THE REPLACEMENT BASIS OF DEPRECIATION IN THE REGULATION OF RATES OF PRIVATELY OWNED UTILITIES

by

MING-CHONG LEE

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Department of Commerce and Business Administration

The University of British Columbia
Vancouver 8, Canada

Date April 10, 1966

ABSTRACT

Economic regulation of business activities appears to be contrary to the philosophy of free enterprise. It can be justified only if it is imposed as a means to serve the public interest - to enhance the economic welfare of society - when the self interest of the producer is likely to prove harmful to the general interest of society. Public utilities are enterprises which have to be regulated in the interest of society and particularly the rates they may charge.

In the regulation of utility rates, cost is often accepted as the proper basis for fixing the rates. Among the costs of rendering a utility service is the cost associated with the use of a capital asset, that is, depreciation expense. There are various bases on which depreciation expense is computed. Thus, there arises the problem of selecting a proper basis for determining the depreciation expense that is consistent with the purpose of rate regulation.

An examination of current literature suggested that there is a case, on theoretical grounds, for adopting the current replacement cost approach to depreciation accounting when the purpose of fixing a utility rate is to serve the interest of society. The case appears strong when a marginal-cost standard is accepted for rate regulation

since, under the assumption of continuity of operations, the cost of replacing the services of a capital asset is the long-run marginal (opportunity) cost of employing the asset in the enterprise; thus, a rate that is fixed on the basis of current replacement cost will promote optimum allocation of resources in the economy.

Even if a "full-cost" standard is employed in the regulation of utility rates, there is still a case for determining depreciation expense on the basis of current replacement cost. A utility rate that is fixed on this basis is more comparable to the price charged in the non-utility sector of the economy and, thus, promotes better allocation of resources between the utility sector and the rest of the economy. It also provides the enterprise an opportunity to maintain intact its productive capacity if this is in the interest of society; for the ability of the enterprise to continue production in the future will not be impaired.

It is recognized that there are practical problems associated with the application of the proposal to a real life situation. However, they are not insurmountable. They appear no greater than the problems associated with the use of reproduction cost new - a concept which has been applied in practice in the history of rate regulation.

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CHAPTER I

INTRODUCTION

Statement of Problem

All economic activities are directed ultimately to the satisfaction of consumers' wants and the promotion of the economic welfare of society. The activities are carried out in various ways. In a free enterprise economy, producers have freedom of action with respect to:

1. What to produce.
2. How to produce.
3. How much to produce.
4. How to distribute their products and at what price to sell them.

In making those decisions, the "invisible hand" of the market system guides the producers so that they meet the choice of consumers and serve their interests in the best manner. In so doing, the producers' own self-interests of maximizing profits are fully met.

For certain industries, the "invisible hand" cannot be depended

upon to guide the actions of the producers in a manner that will best meet the "public interest" of society. Regulatory measures have to be imposed by the "visible hand" of some authority (local or central government or government appointed agency) to correct the deficiencies of the free enterprise system. These industries are the "public utilities". Some utilities are owned and operated by government agencies; others are owned and operated by "private" firms.[1]

Regulation imposed by government generally extends to four areas:[2]

1. Rate (i.e. price at which a service is sold to the public).
2. Quality and quantity of service.
3. Safety of operation.
4. Efficiency of management.

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[1]This is not to be confused with "public" and "private" corporations, a distinction existing in corporation law.

[2]Charles F. Phillips, Jr., The Economics of Regulation, Homewood, Illinois: Richard D. Irwin, Inc., 1965, p. 125.

Of the four, "rate regulation has occupied much of the commissions' time and has been the subject of continuous controversy."[3] It is probable that rate regulation is the greatest problem facing a regulatory authority.

There are two aspects of rate regulation: (a) the rate level or determination of a firm's general level of rates, and (b) the rate structure or determination of specific rates and the relationships between rates.[4]

The first aspect of rate regulation deals with the problem of determining a firm's total revenue requirement.[5] Total revenue is the product of price and the quantity sold at that price. The total amount society pays a utility depends on the rate (price) it is charged and the amount of service it purchases at that rate. Following the economic law of demand, the higher the rate charged, the smaller will be the amount of service that will be consumed. Thus, it is important that a utility rate should be properly fixed; for the level at which it is fixed will affect the consumers' economic welfare through the amount of service that will be demanded, produced and consumed. It will

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[3] Loc. cit.

[4] Ibid., p. 131-4.

[5] Loc. cit.

also affect the investors' welfare through the amount of revenue received and the amount of return on investment earned. Since the interests of investors seem to conflict with those of consumers, it is difficult to fix a rate at a level that is satisfactory to both parties. This is the biggest problem that faces a regulatory authority.

Production capacity and price are necessarily decided in anticipation of demand. In the regulation of a utility rate (price), cost is often accepted as the proper basis for the rate.[6] The cost standard of fixing a utility rate can be (a) a marginal-cost standard, or (b) a full-cost standard.

Since cost is often used as the basis for fixing a utility rate, an improper determination of cost would lead to an improper fixing of a utility rate with unfortunate consequences upon the welfare of society. Included in the costs of rendering a utility service is depreciation expense. Its proper determination is important for the purpose of fixing utility rates since utility companies generally employ a very high proportion of capital assets. There are, however, various interpretations of depreciation and various approaches to the determination of depreciation expense. In the history of rate regulation in public

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[6]J.C. Bonbright, Principles of Public Utility Rates, New York; Columbia University Press, 1961, p. 67.

utilities, various approaches to the determination of depreciation expense have been accepted; among them are depreciation on the basis of original cost, reproduction cost new and a somewhat nebulour "fair-value" cost. There is no consistency in the choice of approach for the purpose of fixing rates. This gives rise to much confusion and conflict over the question: what is the proper cost of rendering a utility service associated with the use of a capital asset?

Purpose and Scope of Study

In view of the question posed above, this study proposes a case, on theoretical grounds, for adopting the current replacement cost approach to depreciation accounting as part of the process of determining the cost of rendering a utility service so that a utility rate can be fixed at a level that is in the public interest.

There is a significant amount of current literature on the concept of current replacement cost (as distinct from the concept of reproduction cost new). However, little has been written on the use of current replacement cost for the purpose of fixing utility rates that are consistent with the main aim of regulating the operations of utility companies.

The area of this study will be confined to those utilities which are operated and owned by private individuals and which, therefore,

are concerned with earning enough revenues to cover costs of operations and also yield a return on investment. No attempt will be made to examine the question of adequate or "fair" return on investment allowable to investors. It is considered as a separate problem altogether. However, a superficial discussion of the problem will be given in an appendix.

Research Methodology

This study draws heavily upon secondary sources for its material. They include books, relevant articles published in various journals, and theses, both published and unpublished. Legal cases on rate regulation also provide useful material for the study.

Chapter Organization

The development of the utility concept and the general characteristics of public utility enterprises are reviewed in Chapter II. An account of the purpose of regulating the operations of public utilities is given in Chapter III. On the assumption that a marginal-cost standard is accepted for rate regulation, Chapter IV presents a case for current replacement cost as the logical and proper basis for determining depreciation expense. Where a full-cost standard is adopted, there is also a case for the current replacement cost approach

to depreciation accounting and this case is developed in Chapter V. Chapter VI illustrates the computational aspect of accounting for depreciation on the basis of current replacement cost. The summary and conclusions of this study are presented in the final chapter.

A review of the various concepts of depreciation and the various approaches to the determination of the amount of depreciation expense, is appended. The current replacement cost concept as propounded by the American Accounting Association, including a computational illustration, is appended separately.

CHAPTER II

THE PUBLIC UTILITY CONCEPT

> The term 'public utility concept' is used to denote that body of economic, social and legal ideas which together constitute the institutional framework within which certain designated enterprises operate.[1]

Difficulty of Definition

The above quotation is an attempt made by Professor H. M. Gray to define the public utility concept. It is a rather broad definition giving little help in identifying a public utility enterprise. Many writers have warned that it is not an easy task to define the concept. Thompson and Smith recognize the difficulty when they say, "Let us recognize at the outset that the public utility concept is not easily boxed about in a water-tight fashion."[2]

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[1] H.M. Gray, "The Passing of the Public Utility Concept", Journal of Land and Public Utility Economics, Vol. 16, Feb., 1940, p. 8.

[2] C. W. Thompson & W. R. Smith, Public Utility Economics, New York: McGraw-Hill, 1941, p. 57.

Clemens points out that "many writers have attempted to define a public utility and none perhaps has succeeded to the satisfaction of anyone save himself. It is doubtful that the attempt is worth its while."[3]

Recognition of a Public Utility by Its Duties and Rights

Clemens also points out that "the reach of the public utility concept may be perceived by the industries it embraces."[4] These industries can be recognized by certain duties and rights assigned to them.

Duties: Public utilities generally have four major duties or responsibilities imposed on them because of their special status.[5] They are:

1. The duty to serve all who apply for service. Within a business market area, and within the limit of its capacity, a utility company must be prepared to serve any customer who is willing and able to pay for the service.

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[3]E. W. Clemens, Economics and Public Utilities, New York: Appleton-Century-Crofts, Inc., 1950, p. 13.

[4]Loc. cit.

[5]C. F. Phillips, Jr., The Economics of Regulation, Homewood, Ill.: Richard D. Irwin, Inc., 1965, pp. 81-2.

2. The duty to render safe and adequate service. A utility company must anticipate foreseeable increases in demand; it must be ready to give instantaneous service on demand.
3. The duty to serve without unjust discrimination. All customers must be served on equal terms. However, if reasonable, regulation may permit a utility company to classify customers for the purpose of rate-making.
4. The duty to charge only a "just and reasonable" price for the service rendered. It is up to the regulatory authority (and court) to interpret this duty.

Evidently, these duties are imposed in order to serve the public interest.

Rights: All businesses, both regulated and unregulated, are entitled to certain rights. The most important general right is the legal protection of private property. In addition to the general rights accorded to all businesses, public utilities usually have three rights that are largely the result of their special status.[6]

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[6] Ibid., pp. 82-3.

They are:

1. The right to collect a reasonable price for their services. A regulatory authority may not force a company to operate at a loss.[7] At the same time, a reasonable return is not guaranteed; it is allowed only if it can be earned.
2. The right to render service subject to reasonable rules and regulations. Just as the public has the right to demand that regulated industries live up to their obligations so have these industries the right to reasonable office hours, prompt customer payments, service deposits, and other contractual conditions.
3. The right of eminent domain, that is, the right to take over private property of other for a purpose deemed to be in the public interest, subject to reasonable compensation.

Clearly, these rights are granted to give reasonable protection to the private interests of regulated industries.

Examples of Public Utilities

In most countries, public utilities traditionally include the following:

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[7] A regulatory authority may force certain services offered by a particular company to be operated at a loss (e.g. passenger railroad service), but a company cannot be forced to operate at an overall loss.

1. Water
2. Gas
3. Electricity
4. Postal and telecommunication services
5. Transportation services - rail, motor, air, water and pipe-line carriers.

Others, which are sometimes included in the same category, are bridges, ferries, wharves and docks, grain elevators and stockyards.

The Legal Concept of Public Regulation

In countries, where the institution of private property is well respected, regulating the operations of a business enterprise appears to contravene a basic right of a private person. In the U. S., regulation presents "the problem ... of reconciling the police power of the states or the constitutional powers of the Federal Government with the constitutional protection accorded to individuals by the 14th and 5th Amendments."[8] The police power of the states is "the broad authority to legislate for protection of the health, safety, morals, and general welfare of their citizens."[9]

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[8] E. W. Clemens, op. cit., p. 14.

[9] C. F. Phillips, Jr., op. cit., p. 50.

The 14th Amendment provides that no state shall "deprive any person of life, liberty, or property, without due process of law."[10] The 5th Amendment contains a similar restriction upon the Federal Government. Thus, there appears to be a grave conflict between public policy and private rights.

The right of government to regulate certain industries, in the U. S., was established in the case of Munn v. Illinois, decided by the U. S. Supreme Court in 1877.[11] It has been regarded as one of the twelve most important cases dealing with regulation in the constitutional history of the U. S.[12] In that case, in answer to the question of whether the State of Illinois had invaded private property rights, the Chief Justice said:

> When one becomes a member of society, he necessarily parts with some rights or privileges which, as an individual not affected by his relations to others, he might retain.....This does not confer power upon the whole people to control rights which are purely and exclusively private; but it does authorize the establishment of laws requiring each citizen to so conduct himself, and so use his own property, as not unnecessarily to injure another .... From this source come the police powers .... Under these powers the government regulates the conduct of its citizens one towards another, and the manner in which each shall use his own property, when such regulation becomes necessary for the public good.[13]

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[10]Quoted in E. W. Clemens, op. cit., p. 14.

[11]Munn v. Illinois, 94 U. S. 113 (1877).

[12]E. W. Clemens, op cit., p. 14

[13]Munn v. Illinois, 94 U. S. 124,125 (1877).

The Court found its legal precedents in the words of Lord Chief Justice Hale of England in an almost forgotten work, De Portibus Maris, written more than two centuries earlier. Elaborating on the Court's decision further, the Illinois Chief Justice added:

> Property does become clothed with a public interest when used in a manner to make it of public consequence, and affect the community at large. When, therefore, one devotes his property to a use in which the public has an interest, he, in effect, grants to the public an interest in that use, and must submit to be controlled by the public for the common good....[14]

Thus, it can be concluded that the legal justification for regulating the operations of public utilities lies in proving that they are "clothed with a public interest" and that regulation is necessary for "the public good". What constitutes the public interest is strictly a matter of judgment, depending on the conditions prevailing at that time.

Origins of the Doctrine of Public Interest

C. F. Phillips, Jr. observes that "there are four recognizable antecedents to our "public interest" concept."[15]

The first antecedent is the development of the concept of "just price" in medieval times. He quotes Glaeser:

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[14] Ibid., 126

[15] C. F. Phillips, Jr., op. cit., pp. 51-3.

> Regulation of private industry has been attempted by government from the earliest times. All attempts at such regulation owed much to a very ancient ideal of social justice, which, as applied to economic life by the early Church Fathers, became their very famous doctrine of justum pretium, i.e., "just price." They opposed this idea to the contemporaneous doctrine of verum pretium, i.e., "natural price," which the Roman law had derived from Stoic philosophy. As contrasted with the doctrine of natural price, which justified any price reached by agreement in effecting exchanges between willing buyers and willing sellers, the "just price" doctrine drew attention to the coercion which may reside in economic circumstances, such as food famine where a buyer is made willing by his economic necessities. Hence, in order to draw the sting of coercion, the early Church Fathers, following St. Augustine, considered only that trading to be legitimate in which the trader paid a "just price" to the producer, and in selling, added only so much to the price as was customarily sufficient for his economic support. There was to be no unjust enrichment.[16]

The second antecedent is the development of guilds during the Middle Ages. Members of the same craft belonged to the same guild. They were obliged to provide service to anyone who wanted it at reasonable prices. The various crafts were known, therefore, as "common carriers", "common inn-keepers", "common tailors", and so forth. As each craft had a monopoly of its trade, they were closely regulated.

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[16]Martin G. Glaeser, Public Utilities in American Capitalism, New York: Macmillan Co., 1957, p. 196.

The third antecedent is the development of granting royal charters providing exclusive privilege to monopolize a line of commerce. In France during the sixteenth century, royal charters were granted by the government to plantations and trading companies, making them monopolies. They were, however, strictly regulated to carry out governmental objectives.

Glaeser remarks:

> No distinct line can be drawn between the guilds, the regulated commercial companies of the fourteenth and fifteenth centuries, and the new, joint-stock companies that sprang into being in the sixteenth century with the discoveries and colonizations. In this development, however, is to be found the origin of our modern notion of a public service corporation.[17]

The fourth antecedent is the common law of England. From it was developed the legal antecedent of the public interest concept. Under the common law, certain occupations or callings were singled out and subjected to special rights and duties. These callings became known as "common callings". A person who practised such a calling, as distinguished from private calling, sought public patronage. He had the duty to provide, at reasonable prices, adequate service and facilities to all who wanted them. The reasonable price was ethically controlled and not market determined. Included in the list of common callings were those of surgeons, smiths, bakers, tailors, millers,

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[17] Ibid., p. 201.

innkeepers, ferrymen, wharfingers, and carriers.[18]

Though it is true that all public utilities are "affected with a public interest", it does not necessarily follow that all businesses held to be "affected with a public interest" are considered public utilities. The U. S. Supreme Court in the Nebbia case took pains to point this out, saying, "the dairy industry is not, in the accepted sense of the phrase, a public utility," though the Court found it to be affected with a public interest.[19]

The Tests of Public Utility Status

E. W. Clemens observes that public utilities exhibit certain characteristics which can be applied as tests to identify an enterprise belonging to this group of regulated industries.[20] However, he warns that there is

> ... no infallible clue to the public utility status. On the contrary, it appears that some industries, once exempt from price regulation, may in the course of time become so affected with the public interest as to become public utilities. Certainly this

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[18] C. F. Phillips, Jr., op. cit., p. 53.

[19] Quoted in E. W. Clemens, op. cit., p. 21.

[20] Ibid., pp. 21-34.

category of businesses seems to be a growing one and the same tests when applied to different industries seem to have yielded different results.[21]

The Test of Devotion of Property to a Public Use: The idea of the devotion of property to a public use was established, in modern times, in the Munn case. All public utilities are found to devote their properties to public use, and are required to serve all comers at reasonable rates without discrimination. There are, however, many industries which can be shown to devote their properties to public use, but they are not treated as public utilities. For instance, public utility status was denied to the radio broadcasting industry in the U. S. in 1937.[22]

The Historical Test: Judges often reason by analogy. If a business has been regulated in the past, there is a presumption that it should continue to be subject to regulation. "A cold storage business was held to be public because it was linked to transportation, the Adam of all public utilities."[23]

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[21] Ibid., p. 21.

[22] Pulitzer Pub. Co. V. F.C.C., 94 F. (2d) 249 (1937).

[23] E. W. Clemens, op. cit., p. 23.

This test is obviously imperfect. Baking, tailoring, and milling were regarded by the English Parliament as public utility services in the past, but they are no longer so treated. In Nebbia v. New York, the U. S. Supreme Court pointed out, "It is clear that there is no closed category of businesses affected with a public interest."[24] Thus, one cannot necessarily look to history to limit the group of public utility industries.

The Franchise Test: E. W. Clemens explains:

> The franchise is ... an instrument of public policy which confers a privilege upon its recipient. If the franchise is exclusive, monopoly is created and the privileges are measurably increased. Possession of a franchise or even of a license carries with it some measure of public utility status.[25]

It is observed that all public utilities possess franchises.

> However, the franchise is not a cause of public utility status. Rather it is an instrument of public policy towards businesses in which the public is concerned because of their economic, social, or political characteristics. It is, in short, the effect of public utility status.[26]

Necessity as a Fundamental Test: One of the important prerequisites of public utility status is necessity of service. In Munn v. Illinois, it was proven that the service of grain elevators was

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[24] Op. cit., 291 U.S. 502, 536.

[25] Op. cit., p. 24.

[26] Loc. cit.

absolutely necessary to the farmers of the Northwest, thus justifying regulation of their operations. The services supplied by water, gas, electricity, telephone and transportation industries are, undoubtedly, necessities of life under modern conditions.

Shoes and clothes are also necessities of life, and yet the industries producing them are not classified and treated as public utilities. Hence, necessity cannot be the only prerequisite of public utility status, though every public utility exhibits this feature.

The Test of Monopoly: Monopoly is another important prerequisite of public utility status. Public concern with a business grows with monopoly. In his attempt to maximize profits, an unregulated monopolist tends to charge "extortionate" prices which are against the public interest. Because of lack of competition, a monopolist can afford to adopt a take-it-or-leave-it attitude towards his customers. He can afford to be complacent and less efficient. This is contrary to the public interest, particularly when he can pass on higher costs to his customers. Thus, there is the fear that the public might be "at the mercy" of a monopolist who is concerned only with his self-interest. Regulating the behaviour of a monopolist is justified on the ground of public interest.

The conditions of monopoly were present in almost all the cases in which a business was declared to be "affected with a public interest".

Thus, "we may conclude without further discussion that monopoly conditions are closely allied with public utility status."[27] It is understandable why industries producing shoes and clothes are not classified as public utilities; the consumer can go to alternative suppliers to get his shoes and clothes and he is at no bargaining disadvantage.

However, it may be noted that although steel can be regarded as an essential product in an industrialized country and despite steel companies in the U. S. being more or less monopolies, they are left unregulated. It is evident that necissity and monopoly are necessary but not sufficient conditions to place a business in the category of public utilities.

Since the test of monopoly is an important one, it is helpful to our understanding of public utility concept to study the forces that work irresistibly to make public utilities monopolies.

Essentiality of Product: The essential nature of a utility service is one of the important factors contributing to the tendency of a utility company to become a "natural monopoly". It makes the demand relatively price inelastic, thus giving the producer an opportunity to manipulate price to his advantage.

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[27] Ibid., pp. 25-6.

Large Capital Investments: The utility industries usually require high capital investments to obtain the capital goods or equipment necessary to produce their services. It is reported that

> The capital requirements of electric, gas, water, street-car, and telephone utility companies are normally from four to six times their annual income. Even a so-called high-capital industry such as the steel industry does not normally require capital in excess of its annual revenue.[28]

This high capital requirement practically precludes the entry of competitors. Those who happen to enter the field first often have an exclusive area to themselves.

Economies of Large Scale Production: Since there is such a high ratio of capital assets to revenue and since these assets are normally large and indivisible units, public utility enterprises generally have a very high percentage of fixed costs and a significant amount of idle capacity. Idle capacity results from the nature of the demand for utility services and the economies of large installations which require plant construction well in advance of current needs. The peculiarity of the type of service provided by a utility company requires that it be prepared to meet its greatest probable peak load even though the peak may be of but short duration. The high percentage of fixed costs and the presence of idle capacity are the factors which encourage the

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[28] Ibid., p. 27

enterprise to extend its market since enlarging its scale of production has the favourable effect of decreasing unit cost. Competition tends to reduce the market size of each individual producer and, thus, make production uneconomical. As a high-capital industry has relatively very low operating (variable) costs, competition under such conditions tends to result in drastic price slashing which is undoubtedly injurious to the financial health of the competing companies in the long run with the consequence that the fittest survives to become a monopoly. Conditions of monopoly are necessary for the survival of a utility company and efficient use of its capital assets.

Localized and Restricted Market: One peculiarity of public utilities is that they supply, directly or indirectly, continuous or repeated services through or along more or less permanent physical connecting links between producer and consumer. For example, gas is supplied through pipes from the gas plant to the premises of its consumer. In the telephone industry, to communicate with one another customers have to be linked up through wires and certain frequencies of radio waves. A regular and fixed route generally exists between one bus or train terminal and another. The result of this peculiar feature is that severely localized, and hence restricted, markets exist for utility companies. Entry by rival companies into an established market is difficult. Where there are rival companies in one particular geographical area, duplication of services often results and economic

waste is inevitable. It is clear that one locality is best served by one efficient utility company.

The Franchise: The granting of franchise to a privileged company, as pointed out earlier, is not the cause of public utility status. It is, instead, the result of it. However, as a matter of public policy, franchises are usually exclusive, thus giving monopoly status to the company in its production (but not pricing) operations.

Other Tests: Clemens also mentions other tests, such as the tests of emergency, conservation of resources and national interest.[29] They are less useful tests since they are applicable to situations other than normal.

Of the several tests of public utility status mentioned above, the tests of necessity and monopoly appear more frequently than others. Thus, it can be said that generally a public utility exhibits the characteristics of a "natural monopoly" rendering a service which is regarded essential to society.

Conclusion

It is clearly not an easy task to demarcate the fields of those

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[29] Ibid., pp. 29-34.

industries classified as public utilities, because "the limits of these fields are not matters of definition but of the judgment of the Court, dealing with the facts of single cases in the light of their conception of public policy within the framework of the Constitution."[30] It is observed that

> The classification of public utilities and the manner of their regulation has changed from time to time. But however the businesses have changed, however the manner of regulation has differed, there is always running through our legal and political institutions the belief that the interest of the public transcends that of the individual....Whatever the business, the lesser private interest must yield to a greater public interest. "Public utility" is a fixed concept, with a changing content.[31]

It can be concluded that whether or not a business enterprise will be regulated and treated as a public utility depends ultimately upon the prevailing public policy reflecting the wishes of society at that point of time.

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[30] Ibid., p. 34.

[31] Loc. cit.

CHAPTER III

THE PURPOSE OF REGULATION

The concept of public utility points out clearly that whether or not an economic enterprise will be classified and treated as a public utility will depend, in the final analysis, on the wishes of society expressed through its government. When the operation of an enterprise proves itself to be "clothed with a public interest", society generally wishes to place the enterprise under regulation by the government. Thus, it is evident that the reason behind regulation must lie in the consideration for public interest.

The Goals of Regulation

C. F. Phillips, Jr. indicates that the purpose of regulating the operation of a privately owned utility enterprise has six major aspects:

> First, ... to prevent unreasonable prices and excessive earnings....
>
> Second, ... to assure adequate earnings so that the regulated industries can continue to develop and expand in accordance with consumer demand....
>
> Third, ... to prevent undue or unjust discrimination among customers, commodities and places....

> Fourth, and closely connected with the above, ... [to provide] consumers with maximum service at the lowest possible price....
>
> Fifth, ... [to promote] the development of an industry or a region....
>
> Finally, ... to insure maximum public safety....[1]

It is admitted that "the conflicting nature of these goals is evident."[2] Also evident are: (1) the attainment of each of these goals, with the exception of the final one, depends on the manner in which the utility rate is fixed, and (2) all the goals are consumer biased. The private interest of the company is subordinated to the interests of consumers, or more generally, to the overall interest of society. Thus, one can make a reasonable assumption that the ultimate purpose of regulation is the optimization of society's economic welfare through a proper pricing (rate-fixing) policy. In support of this statement, Gabriel Dessus says, "Whatever the legal status of the firm (nationalized, controlled, under licence, etc.), it is assumed that its primary objective will be to maximize the economic satisfaction of the community it serves."[3]

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[1]C. F. Phillips, Jr., The Economics of Regulation, Homewood, Illinois: Richard D. Irwin, Inc., 1965, pp. 126-7.

[2]Loc. cit.

[3]Gabriel Dessus, "The General Principles of Rate-Fixing in Public Utilities", in J. R. Nelson (ed.), Marginal Cost Pricing in Practice, Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1964, p. 32.

