cost rate of production is considerably higher than the quantity of service being demanded at the service rate in effect. If it possesses the capacity it does because it can produce the quantity of service now being demanded at a lower unit cost in this plant than in any other that it is practically possible to build, it is in equilibrium insofar as it is possible under the circumstances. If, on the other hand, the firm has capacity in excess of the quantity being demanded because demand has decreased recently and capacity adjustments have not yet been made, then the firm is not in equilibrium. For this discussion, it will be assumed that the firm is in equilibrium and that the
Figure 21

REVENUES AND COSTS PER UNIT OF PRODUCTION
capacity it possesses coincides as closely as in physically practicable with the quantity demanded. Although it is quite possible that the firm may not be in equilibrium - and such a situation may not be at all uncommon - it is impossible to examine every conceivable situation.

It is easy to see that this monopoly could, if unregulated, restrict output, raise price and, as a result, earn a much larger profit than it is possible to earn under regulated conditions. Since, as a regulated monopoly, this alternative is not open to it, the following discussion will be devoted to an examination of the repercussions of an income tax on the firm with its service rate set at the level indicated by the horizontal line SR.

It is already clear that this firm is in a position to meet increased demand and to benefit by any such increase. In fact, if demand were to increase to a point where the quantity demanded at the established service rate was equal to that indicated by the intersection of the marginal cost and service rate lines, the unit costs would be somewhat lower than at the present rate of output though higher than at the low cost rate of production. This, together with the fact that the net service rate (NAR) would be about the same as at the lower rate of output and the volume of sales would be higher, would actually offset in part the reduction in profits caused by the imposition of the tax. Furthermore, the total dollar amount of taxes received by the government would be higher.

The important facts to be learned from this discussion are not
merely that in the short run, the profits of this firm will be re-
duced, or that in this particular case the profit reduction would
be lessened if demand rose. There are several other implications
for long run analysis. This illustration demonstrates why it is
that some segments of regulated industry have been able rather
gradually to reduce service rates despite rising taxes whereas other
segments of regulated industry have had to increase their service
rates sharply and still have had to accept lower returns on invest­
ments.

The above explanation is related closely to the effects of ex­
pansion or contraction on costs of production and to the time inter­
val involved in making adjustments in capacity. Expanding segments
of regulated industry that have and are subject to important economies
of scale are in a position to earn satisfactory profits even though
taxes increase. Increased demand leads to larger scale operations and
to notably lower unit costs of production. Under those circumstances,
as long as tax increases are not so large as to more than offset the
benefits of economies of scale, the utility is able to earn at least
a satisfactory return on investment. Figure 21 illustrates how, even
over rather short periods of time, the effect of increased taxes may
be offset by an increase in demand. Furthermore, under these condi­
tions, the firm will try not to be caught in a position where it
must operate at a rate in excess of its low cost rate of operations.
It will expand capacity so as to take advantage of large scale opera­
tions.
In the segments of regulated industry where there are few or no economies of large scale operation or where demand is not rising or is, in fact, declining, all the factors that work in an expanding business to relieve the repercussions of taxes on profits accumulate instead to place a rapidly growing burden on these firms.

Once again, this analysis leads to the conclusion that an understanding of the relationships among and the shape and slope of the demand and cost curves are vitally important for intelligent policy making. Whether the demand is growing or diminishing and whether the economies of large scale operations are significant, negligible or absent must be known. Of perhaps equal importance is the ability or inability of the firms in the regulated industry to make adjustments in capacity promptly to meet changes in demand.

Figure 21 illustrates again the possible adverse effects on profits of an income tax. The comments that may be made about this illustration are much the same as those made above about Figure 20. There is this exception however. In this case, the imposition of the tax on the regulated firm may not cause the firm to ask for a service rate increase due to the already quite satisfactory earnings position and due to the fact that a higher service rate would still further reduce the quantity demanded and still further increase the unit costs of production. Of course, it is possible that if the service rate were increased, the new lower quantity demanded might be a quantity that could be produced more economically in a smaller plant. In this event the firm might gain by the service rate increase, particularly
if the market is contracting for reasons other than the higher service rates.

Another factor may enter into the decision of the firm to call or not to call the attention of the commission to the adverse effect of the tax on profits. This is that earnings may, even after adjustment for the higher income tax, remain quite high. On the other hand, the commission may be aware of the level of earnings and be permitting the firm to earn these profits either because the firm is entitled to a premium by reason of its exceptionally efficient operations or because the commission has a policy of allowing firms to build up a surplus in periods of high economic activity to carry them over periods of adversity. Whatever the reason, this firm does not appear to be in financial difficulty as was the firm illustrated in Figure 20. The illustration again shows how the conventional explanation of monopoly equilibrium and of the effect on profits of a tax fails to fit regulated monopoly firms.

THE EFFECTS OF THE TAX WHEN THE PLANT IS OPERATING AT A PRODUCTION RATE ABOVE ITS LOW COST RATE

Figure 22 on page 168 illustrates a monopoly firm that is operating at a rate in excess of that at which it can produce at its lowest unit cost. As in the case of the firms illustrated in Figures 20 and 21, this firm is considered to be in equilibrium. Although it would make a larger profit if demand were such that it could operate at the rate indicated by the point where the unit costs are lowest or even where the service rate and marginal cost lines cross, this opportuni-
Revenues and Costs per Unit of Production

Figure 22

Revenues and Costs per Unit of Production

MC
AC
NMR
NAR
SR
AR

Quantity of Production

Revenues and Costs per Unit
ty is denied to it because the regulatory body has approved the service rate indicated by the SR line, and because the quantity demanded by the consumers at that rate is much greater than either quantity indicated above. Nevertheless, at the rate of production required to supply the service demanded, the firm is making a profit in excess of its necessary minimum. It is, of course, making less profit than it could if it operated at any of a rather wide range of smaller rates. Also, it is paying fewer dollars in income taxes by reason of its lower profits.

The firm illustrated in Figure 22 may possess the capacity it does for one or more reasons. It may be because demand has suddenly increased and the firm has not had time to enlarge its capacity. In this case, the firm would not be in equilibrium and the implications involved under these circumstances will not be considered. The restricted capacity in relation to demand may be due, however, to other reasons. Possibly the quantity of service demanded at the established service rate can be produced by the existing firm with its existing capacity at a lower unit cost than in a "capacity adjusted" plant or in any other plant or plants it could build. The state of the engineering arts may be such that to build a larger plant would raise unit costs. Also, it is possible that to reorganize its productive capacity so the quantity demanded could be produced in two or more plants would be more expensive. In any event, if it is assumed that Figure 22 represents an actual situation, the effect on profits of the imposition of an income tax can be identified.

The first significant point to note here is that a decrease in
demand may actually benefit the firm by increasing its profits. This, in turn, will increase total taxes paid. An increase in demand would injure it - at least under the circumstances illustrated and until capacity adjustments could be made - because even though the consumers requested more service, the utility could not take advantage of the increased demand by increasing its service rate as the unregulated monopoly would do. Therefore, increased sales at the established service rate would raise the unit costs of production for all service delivered and the utility would make less profit rather than more.

A decrease in demand would enable the firm to make more profit because the unit cost of production would be rather sharply lower for a lower rate of output. Therefore, if fewer units of the service were sold, the margin between the service rate and the unit cost of production at the lower rate would be wider, and even though the sales volume dropped, the wider margin on the smaller quantity of sales might very well yield a higher aggregate profit than if the firm operated at the higher rate. This would be true because the lower rate of output would cause the rate of operation to be nearer to the low cost rate of production. It would be true even though average revenue - after taxes - was lower for the smaller quantity sold because the average unit cost of production would be much lower for the reduced rate of production than for the higher rate.

There are several striking and peculiar effects of the imposition of the income tax on this regulated firm. Although, in the short run,
the firm will have its profits reduced by the full amount of the tax and the consumers will not be affected, the long-run economic consequences are not likely to be those that conventional analysis describes if the service rate is increased. Of course, it can be argued that there is no necessity for the regulatory commission to authorize an increase in the service rate, but as was pointed out in connection with the discussion of Figure 21, the profit level being enjoyed by the firm may be a bonus to which the utility is entitled by reason of its high level of efficiency. Or it may reflect the policy of the regulatory body to permit the utility to recover from a period of low past earnings or to build up a surplus to help it through low earning periods in the future.

Regardless of the reasons for the relationship among service rate, demand and costs of production, it can be stated without qualification that an increase in the service rate will have repercussions on the consumers and the utility that are not explained by conventional analysis. In the first place, any rate increase will cause the consumers to pay more dollars to get less service. In the second place, an increase in service rate will cause a reduction in the quantity of service demanded. This will, in turn, reduce unit costs of production and not raise them as conventional analysis explains it will. If, therefore, the regulatory body authorized the utility to increase the service rate by an amount sufficient to cover the tax, the effect would not be to restore profits to the level existing before the tax but to raise them above that level.
In such a situation as the one described in Figure 22, the first effect of an income tax on profits will be to reduce them by the full amount of the tax. If, however, the regulatory body wishes to - or feels it must - permit the utility to pass on the tax to the consumer in the form of higher rates, the service rate increase necessary to restore the profits to the level enjoyed prior to the tax need not be an amount equal to the per unit amount of the tax. It can be somewhat less than that amount and the result will be to raise taxes paid by the firm and received by the government.

By way of summary, therefore, it can be said that the immediate consequence of an income tax on a utility such as is shown in Figure 22 will be to reduce the utility’s profit by the full amount of the tax. This certainly places the burden on the utility and its investors. It places no burden on the consumers - at least in the short run. If, however, the utility is permitted to raise its service rate, any rate increase will cause the consumers to pay more total dollars for less service - assuming that the elasticity of demand is less than unitary. Furthermore, an increase in service rate equal to the tax on a per unit basis will very likely be more than enough to restore profits to their pre-tax level. Contrary to conventional analysis, in this case, only part of the tax needs to be passed on to the consumer. The producer can absorb some of the tax and may still have larger aggregate profits than before its imposition.

SUMMARY

Once again the first conclusion regarding the economic consequen-
ces of the imposition of an income tax on a regulated monopoly is that the profits will immediately be reduced - or losses increased - by the amount of the tax. If service rate increases are authorized by the regulatory body, the adverse effects of the tax on the firm can be overcome, provided of course, increased service rates do not significantly reduce the quantity of service demanded or destroy the market altogether.

The amount of service rate adjustment necessary to restore the firm to its original earnings position may vary widely. In some instances, the increase required may be much less than the amount necessary to cover the tax on a per unit basis. In other instances the service rate increase must be substantial. In any and all cases where the service rate is increased, however, it is likely that the consumer will pay more total dollars for less total service. The firm may have higher profits, profits unchanged or lower profits.

The ultimate effects depend on many factors, and before these ultimate consequences can be determined it is necessary to have available a considerable amount of empirical data. The final conclusion appears to be clear. It is virtually impossible to anticipate the effects of a tax unless many facts are known about the relationship among the demand, service rate and cost curves and the shapes and slopes of those curves.
CHAPTER VII
SUMMARY, CONCLUSIONS AND EMPIRICAL RESEARCH

Possibly the best way to conclude is to raise several penetrating questions and then reexamine the material to see how well they are answered. The questions may be the following:

1) What has this study contributed to the understanding of the economic consequences of regulated monopoly taxation?

2) What suggestions can be made for empirical research that will test the concepts formulated in this study?