Economic Welfare in a Free Enterprise Economy

All economic activities are directed ultimately to the satisfaction of consumers' wants. The more satisfied a consumer is, the greater is his (economic) welfare. The extent of his satisfaction (and, thus, his welfare) depends on the amount and also the type of goods or services which are within his means to consume. The economic welfare of a society will evidently depend on the quantity and the "mix" of goods and services produced and the manner in which they are distributed to the various members of the society. Briefly, it can be said that society's economic welfare will be optimum, given a certain level of economic activities, when scarce resources are allocated among the various industries and utilized in such a manner as to produce goods and services in a combination that best meets the preference of society. How this is, or should be, achieved depends on the economic policy of the government.

A totalitarian type of government believes that optimum allocation of resources can be achieved only by some form of "central planning". Flow of resources will be best guided by the "visible hands" of government. A democratic government, which encourages private enterprise, believes that it is best to leave everything, whenever and wherever possible, to the "invisible hands" working through

the market. "It is the function of the markets of the pricing system, in private enterprise, to work out the allocation of resources according to consumers' demands."[4] It is in the market that the consumers will reveal their preferences and it is there that their demands will be met.

Economists generally agree that in a free enterprise economy, scarce resources will be optimally allocated when there is perfect competition in both the product and factor markets.[5] All firms must operate under conditions of perfect competition in order that the market be depended upon to distribute goods and services and allocate resources in an optimum manner. In reality, close semblance of perfect competition exists in the capital funds market in most of the well developed countries. Here, all firms (including privately owned utilities) have to compete with one another for most of the capital funds (external funds) they need in order to obtain the necessary factors of production. But in other markets, especially the product market, perfect competition is often lacking. Some firms, because of

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[4]E. H. Phelps Brown, A Course in Applied Economics, London: Sir Isaac Pitman & Sons, Ltd., 1959, p. 185.

[5]See Tibor Scitovsky, Welfare and Competition, London: George Allen & Unwin Ltd., 1958.
Abba P. Lerner, The Economics of Control, New York: The Macmillan Co., 1962.
Richard H. Leftwich, The Price System and Resource Allocation, Revised Edition, New York: Holt, Rinehart and Winston, 1965.

lack of sufficient number of competitors, have great control over the prices of products they sell; among these firms are unregulated utilities. They are relatively monopolistic in the sale of their products.

Since, in a free enterprise economy, the price mechanism is called upon to act as "a device for determining the best distribution of productive resources"[6], it follows that, if the competitive price is the optimum one for this purpose, any firm that tends to price its product differently from a perfect competitor must have its price regulated or controlled so as to approximate the competitive norm. Thus, in the case of utility enterprises, the main purpose of regulating their rates must be to secure approximation to the competitive norm. In the words of Thompson and Smith,

> ... the basic theory of regulation has been the approximation of this competitive ideal....
> The theory of utility regulation is not a substitute for the competitive order but definitely is based upon it.[7]

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[6]E. H. Phelps Brown, op. cit., p. 201.

[7]C. W. Thompson & W. R. Smith, Public Utility Economics, New York: McGraw-Hill, 1941, p. 10.

The Competitive Norm for Optimum Pricing Practice

The perfect competition model is built upon the basic assumption that there are numerous producers, each of whom has perfect knowledge of the market conditions and attempts to maximize his profit. At the same time, there are numerous consumers or buyers, each of whom has perfect knowledge of the market conditions and attempts to maximize his satisfaction. None of the producers or consumers as an individual has any control over the prevailing price in the market. In other words, the market price is "given" to the individual producer or consumer. The individual producer, however, can vary the quantity of a product he chooses to sell. Evidently, he will sell that amount such that his profit is maximized, and this occurs when his marginal revenue just equals his marginal cost. Since the price is given to him, his marginal revenue will be equal to his average revenue as well as the price. Thus, at the point of equilibrium, the price is equal to his marginal cost.

The individual consumer can also vary the quantity of a product he chooses to consume. Evidently, he will consume that amount which will maximize his satisfaction, and this occurs when the marginal satisfaction (utility) he derives from the product is just equal to the price he pays for the product.

Since the producer and the consumer face a common price, the marginal satisfaction which the consumer derives from the product must be equal to the marginal cost of producing the product at the point of equilibrium. Thus, just the right amount of the product is produced for the consumer; there is no wastage at all in this situation. Extending this situation to cover all buyers and sellers in both the product and factor markets, economists come to the conclusion that when price is equated with marginal cost, the market can be depended upon to allocate resources in accordance with society's preference.[8]

The perfect competition model provides the following "rule" for an optimum pricing practice. Sale must be made at cost, because its object "is none other than the correct orientation of consumer choices."[9] To illustrate this point, Marcel Boiteux uses the sale of electric energy as an example:

> If electric energy is sold at cost, the consumer will make the decision which he would have made in looking at the situation from a national viewpoint. If it is sold too cheaply to some, and at too high a price to others, the first consumers are encouraged to waste by preferring electricity to other forms of energy, or by neglecting to do what they could to use it more efficiently; while the second group will use electricity too parsimoniously, by devoting unnecessary efforts to economizing it, or by preferring forms of energy which are really more costly.[10]

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[8]For more details leading to this conclusion, see the authors cited in Footnote 5.

[9]Marcel Boiteux, "Marginal Cost Pricing", in J. R. Nelson (ed.), op. cit., p. 52.

[10]Loc. cit.

The significant cost is marginal cost. Only when price is equated with marginal cost will there be optimum allocation of resources. Any price that deviates from marginal cost must be a sub-optimum price, because it will tend to misallocate scarce resources.

Definition of Marginal Cost

"If D represents total cost, and q output per unit of time, marginal cost is dD/dq."[11] That is, marginal cost is the derivative of the firm's total cost with respect to its output. Simply, it is the increment in the total cost as a consequent of an increment in the output. Most often the incremental output is referred to as the next unit of output. The precise unit, however, has never been very clear; it can be, say, the next passenger-mile or it can be the total passenger-miles in the next unit of time, say, an hour, a day, a week, or even a year. This has led some people, especially non economists, to describe the consequential change in the total cost as the incremental, variable, or out-of-pocket cost. In this study, the four terms, "marginal", "incremental", "variable" and "out-of-pocket" will be used as synonyms since they express basically the same idea, the difference lying in the treatment of the amount of quantitive change in the output.

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[11]Gabriel Dessus, op. cit., p. 33.

Marginal Cost is Opportunity Cost

The concept of opportunity cost (sometimes referred to as alternative cost) is tied up with the assumption that generally resources are scarce in relation to the demand for them and they can be used for alternative purposes. Steel can be used for making cars or bridges. When a given amount of steel is transformed into cars, the bridges which could have been built out of the steel have been foregone. Thus,

> Economists define costs of production of a particular product as the value of the foregone alternative products which resources used in its production could have produced. The costs of resources to a firm are their values in their best alternative uses. This is called "the alternative cost doctrine" or the "opportunity cost doctrine". The firm, in order to secure the services of resources, must pay them amounts equal to what they can earn in those alternative uses.[12]

In the example given above, the economic cost of making the cars must be the value of the bridges foregone.

The opportunity cost doctrine can be restated in terms of the value of marginal product of any given resource. Under perfect competition, each firm using a given resource employs that quantity of it at which its value of marginal product equals its price. Any discrepancy in resource prices offered by different firms induces units of

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[12]Richard H. Leftwich, op. cit., p. 137.

it to move from the lower paying to the higher paying user until a single price prevails throughout the market. Thus, the resource price, or its cost to any firm, will be equal to the value of its marginal product in its alternative employments.[13] It is, therefore, not difficult to see the identity of marginal cost and opportunity cost. As viewed by J. Wiseman, "Marginal cost is the foregone marginal revenue from the best plan necessarily excluded because the chosen plan is selected."[14]

It can be concluded that for resources to be optimally allocated, the price of any product or factor should be based on opportunity cost; that is to say, from the viewpoint of society's economic welfare, "the accepted rule is that no charge should be made for any amenity, the provision of which imposes no opportunity cost."[15]

Pricing Practice of Unregulated Utility Company

Utility enterprises, if left unregulated, will tend to behave in a manner of a monopolist. It must be admitted that there are several types or degrees of monopolists. In the extreme is "the limiting case of 'pure' monopoly, as we may call it, ... so powerful that he is

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[13] Ibid., p. 294.

[14] J. Wiseman, "The Theory of Public Utility Price - An Empty Box", Oxford Economic Papers, New Series, Vol. 9, 1957, p. 60.

[15] E. H. Phelps Brown, op. cit., p. 238

always able to take the whole of all consumers' incomes whatever the level of his output. This will happen when, ..., the average revenue curve for the monopolist's firm has unitary elasticity and is at such a level that all consumers spend all their income on the firm's product whatever its price. Since the elasticity of the firm's average revenue curve is equal to one, total outlay on the firm's product will be the same at every price. The pure monopolist takes all consumers' incomes all the time."[16] Evidently, he must be the sole producer in the whole community and the demand curve facing him must be shaped like a rectangular hyperbola. However, "pure monopoly has so far never existed, and presumably never will."[17]

No utility enterprise can ever be a pure monopoly. In any community, there are other enterprises producing utility services and non-utility goods or services. A utility enterprise has to compete with these other enterprises for the disposable income of the community. A utility service, though often not a perfect or close substitute for other goods or services, cannot be completely or absolutely "neutral" to or "independent" of all other goods or services. Admittedly, the special rights of a franchise may make a utility company the sole producer of its particular product or service; but it remains that it still has to compete with other firms for the disposable income of the

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[16] A. W. Stonier and D. C. Hague, A Textbook of Economic Theory, London: Longmans, Green & Co., Ltd., 1964, p. 106.

[17] Loc. cit.

community. Therefore, it can be said to be a form of competing monopolist, though, obviously, it does not compete in the same manner and to the same extent as do the "monopolistic competitors" of the type explained by Prof. Chamberlin,[18] who produce and sell slightly differentiated products which are relatively close substitutes for each other.

It can be expected that the demand curve facing a utility company will not be a rectangular hyperbola found in the case of a pure monopoly; nor will it be a horizontal straight line facing a perfect competitor. It will be an intermediate of the two limits, that is, sloping downward from the left to the right but probably steeper than that facing a monopolistic competitor, because there are fewer close competitors (see Figure 1). Such a demand curve implies that the price at which the company sells its service is not "given" to it; it can exercise control over its price by varying the amount of its output - other things being assumed equal - or it can fix whatever price it fancies and adjusts its output according to the quantity demanded by the consumers at that price.

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[18] E. H. Chamberlin, Theory of Monopolistic Competition, Cambridge, Mass.: Harvard University Press, 1946. Especially Chapters IV - VII.

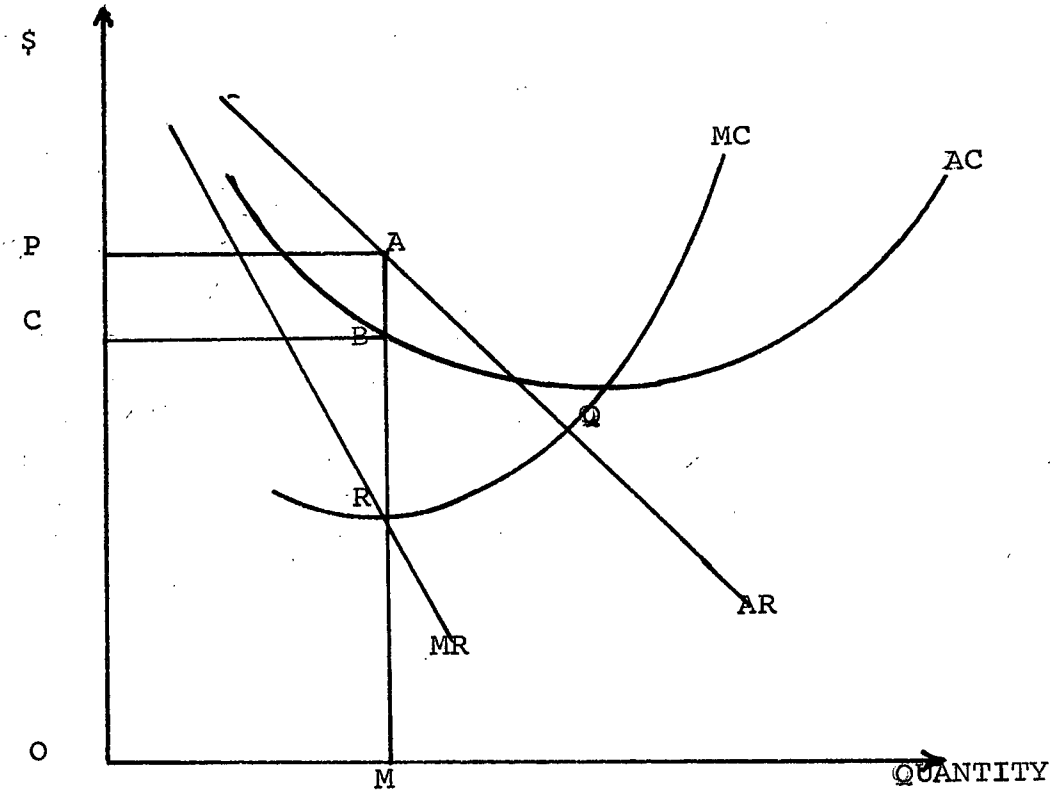

FIGURE 1

SIZE OF OUTPUT WHEN PRICE IS FIXED SUCH THAT MARGINAL COST EQUALS MARGINAL REVENUE

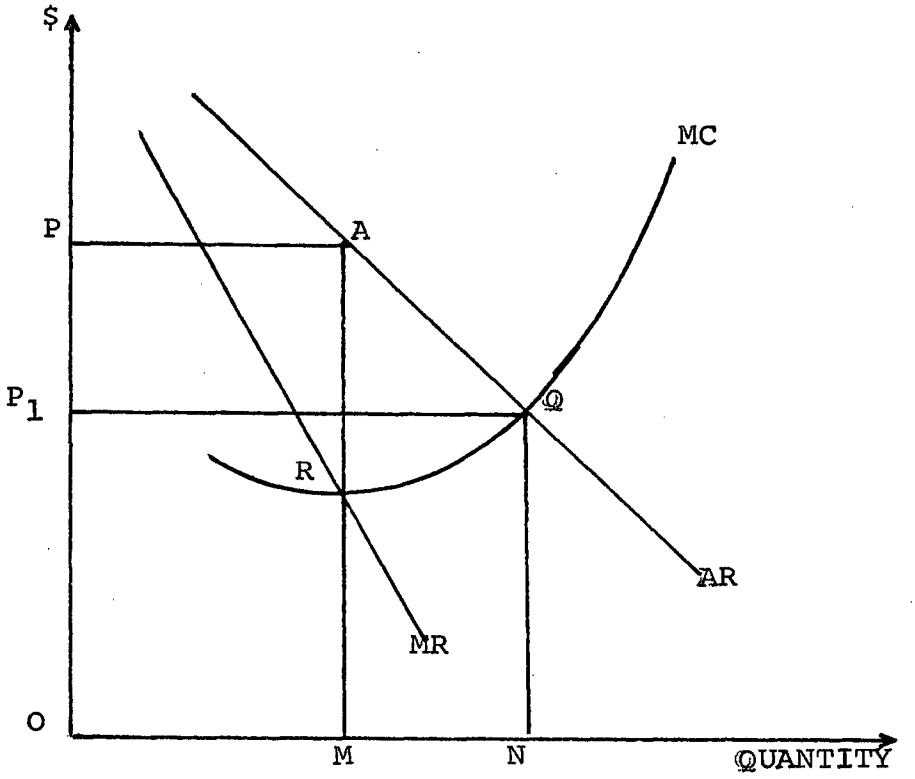

FIGURE 2

SIZE OF OUTPUT WHEN PRICE IS EQUATED WITH MARGINAL COST

With such a demand curve, the marginal revenue (MR) falls below the average revenue (AR). If allowed a free hand, a utility company, in its attempt to maximize profit, will try to produce and sell an amount of service (OM) such that its marginal revenue just equals its marginal cost (MC). At this point of equilibrium, its service will be sold at the price OP and it will be making an amount of "monopoly profit" equal to the area of the rectangle PCBA. Since MR is less than AR, an unregulated utility company will tend to adopt a pricing policy such that its price will be higher than its marginal (opportunity) cost, assuming that maximization of profit is its main goal.

Loss of Welfare When Price Exceeds Marginal Cost

When price exceeds marginal cost, there will be some loss of economic welfare to society. Figure 2 illustrates this. Society is willing to pay an additional amount of revenue, represented by the area AQNM, for an additional amount of service, MN, rather than go without it. The additional cost of producing MN is represented by the area under the curve RQ, i.e. RQNM. This is less than AQNM by an amount equal to the area of AQR. Since the additional cost of producing MN is less than the additional revenue which society is willing to pay rather than go without it, there is, thus, a loss of economic welfare to society and the amount of loss is equal to the area of AQR. Assuming that the AR and MC curves are linear, AQR will

be a triangle and the amount of loss will be equal to the area of the triangle, i.e. 1/2 AR x MN. In other words, the loss of economic welfare, in money terms, will approximate half the difference between the price and the marginal cost times the additional amount of service that is not produced. Thus, the pricing policy of an unregulated utility company will tend to act against the economic welfare of society.

With reference to Figure 2 again, when price is fixed at OP_1 equal to the marginal cost, NQ, an additional amount equal to MN will be produced by the company and consumed by society; thus, there will be no loss of economic welfare to society. This strongly suggests that if regulation of utility rates is aimed at serving the public interest in the best possible manner, then regulation must strive to fix utility rates on the basis of marginal (opportunity) costs. "Maximum-profit" rate-fixing practice, or even "total-cost" rate-fixing practice when there is increasing return, will be out of the question, because it places the private interest of the company well above the general interest of society.

Conclusion

Considering the fact that utility services are essential services and every member of a society must consume some amount of them in one form or another, directly and/or indirectly, it is important to the

general welfare of society that "proper" amounts of scarce resources should be allocated to this group of industries, and this can only be achieved through a marginal-cost pricing practice. Thus, the purpose of rate regulation should be directed to this end.

CHAPTER IV

A CASE FOR REPLACEMENT COST APPROACH TO DEPRECIATION ACCOUNTING (UNDER MARGINAL-COST PRICING)

Marginal-cost pricing for utilities was strongly advocated on the ground of general economic welfare of society by H. Hotelling[1] when he revived the name of Jules Dupuit as a writer on marginal cost for the English-speaking world in 1938. In practice, the pricing policy of Electricité de France has proved the marginal-cost principle to be a workable one.[2]

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[1]H. Hotelling, "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates", Econometrica, Vol. 6, No. 3, July, 1938, pp. 242ff. See also his later note, replying to Prof. R. Frisch, on "The Relation of Prices to Marginal Costs in an Optimum System", ibid., Vol. 7, No. 2, April, 1939, pp. 151-60. For a short history of the development of the philosophy of marginal-cost pricing, see Nancy Ruggles, "The Welfare Basis of the Marginal Cost Pricing Principles", Review of Economic Studies, Vol. 17, 1949-50, pp. 29-46; "Recent Developments in the Theory of Marginal Cost Pricing", ibid., pp. 107-126.

[2]See articles written by engineer economists Gabriel Dessus and Marcel Boiteux which are translated and reprinted in J. R. Nelson (ed.), Marginal Cost Pricing in Practice, Englewood Cliffs, N. J.; Prentice-Hall, Inc., 1964.

It would be rather unfair not to point out that the merits of marginal cost pricing still remain a controversy. There are writers, too, who believe that the marginal cost pricing principle for utilities is "an empty box".[3]

The writer, however, favours the side taken by Hotelling and proceeds on the assumption that marginal-cost pricing in utilities can promote optimum allocation of resources.

Identification of Marginal (Opportunity) Costs

Marginal (opportunity) costs are associated with decisions to acquire those resources or assets which are considered variable. What assets are variable or non-variable depends on the planning period of the management of an economic enterprise. If the planning period is a short one - say, one year - then within that period some

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[3] J. Wiseman, "The Theory of Public Utility Price - An Empty Box", Oxford Economic Papers, New Series, Vol. 9, 1957, pp. 56ff. See also R. H. Coase, "The Marginal Cost Controversy", Economica, New Series, Vol. 13, 1946, pp. 169ff; W. S. Vickrey, "Some Objections to Marginal Cost Pricing", Journal of Political Economy, Vol. 56, 1948, pp. 218ff; "Some Implications of Marginal Cost Pricing for Public Utilities", American Economic Review, Proceedings, Vol. 45, 1955, pp. 605ff; B. P. Beckwith, Marginal Cost, Price-Output Control, New York, 1955; Robert W. Harbeson, "A Critique of Marginal Cost Pricing", Land Economics, Vol. 31, 1955, pp. 54ff; J. C. Bonbright, Principles of Public Utility Rates, New York: Columbia University Press, 1961, Chap. XX, pp. 386-406.

assets will be considered variable and others non-variable. The latter will be those which are durable, indivisible, or specific for that period. For example, fuel, labour service and raw materials will normally be treated as variable since they normally vary with the output within the time period. The costs of acquiring them will be considered as variable costs for the period; they are the marginal or opportunity costs facing the management contemplating production during that period. Assets of the nature of a building or a boiler will be considered durable, indivisible or specific for the short-term period, and the actual costs of acquiring them will be treated as "fixed" or "past" for that period. Thus, such costs are no longer marginal to the management that plans for the short period. There will be no change in the acquisition cost of a "lumpy" (indivisible) asset for increments of output within a certain range. So the past of an indivisible asset cannot be an opportunity cost to the management. The past cost of a durable or specific asset is not an opportunity cost, either, because any use of the available asset during the period will not change the amount of its historical cost.

If the planning period of the management is long one, "at least as long as the lowest common multiple of the life-span of all the factors of production concerned"[4], then all assets will be regarded as variable,

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[4] J. Wiseman, op. cit., p. 60.

because all will have to be reacquired in order to continue operation in the long run. There will be no such things as indivisibility, durability and specificity of assets in a planning period as long as that. Thus, the costs of acquiring all the necessary assets (including buildings and boilers) will be marginal to the management; they are the opportunity costs facing the management. They are costs to be incurred and not costs that have been incurred in the past. Thus, all marginal (opportunity) costs are future costs.

Summing up, "the figure treated as marginal cost will thus depend upon the time period selected."[5] The key to the identification of marginal (opportunity) costs lies in the identification of the planning period considered by the management.

Proper Costs Recoverable By Utility Companies

If it is granted that utility rates should be fixed on the basis of marginal costs, it follows that the proper costs recoverable by utilities from consumers are the opportunity costs - the real economic costs of production. As pointed out above, to identify marginal costs one must identify the length of the planning period. So, what costs are properly recoverable by a utility company through its rates will depend on the length of the planning period contemplated by the company.

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[5] Loc. cit.

Short-Term Planning Period

If the planning period of the company is short - say, less than the average life-span of all its assets - there is the problem of distinguishing assets which are variable from those which are "fixed" with respect to the time period selected. Clearly, the cost of acquiring the variable assets can be included in the rates charged by the company, because they reflect the opportunity costs of producing some amount of service during the period. However, the costs that have been incurred in the past in acquiring the "fixed" assets cannot be included in its rates without causing misallocation of resources, because they are no longer marginal to any production of service during the period. Thus, clearly, such costs as the costs of labour service, fuel and other "raw materials" are legitimately recoverable by including them in the rates payable by the consumers who choose to consume the service rendered by the company during the period. Since they pay the opportunity costs of acquiring those "variable" factors, there is no misallocation of the factors. However, there is no justification, on the ground of society's economic welfare, for the company to attempt to recover the past historical costs of its "fixed" assets through the process of amortization. If historical costs are included in the rates, the resultant rates will differ from the marginal costs of production, and the economic welfare of society will suffer.

When demand for the utility service is not perfectly price inelastic, there would be a lower total consumption of the utility service if the historical-cost-based rates happened to be higher than the marginal costs of production. The acquired "fixed" assets would be under-utilized and, thus, wasted; less variable factors would be acquired by the company than would be preferred by society. All of which would evidently not be in the interest of society.

It follows from above that the traditional accounting treatment of depreciation expense[6] has no place in the regulation of utility rates from the viewpoint of society's economic welfare. As long as depreciation expense is defined as that portion of the historical cost of a "fixed" asset allocated or assigned to a given period, it cannot be accepted as an economic cost chargeable to consumers without adversely affecting the allocation of resources in the economy.

However, the use of a "fixed" asset during the short-term period does incur some opportunity cost. If a "fixed" asset has a second-hand market value (e.g. a truck), then the use of the asset during the period imposes an opportunity cost equal to its realisable market value, which should be deemed recoverable from the consumers who prefer to keep the asset in its present use. If over a year its market value drops on account of its being retained in its present use,

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[6]Traditionally, the accountant treats depreciation expense as the amortized portion of the past acquisition cost of a capital asset. However, there are accountants today who disagree with this traditional treatment. See Appendix A, pp. 149-193.

then the decline in its market value during that year must be the opportunity cost of using the asset for the year and that amount[7] is recoverable from the consumers of that year. This obviously implies that there is an economic case for charging depreciation expense computed on the basis of a decline in market value when a short-term planning period is contemplated.

Some "fixed" assets may not have a ready second-hand market, but they may still have alternative uses. For example, a boiler may be used to drive a generator or a steam boat. If it is used to generate electricity, then the electricity users must pay the opportunity cost equal to the value of the boiler in its use to drive a steam boat; if not, it would be a gain to society if the boiler drove a steam boat. Evidently, the opportunity cost of using the boiler for generating electricity must be the discounted value of the boiler when used to drive a steam boat. (When there is perfect knowledge and perfect mobility of assets as assumed under perfect competition, the discounted value will be equal to the market value of the asset.) Thus, depreciation expense when interpreted to mean a measure of the decline in the present value of the asset in its alternative use can be regarded as a legitimate economic cost recoverable from the consumers when the management does not

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[7] To be more exact, this amount should also include the interest that could have been earned on the realised market value had the asset been sold at the beginning of the period.

contemplate replacing the asset in order to continue operation in the long run.