These and other questions come naturally to mind when the time comes to draw together the contents of the preceding chapters. Perhaps they call for answers that will constitute conclusions. This, at any rate, is their purpose.

REVIEW AND SUMMARY

Conventional monopoly theory does not fit the regulated monopoly segment of the economy. This statement becomes vitally important when it is realized that the basic assumptions of that theory - some stated and some implied - do not apply to regulated monopoly situations. In the first place, the regulated monopoly is not a monopoly in the sense that it has no competitors and that it sells a service for which there is no close substitute at a comparable price. It may possess these characteristics in some areas and for some service but not for all. On the other hand, where the regulated monopoly does possess a market for its service for which there is no close sub-
stitute, that market may be preserved for it by law - at least to some extent. Furthermore, the regulated monopoly does not have the opportunity to adjust price and output to those amounts that will yield it the maximum profit. Yet, those are freedoms that monopoly theory assumes monopolies always enjoy.

Monopoly theory assumes that the firm can and will adjust output and price to maximize its profits. The regulated firm is not free to make such adjustments. The only adjustment it can make is to alter its capacity to match the quantity of service demanded. The regulated monopoly strives always to have its plant operating at its low cost rate when producing the quantity its consumers are demanding of it at the service rate the regulatory commission authorizes. The adjustment for the regulated firm becomes a capacity adjustment and not a simple adjustment of output within a plant as it is described in monopoly theory. The resulting equilibrium point for the regulated firm will be where the quantity demanded is just equal to the rate at which the firm can produce when operating at its low cost rate of production. This is a highly significant point and is fundamental to the whole regulated monopoly analysis.

Marginal analysis in the sense that firms are presumed to equalize marginal revenue and marginal cost is not applicable here. If the regulated firm operates where marginal revenue is equal to marginal cost it is doing so either by accident or under a set of unusual circumstances. In fact, if the regulated firm ever operates with a relationship between the plant unit cost curve and the quantity de-
manded other than that described in the preceding paragraph, it does so either because some change in cost or demand has taken place recently to which adjustments have not yet been made or because "lumpiness" or "indivisibility" of factors prevent these adjustments.

The analysis of regulated monopoly is unique in another respect. Where conventional monopoly theory assumes all monopolies to be monopoly-profit-making monopolies, regulated monopolies often are not. In fact, in the unregulated segment of industry, the level of earnings is a test commonly used to identify monopolies. Monopolies are firms which enjoy "monopoly profits." In this study, on the other hand, the firm referred to as a regulated monopoly may or may not pass the usual profit test. In fact, the usual concept of regulated monopoly envisions a firm that always enjoys a "normal" or "minimum" profit and no more. In practice some regulated firms earn more than a minimum, others just the "normal" amount and still others less than that amount. Regulated monopoly analysis, then, requires a new set of assumptions and a new concept of equilibrium.

With a revised set of assumptions and a new concept of equilibrium, economic analysis leads to new and different conclusions. Instead of proceeding to explain that the effects of the tax change depend largely on the size of the tax, the kind of tax levied, whether the tax is universal or special and certain other factors, this analysis takes into account several additional variables. The dominant one, of course, is the impact of regulatory policy. If a tax is imposed for the first time, increased, decreased or abolished, the effects
depend first on what the regulatory body does and second on the factors usually considered. Unfortunately, this order of impact often leads to the conclusion that the economic consequences of taxes themselves are regulated. Indeed, this is true but such a statement overlooks the regulatory problems that arise when the taxes are changed. Actions (or inaction) by the regulatory agency or agencies have different effects under every set of circumstances. The problems confronting the regulatory body are complicated and unique because the characteristics of the industry are unique. The peculiar equilibrium position which regulated firms seek is one of many reasons why the usual analysis is inadequate.

A survey of the many factors involved quickly leads the researcher to realize that any particular tax change may or may not create conditions justifying a change in authorized service rates. In fact, a change in a service rate that is calculated just to cover the change in the tax rate may set off a chain reaction which only works itself out over a considerable period of time. The only comprehensive generalization that can be made about such a tax change is that its economic effects depend on an extensive list of factors including the following:

1. The action or inaction of the appropriate regulatory commission
2. The size of tax (heavy or light)
3. The kind of tax (universal or special)
4. The type of tax (lump sum, per unit sold, per dollar of revenue, net income)
5. The demand function
6. The plant cost function
7. The capacity flexibility of the plants and industry
8. The industry cost function
9. The historical cost function
10. The relation of the demand, plant cost, industry cost and historical cost functions to each other

Despite the long list of variable factors that influence the economic outcome of a tax change, certain statements can be made. For example, it is easy to understand how the immediate effect of any additional tax imposed on a regulated monopoly will be to reduce the profits of that monopoly by the exact amount of the tax unless the regulatory body authorizes a service rate increase. In fact, even if higher service rates are authorized, the firm will have its profits reduced if the new higher rate destroys business or diverts sales to other producers or to the use of substitutes to such an extent that the effect on earnings of the increased service rate is offset. These statements assume, of course, that the demand is not perfectly inelastic and that the demand and cost functions do not change.

It may also be stated - and this is the new, more comprehensive statement made possible by the analysis presented in this study - that if the regulatory body authorizes an increase in service rate that just yields the firm a net service rate equal to the pre-tax service rate, the outcome of that increase may be either to increase, to leave unchanged or to decrease the profits of the firm upon which the
tax was imposed. The service rate increase will reduce the quantity of service purchased by the consumers and, assuming rather inelastic demand, will cost the consumers more total dollars than the larger quantity purchased at the lower pre-tax rate. Furthermore, in cases where firms are not enjoying "above normal" profits, the tax described if followed by the rate adjustment assumed above may cause firms earning "normal" or "less than normal" profits to suffer or to benefit financially.

The important fact is that the tax may have any of the effects described. Therefore, the outcome cannot be foretold unless the variables are known. This is a very different conclusion from that reached by established monopoly theory which explains that the tax change described would inevitably result in lower profits. Conventional analysis would not lead to the conclusion that the firm might actually earn higher profits after the tax and rate adjustment than before. Neither does it make possible additional insight into the repercussions of the tax on the profitless firms.

The reason why conventional analysis does not explain that the profits might increase or remain unchanged is that the conventional explanation assumes the firm to be operating at a rate below that which would permit it to minimize its unit costs of production. This, it is pointed out, is the rate where marginal revenue equals marginal cost and where profits are maximized. Under those circumstances any reduction in output would inevitably reduce profits. On the other hand, regulated monopoly equilibrium analysis, as developed here,
emphasizes that if the firm were in equilibrium - operating at its low cost rate - before the imposition of the tax, the tax increase would place the firm in a less favorable or more unfavorable position.

It shows also that, under the circumstances, a moderate reduction in output from its low cost rate to a slightly lower rate is likely to raise unit costs of production less than a comparable reduction which takes place from a rate that is already less than the firm's low cost rate to an even lower one. This is important, but it is more important still to recognize that the regulated monopoly may operate at a rate in excess of the low cost rate. Where this occurs, the firm may actually benefit financially if the imposition of a tax causes the regulatory body to authorize a compensating rate increase. The rate increase will reduce output and cause, in turn, unit costs to be lower at the lower rate of production.

In some ways, regulated monopoly tax problems are easier to solve than unregulated monopoly tax problems. For example, if a tax is imposed on a regulated firm and the regulatory agency does not permit the firm to increase its service rates, the repercussions are restricted to those that have to do with the firm and its owners and creditors in the first instance and the public ultimately. If the firm is earning profits equal to or in excess of those of other firms offering equal investment opportunities, the ultimate effects may be negligible. Suppose, for example, that the tax is an income tax and that it applies to all firms regardless of whether they are unregula-
ted or regulated. If the tax is imposed, the unregulated firm will have its profits reduced just as will the regulated firm and if the regulated firm is earning a return comparable to that of unregulated firms it will suffer no more than the unregulated firm.

If the conditions are as assumed, the financial position of the regulated firm will not be impaired - immediately at least - and perhaps even the dividends paid the owners may not be reduced. The firm may not, however, have as much to transfer to surplus for reinvestment and it may not make certain capital improvements that it would otherwise have made. It may not choose to borrow capital to make improvements it would have made out of retained profit. The tax, then, might be the cause of a reduction in investment. If, on the other hand, the firm borrows the capital it needs for improvements - despite the reduction in retained profits - new creditors or equity capital owners will be created or else old investors will buy additional securities. In this event the tax may not lead to a reduction in investment.

As a second alternative, suppose that the regulatory body does authorize an increase in service rate - an increase just equal to the amount of the tax calculated on a per unit basis. The effect will be to cause the consumers to pay more total dollars for less total service. As a result, the firm may have more profit, the same amount of profit, or less profit. Which of these three alternative effects occur in any particular case depends again on the interaction of many factors. Although an infinite number of factor combinations are possible, the
method of analysis may be indicated by the following simply hypothet-
cical cases.

For example, if the demand is inelastic but not highly so, if the firm is operating at a rate in excess of its low cost rate, and if the cost curve is quite V-shaped, then the effect of a tax followed by a service rate increase designed to restore the firm's profit position (assuming perfectly inelastic demand) will be to increase the firm's profit immediately.

If, on the other hand, the demand is quite inelastic and costs are such that a modest reduction in the scale of operations would actually reduce unit costs of production, profits might be left unchanged as a net result of the imposition of the tax and a consequent rate increase.

Finally, if the firm is making a normal profit or more prior to the imposition of the tax, is operating at its low cost rate of production and cannot adjust capacity to meet changes in demand, then the effect of a tax increase accompanied by a service rate increase calculated to restore the firm's position if demand were perfectly inelastic, the net effect of the tax and service rate increase will be to reduce the firm's profit.

At this point, it must be noted that some of the illustrative situations described above do not take into account what might happen over a period of time. If time is taken into consideration, price, demand, costs and the relation among them may change. If one or more of these factors change, the entire analysis must be revised. The
necessary revision depends, of course, on the changes themselves. As an example, suppose that demand does not change, and that the service rate is increased only enough to cover the tax assuming output does not change. But, a service rate increase will reduce output and when this happens the firm promptly alters capacity to make the low cost point on the unit cost curve coincide - quantity-wise - with the new lower quantity demanded. The result of this change probably will be to reduce the anticipated reduction in profits or the anticipated increase in losses whichever may be the case. This conclusion is based on another assumption which is likely to be applicable in some segments of the regulated monopoly sector of the economy and not in others. Whether it is applicable depends on the extent to which the scale of operations affects unit costs of production, the degree to which capacity can be adjusted to match the new lower quantity of service demanded and the rate and significance of technological changes in the industry. If the production characteristics of the industry are such that capacity can be adjusted rather precisely to equal the quantity demanded, and if technological improvements are regularly being made, it may be that the unit costs of production will not be any higher for the smaller than for the larger volume of production.

Under these circumstances, consumers will be paying more for less service but the regulated firm will be in almost the same position - profitwise - that it was before the imposition of the tax. If, however, the industry is characterized by economies of scale, by
lumpiness of factors and by the absence of technological improvement, the unit costs of production in the larger plant may be little or no higher than they would be in any other plant even though the larger plant is no longer operating at or near its low cost rate. In this event, the firm may be unable to improve its position by any adjustment in capacity.

These examples of cases where taxes were increased and the service rate was not, and where both taxes and service rate were increased illustrate some of the possible economic consequences of the imposition of taxes. They do not by any means illustrate all possible cases. In fact, the illustrations used are highly simplified ones. The actual cases are very likely to be ones where the tax increase will be followed at some interval of time rather than immediately by an order of the regulatory body authorizing an increase in the service rate of the firm. The increase may or may not be sufficient to restore profits to their pre-tax level.