Long-Term Planning Period

If the planning period of a utility company is a long-term one, then the costs of acquiring all the assets necessary for continuity of its operation will be marginal to the company. In a long-run situation, none of the assets can be treated as "fixed"; all become variable in relation to the time period. All have to be replaced when they become useless to the company on account of physical wear and tear or obsolescence, and the costs of replacing them are the opportunity costs facing the company; they are the company's marginal costs in the long run. Thus, if society desires that the company should continue rendering its service, then these are the costs that they should be required to pay the company.

Legitimacy of Replacement Cost Approach to Depreciation Accounting

If depreciation expense is to be accepted as the cost of using a certain type of asset referred to by accountants as "fixed asset", then under the continuity assumption, it can be treated as a legitimate expense only when depreciation is viewed as a recognition of the need to replace the services of retired assets. Thus, only depreciation expense

computed from the viewpoint of replacement requirement[8] can be included in utility rates chargeable to consumers without adversely affecting the allocation of scare resources in the economy. When and where no replacement of asset services is required, logically, if resources are not to be misallocated, there should be no charge for depreciation on the basis of replacement as the cost of using up the services of a capital asset.

Under the continuity assumption, there is no case at all for charging depreciation expense based on price-level adjusted cost. A charge for such a depreciation expense is an attempt to recover from the revenues paid in by consumers the original amount of purchasing power committed to the enterprise by the investors in the past. A recovery of the original amount of purchasing power is no way related to the replacement requirements. The cost (or price) of a new asset required for replacement purpose may not move in the same direction or to same extent as the general price level. Thus, when a long-term planning period obtains, a chargeable depreciation expense

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[8]It is to be noted that if it is considered worthwhile continuing the utility service in the long run, then there is the implicit assumption that the alternative uses of the "fixed assets" now being employed in the company have less value to society. In this situation, there is no need to consider their second-hand value or their present (discounted) value in their alternative uses when accounting for the costs of using up their services in their present employment. Thus, under this assumption, depreciation must be based on the current cost of restoring the service potential consumed during the period. See Appendix B, on pages 194-205, for the current replacement cost concept as propounded by the American Accounting Association.

computed on the basis of historical cost adjusted for price-level changes will result in a cost that may be higher or lower than the long-run marginal cost faced by the company with a consequence that resources will tend to be misallocated.

Similarly, it is not proper either to charge a depreciation expense based on reproduction cost new[9]. Such a charge is an attempt to recover from revenues a sum of money which, it is supposed, would enable an identical reproduction of the retired asset. In reality, technological advancement often makes assets acquired in the past obsolete by the time they are retired. New, improved assets are frequently appearing on the scene, and, if there is going to be any replacement, these improved assets are those which will be acquired

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[9]Reproduction cost new has a special meaning to the utility industry in the U.S.A., where "the Supreme Court has held that in valuing utility property reproduction cost must be defined as the present cost of constructing the existing plant under original conditions". (E. M. Bernstein, Public Utility Rate Making and the Price Level, Chapel Hill: University of N. Carolina Press, 1937, p. 24). This implies that to compute the reproduction cost new of an asset, it is necessary to make an inventory of all the factors used in the original construction of the asset, collect or estimate the current prices of all the factors and assume that the original construction conditions are currently prevailing. Great problems, however, will arise when, on account of the asset becoming obsolete, some of the essential factors needed for its reproduction are no longer available and their current prices are nonexistent. For more details about this concept of cost, see J. Bauer & N. Gold, Public Utility Valuation for Purposes of Rate Control, New York: Macmillan Co., 1934, Chap. VI. See also C. W. Thompson & W. R. Smith, Public Utility Economics, New York: McGraw-Hill Book Co., Inc., 1941, pp. 285-99.

for replacement of those retired. The costs of obtaining these new assets will evidently be different from the estimated costs of duplicating the retired ones as they are no longer similar. The reproduction cost new will tend to differ from the actual replacement cost, because it gives no allowance for obsolescence, and this difference in cost will tend to cause misallocation of resources if reproduction cost new is included in the rates payable by consumers.[10]

"Normal" Return on Investment--An Opportunity Cost

In a money economy, resources needed for production (labour service, fuel, managerial skill, land, building, etc.) are acquired through the medium of money or "capital funds". Though capital funds are just a means to acquire real assets, nevertheless they are an economic resource because they are scarce and have alternative uses. Like any other economic resource, a company which uses financial resource must be required to pay the opportunity cost of using it. Its opportunity cost must be the return[11] it could earn in its alternative

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[10]Reproduction cost new would be acceptable for assets that have not become obsolete; for then reproduction and replacement costs should be the same.

[11]The return can take the form of dividend if the financial resource used is designated as share capital or interest if it is designated as loan.

employment. Being rather mobile, the return which a financial investment could earn in any of its alternative employment would tend to be uniform or equal to the "normal" return on investment. Thus, the opportunity cost of using a financial resource must be the "normal" return on investment. If this normal return is not forthcoming, an investor will be tempted to withdraw his funds and invest them elsewhere to take the advantage of a higher return.[12]

If a utility company intends to operate indefinitely, it can be expected to offer a return attractive enough to induce its existing investors (shareholders as well as creditors) to continue with their investments in the company. If it intends to expand its scale of operations in response to society's demand, it can be expected to offer a return on financial investment attractive enough to invite new investors. Thus, the company can legitimately charge consumers a "normal" return on financial investment as part of the opportunity costs of continuing and expanding production.

Continuity Assumption for Utilities

An economic enterprise once established is normally expected to

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[12]For a different approach to the same conclusion, see E. H. Phelps Brown, op. cit., pp. 247-9.

continue operating indefinitely unless competition puts it out of the business, its product becomes obsolete, or its essential resources run out, such as may occur with a coal mine or a gasfield. It has come to be accepted by economists and accountants that it is reasonable to make such an assumption.[13]

In a free enterprise economy, the survival of a firm usually depends on the intensity of competition it faces and the tastes of consumers. The more competitors a firm has, the greater is the threat to its survival, assuming other things remain the same. Likewise, the more frequently consumers change their tastes, the more frequently does the product of a firm become obsolete and the less is its chance of continuing its operation for a long time if it fails to respond to the dynamic changes that are prevailing.

In the case of utility enterprises, except those which work on exhaustible natural resources such as natural gas, most of the threats to survival have been reduced or removed. Competition is greatly

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[13]According to a study made by R. Ma, the assumption is not altogether unreal; the life-span of the large industrial and commercial corporations is a long one and there is some evidence of a trend towards increasing longevity. See "Births and Deaths in the Quoted Public Company Sector in the United Kingdom, 1943-53", Yorkshire Bulletin of Economic and Social Research, Vol. 12, No. 2, Nov., 1960, pp. 92-3.

reduced by the granting of a franchise to an individual regulated utility company so that it becomes more or less the sole producer of a particular type of service within a certain area. Competition, however, cannot be completely eliminated for a utility company, because some degree of substitution is possible between utility services and also between utility services and non-utility services; for example, electricity and gas are close substitutes for heating purposes and both have to compete with oil which, at least in present conditions on the North American continent, is regarded as a non-utility product; train service has the trucking service as its close competitor in the transportation of goods and it has to compete with bus service and airline service for passengers. Generally, it can be said that a utility company faces less competition than a non-utility company, because it enjoys some form of "protection" from the government.

In addition, the service rendered by a utility company is often essential to society and, thus, demand for the service is more certain than the demand for a non-utility service or product. The threat of product or service obsolescence being less imminent, the chances of a utility company's survival are enhanced to that extent. Considering this fact and the fact that entry into the industry is restricted, one can conclude that the continuity assumption is more realistic when applied to a utility company, and it follows that the case is stronger that a utility company should adopt a long-term planning period and consider in its

pricing policy those marginal costs associated with the long-term planning period. Those costs include depreciation expense based on replacement cost.

The proposal that a utility company should adopt a long-term planning period is further supported by the argument that as it is regulated to serve the interest of society in priority to the interests of its private investors (in the case of a privately owned utility company), it should continue to operate as long as society desires and is willing and able to pay the economic costs of operation.

It is the contention of J. C. Bonbright that it is important that a utility company should contemplate a long-term planning period and work out long-term rates, because the rates which play the major role in influencing the types and amounts of utility services which will be used and produced are those rates which are expected to prevail over a considerable period of time. Quoting him,

> It is these longer-run, anticipated rates, when compared with anticipated prices for substitute products or services, on which individuals must rely in making rational decisions whether to install oil-heating or gas-heating furnaces; whether to buy gas ranges or electric ranges for the kitchen; whether to locate an aluminium-reduction plant near the source of hydro-electric power on the St. Lawrence River or to locate it instead near the source of low-cost steam-electric power in the Ohio Valley, etc., etc.[14]

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[14] J. C. Bonbright, Principles of Public Utility Rates, New York: Columbia University Press, 1961, p. 333.

It is inevitable that he should come to the following conclusion:

> I conclude ... with the opinion, which would probably represent the majority position among economists, that, as setting a general basis of minimum public utility rates and of rate relationships, the more significant marginal or incremental costs are those of a relatively long-run variety - of a variety which treats even capital costs or 'capacity costs' as variable costs.[15]

The two quotations clearly indicate that J. C. Bonbright seems to suggest strongly that a utility company should plan on a long-term basis and consider a charge for depreciation as one necessitated by replacement requirements. However, he favours the long-run marginal cost as setting the minimum level for utility rates.

Summary

The case for replacement cost approach to depreciation accounting for the regulation of utility rates rests on three assumptions:

1. The purpose of regulating utility rates is to optimize the economic welfare of society.
2. Marginal (opportunity) cost pricing promotes optimum economic welfare for society through optimum allocation of resources.
3. Continuity of operation is the normal expectation of a utility company. In the interest of society, it continues to

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[15] Ibid., p. 336. The variable "capacity costs" are obviously the replacement costs of capital assets.

operate as long as society desires and is willing and able to pay the economic costs of operation.

Under these assumptions, if there is to be any charge for depreciation of assets, it must be necessitated by the company's decision to replace the assets to ensure continuity of operation; it cannot be anything else.

CHAPTER V

ANOTHER CASE FOR REPLACEMENT COST APPROACH TO DEPRECIATION ACCOUNTING (UNDER FULL-COST PRICING)

The Full-Cost Standard

> A cost standard of rate making has been most generally accepted in the regulation of rates charged by private utility companies.[1]

The theory behind the traditional cost standard of rate making is that rates as a whole must cover costs as a whole. What the standard is implying is strictly a "full-cost" pricing policy (and not a marginal-cost policy). This standard has two main supports:

> The first support for the cost-price standard is concerned with the consumer-rationing function when performed under the principle of consumer sovereignty. Under this principle, potential consumers should be free to enjoy whatever kinds of service, in whatever amounts, they desire as long as they are ready to indemnify the producers, and hence society in general, for the costs of rendition. Only in this way can the consumers be put in a position, as it were, to ration themselves by striking a balance between benefits

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[1] J. C. Bonbright, Principles of Public Utility Rates, New York: Columbia University Press, 1961, p. 67.

> received and sacrifices imposed. If the rates were set at less than cost, either overt rationing would be necessary or else service would have to be supplied in wasteful amounts. If the rates were set at more than cost, use of the services thus priced would be unduly restricted.[2]

It is perceptible that the consumer-rationing function of rates is also concerned with the allocation of resources.

The second support can be generalized as one that is concerned with the private interests of the company (or rather the private interests of its investors). A "full-cost" price is deemed non confiscatory. It can "motivate and enable the producing company to supply the service in the amount demanded."[3] This implies that a full-cost pricing policy would enable "the regulated industries to (a) obtain necessary replacement funds, [and] (b) maintain the real income of investors and prevent confiscation of their property."[4]

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[2] Ibid., pp. 69-70.

[3] Ibid., p. 70.

[4] C. F. Phillips, Jr., The Economics of Regulation, Homewood, Illinois: Richard D. Irwin, Inc., 1965, p. 231.

It is to be noted that however a price level is fixed (whether on the basis of fully distributed cost or marginal cost), it cannot logically provide funds for replacements nor income for investors. Recovery of costs for the purpose of replacement and distribution of income to investors can only be possible when there are enough revenues paid in by the consumers. Since the amount of revenues earned depends on the volume of sales and the price level at which the sales are made, there is, thus, an implicit assumption here that the consumers' price elasticity of demand is known.

The problem with the cost standard is that ' "Cost" like "value" is a word of many meanings, with the result that persons who disagree, not just on minor details but on major principles of rate-making policy, may all subscribe to some version of the principle of "service at cost". '[5] The flexibility of the standard is "one of the reasons for the popularity of a cost-of-service standard of rate making."[6]

The way cost is defined and determined will obviously decide the kind of results which can be expected with respect to the attainment of the purposes of a full-cost pricing practice.[7]

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[5] J. C. Bonbright, op. cit., p. 69.

[6] Loc. cit.

[7] In a static economy, where there is no change in price level and technology, all interpretations of cost - historical cost, price-level adjusted cost, reproduction (duplication) cost and replacement cost - will yield the same result. But in a dynamic economy, different interpretations and treatments of cost are inevitable. One faces a dilemma, in the midst of changing price levels and technology, in one's effort to select a cost standard for the determination of cost of production, results of operations and values of properties suitable for measuring the performance and position of an economic enterprise.

This chapter seeks to maintain that when valuation of utility properties and determination of related depreciation expenses are made on the basis of current replacement cost as propounded by the American Accounting Association,[8] the purposes of a full-cost pricing practice will be better achieved, granting that such a pricing practice is desirable.

Comparability of Costs

In the business world, full-cost pricing appears to be the most common practice not only in the regulated industries but also in those which enjoy freedom of pricing. G. Shillinglaw remarks that

> Accountants are always faced with demands for estimates of full cost per unit of product. ... Most economists and many accountants object strongly to the use of full product unit costs in pricing, but the concept has strong support in business....; the business executive frequently states that he does not want to introduce or sell any product unless its price is adequate to cover full cost plus a normal or target percentage markup for profit.[9]

As this is the case, prices must be based on comparable costs if they are to be comparable and perform efficiently the function of consumer-rationing. It can be shown that costs of production in

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[8]See Appendix B on page 194.

[9]G. Shillinglaw, Cost Accounting: Analysis and Control, Homewood, Illinois: Richard D. Irwin, Inc., 1961, p. 654.

the utility industries are not very comparable with those in the non-utility industries because of the following:

1. Competition: In non-utility industries, competition of one degree or another prevails in the product markets. In some industries, like retailing of consumer goods, competition is close to perfect. The drive of competition often requires a dynamic firm to adopt the latest art of production in order to stay in business. With rapid changes in technology today, obsolescence is a common phenomenon. Excluding the effects of price-level changes, technological improvements tend to reduce the real cost of capital assets, either in terms of productivity or effective life. Thus, a non-utility firm that faces competition and yet wishes to survive is encouraged to replace its obsolete assets frequently in order to keep pace with advancing technology.

A utility company generally faces less competition in the product market (except, perhaps, in the transportation industry). Coupled with the fact that most of its capital assets are relatively more expensive and longer lasting, there is, thus, less incentive for it to replace its assets to keep pace with technology. As a result, the capital assets of a utility company are relatively more obsolete than those of a non-utility with the consequence that its real capital asset costs are higher than they would otherwise be.

2. Large Investment in Durable Assets: In comparison with other forms of business, utility enterprises invest the greater portion of their funds in durable plant and equipment. They require proportionately less operating assets; I. R. Barnes makes the following observation:

> The large investment in fixed capital is a reflection of the technology of the particular utility industry. At one extreme are the telephone companies that render an intangible service that calls for no manufacturing process on the part of the utility company. Even where the utility is manufacturing and distributing a commodity, such as electricity, water, or gas, production is largely a matter of machine technology involving only limited expenditures for labour and raw materials. The large investment of the typical utility also reflects the public obligations that have been imposed upon these enterprises; the necessity of supplying immediately the consumers' demands for service compels an investment adequate to meet the maximum demands which are likely to fall upon the utility enterprise.[10]

Using the ratio of capital investment to gross operating income to illustrate the point, C. W. Thompson and W. R. Smith remark that

> ... practically without exception, American retail and manufacturing concerns in the course of a year receive a gross annual income at least equal to the amount of their invested capital. For example, the annual income of the iron and steel industry has usually been twice its investment. Similar ratios are found in the automobile and paper and pulp industries. In meat packing and retailing, the ratio of income to investment is approximately 3 to 1. In the utility business, on the other hand, the reverse relation exists, with ratios of income to investment ranging as high as 1 to 8.[11]

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[10] Irston R. Barnes, The Economics of Public Utility Regulation, New York: Appleton-Century-Crofts, Inc., 1942, pp. 44-5.

[11] C. W. Thompson & W. R. Smith, Public Utility Economics, New York: McGraw-Hill Book Co., Inc., 1941, p. 82.

Quoting a study of 200 utility companies made by the Bureau of Business Research at the University of Illinois in 1929, they continue:

> This study shows that the most common ratios fall within the limits of 0.06 and 0.20, which converted to our form of expression would be between 16 to 1 and 5 to 1. Within these limits are found half of the 200 companies analyzed.
>
> More recent data are available. A study of financial statements of electric companies for three selected years in Wisconsin, Illinois, and Iowa shows results similar to the Illinois findings.[12]

It is true that not all capital investments are made for the acquisitions of durable assets. In reply to this, they add:

> It might be argued that fixed assets are not equal to the utility investment, because at least part of the quick assets are thereby ignored, but the omission cannot be too serious, since they (fixed assets) account for 85 to 90 percent of total assets.[13]

3. Price-level Changes: Price-level changes with their effects upon the value of money are a common economic phenomenon today in almost all countries. There are two distinguishable types of price movements: short term fluctuations and long term trend. It has been observed that since 1900 there has been a tendency for the general price level to rise so that each successive cycle took place on higher price levels than its predecessor.[14]

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[12] Loc. cit.

[13] Ibid., p. 83.

[14] Ronald A. Ma, A Review of Price-Level Change and Income Determination Concepts, an unpublished thesis submitted in partial fulfilment of the requirements for the degree of M.B.A., University of B.C., 1963, p. 67.

It is reported that

> So far as the United Kingdom is concerned, there was on the average an annual increase of 4% - 5% in the general price level in the following decade (the decade following the Second World War), a magnitude that has not been equalled in its peace time economy in the past century. The experience in other countries, excluding countries whose economies have been disrupted by war or revolution and the South American republics, has been very similar, though in most cases less pronounced.[15]

The causes held responsible for the inflation in the 1950's in most of the countries around the world are:

(a) a boom in the industrialized nations in consumer durables and housing which spread to private investment in plant and equipment.
(b) increases in costs, particularly wage costs, not accompanied by increased output.
(c) in Communist countries, an increasing share of the national product allocated to consumption.
(d) in the underdeveloped nations, the use of deficit financing to promote industrial expansion, leading to excess demand in the absence of a larger agricultural output.
(e) there was no evidence in the industrialized countries of excess of aggregate demand, but there were shortages of specific commodities such as coal and steel.[16]

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[15] Ibid., p. 67-8.

[16] Ronald A. Ma, op. cit., pp. 68-9. There are signs of shortage of copper, another important industrial raw material, in the U. S. See "The Great Copper Shortage", Newsweek, Feb. 21, 1966, pp. 73-4.

Taking the U.S.A. as an example, the consumer price index rose by about 14% over the ten-year period 1951-1961 and the wholesale price index, by about 4% over the same period.[17] Since the consumer price index is more related to the purchasing power of the dollar, it can be said that the value of money is falling significantly over the years. Since most of the durable assets used by a utility company often last at least as long as 10 years and, further, most of its assets are durable ones, the implication is that its cost of production would likely be stated in terms of rather old dollars of higher purchasing power. A non-utility company, on the other hand, uses proportionately much less durable assets; these assets are generally not so long lasting as those found in a utility company and they are replaced more often under the pressure of competition; thus, it can be concluded that the cost of production of a non-utility company would likely be stated in terms of relatively current dollar of lower purchasing power. Consequently, the cost of production of a utility company and that of a non-utility company are not very comparable.

Summing up, the causes of lack of comparability in the costs of production facing the utility industries and the non-utility industries

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[17] See Table 1 on p. 88. The inflationary trend in the U. S. is still climbing today; see Newsweek, Feb. 21, 1966, p. 74.

can be traced to two factors which are characteristic of a dynamic economy:

1. Technological Changes. A more competitive non-utility company is more likely to keep pace with technological developments that tend to cut down the real cost of production. A less competitive utility company, under the protection of a franchise and discouraged by the large financial requirements necessitated by replacements, is less likely to keep pace with technological advancements. Thus, there is very little comparability in the real cost of production.
2. Price-level Movements. Since non-utility companies use proportionately less durable assets of relatively shorter lives and, thus, generally replace all their assets more frequently than utility companies, price-level movements will reduce comparability between their money costs of production.

To promote comparability between the production cost of a utility enterprise and that of a non-utility enterprise some writers suggest the use of reproduction (duplication) cost for the purpose of valuing utility property and determining depreciation expense and

others advocate the use of price-level adjusted cost.[18]

The Use of Reproduction (Duplication) Cost

The classic defence of reproduction cost, on the ground that utility rates based on it will perform their consumer-rationing function efficiently, is made by Harry G. Brown. He believes that it will give better results than the use of original cost. Summarizing his case, he gives the following conclusion:

> We considered, first, the question whether original investment or present cost of duplication should be chiefly considered in valuing railroads (or other public utilities) for the purpose of rate regulation. It appeared that whether the divergence between original investment and present cost is due to changes in the general price level, to changes in the specific prices of materials required for construction, to changes in the value of land, in any case economic waste and loss would be likely to be produced by emphasis on original cost rather than cost of duplication.[19]

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[18]The proponents of historical (original) cost could argue that since the real production cost of a utility company is higher than that of a non-utility company and its money cost is lower, the two types of costs would cancel out each other and bring about comparability when the use of original cost is retained. This argument would be valid if it could be proven that the two costs move in opposite and equal directions; this coincidence, however, is most unlikely.

[19]Harry G. Brown, "Railroad Valuation and Rate Regulation", Journal of Political Economy, Vol. 33, No. 5, Oct., 1925, p. 530. See also his article, "Economic Basis and Limits of Public Utility Regulation", American Bar Association Reports, Vol. 53, 1928, pp. 717ff.

Several cases decided by the U. S. Supreme Court approved the use of reproduction cost as the basis of valuation.[20] However, they were more concerned about the prevention of "confiscation" of utility properties, which would be possible had original cost been used in times of rising prices.

The emphasis on reproduction cost was not accepted by the Court without some vigorous objections. In his dissent to the majority opinion in the Southwestern Bell Telephone case, Mr. Justice Brandeis, though arguing for the merits of prudent investment, mentioned the logic of the cost of reproducing a substitute plant rather than an identical one

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[20] In the legal history, the use of reproduction cost was first mentioned in Smyth v. Ames (169 U.S. 466 (1898)), where it was decided that it should be taken as one of the factors contributing to the "fair value" of a utility property. The exact words used were: "... the present as compared with the original cost of construction...." This phrase could, however, be interpreted to mean something else, such as the present construction cost of a substitute property, i.e., the current replacement cost. Subsequent cases of importance are: Denver v. Denver Union Water Co., 246 U.S. 178 (1918); Galveston Electric Co. v. Galveston, 258 U.S. 227 (1922); Southwestern Bell Telephone Co. v. Public Service Comm., 262 U.S. 276 (1923); Clark's Ferry Bridge Co. v. Public Service Comm., 291 U.S. 227 (1934). In some cases, reproduction cost is mentioned as the only factor to be taken into account, but it generally appears to be the most significant figure in the final valuation. Georgia Railway & Power Co. v. Railroad Commission, 262 U.S. 625 (1923); Bluefield Water Works & Improvement Co. v. West Virginia P.S.C., 262 U.S. 679 (1923).

to take account of changed conditions. He said:

> If the aim were to ascertain the value (in its ordinary sense) of the utility property, the enquiry would be, not what it would cost to reproduce the identical property, but what it would cost to establish a plant which could render the service, or in other words, at what cost could an equally efficient substitute be then produced. Surely the cost of an equally efficient substitute must be the maximum of the rate base, if prudent investment be rejected as the measure. The utilities seem to claim that the constitutional protection against confiscation guarantees them a return both upon unearned increment and upon the cost of property rendered valueless by obsolescence.[21]

The sole weakness of the use of reproduction cost is hinted by Mr. Justice Brandeis; namely, it fails to give proper recognition to the effect of obsolescence upon the real cost of production. It could be inferred from his dissent that he saw the logic of current replacement cost as is understood here since it considers changes in technology, though he was only concerned that the rates should not be "confiscatory" to the company nor "extortionate" to the consumers.

As reproduction cost ignores the cost effect of technological development, its use in the valuation of a utility property and in the determination of depreciation expense will evidently not make the cost of production of a utility company comparable with that of a non-utility company, though it takes into consideration the cost effects of price-level changes. On this ground, utility rates based on reproduction

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[21] Southwestern Bell Telephone Co. v. Public Service Comm., 262 U.S. 276, 312 (1923).

cost cannot perform their consumer-rationing function efficiently since it is not likely that they are comparable with prices established in non-utility industries.

The Use of Price-Level Adjusted Cost

Among the ardent supporters of historical cost adjusted for changes in general price level are W. A. Paton and H. C. Greer. They are against the use of unadjusted historical cost, because in a period of rising prices, utility rates that are based on it will be

> ... so unjustifiably low that they stimulate more consumption than can be provided by available facilities, retarding the expansion of the services avidly sought by consumers, and hampering the full enjoyment of what could be supplied if charges were more nearly in line with today's price level.[22]

The implication of their statement is that rates based on costs adjusted for general price-level changes would bring about better distribution of resources among industries, particularly between utility industries on the one hand and non-utility industries on the other hand, presumably because such rates would be comparable with prices charged in other industries, since costs would be stated in terms of current dollars.

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[22]William A. Paton & Howard C. Greer, "Utility Rates Must Recognize Dollar Depreciation", Public Utilities Fortnightly, Vol. 51, No. 6, March, 1953, pp. 335-6.

The weakness of the argument given above lies in its failure to see the distinction between stating production cost in terms of current dollars and stating production cost in terms of current conditions with respect to the art of production and the value of dollar unit. In other words, it confuses the expression of production cost in terms of purchasing power with the need to state production cost in terms of what the current art of production and the current dollar value are. Since the production costs of competitive industries generally reflect the current art of production as well as the current dollar value, stating the production costs of utility companies in terms of current dollars through the use of price-level adjustment would not make the latter comparable with the former since there is no common denominator.