Judging by the studies referred to in Chapters I and II, the state commissions, at least, seem to consider demand to be perfectly inelastic and costs to be unaffected except, of course, to the extent of the tax increase. This attitude toward demand and costs is subject to criticism, but only to the extent that these commissions fail to take the demand and cost functions into consideration and not because the outcome of their action is inevitably wrong.
Another contribution of this study is to suggest that the results of commission decisions based on the assumption that demand is inelastic may not in all instances be injurious. If demand is quite inelastic - at least within a range more than sufficient to cover any service rate increase that follows the imposition of a tax - and the firm is able to reduce unit costs either by reducing the output rate or by adjusting plant capacity, or both, the service rate adjustment made on the assumptions that demand is perfectly inelastic and unit costs do not change within a rather narrow range of quantities, may not injure the firm.

This review summarizes ways in which this study has contributed to an understanding of the economic repercussions of taxes. Perhaps its chief contributions have been to demonstrate three things. One is that the assumptions applicable to unregulated monopoly are not satisfactory for regulated monopoly analysis. Another is that the equilibrium analysis used for conventional monopoly analysis does not fit regulated monopoly analysis. And the third is that while a new set of assumptions and a new frame of reference produce a more realistic basis for analyzing the repercussions of taxation of regulated firms, they also show clearly that these repercussions are less predictable than conventional analysis suggests. This study points directly to the fact that empirical data are urgently needed to identify clearly the characteristics of the variable factors involved in each particular branch of regulated industry.
This study has shown that conventional analysis is inadequate. It has also provided a new set of assumptions and a new frame of reference designed specifically to fit regulated monopolies. The significance of this development is to provide a better set of tools for the analysis of individual cases. Although it does not provide the material upon which the tools may be used, the empirical data needed and the methods of obtaining them are discussed in the final section of this chapter.

Another contribution of this study is its emphasis on the need for reorientation of tax and regulatory policies. Whereas the current attitude generally is to segregate these two subjects, this study emphasizes that they are closely related. They ought to be united in the sense that the effects of tax policy on regulatory problems are understood and taken into account by Congressmen and legislators. The same is true of the repercussions of regulatory policies upon tax problems. This statement does mean to imply that tax and regulatory activities must be united in one agency. It does suggest, however, that these two subjects are inevitably interrelated and that the relationship ought to be recognized by all policymakers.

No attempt has been made in this study to show whether past tax and regulatory policies have preserved or changed the status of each of the various branches of regulated industry. It did not set out to do so. It has, however, provided a method of analysis to use on current situations that will help when supported by adequate data.
to indicate the probable economic effects on the consumer, the firm and the public of each of four types of taxes.

Attention has been called to the regulatory problems created by the imposition of taxes and possible courses of action under assumed sets of circumstances. Perhaps it is not an exaggeration to state that this study has set up a method of analysis which, when empirical data are available, will give useful insights into the probable effects of taxes on regulated monopoly firms.

While this study has referred several times to regulated monopoly taxes, it has not mentioned any specific tax or shown how to determine the economic effects of the imposition of a particular tax on a particular firm. The reason for this is that the purpose of this study has been to formulate a method of analysis. It has not been to solve particular problems.

This is not to say that problems can be solved definitively by abstract analysis. It does mean to state that the construction of a carefully constructed analytical system must precede the empirical research. That the system constructed in this study can be utilized will be illustrated next.

Suppose the legislature of a state is considering the imposition of a new ton-mile tax on all the motor freight carriers operating within the state and that the revenue collected from the tax is to be used exclusively for road construction and maintenance. Suppose it is known also that the philosophy of the legislators is that all residents are entitled to all-weather roads and that cross-state
arterial highways while important are not considered important enough to be built on the scale of free-ways or non-toll thruways if such construction jeopardizes the state's all-weather secondary road system. Suppose also that the state plans to build toll roads for the main cross state intercity traffic and that those toll roads will be self-sustaining. The question that arises is how can the theoretical tools designed in this study be used to show the probable economic effects of such a tax?

Several important points can be made though none of them is conclusive. If the tax is imposed, the immediate effect will be to reduce the profits of the firms by the amount of the tax. This assumes, of course, that the service rates of the firms cannot be increased without the permission of the regulatory commission. Other repercussions will be felt immediately, however. The return on investments made in the motor carrier industry will be reduced. This will tend to make capital less available or to make it more expensive even though the return on investment may remain attractive after adjustment for the new tax.

The carriers will, no doubt, examine the demand for their service to determine whether or not an increase in service rates will destroy or divert traffic. In some areas and for some products a service rate increase will reduce traffic notably. In other areas and for other products it will not. Under the circumstances, the carrier is very likely to apply for a service rate increase on the class of service that it feels will not be diverted or destroyed by
higher rates. If the commission refuses the request, the carrier will suffer financially in so far as its profits are reduced or its losses increased. This will be true, at least, unless the revenue collected by the state is used to build roads that reduce the motor carriers' unit costs.

In the original set of assumptions it was stated that the state planned to use the revenue for additional road maintenance and construction but that it was not to be used for main highways only. This would indicate that the money would not be used entirely to improve the roads most travelled by the motor carriers. The extent to which the motor carrier would benefit cannot be measured exactly but if a question arises concerning the repercussions on the motor carriers, it can be stated that they will benefit some, even though it may be very little. It certainly can be conservatively stated that the motor truck operating unit costs may show some reduction by reason of the repair work done or new construction. It can also be concluded that the revenue collected by the government will not be used in such a way as to increase the competition offered the motor carriers by other carriers.

So far in this illustration, nothing has been stated that could not have been pointed out without the analysis furnished by this study. Beyond this point, however, the study does make a contribution. Suppose now that the commission authorizes the carrier to increase its service rates by an amount just equal to the tax adjusted to a unit cost basis - this adjustment being cal-
culated on the assumption that the traffic would be neither increased nor reduced by the service rate increase. If the tax is imposed and the service rate is increased, the quantity of service demanded will decline and the carrier's volume of business will be reduced. If the volume of business done is reduced, the unit cost of providing the service probably will change. It will not necessarily increase.

The established monopoly analysis for an unregulated monopoly would demonstrate at this point that the ton-mile tax is a variable cost - a cost that varies more or less directly with volume of traffic - and that marginal costs would rise. The result would be, it would be explained, that the firm would restrict output, raise its price and thereby pass on to the consumer some of the tax, absorb some of it and perhaps pass part of it backward to the suppliers of the factors of production. In other words, output would be reduced until marginal revenue and the new higher marginal cost were equal.

The tools provided by this study indicate a different set of repercussions. If the commission permits the regulated firm to raise its service rates by the amount described, several things will happen. One is that output will decline because less service will be purchased. Furthermore, inasmuch as the service rate increase was calculated on the basis of the volume of business the firm was doing prior to the service rate increase, that increase will not yield the firm enough revenue to enable it to pay the tax and have
left for itself as much revenue as it had before the service rate increase. Therefore, the firm has less aggregate revenue after the tax than before. This in turn means that the firm has less net revenue - provided demand does not change. Demand may change, of course, if the road work done by the state enables the carrier to give swifter and more economical service. Under the conditions described, this does not seem very likely. It can also be stated, however, that the revenue spent by the state probably will not increase the motor carriers' competition. This too is an important point. In other words, railroads and other carriers will not benefit.

The next factor to consider is the unit cost of providing the service. If the volume of business declines, less use will be made of the firm's capacity and its unit costs will tend to rise. They will rise without question within any period required by the motor carrier to adjust capacity downward. This adjustment, however, may take only a negligible period. If it does take only a short period - and there are reasons to believe it does - the change in unit costs will reflect whatever change arises as a result of a change in the scale of operations. If the motor carrier industry is one where there are not many economies resulting from large scale operations, then a moderate decline in the scale of operations will not increase unit costs much. If this is the case, then the repercussions on the carrier may be much less than might be assumed without the analysis made possible by this study. The
carrier will have lower profits or higher losses than before the imposition of the tax for the two reasons discussed, but the extent of the change may be negligible or at any rate less than the conventional analysis would imply. Also, if the rate of technological improvement made in the industry in the past - largely through the use of larger and larger truck trailer units - continues, the effect of the tax on profits may be more than offset in a rather short period of time. The conclusion indicated is that even though the regulatory body does not take into account the demand cost functions, the service rate authorizations made for the carriers may be adequate.

If this same analysis were used to trace the repercussions of a tax imposed on the railroads, the conclusions would undoubtedly be different for several reasons. Whereas the motor carrier was assumed to possess almost perfect capacity flexibility, it is generally agreed that a railroad has very little. The repercussions of a tax followed by a rate increase in many areas of its operations might cause only a moderate reduction in traffic, yet this might have significant repercussions on the profit position of the railroad.

In the first place, if the volume of traffic the railroad is handling is reduced, it may very well be from a rate that is already below the low cost rate to an even less economical rate. The impact on unit cost will be greater than ever under those circumstances. But even if the railroad had its capacity adjusted to
demand so that the volume of traffic being hauled was just the amount the railroad could handle and operate at its low cost rate, it will take a very considerable length of time for that carrier to adjust its capacity downward to meet the new lower quantity demanded. In fact, if indivisibility of factors is brought into the analysis, it seems safe to say that perhaps the carrier will never be able to adjust capacity to the ideal equilibrium rate. The importance of this point must not be overstated, however, because the lumpiness of factors may, under other circumstances, actually benefit rather than financially injure the carrier. For example, suppose a carrier is currently operating at a point beyond its low cost rate of operation. In this case, a benefit might result from the imposition of the tax, if it is followed by a service rate increase, because the rate increase would reduce the volume of traffic and then the carrier would have lower unit costs of operation. The reduction in unit costs resulting from the decline in output might reduce costs to such an extent that any moderate reduction in net aggregate revenue would be more than offset and the profits of the carrier might be increased rather than reduced.

Once more, the conclusion reached is the repercussions on the firm of a tax increase cannot be foretold unless considerable information is available. Perhaps the major contribution of this analysis is to emphasize the difficulty of anticipating the effects of the imposition of a tax even though the amount of the service rate adjustment is known.
It would be easy to apply this analysis to other and more complicated examples but it does not seem worthwhile to do so because several such cases were considered in earlier chapters. It may be useful to repeat, however, that the repercussions in almost every case would be demonstrably different from those indicated through the use of conventional analysis.

EMPIRICAL RESEARCH

The empirical research done in regulated monopoly taxation has been largely in the area of burden analysis. Burden has usually been measured in terms of ratios between taxes paid by the firm or industry during a period of time - usually one year - and some financial measure of the business done during the same period. The ratios were occasionally constructed for each of several years in order to identify trends.

Sometimes the ratio used was between taxes paid and gross revenues. At other times it was a ratio between taxes and net operating income after payment of all direct costs but before deduction of non-operating expenses, financial charges, etc. or a ratio between taxes and net income. These ratios are all useful but they must be used with extreme caution. There are several highly significant reasons why they cannot be used directly to show the economic effect of taxes alone on regulated monopoly firms or industries.