The Use of Current Replacement Cost

The current cost of restoring the exhausted service potential of a capital asset, where there is no insistence upon the use (even hypothetically) of an identical asset, takes into consideration both (a) the current art of production, and (b) the current dollar value. Thus, when utility rates are based on current replacement cost, there is a common denominator between these rates and full-cost prices set by competitive industries; and so comparability in costs and prices is established.

It should be noted that optimum allocation of resources among industries with the aim to promote optimum economic welfare for society can only be achieved with marginal cost pricing. When full-cost pricing is practised, the use of current replacement cost for the valuation of utility properties and determination of depreciation expense would not in any way result in optimum allocation of resources in the economy. In the words of J. C. Bonbright, "if optimum resource allocation were to be accepted as the primary objective of rate-making policy, ... what would be required is not a mere transfer from an actual-cost standard to a replacement-cost standard, but rather a transfer from any standard of total cost to a standard of incremental cost."[23]

However, no one would deny that, even under full cost pricing practice, the use of replacement cost in utility industries would promote better allocation of resources in the economy than if original cost were used, because the former undoubtedly places utility rates on a more comparable level with prices outside the utility industries, and, thus, promotes better allocation of resources between utility industries on the one hand and non-utility industries on the other hand.

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[23] J. C. Bonbright, op. cit., p. 230.

Current Replacement Cost and Determination of Income

The second support for full-cost pricing practice is said to be concerned generally with the private interests of utility companies. Under the assumption that consumers' demand is known such that sale at cost-plus price will provide enough revenues to cover costs fully and to yield reasonable income, it can be accepted for the purpose of discussion here that full-cost pricing practice is in the interest of a utility company in the sense that it enables the company to cover all its costs and to earn some income and, thus, be able to continue operating indefinitely to the advantage of its investors and society as well. Since income is deemed to have been earned after all costs have been recovered from revenues, the problem here narrows down to one of deciding which definition of income is most meaningful to investors and society and which interpretation of cost will help in the proper determination of income so defined.

It is proposed that the following definition of income should be accepted as suitable for the purpose here:

> Income from ordinary operations should represent an amount, in current dollars, which, in the absence of catastrophic loss or discovery of assets, is available for distribution outside the firm without contraction of the level of its operating capacity; or, stated in another way, the amount which, by retention, is

available for expansion of operating capacity.[24]

An income determined with the use of this concept, which is akin to the Hicksian concept of economic income, is "real" income free from any distortion caused by the phenomenon of fluctuating price level with its effect on money value. When the income is disposed of, the original productive capacity of the company will not be impaired and so it can continue producing in the future at least at the same level as before. This is evidently in the interests of (a) investors since there is no "confiscation" of utility properties (defined in the more significant terms of productive capacity) or return of economic (contrasted with financial) capital by being included in the income disposed of, and (b) society since the company is in a position to continue rendering service indefinitely.

There are two ways by which this income can be determined:

1. Matching revenues with costs; income is the surplus revenue. This can be called the matching method which is

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[24]American Accounting Association, Committee on Concepts and Standards - Long-Lived Assets, "Accounting For Land, Buildings and Equipment: Supplementary Statement No. 1", The Accounting Review, July, 1964, pp. 695-6. Looking from another angle, income as defined here can be said to be the change in the economic net worth of an enterprise.

currently used by accountants; and

2. Providing first for the maintenance of real capital (productive capacity) from the revenues; any excess revenue is income. This can be called the maintenance of real capital method, which is acceptable to most economists and also accountants.

When costs are properly defined and determined, both methods should yield identical results.

Current Replacement Cost and the Matching Method of Income Determination

For any proper comparison or matching to be made between two things, it is necessary that there should be a common denominator. It follows from this that current revenues should be matched against only current costs if any meaningful income is to be obtained. With respect to durable or long-lived assets, the current cost of expired services must logically be the current cost of restoration. Thus, income can be meaningfully determined only when current replacement cost is used for the valuation of assets and the determination of related depreciation expense.

The use of historical cost is out of place. Accountants would not add American dollars to Canadian dollars when they prepared consolidated financial statements of an American corporation with subsidiaries

in Canada without first expressing them in some common terms; nor would they deduct costs in Canadian dollars from revenues in American dollars to arrive at the income from operations for a period. Would they then match 1956 dollars with 1966 dollars? They would do and are, in fact, doing just that, making an unrealistic assumption that the dollar unit is stable. As a result of this, accounting income today has not much economic significance. When it is disposed of, there will be some consequential impairment of the productive capacity of the enterprise in a period of rising prices; in other words, when accounting income is determined with the use of historical cost in such an inflationary period, it will inevitably include an element of capital, which, when distributed as dividend, will reduce the productive capacity of the enterprise, and this will not be in the interests of investors and society when such a return of capital is not intended at all.

It is admitted that cost of production in current terms can be obtained by making adjustment for general price-level movements. The income that results from the matching of current revenues with price-level adjusted costs will presumably be in current dollars. This is granted, but it must be realized that <u>cost in current dollars</u> is not exactly the same thing as the <u>current cost</u> of using up asset services in the process of current production; there is a shade of difference between the two. Suppose that x units of asset services are required to

produce one unit of output. In 1960, when the general price index was 100, the x units cost $100. In 1966, when the general price index had gone up to 120, the cost of producing one unit of output in terms of current dollars would be $100 x $\frac{120}{100}$, i.e. $120. If in 1966, because of a combination of (a) a change in technology, (b) changes in the supply of and demand for the asset services, and (c) a change in money value, the x units of asset services would cost $150 to replace, then the current cost (associated with the using up of asset services) of producing the one unit of output would be $150.

Current Replacement Cost and the Real Capital Maintenance Method of Income Determination

When the real capital of an enterprise is defined in terms of productive capacity, maintenance of real capital at the level it was at the beginning of a period, requires restoration of any used up capacity. Thus, before any income can be recognized, what it will cost currently to restore the productive capacity of the enterprise must be deducted first from the current revenues. It follows that in applying this method of income determination, the cost of using the services of an asset for production must be the current cost of replacement, taking into account what it will cost to acquire (either through purchase or through construction) an asset currently available for replacement and having

regard to the latest art of production and the latest value of the dollar unit. Any other definition of cost of asset services must be irrelevant to this method of income determination.

Criticisms of the Current Replacement Cost Approach

Opponents of the current replacement cost approach could rightly argue that the concept should be extended to cover operating (current) assets as well as long-lived assets.[25] No one would deny the validity of this argument since it establishes that all costs must be stated on the same basis. However, it could be counterargued that since operating assets generally turn over at least once a year, their past acquisition costs would be very much the same as their current costs of replacements; the effects of technological changes and price level movements are not likely to be of great significance over a period of one year. Thus, no special cost adjustments are necessary for operating assets which are frequently and regularly replenished, but

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[25] The American Accounting Association has recently recommended that inventories be valued on the basis of current replacement cost to be in line with its earlier recommendation that long-lived assets be valued on the same basis. See Committee on Concepts and Standards -- Inventory Measurement; "A Discussion of Various Approaches to Inventory Measurement: Supplementary Statement No. 2", The Accounting Review, Vol. 39, No. 3, July, 1964, pp. 700-14.

for operating assets which are stockpiled for one reason or another, it is admitted that the use of current replacement cost would be necessary.

The current replacement cost concept could be criticized for making an implicit assumption that the enterprise has an indefinitely long life. It has been shown that this assumption is not altogether unreal, particularly for a utility enterprise.

It is claimed that in view of technological progress the cost of new equipment of stated capacity tends to fall from year to year, so that maintaining the value of equipment by reinvesting depreciation funds will involve some expansion of physical capacity.[26] This will not happen since the current cost of replacement makes adjustments for "differences in operating characteristics such as cost, capacity, and quality."[27]

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[26] Encyclopaedia Brittanica, Chicago: William Benton (Publisher), 1959, Vol. 7, pp. 230-1.

[27] American Accounting Association, op. cit., p. 695.

It is stated that "the replacement cost theory is often treated as synonymous with the concept of a replacement fund, that is, the income of an enterprise is determined after provision has been made for the replacement of assets consumed in earning that income;" and that "some accountants would reject the replacement cost concept, regarding it as an invalid confusion of income measurement and cost recovery on the one hand and funding, a managerial function, on the other."[28] It is rather unfortunate that the current replacement cost concept is interpreted by some to imply that the use of the concept requires specific funds be set up for replacements of specific assets when they are retired. It would also be unfortunate for any one to suggest that charging depreciation expense based on current replacement cost would provide funds for replacements of assets.

It must be pointed out here that the use of current replacement cost for depreciation accounting is a means to the same end as the use of historical cost; that is, it is nothing more than a basis for determining the proper cost of rendering service. The difference between the two cost concepts should not be viewed as a difference between one that attempts to provide funds for replacements or requires the provision

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[28]Ronald A. Ma, op. cit., p. 113 & footnote 24 thereon.

of a replacement fund on the one hand and one that attempts to recover costs incurred from revenues earned on the other hand. Rather it should be viewed as a difference between the ways that cost of production is interpreted for the purpose of pricing or determining income for a period. The current replacement cost concept simply maintains that the correct cost of production with respect to the use of the service potential of an asset in the process of production is the current cost of restoring the service potential; whereas the historical cost concept suggests that it is the allotted portion of the past acquisition cost of an asset. Thus, according to the former concept, the proper price which consumers should be made to pay must include this current cost of restoration. Whether or not an actual replacement fund has been, or should be, created out of revenues restricted from disposal (by a charge of this depreciation expense) is, it is granted, a managerial function.[29]

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[29]As the replacement cost concept is associated with the idea of necessity of replacement, it is logical that, under the continuity assumption, the management should replace assets whenever the occasion for it arises. However, it is admitted that how the management should attempt to maintain the productive capacity of the enterprise is strictly a managerial function.

Ronald A. Ma (op. cit., p. 115) believes that "even where an amount equivalent to the depreciation charge is set aside each year and invested in a fund, ... such a fund would meet eventual replacement costs if the annual premiums were based on current price levels (i.e. current general price level); ..."Would it not be more correct to say that the premiums should be based on current price levels of specific assets if the fund were to be sufficient to meet eventual replacement costs?"

What is important here is that the company (and society) should consider itself adequately compensated for rendering the service to consumers when they have paid a price that includes an element of current cost of replacement.[30]

> It has often been claimed that one of the merits of historical cost depreciation is that it pinpoints efficiency, since a firm with a management farsighted enough to purchase its fixed assets when prices are low will show consequentially larger profits (because of the lower depreciation charge).[31]

This claim of measurement of efficiency in performance is hollow on two counts: (a) It is doubtful that all the fixed assets bought by the management were the results of preplanned speculation in mind. When a piece of essential equipment breaks down, can a management be judged as efficient when it postpones buying a replacement to a later

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[30]This "compensation" concept arises from what J. C. Bonbright regards as 'the income-distributive function of rates in the more generally acceptable version that I have called, ..., the "compensation version". Under this version, an individual with a given income who decides to draw upon the producer, and hence on society, for a supply of public utility services should be made to "account" for this draft by the surrender of a cost-equivalent opportunity to use his cash income for the purchase of other things.' (op. cit., p. 70.) It is the writer's contention that a proper measure of this "cost-equivalent opportunity to use his cash income for the purchase of other things" should take into account the current cost of restoring exhausted service potential of an asset.

[31]Ronald A. Ma, op. cit., p. 114.

date when price is expected to be lower? (b) The "consequentially larger profits" may contain "inflationary" money profits which are in fact, windfall "gains" beyond the control of the management. If these profits were distributed, the productive capacity of the enterprise would be impaired; could this be a sign of efficient management?

It is here maintained that the use of current cost of replacement would give a more meaningful measure of the performance of management. It segregates windfall gains as an indication of efficient management. Further, the use of current cost of replacement places the management of a company in a position comparable to that of one which manages a company using (perhaps, hypothetically) the latest machines and equipment acquired at current costs. This gives a better relative measure of the performance of a management. Finally, an income which is arrived at after cost receovery has been made for the replacement of used up productive capacity gives a more meaningful measure of good or wise management under the continuity assumption not only from the viewpoint of investors but also from the viewpoint of society.

Another strong criticism of the use of current cost of replacement is that the cost data so computed are not objective. This is granted. However, it can be pointed out that a number of accounting data presented on the financial statements today bear elements of subjectivity; for example, estimates of bad debts for a period, estimates

of the economic lives of long-lived assets and the amounts of depreciation expense for the period and appraisal surplus related to write-up of an asset; the book value of an asset at any point of time is often a subjective figure. It could be argued that it is the question of degree of subjectivity that matters here.

A searching question could be asked: when the replacement cost of an asset rises for a number of years and then declines shortly before actual replacement is due, the company would be holding surplus cash resources or other funds while its income statements of prior years might have recorded deficits on account of the inflated depreciation charge. Would not this mean that the use of replacement cost might cause distortion in periodic income measurement? The weakness here does not in any way imply inferiority of the concept of replacement cost. It simply illustrates the difficulty of making a reliable forecast of future events. Such an error in the measurement of periodic income is possible even with the use of "objective" historical cost. For example, when a machine is sold, its second-hand market price might be higher than its depreciated book value, thus, giving rise to "a gain on the sale of a fixed asset", which is nothing more than a manifestation of the fact that depreciation charges in the past years (even though computed on the basis of "objective" historical cost) were overstated with the results that incomes of past years were understated.

TABLE 1.

Wholesale Price And Consumer Price Indexes And Annual Percentage Changes, United States, 1890 - 1961 (1957 - 59 - 100)

Year	Wholesale Price Index	Consumer Price Index	Year	Wholesale Price Index	Consumer Price Index
1890	30.7		1926	54.8	61.6
1891	30.6		1927	52.3	60.5
1892	28.5		1928	53.0	59.7
1893	29.2		1929	52.1	59.7
1894	26.2		1930	47.3	58.2
1895	26.7		1931	39.9	53.0
1896	25.4		1932	35.6	47.6
1897	25.5		1933	36.1	45.1
1898	26.5		1934	41.0	46.6
1899	28.5		1935	43.8	47.8
1900	30.7		1936	44.2	48.3
1901	30.2		1937	47.2	50.0
1902	32.2		1938	43.0	49.1
1903	32.6		1939	42.2	48.4
1904	32.7		1940	43.0	48.8
1905	32.9		1941	47.8	51.3
1906	33.9		1942	54.0	56.8
1907	35.7		1943	56.5	60.3
1908	34.4		1944	56.9	61.3
1909	37.0		1945	57.9	62.7
1910	38.6		1946	66.1	68.0
1911	35.5		1947	81.2	77.8
1912	37.8		1948	87.9	83.8
1913	38.2	34.5	1949	83.5	83.0
1914	37.3	35.0	1950	86.8	83.8
1915	38.0	35.4	1951	96.7	90.5
1916	46.8	38.0	1952	94.0	92.5
1917	64.3	44.7	1953	92.7	93.2
1918	71.7	52.4	1954	92.9	93.6
1919	75.8	60.3	1955	93.2	93.3
1920	84.5	69.8	1956	96.2	94.7
1921	53.4	62.3	1957	99.0	98.0
1922	52.9	58.4	1958	100.4	100.7
1923	55.1	59.4	1959	100.6	101.5
1924	53.6	59.6	1960	100.7	103.1
1925	56.6	61.1	1961	100.3	104.2

Source: Ronald A. Ma, A Review of Price-Level Change and Income Determination Concepts, unpublished M.B.A. thesis, The University of British Columbia, Vancouver, 1963, Table 1, p.79.

CHAPTER VI

COMPUTATION OF ANNUAL DEPRECIATION: AN ILLUSTRATION

There are two basic computational problems in accounting for depreciation which aims at determining periodically the amount of cost resulting from the use of services rendered by long-lived assets. They are:

1. The problem of determining the total asset-service cost to be recovered over the useful life of an asset; this is strictly a problem of selecting a proper depreciation base and estimating the net salvage value of the asset.
2. The problem of distributing the total amount of asset-service cost over the accounting periods; this is a problem of selecting the most appropriate depreciation method. It is occasioned by the need to measure cost of production and income periodically.

Thus, the factors to be considered when computing the annual depreciation expense are:

1. The depreciation base.

2. The net salvage value of the asset.
3. The economic (useful) life of the asset.
4. The method (or rate) of depreciation.

Estimating the Useful Life of an Asset

Simply stated, the useful (economic) life of an asset comes to an end at the moment the management decides to retire it from active service because of the following reasons:

1. It is completely broken down or worn out by such physical factors as wear and tear, or decay due to the corrosive or erosive actions of the elements.
2. It is more economical (from the viewpoint of reducing costs or increasing profits) to employ a new asset in its place even though its physical life has not ended. This is often the result of obsolescence brought about by technological progress. It may be also due to the inadequacy of the asset to meet increased volume of demand.
3. Retirement of the asset may be the consequence of product obsolescence. This is not a very common case, because, though a particular product may become obsolete and the asset is no longer useful in that area of

> employment, the same asset can often be used to produce some other products which have not become obsolete.

The three reasons for retiring an asset suggest that its useful life is conditioned by both physical factors and economic (or functional) factors. An asset's useful life is as long as its physical or economic life, whichever is the shorter. Estimating this life is a complex problem because of the various factors that have to be considered together. As pointed out by E. L. Grant and P. T. Norton, Jr.,

> ... no advantage is gained by separating one cause of retirement from another. In fact, some confusion may result from the attempt to classify every retirement as due to either physical depreciation or functional depreciation. Most retirements are motivated by physical and functional factors in varying proportions.[1]

Statistical Approach to Estimate of Useful Life

The two joint writers mentioned above suggest that:

> A good starting point for estimating lives of property units in the future is to examine the evidence of the past. Various statistical approaches to the study of the mortality of physical property have been developed....
>
> The statistical approach has made it evident that physical property units are something like human beings in their

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[1]Eugene L. Grant & Paul T. Norton, Jr., Depreciation, New York: The Ronald Press Co., 1949, p. 19.

> mortality characteristics. If one starts with a number of identical physical property units, some will survive longer than others. That is, some will be retired short of the average life; others will last longer than the average life.[2]

Two general types of statistical approach are:[3]

1. Actuarial methods, which aim at determining survivor curves and frequency curves for annual retirements, as well as giving estimates of average life. These methods are generally similar to the methods developed by life insurance actuaries for the study of human mortality, although variations peculiar to physical property mortality studies have been developed.
2. Turnover methods, which aim only at an estimate of average life.

Though the statistical approaches may be helpful in predicting the useful life of an asset, it should be cautioned that they do have shortcomings which must be given proper attention. First, they rely heavily on past data. To some extent they can be depended upon to forecast the physical life of a similar asset. As explained earlier, the useful life of an asset does not depend on physical factors alone. So, in view of rapidly changing technology today, allowance has to be given

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[2] Ibid., pp. 42-3.

[3] Ibid., pp. 44-86.

to such functional factors as obsolescence and inadequacy which could be expected in the future to reduce the useful life of a machine to much less than its physical life estimated on the basis of past data. Second, because of technological progress, a firm is unlikely to obtain similar assets for replacement purposes. Thus, past data will not be very helpful in predicting the useful lives of assets which no longer possess similar physical characteristics. Even if an asset may possess similar operating characteristics as its predecessor, its physical or chemical constituents may differ significantly and, thus, its physical life can be expected to be different. For example, a railway coach built of aluminium metal has a physical life different from that of one built of timber, though both may possess similar physical operating characteristics. It is reported that a study made by the Machinery and Allied Products Institute (U.S.) shows that changes in the estimated statistical life of an asset could be expected over the passage of time.[4]

As technology is rapidly improving today, it can be expected that obsolescence will be the major factor in deciding the useful life of an asset.[5] Too much reliance should not be placed upon statistical

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[4] Ibid., pp. 220-1.

[5] One authority has estimated that about 20% of all past retirements have resulted from physical causes; the remaining 80% from functional causes. See L. R. Nash, "A New Depreciation Fallacy", Public Utilities Fortnightly, Vol. 30, 1942, pp. 761, 766.

methods which are based on past data. Instead, better techniques of forecasting should be developed to take into consideration expected changes in technology.

Estimate of Useful Life Based on Forecast of the Net Service Values of an Asset.

When a capital asset should be retired and when replacement is due are undoubtedly important managerial functions. Thus, it follows that the useful life of a capital asset is essentially a function of managerial decision.

In a money economy, the management of a firm is concerned more about the monetary earnings of a machine than its physical performance. Admittedly, its physical performance does have an effect on the size of its monetary earnings. What is of real significance to the management are (a) the revenues that could be expected from the product of the machine and (b) the money costs of operating the machine to produce the revenues. Physical performance is important in so far as it affects the money costs of operations. The figure that the management really looks for with respect to the employment of a capital asset is its "net service values" which is defined as

> ... that part of "real" revenue contributed directly by the plant asset, less all operating costs other than depreciation,

> which are properly chargeable against such revenue; in capital budgeting jargon, this concept would be equivalent to the stream of net cash flows. These operating costs include repairs and maintenance costs, plant asset supervisory cost in the particular area, set-up and adjustment cost, and certain lost costs, such as spoiled material costs resulting from the loss of precision of the plant asset, idle capacity cost, and others.[6]

The net service values of a capital asset can be expected to decline for various reasons as time goes on. If the expected decline could be properly discounted, then the moment the present value of the decline in the net service values just exceeds the present incremental cost of acquiring and operating a new asset, there is economic justification for retiring the old asset and replacing it with the new one, assuming that there is still demand for its product. This is the moment of time that decides the termination of the useful life of a capital asset. If, however, its product is becoming obsolete and there is no economic justification for replacement to continue with its production, then the useful life of the existing asset expires the moment its net service values diminish to zero, or, if it could be sold, the moment the present value of its expected net service values just falls below its current market value.

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[6] Isaac Newton Reynolds, An Analysis of Depreciation Methods and Bases, Research Paper 9, School of Business Administration, University of North Carolina - Chapel Hill, May, 1962, p. 8. Note: this concept of "net service values" is similar to the economic concept of "quasi-rent".

Thus, any forecast of the expected useful life of a capital asset should logically take into consideration the expected flow of its net service values.

Factors Affecting the Flow of Net Service Values

The flow of an asset's net service values depends primarily on four factors:[7] (a) the trend in operating costs, (b) the physical efficiency of the asset, (c) the amount of competition which may be expected from improved alternative; the gradual encroachment of obsolescence and inadequacy, and (d) the expected rate of use of the asset. A fifth factor can be added here; it is the expected strength of the demand for the product of the asset.

Trend in Operating Costs: Most capital assets require, during their service lives, a flow of repair and maintenance expenditures, which may vary with age and use. In a few cases, these operating costs of capital assets may be uniform or nil. For example, the poles of a telephone company and the ties of a railway company require little or no repairs and maintenance during the time they are in service. In many industrial firms, repairs may be sporadic and proceed in spurts.

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[7] Isaac Newton Reynolds, op. cit., pp. 8-14.

> As a general rule, however, the flow of maintenance expenditures rises with age and use. Such a rise would tend to make a plant asset less desirable both cost-wise and service-wise.[8]

Assuming that proceeds from sales remain unchanged, rising expenditures for purposes of repairs and maintenance will reduce the flow of net service values and hasten the retirement of the asset.

Some indication of what the operating costs of an asset would be in the future may be obtained from accounting records. If the new asset is similar to an old one in operating characteristics, fairly reliable cost data may be obtained; but, if the asset is a new invention, it will be necessary to "guesstimate" its future operating costs. Since technological progress introduces many new inventions, an accurate forecast of future operating costs would be impossible in most cases, because cost data of old, obsolete assets will not be of much help.

There are other operating costs, such as material spoilage and idle plant cost due to frequent shut-down for repairs. For the most part, they appear to rise with age and use.

Physical Efficiency of Asset: It has often been observed that the efficiency of different capital assets varies with age and use. Some of them remain almost 100% efficient for most of their service lives.

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[8] Ibid., p. 9.

In some rather unusual cases, the efficiency of some plant assets may even increase with age and use. However, in the majority of cases, capital assets deteriorate progressively in the quality and adequacy of their services as they age.[9] The effect of progressive deterioration of physical efficiency is, ceteris paribus, to increase the total costs of production, reduce the net service values and, thus, shorten the useful life of an asset.

When available, studies of engineers on declining efficiency of capital assets help in determining the effect of this factor on the flow of net service values.

Competition from Improved Substitutes:

> As obsolescence encroaches upon an asset currently in use, the net value of even the same quantity and quality of services rendered by the property in successive periods, will decline. Also, it is apparent that the quality of the services rendered by the plant assets, even when it does not deteriorate absolutely, declines relative to the value of the services that could be obtained from available alternatives.[10]

Thus, the impact of technology is to reduce the net service values of capital assets, in relative terms, and this has the effect of shrinking the useful lives of existing assets.

Besides improvements in existing machines and processes, there

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[9] Ibid., p. 10.

[10] Ibid., p. 11.

are three other related factors which act to cause a decline in the value of services rendered by machines in successive periods: (1) shifts in consumer demands can reduce or eliminate revenue from existing assets, (2) shifts in relative costs and prices can throw competition awry, and (3) development of new products can make obsolete the products produced by the plant facilities.

It is admitted that

> The pre-measurement of the effect of future obsolescence on the net value of services rendered by assets in successive periods is a difficult task. After all, it must be recognized that improvement in available substitutes, whether involving cost or service, usually come in spurts, with intervals of comparative stagnation. Due to these aberrations in the downward movement of service values, it will be impossible to premeasure accurately the competitive effect of improved alternatives on net service values of plant assets. History offers some guidance, but it offers little that can be measured precisely. If measurements cannot be made from experience, it will be necessary to resort to an estimate based on reasonable assumption. An assumption which seems to be reasonable, when occurrences spaced in random fashion over time are examined, is that the decline in net service values with ages will occur, <u>on the average</u>, at a uniform rate.[11]

<u>Expected Rate of Use of Asset</u>: This factor will affect the amount of services, in terms of <u>physical volume</u>, which may be expected of an asset over the years. If the demand for its product is expected to diminish in the future, its expected rate of use will also

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[11] <u>Ibid</u>., pp. 11 & 12.

diminish and so will its net service values. The effect of such an expectation is to speed up the retirement of a capital asset owing to product obsolescence.

Difficulties in Estimating the Useful Life of an Asset on the Basis of Its Expected Net Service Values

The first difficulty lies in the uncertainty of making reliable forecasts of the various factors, especially the expectation of obsolescence. The next difficulty becomes apparent when a firm employs various assets at the same time. It would be very difficult to isolate both the anticipated costs and real revenues applicable to a single asset. It would be just like trying to allocate joint costs to products which are jointly produced. On the other hand, it may be possible to project a reasonable pattern of service value movements for groups of assets or for a whole plant.

These difficulties should not suggest that this method of estimating the useful life of a capital asset is inferior. Conceptually, at least, it is a superior method, because it takes into consideration the effects on the useful life of an asset of both the physical as well as the functional factors that cause depreciation of the asset. The difficulties should suggest, instead, that more research be undertaken to improve the techniques of forecasting.

Estimate of Net Salvage Value

The net salvage value of an asset is the amount which will be realized when it is removed from operational use and sold, less any cost of dismantling and removal from the premise. The size of this amount depends on the characteristics of the asset and the point of time at which the management decides to dispose it of. For the purpose of estimating prospective salvage values, assets can be classified in the following manner:[12]

1. Assets that as a matter of policy are traded in on new assets or sold in an established second-hand market while they still have a substantial remaining physical capacity for service. They are obsolete to the company which disposes them of, but are not obsolete to those companies buying them up. This class may include such assets as motor cars, trucks, typewriters, calculating machines, and various types of construction machinery. As they are generally sold long before the end of their physical lives by the company which first acquires them, they may be expected to have substantial positive salvage values.

2. Assets where the prospective costs of removal on retirement are small and the prospective proceeds from disposal - possibly as scrap -

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[12]Eugene L. Grant & Paul T. Norton, Jr., op. cit., pp. 145-6.

are also small. These are the assets which do not have established second-hand market and are generally retained until their physical lives are almost or completely over. For such assets, it is common to estimate a net salvage value of zero.

3. Assets where the prospective costs of dismantling and removal are appreciably greater than the prospective proceeds from disposal. Such assets have prospective negative salvage values.

The prospective net salvage value of an asset must be taken into account when determining the total amount of asset-service cost to be recovered over the life time of the asset. A positive net salvage value will reduce the size of the depreciation base while a negative value will increase it.

Estimate of the Proper Depreciation Base

Where the original cost of an asset is used as the basis for depreciation accounting, determining the depreciation base does not present much difficulty, because the original acquisition cost is a known amount. The depreciation base of the asset is its original acquisition cost less its prospective net salvage value. Where the current replacement cost of an asset is used, difficulties arise in determining the depreciation base, because it has to be estimated. Some useful

guidelines are given by the American Accounting Association in estimating the current replacement cost of an asset.[13]

Where there is an established market for assets of like kind, estimating the depreciation base is not much of a problem. For example, if a telephone company uses poles and the current market price of a similar pole is $50, then the current replacement cost of a pole is $50, and the depreciation base for a pole is $50 less the net salvage value of the pole to be replaced.

Where there is no established market, current cost may be estimated by reference to the purchase price of assets which provide equivalent service capacity - the price to be adjusted for differences in operating characteristics, such as cost, capacity and quality.[14]

Illustration: Assuming a bus-service company is, at present, using a fleet of 40-passenger buses powered by gasoline engines. Technological progress has brought out a more efficient 50-passenger bus powered by a diesel engine, making the 40-passenger buses obsolete. Suppose, the old 40-passenger buses cost $40,000 each when acquired new; the operating cost for each bus was $100,000

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[13] The Accounting Review, July, 1964, p. 695.

[14] Loc. cit.

over its life, and its current net salvage value is $5,000. The new 50-passenger bus costs currently $55,000 and, assuming that its diesel engine is more efficient, its estimated operating cost over its useful life is $95,000. If the old and the new bus have the same running life of 100,000 miles, then the service capacity of the former is 40 x 100,000 i.e. 4,000,000 passenger-miles and that of the latter is 50 x 100,000 i.e. 5,000,000 passenger-miles. If a 40-passenger bus is retired now, the current incremental cost of restoring the service capacity of 4 million passenger-miles is as follows:

$\frac{\text{4 m. passenger-miles}}{\text{5 m. passenger-miles}}$ × (the current acquisition cost of the new bus less the net salvage value of the old bus less the difference in operating costs)

That is,

$$\frac{4}{5} \times [55{,}000 - 5{,}000 - (100{,}000 - 95{,}000)].$$

That is, $\frac{4}{5} \times (45{,}000) = \$36{,}000$

The difference between $45,000 and $36,000 (i.e. $9,000) represents the additional investment cost for expanding the service capacity from 4 million passenger-miles to 5 million passenger-miles, and normally the investors (and not consumers) can be expected to pay this additional cost if they desire to expand the operations of the company. Only $36,000 can be legitimately recovered from the consumers (passengers) through including depreciation expense (based on this amount)

in the fares. This amount is then the proper depreciation base. It can be expected to be lower than the past acquisition cost of the old bus because of the favourable cost effects of technological improvements. If, however, the upward cost trend of rising price levels is greater than the downward cost trend of technological progress, then the depreciation base can be expected to be larger than the past acquisition cost of the asset.

For some assets, it may not be possible to obtain their current replacement costs by reference to the purchase prices of similar or equivalent assets. These assets are those which are specially constructed to meet the specific needs of a company, and for which there is no market at all. In these cases, "adjustment of historical cost by use of specific price indexes may provide acceptable approximation of current cost".[15] Thus, the technique of estimating the reproduction cost new of an asset is applicable here; however, allowances should be given not only to the movements of prices of specific factors which would be used in the reproduction but also to the prevailing art of production to take into account the effect of encroaching obsolescence. The depreciation base for such an asset will be its reproduction cost new less its net salvage value.

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[15] Loc. cit.

Depreciation Methods

How much of the total asset-service cost will be charged off as the depreciation expense for a year will depend on the depreciation method selected. In the past five decades, many methods have been devised for allocating the total cost of using a capital asset over the accounting periods that span the useful life of the asset. Briefly, the various methods can be classified as follows:[16]

I. Amortization methods.

   A. Straight-line method.
      1. Based on time.
      2. Based on activity.

   B. Declining-amount methods.
      1. Multiple straight-line methods, including the sum-of-the-years'-digits method.
      2. Diminishing-balance methods.

   C. Interest Methods.
      1. Compound interest method.
      2. Sinking fund method.

II. Retirement method.

III. Replacement method.

IV. Retirement reserve method.

V. Depreciation as a function of revenue.

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[16]For good descriptions of these various methods, including their merits and demerits, see I. N. Reynolds, op. cit., pp. 29-53, 93-101.

The "Ideal" Method of Depreciation

George Terborgh[17] and I. N. Reynolds[18] suggest that there is an "ideal" method of accounting for depreciation. Their method is based on the concept that "capital is a value magnitude, and is consumed as value is exhausted,"[19] and "... depreciation is the exhaustion of capital value."[20] Accepting this concept, G. Terborgh concludes that "the pattern of value erosion therefore sets the pattern for the depreciation charge."[21] Thus, if it is possible to project the pattern of net service values of an asset, it is possible to establish the proper relationship of the schedule of depreciation charges to the net service value curve. Explaining further, I. N. Reynolds adds:

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[17] George Terborgh, Realistic Depreciation Policy, A Machinery and Allied Products Institute Study, 1954, pp. 20-7.

[18] I. N. Reynolds, op. cit., pp. 12-3.

[19] G. Terborgh, op. cit., p. 27.

[20] Loc. cit. The capital value of an asset is defined as the present (discounted) value of the values of future services expected of the asset (ibid., p. 29).

[21] Loc. cit.

> If money had no value in use, the task of determining depreciation would be simplified. All that would be necessary ... would be to relate the depreciation charges directly to the net service values as projected for [the asset].[22]

Money, however, does have value, which is the return (interest) it can earn over time. So, Reynolds continues:

> By inference, therefore, an ideal depreciation method is one which allocates cost in such a way as to produce a uniform return on beginning of period unamortized investment in all periods at the rate of return implicit in the original transaction by which the asset was acquired. This proposition requires that consideration be given to the interest factor.
>
> The interest rate implied in the purchase transaction is not the borrowing rate; it is, rather, the earning rate of the asset itself. This concept is referred to by economists as the marginal efficiency of the asset.
>
> If the schedule of net service values and the cost of the asset are known, the implicit rate of return would be that rate which when applied to the remaining annual series of net service values would yield a discounted value equal in amount to the cost, or unamortized cost, of the plant asset at the beginning of the year in which the discounting procedure takes place.
>
> If the schedule of net service values can be estimated reasonably and if the interest rate can be determined, it is possible to calculate the depreciation by the ideal method described. For example, depreciation for any year would be the difference between the present value of all future net service values at the beginning of the period and the present value of all future net service values remaining at the end of the period, discounted at the appropriate rate of discount.[23]

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[22] I. N. Reynolds, op. cit., p. 13.

[23] Ibid., pp. 13-14. This ideal method evidently fits into the concept that depreciation is the decline in the present value of an asset. See J. R. Hicks, "Maintaining Capital Intact: A Further Suggestion," Economica, May, 1942; pp. 176-7.

Working out an example, he shows that if the pattern of net service values is a uniform series, the depreciation expense for each year would be an increasing amount.[24] This can be expected because of consideration for the interest factor.

Practical Difficulties of the "Ideal" Method of Depreciation

As pointed out earlier, making a reliable estimate of the pattern of net service values of an asset is almost an impossible task, because of the difficulty of forecasting and the problem of isolating both the anticipated costs and real revenues applicable to a single asset. Further, estimating the proper discount rate requires too much guess work. I. N. Reynolds himself admits that "it would be too difficult to apply this "perfect" plan even if it were possible to isolate the anticipated net service values for given assets."[25]

There are additional reasons to show why this ideal method cannot be applied particularly to regulated utility companies, especially when current replacement cost is advocated as the basis for depreciation accounting. First, the utility rates are regulated; and so the pattern of net service values of an asset employed by a utility company

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[24] Ibid., pp. 14-7.

[25] Ibid., p. 16.

will depend on the manner in which the rates are fixed. Since the rates are usually fixed on the basis of cost, which includes depreciation expense, one will soon fall into a circulatory reasoning when one attempts to determine the pattern of the net service values of the asset in order to use it for determining the amount of depreciation expense. Second, the ideal method is applicable in a situation where depreciation is viewed as "value erosion". In regulated utilities, where rates are not determined by the free interplay of the forces of supply and demand, this concept of depreciation cannot be properly entertained; and so the ideal method has no logical application here. Third, the practical application of the ideal method carries an implicit assumption that the depreciation base must be a known, fixed amount. It is assumed that this amount is the initial sum of financial investment made by the company to acquire the services of an asset. In other words, the depreciation base should be the original cost of an asset. Thus, the ideal method is not feasible where the depreciation base is the current replacement cost, because the amount is not known in advance and it changes as more information (about the purchase price of a similar or equivalent asset intended for replacement) becomes currently available.

These practical difficulties of applying the ideal method of depreciation suggest that the currently used "formalized" methods still have an important place in depreciation accounting.

A Practical Method of Depreciation for Utility Plant Assets

The purpose of depreciation accounting for rate regulation should be to determine the cost of producing a certain amount of utility service, which is attributable to the use of a capital asset, so that a consumer will not be made to pay more than what he should for consuming a unit of utility service. Thus, it follows that an ideal method of depreciation for this purpose is one which attempts to assign the asset-service cost to each unit of utility service produced. This suggests the use of the straight-line method based on production units. This method, however, has an important practical problem. It requires a reliable forecast of the expected production rate of the asset over its useful life, and this, in order to establish a reasonable depreciation rate, requires a reliable forecast of the total demand for the product of the asset over its life time. This is, no doubt, a complex problem, especially when most of the assets used by utility companies have rather long lives.

It is proposed that, for reasons given below, the straight-line method based on time could be applied without ill consequence. Since utility services are essential services and the demand for them is relatively price inelastic, the amount of services that would be produced and consumed would not be likely to fluctuate widely from year

to year. As the annual production rate of an asset could be expected to remain rather steady in a matured industry such as the public utility, charging annually a uniform depreciation rate on a time basis, would not cause the annual cost of producing utility services to be grossly overstated or understated. Further, this method has the advantages of simplicity and convenience. On account of these advantages, it has been widely used.

Computation of Annual Depreciation Expense Based on Future Replacement Cost

It can be argued that since an asset will be replaced only when it is retired some time in the future, the depreciation base should be the future cost of the asset at the expected time of replacement. In the interim years, any change in the purchase price of the asset should not cause any concern as long as over the years of the asset's useful life enough cost will be recovered through depreciation charges to meet the actual cost of replacing the asset at the end of its life.

Assume:
1. Depreciation rate is 20% per year on a straight-line basis.
2. Useful life of asset is 5 years.
3. Net salvage value of present asset is zero.
4. The future replacement cost of the asset in the final year of its life is $10,000 (adjusted for differences in

operating costs and other characteristics).

TABLE II

COMPUTATION OF ANNUAL DEPRECIATION EXPENSE BASED ON FUTURE REPLACEMENT COST OF THE ASSET

Year:	I	II	III	IV	V
Annual Deprec. Charge	$2,000	2,000	2,000	2,000	2,000
Accum. Depreciation at year end	$2,000	4,000	6,000	8,000	10,000

If all expectations came true, Table II shows that if a replacement fund had been set up equivalent to the annual depreciation charges, there would be sufficient funds for complete replacement of the asset services at the end of Year V.

However, it could be assumed that the amount of revenue restricted by the charge of annual depreciation expense would be re-invested in the enterprise or could be used to buy securities outside. In either case, it would be necessary to recognize the amount of return (or interest) which was earned (or could be earned) on the re-invested funds (equal to the accumulation of annual depreciation charges).

Assuming a rate of return of 5%, Table III shows the effect of re-investing funds accumulated through charging depreciation expense annually against revenues. By the end of the fifth year, the total amount of depreciation charges recovered from the consumers plus the return on re-investment adds up to $11,603, which exceeds the actual cost of replacement by $1,603. Thus, if consumers were asked to pay $2,000 annually for depreciation, they would end up paying $1,603 more than what was sufficient for replacement. Even if the management of the company failed to re-invest available funds either internally or externally, the interest factor should not be ignored altogether, because consumers should not be expected to pay for the failure of the management to take advantage of investment opportunities.

Taking into account the interest factor, the annual depreciation charges, which consumers could be expected to pay, would be as indicated in Table IV. The accumulated depreciation amounts to $8,620 at the end of year V, which, together with the accumulated amount of return on re-invested depreciation charges, would provide a fund sufficient to effect replacement of the asset at the end of its life.

TABLE III

The Effect Of Reinvesting Accumulated Depreciation Earning A Rate Of Return Of 5% Compounded Annually

	Year I	Year II	Year III	Year IV	Year V
Annual Depreciation	$2,000	2,000	2,000	2,000	2,000
Year I					
Return on Investment	100				
Accum. Deprec. plus Return on Investment -	2,100	2,100			
Year II					
Amount of Investment		4,100			
Return on Investment		205			
Accum. deprec. plus Return on Investment		4,305	4,305		
Year III					
Amount of Investment			6,305		
Return on Investment			315		
Accum. deprec. plus Return on Investment			6,620	6,620	
Year IV					
Amount of Investment				8,620	
Return on Investment				431	
Accum. deprec. plus Return on Investment				9,051	9,051
Year V					
Amount of Investment					11,051
Return on Investment					552
Accum. deprec. plus Return on Investment					11,603
Cost of Replacement					10,000
EXCESS OVER COST OF REPLACEMENT					1,603

TABLE IV

Annual Depreciation Charge Based On Future Replacement Cost With Adjustment for 5% Rate of Return on Accumulated Depreciation

Year	I	II	III	IV	V	Total
Annual depreciation	$1724	1724	1724	1724	1724	$8620
Yr. I: Return on invest.	86					86
Accum. deprec. plus return on investment	1810	1810				
Yr. II: Amount of investment		3534				
Return on investment		177				177
Accum. deprec. plus return on investment		3711	3711			
Yr III: Amount of Investment			5435			
Return on investment			271			271
Accum. deprec. plus return on investment			5706	5706		
Yr. IV: Amount of investment				7430		
Return on investment				371		371
Accum. deprec. plus return on investment				7801	7801	
Yr V: Amount of investment					9525	
Return on investment					475	475
Accum. deprec. plus return on investment					$10000	$10000
Cost of Replacement at end of Year V					$10000	

Practical Problems Associated with the Use of Future Replacement Cost

It should be noted that there are practical problems associated with the use of the methods illustrated above. First, it is extremely difficult to make a reliable forecast of what the replacement cost will be at the end of an existing asset's useful life, especially when most of the assets employed by a utility company have lives of more than 10 years. Expediency suggests that it is more practical and reliable to establish the depreciation base of an asset on the basis of such information as purchase price of a similar or equivalent asset that is currently available. By making adjustments to the depreciation base and the related annual depreciation and accumulated depreciation whenever new information becomes currently available, it can be illustrated (as it will be done below) that no more depreciation expense will be charged against consumers over the life of the asset than that which is just sufficient to meet the actual replacement cost at the time of replacement. This suggests that for practical reasons the depreciation base of an asset can be determined on the basis of its current replacement cost without ill consequences.

Second, making a reasonable forecast of the rate of return to be used for adjusting the annual amount of depreciation charge is also

extremely difficult. In reality, the rate of return is never constant; it fluctuates with conditions prevailing at a particular moment of time.

Lastly, it is exceedingly difficult to make adjustments for the interest factor when the depreciation base is allowed to vary with time to accommodate changes in the current replacement cost of the asset.

Thus, for practical reasons, it may be necessary to ignore the interest factor in the computation of annual depreciation charge.

Computation of Annual Depreciation Expense Based on Current Replacement Cost

Table V assumes that there are no changes in general price levels over the years of the asset's life, but technological progress reduces annually the real cost of restoring exhausted service capacity

TABLE V.

Computation of Annual Depreciation & Holding Loss Showing The Effect of Progressing Technology Such That Current Replacement Cost Declines 10% Annually, Assuming Constant Price Level And Zero Net Salvage Value.

HOLDING LOSS

(A) Original cost of asset when purchased
(B) Current replacement cost (new) as at the end of the year
(C) Adjustment to asset account (Credit)
(D) % of asset's life remaining as at the beginning of year
(E) Unrealized holding loss as at the beginning of the year
(F) Holding loss realized up to the beginning of the year
(G) Holding loss realized for the current year
(H) Unrealized holding loss as at the end of the year
(I) Total holding loss by the end of the year

ANNUAL DEPRECIATION (straight-line based on time)

(J) Annual depreciation (original cost)
(K) Adjustment for difference in depreciation base (Credit)
(L) Unadjusted annual depreciation (current replacement cost)
(M) Adjustment for overcharging depreciation in prior years
(N) Adjusted depreciation charge for the year (replacement cost)

ACCUMULATED DEPRECIATION

(O) Accumulated depreciation (original cost) (Credit)
(P) Adjustment for realized holding loss
(Q) Accumulated depreciation (current replacement cost) (Credit)

	Year 1 $	11 $	111 $	1V $	V $
	10000	10000	10000	10000	10000
	10000	9000	8000	7000	6000
	(O)	(1000)	(2000)	(3000)	(4000)
	100%	80%	60%	40%	20%
(D) × (C)	(O)	800	1200	1200	800
(C) - (E)	(O)	200	800	1800	3200
20% × (C)	(O)	200	400	600	800
(E) - (G)	(O)	600	800	600	(O)
(I) = (C)	(O)	1000	2000	3000	4000

						Accumulation
20% × (A)	2000	2000	2000	2000	2000	10000
20% × (C)	(O)	(200)	(400)	(600)	(800)	(2000)
(J)-(K) or 20% ×(B)	2000	1800	1600	1400	1200	8000
	(O)	(200)*	(400)*	(600)*	(800)*	(2000)*
	2000	1600	1200	800	400	6000

	(2000)	(4000)	(6000)	(8000)	(10000)
(F) + (G)	(O)	400	1200	2400	4000
	(2000)	(3600)	(4800)	(5600)	(6000)
% of (B)	20%	40%	60%	80%	100%

* Its corresponding debit is already included in (F)

of the asset such that at the end of its useful life (Year V) the current cost of replacement is $6,000 compared to $10,000 original cost. A straight-line method of depreciation based on time is applied to compute the amount of annual charge. There is no net salvage value. Row (C) indicates, for each year of the asset's useful life, the difference between the original cost of the asset and the current cost of an equivalent asset adjusted for differences in such operating characteristics as capacity and efficiency. This difference represents the amount of "holding loss" for each year resulting from holding on to an asset which is less efficient than one that is currently available. At the end of Year V, the amount of "holding loss" adds up to $4,000. Since the actual replacement cost at the end of Year V is $6,000, only this amount should have been recovered from the consumers over the past five years; that is to say, the accumulated depreciation account should show this amount at the end of Year V.

Since the asset does not come to the end of its useful life until the end of Year V, not the whole amount of "holding loss" in each year will be considered "realized". The amount that can logically be considered to have been "realized" in a year is equal to that portion of the total "holding loss" in that year corresponding to the fraction of the asset's life deemed to have expired up to the end of that year. For example, in Year III, the total "holding loss" in that year is $2,000

(Row (I) or (C)). As at the beginning of Year III, 40% of the asset's useful life has expired; and so 40% of $2,000, i.e. $800 (Row (F)), has been realized up to that point of time. By the end of that year, another 20% of the asset's useful life has expired. This increases the amount of realized "holding loss" in Year III by 20% of $2,000, i.e. $400 (Row (G)), to $1,200 (Row (P)) by the end of that year. By this manner of computation, $4,000 of "holding loss" would have been realized by the end of Year V when the asset has expired completely and is due for replacement. This amount of "holding loss" should not be interpreted to mean a real loss; it appears to be a loss (to the investors) because a smaller amount of capital asset cost is recovered from the consumers. As this smaller amount is sufficient to maintain the productive capacity of the plant at its original level, there is no real economic loss at all. It is, in fact, an indication of the extent to which the real cost of production, with respect to the use of capital assets, has fallen as a consequence of progressive technology.

Row (J) shows the amount of annual depreciation that would be charged to consumers if depreciation expense were determined on the basis of historical cost. These charges would result in an accumulated depreciation amounting to $10,000 by the end of Year V (Row (O)). Since $6,000 would be sufficient to restore the exhausted productive capacity of the plant at the end of Year V, the excess of

$4,000 ($10,000 - $6,000) would represent the amount by which the consumers had been overcharged.

Row (L) indicates the amount of depreciation expense that would be charged for each year, computed on the basis of current replacement cost. The difference between Row (J) and Row (L) corresponds to the amount of "holding loss" realized for a particular year (see Row (G)). If no additional adjustments were made to the annual depreciation expenses shown along Row (L), the accumulated amount would add up to $8,000, which is $2,000 more than what would be necessary. Thus, further adjustments have to be made for the following reasons: Starting with Year II, the unadjusted annual depreciation expense is $1,800 (Row (L)). Since the depreciation base is now $9,000 (Row (B)), the annual depreciation expense for Year I should have been also $1,800. Thus, the depreciation expense in Year I was overcharged by $2,000 - $1,800, i.e. $200; and so the current year's depreciation charge should be reduced by this "error" to $1,600 (Row (N)). In Year III, the unadjusted depreciation expense is $1,600 (20% of the new base, $8,000); but for Years I and II, the annual depreciation expense was thought to be $1,800. Thus, the annual depreciation expense for the past two years was overstated by $200 ($1,800 - $1,600). So, the depreciation charge for Year III should be reduced by 2 x $200 to $1,200. For

Year IV, the depreciation charge should be reduced by 3 x $200 to $800, and for Year V it should be reduced by 4 x $200 to $400. By making such adjustments in recognition of the "errors" made in the past years, the accumulated depreciation would come up with just $6,000 (See Rows (N) and (Q)). These are the proper annual depreciation charges which the consumers are required to pay.

Table VI assumes that there is no change in technology; that is, there is no change in the real cost of production. However, the general price level fluctuates with a rising trend over the years, such that the cost of replacement at the end of Year V, adjusted for changes in money value, amounts to $20,000. Since the replacement cost exceeds the original cost, there appears to be a "holding gain" in this case. This apparent gain results from the fact that the company is holding on to an asset which is cheaper, in money terms, than the one that is currently available, and the consumers are required to pay more than the original cost of the asset in order to enable replacement to take place at the end of Year V. This "holding gain", however, should not be mistaken for a real economic gain, because if it is disposed of, the productive capacity of the plant would be impaired. This gain is nothing but a manifestation of the fact that the money cost of production, with respect to the use of capital assets, has increased as a result of a fall in the value of a monetary unit.

TABLE

COMPUTATION OF ANNUAL DEPRECIATION
CHANGING PRICE LEVEL SUCH THAT CUR
UALLY, ASSUMING UNCHANGED TECHNOL

HOLDING GAIN:

(A) Original cost of asset when purchased
Current price-level index as at the end of the year
(B) Current replacement cost (new) as at the end of the year
(C) Adjustment to asset account (credit)
(D) % of asset's life remaining as at the beginning of year
(E) Unrealized holding (gain) as at the beginning of year
(F) Holding (gain) realized up to the beginning of year
(G) Holding (gain) realized for the current year
(H) Unrealized holding (gain) as at the end of the year
(I) Total holding (gain) by the end of the year

ANNUAL DEPRECIATION:

(J) Annual depreciation (original cost)
(K) Adjustment for difference in depreciation base (credit)
(L) Unadjusted annual depreciation (current repl. cost)
(M) Adjustment for (over-) under charging depreciation in prior years
(N) Adjusted depreciation charge for the year (replacement cost)

ACCUMULATED DEPRECIATION:

(O) Accumulated depreciation (original cost) (credit)
(P) Adjustment for realized holding (gain) loss
(Q) Accumulated depreciation (current replacement cost) (Credit)

AND HOLDING GAIN SHOWING THE EFFECT OF RENT REPLACEMENT COST FLUCTUATES ANN- OGY AND ZERO NET SALVAGE VALUE.