Even if the burden ratios show that the share of revenues - gross or net or both - taken by taxes is high or higher than in other
branches of regulated or unregulated industry, this fact by itself
cannot be taken to mean that taxes on the particular branch of
regulated industry are too high. The ratio of taxes to revenue is
not necessarily high by reason of high taxes alone. The revenues
to which taxes are being related are regulated revenues. They are
what they are in part as a result of regulatory policy. They are
also what they are in part as a result of economic conditions.
Therefore, if the ratios show that taxes are taking a larger portion
of revenue or income from one firm or industry than from other firms
or other industries, the only accurate statement that can be made
is that regulatory policy, taxes and business conditions together have
resulted in a higher portion of revenues or income being taken by
taxes in one industry than in another. The ratios by themselves
cannot be used to show the burden of taxes.

To illustrate this point, suppose that the ratio of total
taxes paid to gross revenues for the railroads is higher than that
for the motor trucking firms. Suppose also that the ratio for the
railroads is rising whereas for the trucking firms it is declining.
Can it be concluded that taxes are too high on the railroads or
too low on the motor carriers? No such definite conclusion can be
drawn. The differences may be due to the fact that the two indus-
tries are subject to different regulatory policies or to different
regulatory commissions or to a combination of these and other
factors.

This study opens the way for a different approach to the
problem of measuring the economic consequences of taxation. At this point, two suggestions are made. First, the persons who direct the operations of the regulated firm and the regulatory body and the consuming public are potentially useful sources of information. Second, the data collected must be of a character that will enable the researcher to duplicate the models carried through in this study. The models can then be built on information obtained directly from the persons who make the decisions in the industry.

The data must be of such a character that they will indicate the nature of the demand and cost curves, the possibility of making capacity adjustments and the time period involved in making such adjustments. Some of these data must be obtained directly from the businessmen and the questions asked them must be ones that they are asked regularly and to which they give replies regularly and promptly. Wherever possible, the information collected must be quantitative in nature. The questions ought to be worded in terms used in the industry.

The information obtained from the businessmen must be supplemented and verified so far as possible by data collected from the regulatory commissions and the consumers of the public utility service. The questions asked will need in each instance to be developed carefully with the help of persons associated closely with the industry in question. Also, a careful pilot analysis will need to be made to test the usefulness of the data collected. A proposed set of questions to be asked of operators in the motor trucking
industry is included in the appendix to this chapter.

Questions must also be asked of the shippers and the commissioners to learn what they think are the characteristics of demand and cost in the motor carrier industry. This information will strengthen or weaken the confidence the researchers may place in the data obtained from the industry representatives.

If such actual tests of the analytical techniques developed here show the results to be worthwhile, similar studies could be made for the other branches of regulated industry. Perhaps a study of the railroads would follow that of the motor truck carriers. Information from these two branches of industry might reveal the effects of taxes on each of them and make it possible to tell what change in competitive relationship is likely to follow the imposition or removal of a proposed tax.

Thus many technical problems must be solved before it will be possible to use the theoretical tools developed in the preceding chapters. Application of the tools, based on carefully collected empirical data, will have to be made before the analysis presented here and be implemented either in tax or regulatory policies. Nevertheless, the new assumptions made and the new frame of reference provided for future study of the economic consequences of specific taxes upon specific firms in the regulated monopoly segment of American industry should help lay the foundation for a broader understanding of regulated monopoly taxation in the future than has been possible in the past.
APPENDIX A TO CHAPTER VII

AN ILLUSTRATIVE SET OF QUESTIONS TO BE ASKED EACH OPERATOR IN THE MOTOR TRUCKING INDUSTRY

DEMAND

1. If you raised all your tariffs 5 per cent, would the volume of your business decline? ___
   If so, how much - percentage-wise? ___

2. If you raised all your tariffs 10 per cent, would the volume of your business decline? ___
   If so, how much - percentage-wise? ___

3. If you raised all your tariffs 15 per cent, would the volume of your business decline? ___
   If so, how much - percentage-wise? ___

4. If you raised all your tariffs 20 per cent, would the volume of your business decline? ___
   If so, how much - percentage-wise? ___

5. If you raised all your tariffs and you did lose traffic, what class or classes of traffic would you lose? ______________
   Why? _________________________________________________________________

6. If your expenses rose to such an extent that you decided to increase your tariffs, what tariffs would you increase? __________
   Why? _________________________________________________________________
7. Are your tariffs generally lower than those of the railroads for comparable traffic?
If so, how much?
If not, why not?

3. Why is it that traffic that has traditionally been carried by railroads is now being carried by trucks (steel, for example)?

If it is due to lower tariffs, how much lower are your tariffs?

COST
1. If the volume of traffic (ton-miles) you handle suddenly increased 5 per cent, would your costs per unit of traffic handled increase or decrease?

How much?
Why?

2. If the volume of traffic (ton-miles) you handle suddenly increased 10 per cent, would your costs per unit of traffic handled increase or decrease?

How much?
Why?

3. If the volume of traffic (ton-miles) you handle suddenly increased 15 per cent, would your costs per unit of traffic handled increase or decrease?
4. If the volume of traffic (ton-miles) you handle suddenly increased 20 per cent, would your costs per unit of traffic handled increase or decrease? __________
   How much? _____________________________________________
   Why? _____________________________________________

5. If the volume of traffic (ton-miles) you handle suddenly decreased 5 per cent, would your costs per unit of traffic handled increase or decrease? __________
   How much? _____________________________________________
   Why? _____________________________________________

6. If the volume of traffic (ton-miles) you handle suddenly decreased 10 per cent, would your costs per unit of traffic handled increase or decrease? __________
   How much? _____________________________________________
   Why? _____________________________________________

7. If the volume of traffic (ton-miles) you handle suddenly decreased 15 per cent, would your costs per unit of traffic handled increase or decrease? __________
   How much? _____________________________________________
   Why? _____________________________________________

8. If the volume of traffic (ton-miles) you handle suddenly decreased 20 per cent, would your costs per unit of traffic handled increase or decrease? __________
How much? _____________________________________________________________
Why?  _____________________________________________________________