YEAR:	1	11	111	1V	V	
	$10000	$10000	$10000	$10000	$10000	
	100	90	130	150	200	
	10000	9000	13000	15000	20000	
	O	(1000)	3000	5000	10000	
	100%	80%	60%	40%	20%	
(D) × (C)	O	800	(1800)	(2000)	(2000)	
(C) - (E)	O	200	(1200)	(3000)	(8000)	
20% × (C)	O	200	(600)	(1000)	(2000)	
(E) - (G)	O	600	(1200)	(1000)	O	
(I) - = (C)	O	1000	(3000)	(5000)	(10000)	
						Accum- ulation
20% × (A)	2000	2000	2000	2000	2000	10000
20% × (C)	O	(200)	600	1000	2000	3400
(J)-(K)or 20% x(B)	2000	1800	2600	3000	4000	13400
	O	(200)*	1600*	1200*	4000*	6600
	2000	1600	4200	4200	8000	20000
	(2000)	(4000)	(6000)	(8000)	(10000)	
(F) + (G)	O	400	(1800)	(4000)	(10000)	
	(2000)	(3600)	(7800)	(12000)	(20000)	
%of (B)	20%	40%	60%	80%	100%	

* Its corresponding debit/credit is already included in (F)

As the current cost of replacement is rising over the years, it can be expected that the annual depreciation charge (see Rows (L) and (N) in Table VI) will rise, too.

In reality, both technology and the value of a monetary unit can be expected to change at the same time over the years of an asset's life. The effects of these changes upon the amount of annual depreciation charge are illustrated in Table VII.

TABLE

COMPUTATION OF ANNUAL DEPRECIATION
EFFECTS OF CHANGES IN TECHNOLOGY

HOLDING GAINS & LOSSES:

(A) Original cost of asset when purchased
Decrease in cost due to technological progress
Current price-level index
(B) Current replacement cost (new) as at end of year
(C) Adjustment to asset account (credit)
(D) % of asset life remaining as at beginning of year
(E) Unrealized holding (gain) loss as at beginning of year
(F) Holding (gain) loss realized up to beginning of year
(G) Holding (gain) loss realized for the current year
(H) Unrealized holding (gain) loss as at the end of year
(I) Total holding (gain) loss by the end of year

ANNUAL DEPRECIATION: (Straight-line based on time)

(J) Annual depreciation (original cost)
(K) Adjustment for difference in depreciation base (credit)
(L) Unadjusted annual depreciation (current repl. cost)
(M) Adjustment for (over-) under-charging depreciation in prior years
(N) Adjusted depreciation charge for the year (replacement cost)

ACCUMULATED DEPRECIATION

(O) Accumulated depreciation (original cost) (Credit)
(P) Adjustment for realized holding (gains) losses
(Q) Accumulated depreciation (current replacement cost) (Credit)

VII

AND HOLDING (GAIN) LOSS SHOWING THE
AND PRICE LEVEL; TABLES V & VI COMBINED

YEAR:	1	11	111	1V	V	
	$10000	$10000	$10000	$10000	$10000	
(Row(B), Table V)	10000	9000	8000	7000	6000	
(From Table VI)	100	90	130	150	200	
	10000	8100	10400	10500	12000	
	O	(1900)	400	500	2000	
	100%	80%	60%	40%	20%	
(D) × (C)	O	1520	(240)	(200)	(400)	
(C) - (E)	O	380	(160)	(300)	(1600)	
20% × (C)	O	380	(80)	(100)	(400)	
(E) - (G)	O	1140	(160)	(100)	(O)	
(I) = (C)	O	1900	(400)	(500)	(2000)	

						Accum-ulation
20% × (A)	2000	2000	2000	2000	2000	10000
20% × (C)	O	(380)	80	100	400	200
(J)-(K) or 20%(B)	2000	1620	2080	2100	2400	10200
	O	(380)*	920*	60*	1200*	1800
	2000	1240	3000	2160	3600	12000

	(2000)	(4000)	(6000)	(8000)	(10000)
	O	760	(240)	(400)	(2000)
	(2000)	(3240)	(6240)	(8400)	(12000)
% of (B)	20%	40%	60%	80%	100%

* Its corresponding debit/credit is already included in (F)

CHAPTER VII

SUMMARY AND CONCLUSIONS

Summary

Public utilities are those industries which render services essential to the welfare of society. They tend to become monopolies because of the essential nature of their service-products and the fact that they generally have to operate on a large scale in order to be economic producers. Competition is detrimental to their survival. Monopolistic behaviour on their part in the product market is detrimental to the economic welfare of society. A solution to this problem calls for regulatory measures to be imposed upon them so that the public interest will be best served. In the interests of society as well as investors, regulation provides an opportunity for the survival of a utility company by eliminating harmful competition through the granting of franchise to a restricted number of producers, usually one, in one locality.

Regulating the rates which utility companies are permitted to charge consumers is often the biggest problem facing a regulatory

authority. A proper basis has to be determined in order to fix rates that are "just and reasonable". It has been accepted that cost is the proper basis. However, it must be noted that cost is capable of being interpreted in several ways.

As the ultimate purpose of regulation is optimization of the economic welfare of society, which is attained only when there is economic allocation of scarce resources, it is maintained that the relevant cost for rate fixing purpose is marginal (opportunity) cost. Under the assumption that a utility company will continue rendering desirable service indefinitely in the interest of society, all depreciable long-lived assets must be replaced when they are retired for physical or functional reasons so that the productive capacity of the company will not be impaired and production in the future curtailed. As depreciation expense is recognized as a cost of operation associated with the use of depreciable assets, it follows that depreciation expense as a marginal (opportunity) cost of continuing operations in the long run must be determined on the basis of replacement cost. A workable concept of replacement cost is current replacement cost as propounded by the American Accounting Association. Depreciation expense determined on the basis of any other interpretation of cost cannot be accepted as a marginal cost associated with the employment of durable assets for the purpose of rendering service in the long run. A utility

rate, which is fixed on the basis of costs that include depreciation expense computed on a basis other than current replacement cost, will not promote economic allocation of scarce resources and, thus, will not be in the best interest of society; it is not consistent with the ultimate purpose of regulation.

It is argued that marginal cost pricing, though it is in the best interest of society, may not be "fair" to a utility company (or rather its investors), because when it is producing in a region of decreasing unit cost (which can be expected when a utility company is expanding its scale of operation) its marginal cost is less than its average total cost and, thus, total revenue received from sale at marginal cost will not be sufficient to produce a "budgetary equilibrium".[1] It is feared that as a consequence of this, the company will soon find itself in financial difficulty and will not be in a position to carry on production in the future unless it is granted sufficient subsidies by the government.

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[1]Marcel Boiteux points out that "when one speaks of budgetary equilibrium and of average cost, this is the language of accountants and not of economists. The average accounting cost is being discussed and not the average economic cost." ("Electric Energy: Facts, Problems and Prospects", in J. R. Nelson (ed.), Marginal Cost Pricing in Practice, Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1964, pp. 25-6.

Marginal-cost pricing can also give rise to a situation in which total revenues far exceed total costs. This can happen when the company is producing in a region where unit cost is rising but marginal cost is rising faster than the former. Such a situation appears to be against the interest of society since it is made to pay more than the total costs. Thus, it is contended that a "just and reasonable" rate should be based on fully distributed cost so that it will be neither "confiscatory" to the investors nor "extortionate" to society. A full-cost standard is also preferred for the reason that marginal-cost pricing is difficult to put into practice.

A fully distributed cost, however, can be computed on the basis of past acquisition cost, price-level adjusted cost, current replacement cost, or any other concept of cost. In the interests of both society in general and investors in particular, it is shown in Chapter IV that the most significant cost to be used for the fixing of a full-cost rate is current replacement cost. The significance of this cost lies in the following:

(a) It ensures that what society pays for a utility service is no more than what it costs to produce that service under present conditions taking into consideration the current art of production and the current value of the monetary unit. Thus, society pays a rate that includes no cost differential resulting from management that fails to keep pace with time.

(b) A utility rate fixed on the basis of current replacement cost is more comparable with prices charged by unregulated competitive industries and, thus, it has the effect of promoting better distribution of economic resources between utility industries and other industries. This is in the interest of society in general.

(c) The use of current replacement cost gives a better and more meaningful measurement of income. It approximates the Hicksian economic income. When that income is disposed of, the productive capacity of the company will not be impaired. When income is determined on this basis, there is no fear of unintentional return of economic capital in the form of dividends. Thus, when a utility rate is fixed on full cost that includes depreciation expense determined on the basis of current replacement cost, it cannot be "confiscatory" to investors, because the company will be in a position to operate at least at the same level as before assuming that there is enough revenue to cover all expenses thus determined; this is evidently favourable to both investors and society in general.

Conclusions

It is the conclusion of this study that under marginal cost standard or full cost standard for rate regulation, there is a case for determining depreciation expense on the basis of what it costs to replace

the asset under present conditions taking into consideration the current art of production and the current value of the monetary unit. If there is any case against the use of current replacement cost, it will lie in the practical problems of applying the concept to a real situation. It is admitted that the data would not be as objective or verifiable as they would be if historical cost or historical cost adjusted for price-level change in accordance with a published price index, were used as the basis.

It could be argued that lack of objectivity or complete accuracy of data should not preclude their use when it is known that they would provide more useful or meaningful information. For instance, though no one would testify that the Consumers' Price Index or Cost of Living Index is absolutely free from subjective estimate and is completely accurate as an indication of the purchasing power of money, yet it is used for many purposes. It has been used to give an indication of what the "real" growth of the GNP of a country is, and on the basis of this information many economic decisions have been made and many plans have been drawn up and carried out.

When current replacement cost is used for rate regulation, there is evidently a need for greater control over asset accounts and depreciation expense account to prevent unreasonable amounts from being included in them. Frequent adjustments have to be made to the

relevant accounts in order to accommodate changes in cost data that are currently available. Obviously, these adjustments have to be verified and approved by the regulatory authority, which may require the company to submit reports on the relevant accounts frequently (say, once a year) in order to ensure that the cost data are kept properly and up to date. Thus, there are auditing problems. Disputes between the regulated company and the regulatory authority can be expected since there is room for disagreement over the amount to be accepted as the proper depreciation charge.

It is admitted that the use of current replacement cost will not make the task of rate regulation easier. It is recognized that much research is required in the area of developing methods that will eliminate or reduce the practical problems of implementing the proposed approach to depreciation accounting.

Disregarding the question of practicality, it cannot be denied that the use of current replacement cost is <u>conceptually superior</u> to the use of any other interpretation of cost for the purpose of regulating utility rates to serve the public interest. The practical problems, however, are not insurmountable; for they are no greater than those faced by some of the regulatory authorities in the U. S. which adopted the use of the debatable concept of reproduction cost new.

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APPENDICES

APPENDIX A

DEPRECIATION: CONCEPTS AND METHODS OF DETERMINATION

> The question of Depreciation is one upon which so many articles have been written, and so many opinions expressed, that there would not appear to be much more which could profitably be said upon the subject.[1]

This is not an attempt to add something new to the much discussed subject of depreciation. It only seeks to sample some of the popular notions about depreciation and to understand the reasons for the diversity of opinions.

As pointed out by E. L. Grant and P. T. Norton, Jr.,

> The meanings of words develop out of their use. Through useage words acquire several different meanings. Depreciation is one of these words.[2]

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[1] J. H. Armstrong, "Depreciation Reserves", The Accountant, Aug. 8, 1903, p. 1014.

[2] E. L. Grant & P. T. Norton, Jr., Depreciation, New York: The Ronald Press Co., 1949, p. 11.

Over the past years, the word has been used by various people to mean various things. Amongst accountants alone, it has been described variously as a loss, a provision for a loss, a recovery of a loss, a decrease in the value of assets and a maintenance of assets.[3] Can depreciation mean all these things? Are they related to one another? Littleton points out that depreciation was not a clear concept in the writings before 1800, but in the nineteenth century the recognition of depreciation as an asset-valuation concept became unmistakable.[4]

Depreciable Assets

Accountants generally classify the assets of an enterprise into (a) current and (b) fixed. Fixed assets are those which render services to the enterprise beyond one fiscal year or the normal operating cycle of the business, whichever is longer, and, more

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[3]Quoted in Henry R. Hatfield, "What They Say About Depreciation", The Accounting Review, Vol. 11, No. 1, March, 1936, pp. 18-26.

[4]A. C. Littleton, Accounting Evolution to 1900, New York: American Institute Publishing Co., Inc., 1933, p. 225.

important, are not intended for sale.[5] There are basically three types of fixed tangible assets:[6]

1. Non-depreciable assets - those with indefinitely long lives of services, such as land, canals and railway tunnels.
2. Depreciable assets - those with exhaustible and, thus, limited useful lives, but are replaceable. Examples are buildings, machines and tools.
3. Exhaustible and irreplaceable assets; these are natural resources such as mines and oil wells.

Depreciation is a phenomenon associated with the second type of fixed assets.

To an economist, all assets, whether they are "current" or "fixed", are economic resources and they deteriorate with use and age in terms of quantity and quality of services rendered or in terms of usefulness or value in relation to the demand for their products.

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[5]The C.I.C.A. defines a fixed asset thus: "Fixed asset. A tangible long-term asset, such as land, building, equipment, etc., held for use rather than for sale." (Accounting Terminology, 1957, p. 32. Emphasis supplied). See also the Inst. of C.A.'s in England and Wales, Members' Handbook, Section N, para. 1.

[6]H. G. Avery, Accounting for Depreciable Fixed Assets, Published Ph. D. dissertation, Columbia University, 1940, p. 9.

Thus, they all have definite useful lives. The classification of assets into "current" and "fixed" arises from the need to segment time into convenient accounting periods. It has no economic significance.

Characteristics of Depreciable Assets

Besides the characteristics of (a) having an exhaustible life and (b) not being intended for sale but to be held for use until its useful life is over, a depreciable long-lived asset is also characterized by the fact that it normally retains its physical form throughout its life. Only the intangible service which it renders finds its way into the finished product; even then, it is often not possible to relate a certain amount of service inputs to particular finished products or to the stream of finished products of a particular period. Thus, measurement of the amount and the value or cost of intangible service rendered by a durable asset in the process of production presents a problem which is not faced in the measuring of the amount and the value of an asset, such as raw material, that is embodied physically into the finished product (though its form may undergo some physical or chemical change in the process). In the case of the intangible service rendered by a human being in his role as a worker or a manager, there is no measurement problem, because he can bargain for his wage or salary, which is the price or value of his service.

Thus, the peculiar characteristics of a durable asset make the measurement of the amount and the value of its service contribution a very difficult task. This is the crux of the problem of depreciation accounting.

Depreciation as a Fact: Generally Accepted

L. Goldberg points out that "philologically, the word 'depreciation' means a fall in price or a fall in value."[7] He believes that "... historically the word was used in this sense before it was applied to that of physical deterioration."[8] Since physical deterioration will affect the price or value of an asset subsequent to the date of its acquisition, it is logical to associate depreciation with its physical conditions.

There is much truth in H. R. Hatfield's statement that every fixed asset takes an "irresistible march to the junk heap"[9] from the moment it is put into use, because it is generally recognized as a fact that "at a certain stage of its existence an asset can no longer be

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[7] L. Goldberg, Concepts of Depreciation, Australia: The Law Book Co. of Australasia Pty Ltd., 1960, p. 4.

[8] Ibid., p. 12.

[9] H. R. Hatfield, Accounting, New York: Appleton Century Crofts, Inc., 1927, p. 120.

effectively used for the purpose for which it was acquired".[10] The phenomenon that leads a durable asset to the eventuality of its retirement on account of declining usefulness or value, is generally referred to as depreciation by accountants, engineers, economists, businessmen and courts of law.

This decline in usefulness or value is sometimes interpreted as a loss. Since it is associated with the activity of production, it is recognized as a cost of production, which is chargeable against the proceeds from the sales of the product in the measurement of business performance as reflected in the net income determined for the period. Under the going concern assumption, there appears a need to provide for this loss or to recover this loss so that the capital of the enterprise, in terms of physical or financial amount, will be maintained.

Generally, it is agreed that an asset loses its usefulness or value because of two types of factors: (a) physical and (b) functional.[11] The important physical factors are (i) wear and tear through

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[10] L. Goldberg, op. cit., p. 8.

[11] E. L. Grant & P. T. Norton, Jr. point out that "some writers use this classification to restrict the meaning of depreciation. Thus they speak of 'depreciation and obsolescence' as if depreciation referred to decrease in value due only to the so-called physical causes, and obsolescence referred to decrease in value due to the so-called functional causes. In some cases, they even go one step further and suggest that only physical depreciation should be considered.... Confused thinking of this sort has been responsible for many errors in business decisions and for some mistakes in public policy." (op. cit., p. 20).

use and (ii) decay over time resulting from the actions of the elements. The functional factors are generally recognized to be (i) obsolescence brought about by technological improvement or a change in consumers' taste that causes the demand for the product of the asset to diminish eventually, and (ii) inadequacy brought about by a rise in the demand for the product of the asset such that the asset has to be retired prematurely on account of its inadequate capacity to meet the volume of demand. Both types of factors act together to cause the eventual retirement of an asset. There is no advantage to be gained by separating one cause of retirement from another.[12] Thus, depreciation can be said to be a function of both use and time.

Since there is some common understanding amongst the accountants, engineers, economists, businessmen and courts of law about the phenomenon of depreciation and its causes, it can be concluded that there is a generally accepted concept of depreciation as a fact, and that is, depreciation is the phenomenon of an interplay of both physical and non-physical forces acting to reduce the usefulness or value to an economic enterprise of a relatively permanent tangible asset such that it has to be retired from service eventually.[13] It is

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[12] Ibid., p. 19.

[13] For some of the definitions of depreciation as a fact, see: The Canadian Institute of C.A.'s., Accounting Terminology, 1957, p. 23. U.S. Supreme Court in Lindheimer v. Illinois Bell Tel. Co., 292 U.S. 151 (1934). National Association of Railroad and Utilities Commissioners, Report of Committee on Depreciation for the Year 1943 and 1944, p. xiv.

recognized as an item of business expense.

Depreciation as an Amount to be Determined: A Controversy

It is unfortunate that there is no consensus of opinion with regard to the amount to be determined as depreciation. G. Terborgh remarks,

> It is one thing to agree that depreciation should be charged as a cost of doing business; it is another to say how it should be measured. On the question of measurement there is still wide disagreement....[14]

This shows that the concept of depreciation as an amount lacks universal acceptance; there are conflicting and confusing ideas about it. Controversy over the question of measurement has been going on ever since accounting for depreciation has come to be a generally accepted practice. There are disagreements not only among accountants, economists, businessmen and engineers, but also among the members of each group.

Causes of Controversy

Generally speaking, one of the main causes of the controversy over the determination of depreciation is rooted in the misunderstanding

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[14] G. Terborgh, Realistic Depreciation Policy, Machinery and Allied Products Institute Study, 1954, p. 3.

of the purposes for which it is intended. Different people want to determine depreciation for different purposes, and, therefore, it is inevitable that they should differ from each other in their methods of determination. There are also differences in the interpretations of the value of an asset. Some maintain that it is the decline in its use-value that should be recognized in defining the purpose and measuring the amount of depreciation; others believe that the significant interpretation of value is exchange value.

Misuse or misunderstanding of the word "depreciation" itself adds much to the controversy. It has been "grossly overworked ... and ... is currently used in varying senses and with different connotations, so that if A uses the word in communication with B, it is likely to be not much more than a lucky chance if B understands it in precisely the same sense as is meant by A."[15]

In view of the causes of the controversy, it is understandable that "writers on depreciation seem to agree on nothing except that other writers on the subject are somewhat confused."[16]

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[15] L. Goldberg, op. cit., p. 2

[16] E. L. Grant, "Fundamental Aspects of the Depreciation Problems" in David Solomons, Studies in Costing, London: Sweet and Maxwell, 1952, p. 292.

Purposes of Depreciation Accounting

The purposes of accounting for depreciation can be summarized as follows:

1. To determine the value of an asset at a point of time. This asset-valuation purpose is, of course, balance sheet oriented.
2. To determine the cost of business operation for the purposes of pricing and measuring business performance as reflected in the net income. This purpose is income-statement oriented.

As pointed out earlier, the original and popular meaning of depreciation is a fall in value (price); and so, by inference, the original purpose of accounting for depreciation must be asset valuation. This can be expected, because in the early days of accounting, the main emphasis was on the balance sheet. However, the emphasis has now been shifted onto the income statement and "depreciation began to be recognized as a cost of operation at the time when emphasis was shifted from the balance sheet to the income statement."[17]

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[17]Phayom Bhavilai, Concepts of Depreciation and Their Implication in Accounting Theory and Practice, Unpublished Ph. D. Thesis, University of Illinois, 1957, p. 3.

Since asset valuation does not serve much purpose as long-lived assets are normally not meant for sale and since greater importance is now placed on the income statement, it is evident that today the main purpose of depreciation accounting is to determine the cost of operation so as to measure the net income for a period. Those writers who interpret the value of an asset to be its use value would obviously favour this purpose of accounting for depreciation.

Problems of Depreciation Accounting in Relation to Other Problems

In line with the thinking that the main purpose of depreciation accounting should be oriented to the income statement, the American Institute of C.P.A.'s. describes depreciation accounting as follows:

> Depreciation accounting is a system of accounting which aims to distribute the cost or other basic value of tangible capital assets, less salvage (if any), over the estimated useful life of the unit (which may be a group of assets) in a systematic and rational manner. It is a process of allocation, not of valuation. Depreciation for the year is the portion of the total charge under such a system that is allocated to the year. Although the allocation may properly take into account occurrences during the year, it is not intended to be a measurement of the effect of all such occurrences.[18]

The important point to be noted is that depreciation accounting is strictly a process of allocating cost (or other basic value) and not a process of valuing an asset. This idea of cost allocation is subscribed

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[18]Committee on Terminology, Accounting Terminology Bulletin No. 1, para. 56.

to by the Canadian Institute of C.A.'s.[19] and The Institute of C.A.'s. in England and Wales.[20]

Logically, the process of allocation cannot be done in isolation from the process of valuing a capital asset whose cost or basic value is to be allocated. One must know what cost or value to attach to the asset before one can know how much to allocate (or to recover) each period. If the process of attaching some dollar figure to a capital asset is called valuation of asset, then depreciation accounting as a process of cost allocation cannot be carried out without giving proper regard to asset valuation, though depreciation accounting per se may not be asset valuation. How one values a capital asset will evidently affect the amount to be allocated or recoverd through the process of charging depreciation expense. Thus, the problem of depreciation accounting is ultimately linked with the problem of asset valuation.

Since depreciation accounting as a process of cost allocation is tied up with the purpose of cost determination, the problems of depreciation accounting and income determination are, therefore, interrelated and cannot be studied apart from each other. L. Goldberg

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[19] Accounting Terminology, 1957, p. 24.

[20] Members' Handbook, Section N, para. 2.

points out,

> Whatever specific meaning we attach to the word "depreciation" ..., it soon becomes clear that one of the principal purposes behind any attempt to define or measure depreciation is the desire or need to assess income (or profit) for a given period. So that, in any discussion on depreciation, we are likely to find ourselves faced sooner or later with the problem of income determination.[21]

In the determination of income for a period, it is essential to recognize the distinction between income as a flow and capital as a stock. The concept of income and the method for its determination cannot be studied separately from the concept of capital and capital maintenance. Differences in opinions on the nature and measurement of income and capital will give rise to differences in the purposes for which depreciation accounting is intended.

Thus, the problem of accounting for depreciation is interrelated with the following problems:

(a) defining the concepts of income and capital,

(b) measuring income and maintaining capital intact,

(c) valuing capital assets, and

(d) determining the cost of operation.

Differences in the treatment of any of the problems (a) to (d) will

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[21] L. Goldberg, op. cit., 110.

undoubtedly give rise to differences in the treatment of depreciation accounting.

A Resume of Concepts of Income and Capital Maintenance

For a proper understanding of the controversy over the measurement of depreciation, a resume of some of the concepts of income and capital maintenance will be of help. Out of expediency, a cursory survey will be given of the traditional accounting concept and an economic concept of income.

The Traditional Accounting Concept of Income

In financial accounting, net income is the surplus arising out of the matching of expenses (expired costs) and related revenues,[22] or, as Paton and Littleton put it, of effort and accomplishment.[23] The net income for a year will be the excess of revenues earned over expenses incurred during the year, both computed on an accrual basis.

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[22] M. Backer (ed.), Handbook of Modern Accounting Theory, New York: Prentice-Hall, Inc., 1955, p. 209.

[23] W. A. Paton & A. C. Littleton, An Introduction to Corporate Accounting Standards, American Accounting Association Monograph No. 3, Iowa City: Athens Press, 1955, pp. 14-8.

The traditional accounting concept based on the postulate that the value of the monetary unit is relatively stable requires that

> ... net income be determined by matching expired costs measured in terms of the number of dollars invested at time of acquisition - the "size" determined by the purchasing power of the monetary unit at that date - against revenue stated in terms of the purchasing power of the current year's dollars.[24]

The implication is that the traditional accounting income is nothing more than just dollar income; the accountants are concerned with the need to account for, or to maintain, the original stock of monetary units committed by investors to the enterprise before any income as a surplus sum can be anticipated.

The Economic Concept of Income

There is a great deal of disagreement among economists over the question of what income is. Several schools of thought have sprung up over the issue and their concepts are not only conflicting but sometimes also confusing.

The Hicksian concept of economic income enjoys wide acceptance among both economists and accountants. Thus, it will be discussed here as a sample - though admittedly a rather imperfect

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[24]Issac Newton Reynolds, An Analysis of Depreciation Methods and Bases, Research Paper 9, School of Business Administration, University of North Carolina, Chapel Hill, p. 65.

sample - of what economic income is. Prof. J. R. Hicks defines income as follows:

> The purpose of income calculation in practical affairs is to give people an indication of the amount which they can consume without impoverishing themselves. Following out this idea, it would seem that we ought to define a man's income as the maximum value which he can consume during a week and still expect to be as well off at the end of the week as he was at the beginning. Thus, when a person saves, he plans to be better off in the future; when he lives beyond his income, he plans to be worse off. Remembering that the practical purpose of income is to serve as a guide for prudent conduct, I think it is fairly clear that this is what the central meaning must be.[25]

The adaptability of Hicks' definition has an appealing advantage. By substituting a company, a society or a nation for "a man" in definition, it can be used to determine the income of any entity.

The important points about his definition are:

1. Income is a <u>surplus</u> - the maximum disposable amount. This idea about income is, no doubt, acceptable to accountants.
2. Income to Hicks is income in <u>real</u> terms - the maximum <u>value that can be consumed</u>. This is in contrast to the money income of the accountant.
3. The phrases, "without impoverishing themselves" and "as well off ... as", strongly suggest the importance and

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[25] J. R. Hicks, <u>Value and Capital</u>, London: Oxford University Press, 2nd edition, 1946, p. 172.

necessity of maintaining the original earning power or capacity of the entity. Though this idea of maintenance is, in a way, similar to the accountant's, a sharp difference, however, lies between them. Hicks is more concerned with the maintenance of capital in real terms; whereas the accountant is interested only in money capital.

4. Income can be increased; one can be "better off in the future" by enlarging the stock of earning power through additional investment made possible by savings (i.e. non consumption of earned income). This is recognized by accountants who see the wisdom of retaining earned surplus in the enterprise.

5. Likewise, future income can diminish and, thus, one can be "worse off" when the original stock of earning power is impaired by overconsumption - i.e. "when one lives beyond one's income."

6. Hicks' income is income ex ante; whereas the accountant's income is essentially income ex post.

7. The practical purpose of income determination is "to serve as a guide for prudent conduct". It is, thus, evident that Hicks' approach to income determination has an implication for proper economic planning for the future welfare of society.

It appears that the significant difference between the accountant and the economist is that the accountant recognizes only realized dollar income and looks only at the dollar capital of an enterprise. The Hicksian school, on the other hand, seeks the determination of real income and the maintenance of real capital.

Since opinions differ greatly in the interpretations of (a) the value of usefulness of an asset, (b) the concepts of income and capital, and (c) the purpose of accounting for depreciation, there arise a great variety of approaches to the measurement of depreciation. Basically, the various approaches fall into two types: (a) the cost approach and (b) the value approach.

The Cost Approach to Depreciation Accounting

The cost approach takes the view that a durable asset is strictly meant to be kept by an enterprise for use rather than for sale; and so to the enterprise, the asset is useful or valuable because of its use value. The purpose of accounting for the decline in the use value of an asset (i.e. depreciation) is to determine how much cost to assign to the production during a period.

Opinions, however, differ on the question of what cost is the proper one to be allocated or recovered through the process of

depreciation accounting. There are three interpretations of cost: (a) historical (original) cost, (b) price-level adjusted cost, and (c) replacement cost and its various versions.

The Historical Cost Approach

The traditional accountants maintain that the proper cost to be allocated through the process of depreciation accounting is the original acquisition cost of an asset. This approach is the outcome of the following:

1. The traditional method of valuing a long-lived asset:

   > Fixed assets should be carried at cost of acquisition or construction in the historical accounts, unless such cost is no longer meaningful.[26]

2. The traditional definition of expense:

   > Expense in its broadest sense includes all expired costs which are deductible from revenues.[27]

   It follows that depreciation expense must be that portion of the total historical cost of an asset, which is deemed to have expired during a period.

3. The stable monetary unit postulate:

   > ..., continued adherence to historical dollar accounting is based on the assumption that changes in the purchasing

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[26]Paul Grady, Inventory of Generally Accepted Accounting Principles for Business Enterprises, A.I.C.P.A. Accounting Research Study No. 7, New York: American Institute of C.P.A.'s, Inc., 1965, p. 252.

[27]Ibid., p. 434.

power of the monetary unit are not of sufficient importance as to require adjustment.[28]

Thus, it is assumed that accounting income determined on the basis of historical cost is free from "distortion".

4. The treatment of the acquisition cost of an asset as a form of prepayment:

Plant cost is an extreme form of prepayment; depreciation accounting is the means by which such prepayment is assigned to production.[29]

Criticisms Against the Historical Cost Approach

When Does Cost Expire? The traditional treatment of depreciation expense as the expired portion of plant cost allocated to the year's business operation has brought out the question, when does cost really expire? J. C. Bonbright asserts that cost expires at the time the outlay or purchase is made. He argues that if cost expires at all, or if it can be said to expire, then it expires completely when the asset is purchased since purchase is made once and for all. When the asset is recorded on the books, it is nothing but a statement of the historical fact that a purchase was made. The recorded cost, he maintains, does not and cannot expire gradually over the

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[28] Ibid., p. 30.

[29] W. A. Paton & A. C. Littleton, Op. cit., p. 88-9.

period of years during which the acquired asset loses its usefulness to the enterprise. Thus, his conclusion is that depreciation expense cannot be treated as the expired portion of the historical cost of an asset.[30]

Assets Acquired Without Costs: G. Terborgh points out that the cost concept of depreciation expense breaks down when an asset is acquired without cost.[31] He contends that since no cost is incurred, there should be no cost to capitalize and, thus, no cost to depreciate. He concludes that it is the value of an asset acquired, not the cost, that is the real and proper measure of the amount depreciable. Depreciation, in his opinion, is "value erosion".[32]

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[30]J. C. Bonbright, "The Concept of Depreciation as an Accounting Category", The Accounting Review, Vol. 5, No. 2, June 30, 1930, pp. 117-24.

[31]In such a situation, an accountant would normally obtain the "fair value" of the donated asset and then amortize this value (not cost) over the years of the asset's useful life in acknowledgment of the fact that the service of the asset has value to the enterprise, which has to be recognized in the income statement for proper determination of income.

[32]G. Terborgh, Op. cit., pp. 23-6.

The Unrealistic Stable Monetary Unit Assumption: The strongest case against the historical cost approach to asset valuation and depreciation determination lies in the argument that it is not realistic at all to assume that the value of the monetary unit is stable in a world characterized by fluctuating prices. Accounting on this assumption amounts to adding and subtracting dollars of different purchasing powers with the result that the financial statements will contain some distortion. Joel Dean terms the excess of revenue over the absorbed original dollar invested capital "jumbled-dollar" profits.[33] It reflects a mixture of the following:

1. The results of operations.
2. The results of "buying right", or the reverse - the "timing" of acquisition.
3. The effect of the relative price changes - greater or less than the general price change - of specific plant assets consumed.
4. The effect of changes in the general price level.

Such a net income is far from the Hicksian economic income since it is not related to the concept of maintaining real capital. It is maintained that "net income composed of such a mixture obviously has serious limitations from the standpoint of its usefulness to management

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[33]Joel Dean, Managerial Economics, New York: Prentice-Hall, Inc., 1951, p. 22.

in making decisions."[34] This is evident in the following remark made by the Chairman of the Finance Committee of the U. S. Steel Corporation, Mr. E. M. Voorhees:

> The item, "Added to Cover Replacement Cost", on U.S. Steel's income statement is designed to restore realism in the measurement of depreciation cost in the light of the dollar debasement transpiring between the time facilities were originally purchased and current accounting periods.
> .....
> If a business is to continue it is necessary to recover the purchasing power of sums originally invested in tools of production so that the tools may be replaced as they wear out.[35]

In 1958, Business Week reported that

> As a result of a survey of businessmen and the heads of business schools, the American Institute of C.P.A's. is about to reconsider the accepted accounting procedure for treating depreciation in reports to stockholders.
> Accountants have traditionally based depreciation on the actual cost of plant or equipment. Prices, however, have risen so sharply that many industries contend that it's unrealistic not to base depreciation on current replacement costs.
> Seventy-four percent of the answers to the Institute's survey favour changes in accounting practices so as to reflect current dollar costs of depreciation when reporting to stockholders.[36]

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[34] I. N. Reynolds, Op. cit., p. 71.

[35] Statement made before the Subcommittee on Profits of the Joint Congressional Committee on the Economic Report, Washington, D.C., December 21, 1948.

[36] Business Week, April 5, 1958, p. 79.

The Price-Level Adjusted Cost Approach

Realizing the shortcomings of the use of historical cost, accountants are beginning to move in the direction of recognizing the importance of making price-level adjustment to historical cost so that financial statements will present more meaningful data.[37] With their historical costs adjusted for general price-level movements, assets and depreciation charges will then be stated in terms of dollars with constant purchasing power. Revenues in current dollars will be matched with expenses in current dollars in the determination of net income for a period, and business capital will be maintained in terms of original stock of purchasing power contributed by investors. The effect of making such an adjustment is that the illusory portion of the "jumbled-dollar" net income is segregated from the contemporary - dollar net income.

It is to be noted that the contemporary-dollar net income makes no allowance for the maintenance of real capital, simply because the prices of specific assets do not generally move in the same direction

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[37] See the American Institute of C.P.A's. Research Study No. 6, Reporting the Financial Effects of Price-Level Changes, 1963. This is the outcome of the survey undertaken in 1958.

See also Perry Mason, Price-Level Changes and Financial Statements - Basic Concepts and Methods, American Accounting Association, 1956.

or to the same extent as the general price level. Thus, it does not approximate the Hicksian economic income.

Static Assumptions

The historical cost approach is based on two static assumptions, viz., (a) that there is no change in the value of money and (b) that there is no change in technology. The price-level adjusted cost approach removes the first unrealistic assumption but still retains the second one.

The Replacement Cost Approach

The replacement cost approach to the determination of depreciation expense is closely tied up with the idea of maintaining real capital intact, which is an integral part of the Hicksian concept of income. If a business enterprise aims to operate indefinitely, it must necessarily take steps to protect and preserve its stock of real capital, not just money capital. Thus, replacement, or rather restoration, of real capital is a necessary business function if continuity of operation is the normal expectation of the business enterprise.

Economists are more concerned about real income and the general welfare of society. Maintenance of real capital is essential for the betterment of the economic welfare of society. Thus, economists would generally subscribe to the replacement concept of

depreciation;[38] for implicit in this concept is the expectation of continuity of economic activities with a continuous flow of disposable income for the benefit of society.

What Is To Be Replaced? Proponents of the replacement concept, however, do not often agree with each other on what is to be replaced. They have different ideas about what real capital is and so, naturally, they differ in what should be replaced to restore the stock of capital to its original level.

The U. S. Supreme Court, when dealing with cases on public-utility depreciation, had suggested that:

> The principal purpose of depreciation accounting is to provide for the financing of replacements of property.
> .....
> Another purpose ... is to prevent the impairment of capital investment.[39]

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[38] R. G. James observes that "a great deal of the economic literature on depreciation is in terms of maintaining productive capacity. Typical is the study and calculation of national income ..." See his article, "What Do Executives Think Depreciation Is?", N.A.C.A. Bulletin, May, 1954, p. 1141.

[39] This is the conclusion of Perry Mason after having studied legal cases relating to the subject. See his article, "The Supreme Court on Public-Utility Depreciation", The Accounting Review, Sept., 1936, pp. 243-70; reprinted in M. Moonitz and A. C. Littleton (eds.), Significant Accounting Essays, New Jersey: Prentice-Hall, Inc., 1965, pp. 337-89.

But the Court has never been clear in its interpretations of "property" and "capital investment". Further, it was rather inconsistent in its prescription of methods by which utility companies were allowed to effect replacement of property or to prevent the impairment of capital investment. At times, they were allowed to recover "original costs"[40] through the depreciation charge; at other times, it was "reproduction costs"[41] or some "fair-value" costs[42]. However, it is clear that the Court's intention behind its various decisions was to establish the right and duty of a utility company to protect its capital, whatever it may be, and to include in its rates a charge or provision for this purpose so that it could continue to serve the community. This is how the Court

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[40] In utility accounting, "original cost" means the cost of a capital asset as at the time it was first employed in rendering utility service.

[41] "Reproduction cost" generally means the cost of duplicating an identical asset under present price conditions. This is a concept of replacement with identical assets.

[42] "Fair value" is a composite figure arrived at after giving proper weights to all the elements of value. See Smyth v. Ames, 169 U. S. 466 (1898).

put it in the Knoxville Water Co. case:

> Before coming to the question of profit at all the company is entitled to earn a sufficient sum annually to provide not only for current repairs, but for making good the depreciation.
> .....
> It is not only the right of the company to make such a provision, but it is its duty to its bond and stockholders, and, in the case of a public service corporation, at least, its plain duty to the public.[43]

Some proponents of the replacement concept vaguely suggest that an enterprise must "replace a capital good at the end of its ... life".[44] Others are more specific to suggest the replacement of "equivalent objects".[45] However, it is often not very clear whether they mean replacement with an identical asset or an asset with equivalent productive capacity.

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[43] Knoxville v. Knoxville Water Co., 212 U. S. 1 (1909)

[44] See, for example, A. A. Ring, "The Economic Liability to Replace", Public Utilities Fortnightly, Vol. 63, No. 2, Jan. 15, 1959, p. 74; R.A.D. Egerton, "The Capital Coefficient and the Rate of Depreciation", The Economic Journal, Mar., 1953, p. 112.

[45] A. C. Pigou, "Maintaining Capital Intact", Economica, Aug., 1941, p. 271. See also J. Bauer, "Depreciation", Encyclopaedia of the Social Sciences, p. 98; and Edwin Cannan, Wealth, 3rd ed., London: P. S. King & Sons Ltd., 1928, p. 155.

Replacement of Productive Capacity: In a world of rapid technological changes, assets become obsolete soon and similar assets for replacements are usually not available. Recognizing the cost effects of obsolescence and price changes, some people contend that it is the productive capacity of an asset (or a stock of assets) that should be restored when exhausted so as to maintain the overall productive capacity of the enterprise. R. G. James, reporting from a survey he undertook, said,

> Twenty-one of the fifty-two opinions were classifiable into a category of depreciation theory which we can call "recovery of productive capacity". This can be interpreted as a theory holding that enough funds should be withheld from income to insure that the "productive" or "service" capacity of the business could be maintained.[46]

He attributed the following statement to Leonard Spacek:

> In my opinion, the first purpose of an annual provision for depreciation is the recovery of the economic cost of the depreciable property consumed during the year. The economic cost is not recovered unless the depreciation is sufficient to maintain the service capacity of the plant.[47]

The American Accounting Association advocates that depreciation expense should be based on the current cost of restoring exhausted

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[46] R. G. James, Op. cit., p. 1140. He added: "It was not surprising ... to find the stronger support for this concept among the line executives rather than the accountants, since the former probably conceive of business more in physical terms than do the latter". (p. 1141).

[47] Ibid., p. 1142.

"service potential" of an asset.[48]

Those who support replacement of service or productive capacity, take the following view with respect to a capital asset:

> Fixed assets are not to be viewed as masses of matters that bespeak the constructive and inventive genius of man. When we buy them, even though we buy matter, we really buy the services and uses that are inherent in them. When they are put to the tasks for which they are wanted, we earn these uses. Looking at the problem from this angle, we might properly say that an investment in fixed assets is ... an investment in the service units of the assets.[49]

The above are only some of the suggestions which have been made in answer to the question of what should be replaced. They indicate that there is no consensus of opinion amongst the advocates of the replacement approach to depreciation determination.[50]

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[48] See Appendix B.

[49] W. B. Castenholz, This Thing Called Depreciation - A Supplementary to a Solution to the Appreciation Problems. Chicago: La Salle Extension Univ., 1931, p. 67.

[50] For more of the various interpretations of capital maintenance, see H. W. Sweeney, "Maintenance of Capital", The Accounting Review, Dec., 1930, pp. 277-87; reprinted in M. Moonitz and A. C. Littleton (editors), op. cit., pp. 248-61.

When Replaced? The problem of replacement is further complicated by the problem of timing. Should the computation of replacement requirements be based on the assumption that the real capital assets are being continuously replaced or on the assumption that they will be replaced only at the time of their eventual retirement? On the basis of the second assumption, the relevant replacement cost will be logically the future replacement cost. This approach, however, has the practical problems of making a reliable estimate of the useful life of an asset and making a reasonably accurate forecast of the future cost of replacement as at the end of the asset's life.

On the assumption that the productive capacity of an asset is being continuously replaced, then the relevant cost is the current replacement cost of the asset. This approach is more practical than the one based on future replacement cost, because information about current cost of replacement is more readily available and more objective or reliable. This is the approach advocated by the American Accounting Association.[51]

The Value Approach to Depreciation Accounting

The arguments of those who advocate the value approach to

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[51] See Appendix B.

depreciation accounting can be summed up in the following words of G. Terborgh:

> Obviously, it is not the incurment of a cost as such that justifies the capitalization and subsequent depreciation of an asset; it is the existence of the value acquired through the outlay. If there is no such value, there is nothing to capitalize and depreciate; if, on the other hand, valuable assets are acquired without the incurrence of cost, an allowance for their depreciation is no less appropriate for that reason. The value, not the cost, is the real measure of the amount depreciable.[52]

That cost and value are two different things is well explained by A. C. Littleton. He points out that

> ... things are not useful because they cost effort, effort is expended because things are useful; goods are valuable not because they cost something, costs are incurred because goods are valuable - or are thought to be valuable. Hence cost is not the basis of value; if cost is a proper basis for the inventory of a stock of unsold goods, it must be for other reasons than that it expresses the value of the goods. As an expression of the investment in goods, cost is quite acceptable, but not as an expression of their value.[53]

Thus, according to the "value" school of thought, historical costs, price-level adjusted costs and replacement costs cannot be "the real measure of the amount depreciable".

The "value" concept of depreciation expense is, briefly, thus:

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[52] Op. cit., pp. 23-4.

[53] A. C. Littleton, "Value and Price in Accounting", The Accounting Review, Vol. 4, No. 3, Sept., 1929, pp. 150-1.

> This concept implies that the value of one asset is in some way computed at two different dates. The value at the later date subtracted from the value at the earlier date is the depreciation, regardless of what combination of causes may have been responsible for the value change. When "depreciation" is used in everyday speech, this is the meaning generally implied; it is also implied by most dictionary definitions.[54]

Or, as G. Terborgh puts it, depreciation is "value erosion" and depreciation accounting is "a process of value amortization".[55]

Definitions of "Value"

The main problem with the "value" concept is the definition of "value". It is "a word of many meanings"[56]; some of them are economic meanings; others are in such fields as art, ethics, mathematics and philosophy. Though value is a highly subjective thing, there are, however, two measures of value that are capable of being quantified, viz., (a) market value - i.e. price, and (b) present (discounted) value; these are the usual economic meanings of value.

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[54]E. L. Grant & P. T. Norton, Jr., op. cit., p. 11.

[55]G. Terborgh, op. cit., pp. 20-7.

[56]Justice Brandeis in Southwestern Bell Telephone Co. v. Public Service Comm. of Missouri, 262, U. S. 276 at 310 (1923).

Thus, depreciation expense can be determined on the basis of the market value or the discounted value of an asset.

The Market Value Approach

The market price of an asset is an objective measure of its value, because "price ... is a compromise ... between ... subjective estimates and is measured by the quantity of money for which the article is exchanged."[57] Accordingly, some contend that depreciation expense should be the amount representing the decline in the market value of a capital asset between two points of time.[58]

In his discussion on determining the market value of an asset, J. C. Bonbright explains that to obtain the market value of an asset, for asset valuation purpose, is

> ... to estimate the price for which the property could be sold by some stipulated seller to anyone else, the conditions of the assumed sale being left for selection by reference to the purpose for which the valuation is being made.[59]

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[57] A. C. Littleton, op. cit., p. 149.

[58] See E. L. Grant & P. T. Norton, Jr., op. cit., p. 11; and J. H. Burton, Sinking Funds, Reserve Funds and Depreciation, London: Sir Isaac Pitman & Sons, Ltd., p. 1922, p. 37.

[59] J. C. Bonbright, Valuation of Property, Vol. 1, New York: McGraw-Hill Book Co., Inc., 1937, p. 65.

He points out that

> ... the essence of the concept (of market value) lies in its reference to the exchangeability of the property as the test of value. A transfer of ownership is assumed, and value is determined by the price at which this real or imagined transfer takes place.[60]

In theory, this concept of depreciation expense is logical and sound. In reality, however, very few capital assets have that assumed degree of exchangeability; "... many properties highly prized for the special purposes for which they are designed, are of trivial value because only the present owner is in a position to exploit them."[61] Since ready second-hand market for capital assets is not common, it is admitted that "the concept has but a limited usefulness in the valuation of property."[62] Thus, determination of depreciation expense by reference to the market value of a capital asset has, therefore, little practical application.

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[60] Ibid., p. 66.

[61] Loc. cit.

[62] Loc. cit.

Discounted Value Approach

Though a capital asset does not normally have a proper market value, the service it renders, however, has a market value when it becomes "embodied" in the finished product and is sold as a constituent of the product. This leads some people to suggest that the value of a capital asset can be ascertained indirectly from a study of the expected market value of its service as asimilated in the finished product. Accordingly, the value of a capital asset at any point of time is the total receipts which its service is expected to fetch in the future, discounted back to that point of time.[63] Logically, at the point of purchase, the present (discounted) value of a capital asset to its owner must be at least equal to the actual price he pays for it. Under an assumed perfect condition, the market price of an asset will equal its discounted value. For example,

> ... if buyers and sellers could forecast accurately their need for office space and its availability at all relevant times in the future, the office building would have a current (market) value equal to the present (discounted) value of the rents (less out-of-pocket expenses) on the offices it contains.[64]

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[63] See G. Terborgh, op. cit., p. 29.

[64] R. T. Sprouse & M. Moonitz, A Tentative Set of Broad Accounting Principles for Business Enterprises, American Inst. of C.P.A's., Accounting Research Study No. 3, 1962, p. 33.

As depreciation is "value erosion", it follows that

> ... depreciation for any year would be the difference between the present value of all future net service values at the beginning of the period and the present value of all future net service values remaining at the end of the period, discounted at the appropriate rate of discounted.[65]

Practical Problems

There are several practical problems inherent in this concept of depreciation expense. To begin with, this method of determination calls for estimates of three things related to future events: (a) the expected market value of the finished product which the asset helps to produce with its service, (b) the length of the useful life expected of the asset, which is affected by the useful life of the finished product besides other factors, and (c) the relevant discount rate. Thus, it has to be admitted that the resultant depreciation expense for a period will be as reliable as the subjective estimates of these items.

In a multi-asset business enterprise, an asset by itself is not of much use to the enterprise; it becomes useful only when it is employed in conjunction with all other assets to produce a finished product.

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[65] I. N. Reynolds, op. cit., p. 14. See also, J. R. Hicks, "Maintaining Capital Intact: A Further Suggestion", Economica, May, 1942, pp. 176-7; M. J. Gordon, "Depreciation Allowance, Replacements and Growth: A Comment", American Economic Review, Vol. 43, No. 4, Sept., 1953, p. 610; A. Marston, R. Winfrey and J. C. Hampstead, Engineering Valuation and Depreciation, 2nd edition, New York: McGraw-Hill Book Co., Inc., 1953, p. 182.

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Since the finished product is the result of joint contributions of all the assets, there is the difficult problem of how to identify the contribution from each asset so that the market value of the finished product could be apportioned accordingly in order to determine the value of each individual asset. This problem is similar to the problem of how to apportion joint costs.

If, as a way to solve the apportionment problem, the depreciation expense for a period is to be viewed as the depreciation of the whole stock of assets employed by the business enterprise during the period, then there is the implication that so-called current assets and intangible assets as well as other assets like land, all exhibit the same phenomenon of depreciation that characterizes deprecaiable capital assets such as buildings and equipment.

The discounted value approach cannot be applied in a situation where the product price is fixed by some authority on the basis of costs which include depreciation expense. This refers particularly to the utility industry.

Further, an application of this approach to asset valuation and determination of depreciation expense may give rise to a situation in which there is no depreciation but, instead, <u>appreciation</u> of asset. How such a situation may arise is explained by R. Eisner in his

rejoinder to M. J. Gordon's reply[66] that depreciation should be determined on the present value basis:

> For one thing, current value must really vary with expected future receipts, since, of course, future receipts cannot be known currently. But this means that if business expectations improve, values of assets, cet. par., rise. Would Gordon then have business firms note an "appreciation credit" which would be an addition to their current profit figure?[67]

Generally, business expectations improve with a rising price trend; and so future earnings of assets would be expected to increase and their discounted values would rise, too. This means that in a period of rising prices, there may be appreciation credit, and thus, there may be no depreciation at all.

Comment on Value Approaches

Conceptually, the two value approaches are logical and acceptable since it can be argued that an asset is useful to an enterprise when it has economic value. When its value (discounted value of expected receipts) has disappeared for one reason or another, its usefulness to the enterprise is over and retirement from service is called for.

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[66] M. J. Gordon, op. cit., pp. 609 ff.

[67] R. Eisner, "Depreciation Allowances, Replacement Requirements and Growth; A Rejoinder", American Economic Review, Vol. 43, No. 4, Sept., 1953, p. 616.

Since the economic value of an asset is dependent upon the patterns of expected inflow of receipts and expected outflow of operating costs associated with the utilization of the asset, it is evident that the value approaches to the determination of depreciation expense take into consideration the realistic expectations of (a) changes in the value of the monetary unit and (b) changes in technology, both of which will affect the economic value of the asset. A falling money value will enhance the value of the asset because of a rising price trend; whereas an improvement in technology will lower the value of the asset relative to a more efficient one. Further, use and age will tend to lower the value of the asset through increasing the absolute size of its operating costs. Thus, unlike the historical cost and price-adjusted cost approaches, the value approaches are not based on static assumptions.

Disregarding practical difficulties, a value approach is conceptually superior to a cost approach when the purpose of depreciation accounting is to determine the value of an asset. If the value of an asset rises (on account of, say, rising prices) there is justification in recording "an appreciation credit" if the purpose is to determine the proper value of the asset. This can be reflected in the account only with the use of a value approach to depreciation accounting. If, however, the purpose of depreciation accounting is to determine the costs of business operations, then a cost approach

is more logical and practical. Evidently, a value approach is balance-sheet oriented; whereas a cost approach is income-statement oriented.

CONCLUSION

It can be concluded that though there are various approaches to the determination of depreciation expense, it is clear that each approach has its own uses. Confusions and conflicts arise only when there is a misunderstanding of the uses of the various approaches. W. A. Lewis senses the root cause of all depreciation troubles when he says:

> The truth is that each purpose for which depreciation is measured requires a different concept. Nothing but confusion would flow from deciding that one of these concepts is more 'scientific' than all others, and from trying to make it serve all purposes.[68]

L. Goldberg believes that much of the confusion will disappear if more precise or descriptive terms or phrases are used to explain the various purposes for which depreciation accounting is intended:

> If, by "charging depreciation" we mean an allocation of historical cost, let us use words (such as "cost-allocation" and "proportion

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[68] W. A. Lewis, "Depreciation and Obsolescence as Factors in Costing" in J. L. Meij (ed.), Depreciation and Replacement Policy, Amsterdam: North-Holland Publishing Co., 1961, p. 34.