CAPACITY ADJUSTMENT

1. If your business volume increased 5 per cent would you acquire additional:
   a) trailers? _______________ How soon? ______
   b) tractors? _______________ How soon? ______
   c) terminal facilities ____________ How soon? ______
   d) other facilities or supervisory personnel
      What? ____________________________
      How soon? ____________________________

2. If your business volume increased 10 per cent would you acquire additional:
   a) trailers? _______________ How soon? ______
   b) tractors? _______________ How soon? ______
   c) terminal facilities ____________ How soon? ______
   d) other facilities or supervisory personnel
      What? ____________________________
      How soon? ____________________________

3. If your business volume increased 15 per cent would you acquire additional:
   a) trailers? _______________ How soon? ______
   b) tractors? _______________ How soon? ______
   c) terminal facilities ____________ How soon? ______
d) other facilities or supervisory personnel
   What? ____________________________
   How soon? _______________________

4. If your business volume increased 20 per cent would you acquire additional:
   a) trailers? ______________________ How soon? _________
   b) tractors? ______________________ How soon? _________
   c) terminal facilities _____________ How soon? _________
   d) other facilities or supervisory personnel
      What? ____________________________
      How soon? _______________________

5. If your business volume decreased 5 per cent would you sell or dispose of:
   a) trailers? ______________________ How soon? _________
   b) tractors? ______________________ How soon? _________
   c) terminal facilities _____________ How soon? _________
   d) other facilities or supervisory personnel
      What? ____________________________
      How soon? _______________________

6. If your business volume decreased 10 per cent would you sell or dispose of:
   a) trailers? ______________________ How soon? _________
   b) tractors? ______________________ How soon? _________
   c) terminal facilities _____________ How soon? _________
d) other facilities or supervisory personnel

What? __________________________________________

How soon? ______________________________________

7. If your business volume decreased 15 per cent would you sell or dispose of:

   a) trailers? _____________________ How soon? _________

   b) tractors? _____________________ How soon? _________

   c) terminal facilities How soon? _________

   d) other facilities or supervisory personnel

          What? __________________________________________

          How soon? ______________________________________

8. If your business volume decreased 20 per cent would you sell or dispose of:

   a) trailers? _____________________ How soon? _________

   b) tractors? _____________________ How soon? _________

   c) terminal facilities How soon? _________

   d) other facilities or supervisory personnel

          What? __________________________________________

          How soon? ______________________________________

9. If your business volume increased 5 per cent and you made adjustments to handle the larger volume, would your costs per unit of traffic hauled be:

   a) higher _______ How much? __________

   b) the same _____ Explain. ____________

   c) lower _______ How much? ___________
10. If your business volume increased 10 per cent and you made adjustments to handle the larger volume, would your costs per unit of traffic hauled be:
   a) higher _________ How much? __________
   b) the same _________ Explain. __________
   c) lower _________ How much? __________

11. If your business volume increased 15 per cent and you made adjustments to handle the larger volume, would your costs per unit of traffic hauled be:
   a) higher _________ How much? __________
   b) the same _________ Explain. __________
   c) lower _________ How much? __________

12. If your business volume increased 20 per cent and you made adjustments to handle the larger volume, would your costs per unit of traffic hauled be:
   a) higher _________ How much? __________
   b) the same _________ Explain. __________
   b) lower _________ How much? __________

13. If your business volume decreased 5 per cent and you made adjustments to handle the smaller volume, would your costs per unit of traffic hauled be:
   a) higher _________ How much? __________
   b) the same _________ Explain. __________
   c) lower _________ How much? __________
14. If your business volume decreased 10 per cent and you made adjustments to handle the smaller volume, would your costs per unit of traffic handled be:
   a) higher _______ How much? _______
   b) the same _______ Explain. _______
   c) lower _______ How much? _______

15. If your business volume decreased 15 per cent and you made adjustments to handle the smaller volume, would your costs per unit of traffic handled be:
   a) higher _______ How much? _______
   b) the same _______ Explain. _______
   c) lower _______ How much? _______

16. If your business volume decreased 20 per cent and you made adjustments to handle the smaller volume, would your costs per unit of traffic handled be:
   a) higher _______ How much? _______
   b) the same _______ Explain. _______
   c) lower _______ How much? _______
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P-2a 542 (1944); 56 PUR (N.S.) (1945) p. 173.
My full name is Ivon William Ulrey. I was born near Westerville, Ohio on September 22, 1908. My secondary school education was obtained in Columbus and Cleveland, Ohio. I received the Bachelor of Science degree from The Ohio State University in 1931. Expenses for my college education were earned by working for the Ohio Fuel Gas Company in Columbus, and upon graduation I was transferred to the New York City office of the Columbia Gas and Electric Corporation. I worked for that company and its affiliates for nine years, serving during that time as statistician, accountant and assistant to the Financial Vice-President of Columbia Gas and Electric Corporation.

During my employment in New York, I obtained the degree of Master of Business Administration from New York University. In 1940, prior to entering the United States Navy in 1941, I was senior economist for the Fabricated Products, Iron and Steel Price Division of the Office of Price Administration in Washington, D.C. Upon entry into the Navy, I became radio and cable censor and chief of the Preparations Division of the New York office of the Radio and Cable Censor, U.S. Navy. In 1944, at my request, I was transferred to the Bureau of Ordnance, U.S. Navy, Washington, D.C. where I was chief of Rocket and Bomb Procurement until the end of World War II.

Since 1946, except for periods as Assistant Administrator for Economic Policy, Office of Price Stabilization, Washington, D.C. and comparative cost analyst for the Tennessee Valley Authority, Chattanooga, Tennessee, I have held the position of Instructor in the Department of Economics at the Ohio State University while working toward the degree of Doctor of Philosophy.