> of cost allocated against past revenue") which will convey this meaning. If we mean attempting to provide resources for future replacement of assets, why not use words (such as "provision for future replacement") which will bring this meaning out? If we mean adjustment to present market costs, why not use words which say so; if we mean an estimate of wearing out, let us indicate this clearly and unequivocally. To use a word like "depreciation" or a phrase like "provision for depreciation" which is now so confused is not quite fair to ourselves or to the readers of our statements and reports.[69]

A NOTE

Depreciation Expense - A Source of Funds?

Much controversy exists as to whether depreciation accounting provides funds, or sets up a fund. The replacement approaches to depreciation accounting appear to suggest very strongly the idea of providing funds or setting up a fund. The accountant's practice of placing depreciation charge in the category of "Source of Funds" in his Statement of Source and Application of Funds also appears to suggest (rather erroneously) the same idea. Part of the reason for the controversy can be traced to the confusion over what the term "funds" means. In its narrow sense, it generally means cash; a broader interpretation of it usually identifies it as "all financial resources arising from transactions with parties external to the business enterprise".[70]

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[69] L. Goldberg, op. cit., p. 25

[70] A.I.C.P.A., The Statement of Source and Application of Funds, Opinions of the Accounting Principles Board No. 3, Oct., 1963, para. 2.

Taking the broader interpretation of funds, it has to be admitted that an enterprise has only two main sources of funds, one coming from contributions made by shareholders, creditors and donors and the other from proceeds paid in by buyers of the enterprise's products and its retired capital assets. These funds usually come in as cash or other liquid assets, most of which will be converted into capital assets and other less liquid assets for revenue-earning purposes, i.e. for generating more funds. Of the two major sources, the one from sales is the more important one, being regular in its flow and the life blood of the enterprise. The survival of an enterprise depends primarily on this source. If society approves of an enterprise, it makes it a success by patronising it and giving it the necessary funds for survival through regular and large payment of revenues. This being the case, a depreciation charge can never be a source of funds; it can never provide the funds for replacement purposes. Only customers' revenues, investors' contributions, creditors' loans or donors' gifts can do so. What then are the effects of depreciation accounting?

As summarized by Perry Mason, the financial effects of depreciation accounting are as follows:

1. The recording of depreciation as such has no effect upon the amount of current funds which come into the business except insofar as the selling price of a product may be

based upon its cost of production, as in the case of a cost-plus contract. Once the selling price is fixed, the making of the bookkeeping entries for depreciation can have no effect upon the total receipts or revenue; an increase in the amount of depreciation will not increase the revenue or flow of funds into the business and the reduction or omission of an entry for depreciation will not decrease it.

2. Whenever the revenue covers all of the expenses including the depreciation, there will be an increase in net assets other than the depreciating property equal to the amount of depreciation charged off. The deduction of depreciation from revenue does not involve an expenditure of funds, so the funds received in connection with sales and other revenue will to this extent be retained in the business." [71]

It is granted that depreciation charge is not a source of funds, nor is it an attempt to set up a fund. A conscious attempt to set up a fund for replacement purposes will involve transferring assets to a special "fund account"; the transferred assets come ultimately from sales proceeds or from contributions made by investors and others, but not from depreciation charges.

However, when revenues are sufficient to cover all expenses including a charge for depreciation, depreciation accounting then provides, or rather preserves, funds for the enterprise because of the fact that it (a) "restricts the amount of dividends which might be distributed to shareholders if it were not recorded"[72], and (b) "does

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[71] Perry Mason, "Cash Flow" Analysis and the Funds Statement", A.I.C.P.A. Accounting Research Study No. 2, p. 31

[72] Ibid., p. 30

not involve an expenditure of funds, so the funds received in connection with sales and other revenue will to this extent be retained in the business."[73] Thus, in the sense that funds originally from customers are retained in the business enterprise and not distributed as dividends because depreciation expense is deducted in the computation of net income available for disposal, then depreciating accounting does preserve funds to the amount so restricted from disposal in times of business success.

What is done or should be done with the funds retained in the business by the deduction of depreciation is strictly a managerial matter. If the management decides to end the enterprise, with the approval of investors, it will be expected to return the funds to the investors. The normal expectation, however, is continuity of operation, especially when the enterprise is doing well; and so the management will be expected to use the funds in the manner that will best ensure the success of the enterprise. The funds could remain in liquid forms or be converted into equipment, buildings, raw materials, etc. The important thing is that they should be so utilized as not to impair but to maintain or improve the earning power of the enterprise. This means that the funds could be used to replace retired assets with identical assets, or equivalent, better or entirely

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[73] Ibid, p. 31

different assets.

Summing up, depreciation accounting is not a process of setting up a fund, nor is it a source that provides funds; it is merely a process of determining the total costs of doing business so as to serve as a basis for pricing products and to measure net income as an indication of business performance, or a process of determining the value of an asset at a point of time.

> Furthermore, the recognition of depreciation of plant assets has no direct relation to what becomes of the funds received from customers. Funds derived from sales of merchandise are used currently to pay operating expenses, to reduce long-term debt, to pay dividends, to replace or expand inventories, to acquire additional plant assets, and for other uses depending upon changing conditions and changing managerial attitudes.[74]

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[74] I. N. Reynolds, op. cit., p. 5.

APPENDIX B

THE CURRENT REPLACEMENT COST CONCEPT AS PROPOUNDED BY THE AMERICAN ACCOUNTING ASSOCIATION [1]

The replacement cost concept as propounded by the A.A.A. for the valuation of assets and the determination of depreciation expense is evidently an extension of its interpretation of assets. It defines assets as "economic resources devoted to business purposes within a specific accounting entity; they are aggregates of service potentials available for, or beneficial to, expected operations." (Emphasis supplied). The notion of "service potentials" provides a sound conceptual basis for asset valuation.

Admittedly, the true (economic) value of the service potential of an asset is "the discounted value of future cash flows" expected from it. However, there are practical difficulties associated with

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[1] Abstracted from the American Accounting Association, Committee on Concepts and Standards - Long-Lived Assets, "Accounting for Land, Buildings and Equipment: Supplementary Statement No. I", The Accounting Review, Vol. 39, No. 3, July, 1964, pp. 693-9.

this measurement of asset value. The A.A.A. recognizes that "rarely...can the economic value...of service potentials be measured in ways that meet the test of verifiable evidence.... Predicting cash flows and allocating them to individual assets in the typical situation where cash flows are the result of the joint use of many assets present insurmountable difficulties." Thus, it suggests that "practical approximate measurement of service potential may be attained by reference to the current cost of securing the same or equivalent services."

The A.A.A. is aware that "at the acquisition date of an asset, the value of its service potential is presumed to be at least as great as its purchase price. If this were not the case, the asset presumably would not have been purchased." Thus, the purchase price (which can be viewed as the current replacement cost at point of purchase) can be accepted as a reliable measure of the value of the service potential of an asset at its acquisition date. Subsequent to that date, the purchase price cannot remain a measure of the asset value because of changing events which govern its value. Recognizing this fact, A.A.A. formulates a general rule for determining the value of an asset: "The current cost of obtaining the same or equivalent services should be the basis for valuation of assets subsequent to acquisition, as well as at the date of acquisition."

Some Guides for the Determination of Current Replacement Cost:

1. "Where there is an established market for assets of like kind and condition, quoted prices provide the most objective evidence of current cost. Such prices may be readily available for land, buildings, and certain types of standard equipment."

2. "Where there is no established market for assets of like kind and condition, current cost may be estimated by reference to the purchase price of assets which provide equivalent service capacity. The purchase price of such substitute assets should be adjusted for differences in operating characteristics such as cost, capacity, and quality. (Emphasis supplied).

3. "In other cases, adjustment of historical cost by the use of specific price indexes may provide acceptable approximations of current cost. Appraisals are acceptable only if they are based on the above methods of estimating current cost."

Change in Asset Value Over Time

The A.A.A. points out that "two factors arising subsequent to the date of acquisition may cause the current cost of a long-lived asset to differ from acquisition cost.

1. Expiration of service potential of the asset resulting from use,

physical deterioration, or obsolescence anticipated at the time of purchase. This expiration is referred to ... as depreciation.

2. Changes in technology or demand that were not anticipated at the time of purchase, and changes in the general price level. These changes are referred to ... as holding gains and losses.

Depreciation

"Depreciation reflects the estimated expiration of service potential of the asset.[2] It is usually an important element in the measurement of income from ordinary operations.

"Income from ordinary operations should represent an amount, in current dollars, which, in the absence of catastrophic loss or discovery of assets, is available for distribution outside the firm without contraction of the level of its operating capacity; or, stated in another way, the amount which, by retention, is available for expansion of operating capacity.[3] Measurement of this concept of income from

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[2]This definition is acceptable to the pricing practice under the marginal cost rule; however, it should be subject to the qualification that it should be associated only with those assets which the management intends to replace under continuity assumption.

[3]This evidently bears a very close resemblance of the Hicksian (economic) concept of income: "...we ought to define a man's income as the maximum value which he can consume during a week and still expect to be as well off at the end of the week as he was at the beginning. Thus, when a person saves, he plans to be better off in the future; when he lives beyond his income, he plans to be worse off". J.R. Hicks, Value and Capital, London: Oxford University Press, 2nd Edition, 1946. p. 172.

ordinary operations can be accomplished only if the expiration of service potential is measured in terms of current cost. That is, in order to continue operations without contracting the level of operating capacity, exhausted services must be restored; the relevant cost of expired services is the current cost of restoration." (Emphasis supplied).

For the determination of periodic depreciation expense, the current replacement cost to be used in the computation can be the one as at the end of the period or it can be the average cost of the current period. The choice between the two is somewhat arbitrary, because it is recognized that "the process of depreciation is apt to be a continuous one." The A.A.A. feels that "this procedure is most practical and that the accounting results are not apt to be materially improved by further refinements."

"As long as expectations do not change, periodic estimates of depreciation should be consistent with the pattern of service expirations anticipated at the time of acquisition. In most cases, the precise pattern of service expirations is impossible to determine and may well change during an asset's useful life. Accordingly, use of a conventional formula is apt to provide the most practical and objective measurement for depreciation."

Holding Gains and Losses

As pointed out earlier, holding gains and losses are the results of two factors:

1. "Specific price changes that reflect altered technology or demand conditions," and
2. "movements of the general price level."

Such gains and losses are measured by "the difference between (1) the replacement cost (new) of an asset, less accumulated depreciation as of the beginning of the period, both measured in terms of the replacement conditions existing at the beginning of the period, and (2) the replacement cost (new) of an asset, less accumulated depreciation as of the beginning of the period, both measured in terms of the replacement conditions existing at the end of the period. The result is to exclude the effect of the current period's depreciation". An alternative calculation is given by the following formula: $(R_t - R_{t-1})\left(1 - \frac{D_{t-1}}{R_{t-1}}\right)$, where

R -- replacement cost,

D -- the accumulated depreciation account balance,

t -- the time period.

It is noted that such holding gains and losses contain two elements:

1. True capital gains and losses that result from factor 1. In

Economics, this type of gain is not considered a part of economic income that can be disposed of.

2. Monetary gains and losses that result from factor 2, viz. changes in the value of money. These are not part of the real economic income either.

Thus, the A.A.A. cautions that such gains (both types) "are not distributable without contraction of operating capacity and therefore do not enter into the measurement of income from ordinary operations. Similarly, such losses do not necessarily reduce operating capacity and therefore are not deducted in arriving at income from ordinary operations." However, it adds, "such value changes do represent changes in the equity of the stockholders [4] and must be recognized in the overall measurement of total net income for the period during which such changes occur."

The two types of holding gains and losses can be segregated by making adjustment for the price-level change. The A.A.A., however, felt precluded from making a recommend ation on the segregation, because "accounting for long-lived assets assumes implicitly that the effects of price level changes are not sufficiently important

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[4] These changes in equity are only changes in monetary terms; they do not, in any way, represent changes in the economic (or real) net worth of the company.

to justify separate recognition, (and) ... an accounting for general price-level changes concerns all of financial reporting, not merely long-lived assets."

Computational Illustrations

Holding Loss: Applying the given formula $(R_t - R_{t-1})(1 - \frac{D_{t-1}}{R_{t-1}})$ to the data stated for Table V on page 119, the computation of holding loss for each of the five years is given in Table VIII on page 203. Row (I) shows the (unrealized) holding losses for the five years resulting from the application of the formula. The amount of holding loss realized for each of the five years is indicated along Row (M).

Annual Depreciation: For ease of computation, Table Viii assumes that 20% of the asset's service potential is consumed annually and, thus, the depreciation expense for each year is equal to 20% of the current cost of replacing the asset completely. The Table works on the basis that the end-of-period current cost of replacing the asset completely is the relevant depreciation base, following the suggestion of the Committee (see Row (B)). Following the proposal of the Committee, the annual depreciation expense for each of the five years is as indicated along Row (K). Row (J) shows what the annual depreciation expense would have been if the original cost were used

instead. The difference between the original-cost depreciation expense and the current-cost depreciation expense measure the amount of holding loss realized for the year. It is equal to the extent to which the income for the year is overstated in relation to what it would have been if the original cost were used, so that the apparent holding loss for the year will cancel out the apparent increase in the year's income.

Comment

It is to be noted that the accumulated depreciation computed on the basis of current replacement cost adds up to $8,000 (see Row (K)) by the end of Year V. This exceeds the current replacement cost (new) of the asset as at the end of Year V by $2,000. Thus, there is a discrepancy to be explained. This excess of $2,000 in the accumulated depreciation implies that the income accumulated over the past five years, measured on the basis of current replacement cost, has been understated to the extent of $2,000. This "error" can be explained by examining Rows (I) and (M). The accumulated amount in Row (I) seems to suggest that $2,000 of holding losses were not recognized to have been realized over the years; only $2,000 (Row (M)) were recognized as having been realized over the years. Taking Year II as an example,

RECOMPUTATION OF TABLE V

(A) Original cost (new)
(B) Current Replacement Cost (new) as at the end of year
(C) % of Asset's life that has expired as at beginning of year
(D) R_{t-1}
(E) R_t
(F) $(R_t - R_{t-1})$
(G) D_{t-1}
(H) $\left(1 - \frac{D_{t-1}}{R_{t-1}}\right)$
(I) Holding Loss Not Realized In Current Year (as at beginning of year)
(J) Annual Depreciation (Original Cost)
(K) Annual Depreciation (Current Replacement Cost)
(L) Difference in annual depreciation charge owing to change in depreciation base -
(M) Current year's realization of holding loss resulting from (L)

Realization of (I) over the Years:* (St.-line time basis)

(N) $800 holding loss of year II
(O) $600 holding loss of year III
(P) $400 holding loss of year IV
(Q) $200 holding loss of year V
(R)

* These eventual realizations of holding losses over the years should be countered by reducing depreciation charges for those years to the same extent (as is done in Row (M) Table V.)

USING THE A.A.A.'s FORMULA $(R_t - R_{t-1})(1 - \frac{D_{t-1}}{R_{t-1}})$

YEAR:	1	11	111	1V	V	Accumulation
	$10000	10000	10000	10000	10000	
	10000	9000	8000	7000	6000	
	0%	20%	40%	60%	80%	
	10000	10000	9000	8000	7000	
(E)= (B)	10000	9000	8000	7000	6000	
	0	1000	1000	1000	1000	4000
(C)× (D)	0	2000	3600	4800	5600	
1 - ((G)÷(D))	100%	80%	60%	40%	20%	
(F) × (H)	0	800	600	400	200	2000
20% × (A)	2000	2000	2000	2000	2000	10000
20% × (B)	2000	1800	1600	1400	1200	8000
(J) - (K)	0	200	400	600	800	2000
	0	200	400	600	800	2000
		200	200	200	200	800
			200	200	200	600
				200	200	400
					200	200
		200	400	600	800	2000

the $800 of holding loss unrealized as at the beginning of the year appears to have been "forgotten" altogether for the rest of the years. To correct this "mistake", the outstanding amount has to be spread over the years that follow from the beginning of Year II, assuming that an equal amount is realized for each of the following years (See Row (N)). Rows (O) to (Q) show similar corrections made for the other outstanding amounts. When the amounts along Row (R) are deducted from those along Row (K) - as it is done in Table V along Row (M) - the accumulated depreciation as at the end of Year V will be reduced to its proper amount of $6,000. The total amount of realized holding losses as at the end of Year V is equal to the sum of (1) the accumulated amount along Row (R) and (2) that along Row (M), i.e. $4,000. Thus, when these adjustments are made, Table VIII and Table V will give the same results.

The A.A.A. is, undoubtedly, more concerned about proper income determination for each of the accounting years. Thus, it is justified in suggesting that the proper charge for annual depreciation is as indicated along Row (R). Presumably, adjustments for over or under-depreciation in prior years would be made in the statement of retained earnings; all the amounts along Row (R) would be credited there.

APPENDIX C

REGULATION OF RETURN ON INVESTMENT ALLOWABLE TO INVESTORS

The Importance of Adequate Return on Investment

So far, only the cost-determination aspect of rate regulation has been dealt with; no mention has been made of the return-on-investment aspect of rate regulation. If a utility company is expected to continue rendering service in the long run, it must be given an opportunity to earn an amount of revenue sufficient not only to cover operating expenses including depreciation charge but also to yield a return on financial investment. This return must be attractive enough to induce existing investors (shareholders and creditors) to continue with their investments in the company to invite new investors to contribute additional financial resources towards expansion of operations in response to society's demand. Thus, the level at which the general rate of a utility company would be fixed, would depend not only on (a) the size of the operating costs but also on (b) the amount of financial charges required to meet the expected "normal" dividend and interest payments. The sum of (a) and (b) determines a company's total revenue requirements. In other words, society can be expected to

pay this sum of money for the benefit of consuming a certain amount of service rendered by the company. That a "just and reasonable" rate should be one that would provide the company an opportunity to earn this amount of revenue is evident in the following words of the Honourable F. B. Carvell, K.C., Chief Commissioner of the Canadian Board of Transport Commissioners:

> ...considering the fact that their rates are controlled, in my judgement they should be allowed such a rate as will provide for - (1) operation; (2) maintenance; (3) depreciation; (4) interest; and (5) dividends and, in addition to this, some amount which will place the company in such a position that additional capital can be obtained for necessary extensions. (From the B.C. Telephone Co. Case (1921) II JOR & R at page 216)[1]

The Rate Base Method

One popular method of determining the amount of return allowable to investors is the rate base method. The rate base is the "value of a company's property used and useful in the public service minus accrued depreciation"[2] or "net investment in the property".[3]

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[1]Quoted in Hugh E. O'Donnell, KC, "Development of Rate Regulation in Canada", Public Utilities Fortnightly, Vol. 46, No. 11 Nov. 23, 1950, pp. 744-5.

[2]Charles F. Phillips, Jr., The Economics of Regulation, Homewood, Illinois: Richard D. Irwin, Inc., 1965, p. 214.

[3]Ibid, p. 132.

The product of the rate base and a fixed rate of return[4] gives the amount of return on investment allowable to the investors. If a company's property is valued $120 m. (new) and the accrued depreciation amounts to $20 m., the rate base is $120 m. - $20 m, i.e. $100 m. If the rate of return is fixed at 6%, then the amount of return on investment allowable to the investors of the company is 6% of $100 m., i.e. $6 m., out of which the company pays dividends on common shares and preferred shares and interest on long-term loans.

Regulation of Return Under Marginal Cost Standard

The rate base method of determining the amount of maximum return on investment requires that all items of utility property should be valued on some basis (historical cost, reproduction cost, "fair value", etc.) and the total amount of accumulated depreciation be determined. Under the marginal cost standard of rate regulation, not all assets will be valued at their current replacement costs to determine the amount of depreciation chargeable to consumers. Only those assets, which will be replaced on their retirement and for which a depreciation charge is economically justifiable, will be valued at their current replacement costs. There will be no depreciation charge

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[4]For an account of how a "fair" rate of return is fixed, see ibid, Chapter 9, pp. 261-303.

for those assets which need no replacement for one reason or another. Thus, some assets will be valued on the basis of current replacement cost; others will be valued on some other bases. Since all the assets will not be valued on the same basis, a satisfactory rate base cannot be obtained in this case.

Further, the amount of allowable return determined with the use of a rate base and a fixed rate of return may not be the amount that can be considered as the opportunity costs of using financial resources in a particular utility company. If the company uses long-term loans and the normal interest rate on similar types of loans outside the company is 5%, then the opportunity cost of using the long-term loans in the company is 5%. If the company uses common share capital and the normal dividend rate for a share with similar degree of risks outside the company is 7%, then the opportunity cost of using the equity finance in the company is 7%. Thus, the amount of financial charges (dividends and interests) which can be considered as the opportunity costs of using financial resources in a utility company, will be the sum of the "normal" rate of return on each type of capital funds times the amount used of each type of capital funds. This amount can be regarded as the normal "corporate fiscal requirement".[5]

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[5] Hugh E. O'Donnell, op. cit., p. 744.

Under the assumption that the company will continue operating in the long run and will continue requiring the use of the financial resources in the company, then society can be expected to pay the normal corporate fiscal requirement under the marginal-cost pricing principle since it represents the opportunity cost of retaining the use of the financial resources in the company. The amount of return allowable to investors determined with the use of a rate base and a fixed rate of return may not equal the amount of normal corporate fiscal requirement, because once the rate base and the rate of return are established, the company can alter its capital structure so as to "trade on equity" (or take advantage of "leverage") and, thus, enable the common shareholders to earn a higher rate of dividend, which may exceed the "normal" rate for industries having corresponding risks. In this case the normal corporate fiscal requirement will be exceeded and the purpose of regulating a utility company to prevent the earning of high rate of dividend will be defeated. Further, if the rate base is not properly determined, then, cet. par., the amount of maximum return on investment will also deviate from the normal corporate fiscal requirement.

The Use of "Corporate Fiscal Requirement" Method

The corporate fiscal requirement method is suitable for determining the amount of return on investment allowable to investors under

the marginal cost standard of fixing utility rates. The amount of normal corporate fiscal requirement plus all operating costs (including depreciation expense) stated on the basis of current replacement cost represents the opportunity cost of rendering a utility service in long run. Assuming that long run operation is desired by society or it is in its interest, then this amount of total revenue requirement is recoverable from society; that is to say, the general rate level should be based on this amount.

The corporate fiscal requirement method of regulating the amount of return on investment for the purpose of fixing utility rates has been successfully applied in the history of regulation. It was reported that:

> As recently as September 22, 1950, the Canadian Board of Transport Commissioners rendered judgment approving an application by the British Columbia Telephone Company for an increase in telephone rates. The board disposed of the matter on the basis of the company's fiscal requirements rather than upon a rate of return on a rate base.
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> .....
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> In this recent decision, the board was only re-affirming a regulatory principle which has become fairly well settled in Canada for more than a quarter of a century.[6]

It was pointed out that this type of regulation of rates was mentioned in the charter of the Liverpool and Manchester Railway

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[6] Ibid., p. 744.

in England more than 65 years ago.[7]

When the corporate fiscal requirement method is applied, regulation of rates is simplified to the extent that whenever it becomes necessary to alter the amount of allowable return to reflect current conditions, changes can be effected by raising or lowering the rate of return (dividend or interest) that is allowed on each type of capital funds contributed to the enterprise; the time-consuming and expensive process of adjusting the rate base and/or the fixed overall rate of return is avoided. However, under the marginal cost standard of rate making, the problem of valuation cannot be avoided altogether; depreciable and replaceable assets have to be valued on the basis of current replacement cost in order to determine the amount of depreciation charge.

Treatment of Excess of Current Replacement Cost Over Original Cost

Though technological progress has, on the whole, the effect of reducing the current cost of replacement, a fall in the value of money due to rapidly rising prices may have a greater counter effect and, thus, raise the actual current cost of replacement. When an asset is valued on the basis of higher current replacement cost, an

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[7] Ibid., p. 657.

"appreciation" or "appraisal" credit will result. What is the proper treatment for this credit item?

This credit will increase the owners' equity section of the balance sheet. Since depreciation expense is based on this higher replacement cost, there will be an increase in the assets of the company, in money terms, when there is sufficient revenue to cover all operating expenses including the depreciation charge. When the asset is fully depreciated, the increase in the monetary assets of the company will equal the amount of excess of current replacement cost of the asset over its original acquisition cost, assuming that revenue is adequate all the time. This increase in monetary assets is, in fact, additional contribution made to the company by the consumers who have paid higher rate because of larger charge for depreciation expense. Since this excess represents an increase in the money value of the physical assets employed in the company and since it could be argued that investors could liquidate the enterprise, if they choose, to obtain the monetary funds for investment elsewhere, they could be allowed to earn a normal rate of return on this larger amount of money capital.

Following the same line of argument, whenever current replacement cost is less than the original cost of an asset, the investors should be allowed to earn no more than a normal rate of return

on the smaller amount of money capital since, if the enterprise were liquidated, that would be the amount of money they could expect to get back. The argument can also be stated thus: if a hypothetical new company is formed today, it needs less financial resources to obtain the same amount of productive capacity to serve the consumers; and so the consumers need to pay less financial charges. The only justification for paying lower rate of return to investors is when the normal rate of return on investment outside the company is also low. If the "outside" return is high, the present investors may be induced to withdraw their funds from the company to invest elsewhere.

When Marginal Cost is Less Than Average Cost.

As pointed out earlier, when a utility company is producing in the region of decreasing unit cost, its marginal cost will be less than its average total cost and sale at marginal cost will result in "budgetary imbalance". Concern is expressed that this "imbalance" is injurious to the "financial health" of the company and may cause the company to wind up its operations eventually.

The decreasing cost (or increasing output) is a technological phenomenon resulting from increasing the scale of operations or from employing more efficient input factors. Charging a lower rate, because of decreasing cost, will not in any way impair the productive capacity

of the company when the revenue from selling at the lower rate covers all operating expenses (including depreciation computed on the basis of replacement cost). If the lower utility rate also includes a rate of return on financial investment just sufficient to induce the investors to continue investing in the company, then the survival of the company will not be threatened even though the utility rate based on these marginal costs may not produce a "budgetary balance".

Regulation of Return Under Full-Cost Pricing Standard

The use of current replacement cost should not make the problem of regulating the amount of return allowable to investors different from, or more difficult than, that encountered when the reproduction cost basis is used. If the rate base method is adopted, then the current replacement cost will be used as the basis for valuing utility property instead of the reproduction cost.

Conclusion

It is evident from above that the use of current replacement cost, under marginal-cost or full-cost pricing standard, will not increase the problem of regulating the amount of return allowable to investors. The currently used method based on the concept of "corporate fiscal requirement" or the concept of "rate base" can be successfully applied.