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Regulatory policies on liberalized depreciation and their effects upon public utilities

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REGULATORY POLICIES ON LIBERALIZED DEPRECIATION AND THEIR EFFECTS UPON PUBLIC UTILITIES

by

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INTRODUCTION: FACTORS LEADING TO THIS STUDY; PURPOSE AND SCOPE OF INVESTIGATION

In February of 1958 the author initiated correspondence with representatives of (a) various regulated public utilities, (b) organizations such as Edison Electric Institute, and (c) firms acting as consultants to utilities. The purpose of such correspondence was threefold. First, these sources[a] were asked for an expression as to what constituted

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[a]Persons contacted were:

1. Coleman, Wilgar. Editor, Edison Electric Institute, 420 Lexington Avenue, New York 17, New York. Information on existing surveys of depreciation policy. Private communication. 1958.

2. Fitch, W. C. Valuation Engineer, Gannett, Fleming, Corddry, and Carpenter. Harrisburg, Pennsylvania. Information on current problems in valuation. Private communication. 1958.

3. Hummer, J. W. Vice President, Iowa Power and Light Co., Des Moines 3, Iowa. Information on current problems of utilities. Private communication. 1958.

4. Ruish, Ed. Vice President, Iowa Public Service Co., Sioux City 2, Iowa. Information on current problems of utilities. Private communication. 1958.

5. Schuchart, P. M. Chairman, Committee on Depreciation, National Association of Railroad and Utilities Commissioners, 5310 I.C.C. Building, P. O. Box 684, Washington 4, D. C. Information on surveys and problems in depreciation. Private communication. 1958.

6. Softly, Alfred E. Accounting Director, Edison Electric Institute. 750 Third Avenue, New York 17, New York. Information on industry practices in computing liberalized depreciation. Private communication. 1958.

the real and practical problems of today's public utility in depreciation, valuation, taxation, rate-setting, and related studies. Second, the correspondents were requested to comment upon research problems suggested by the author. Third, some of these persons were questioned as to the existence of current survey data with regard to specific information.

The responses indicated considerable interest in the liberalized (accelerated) depreciation methods permitted by the Bureau of Internal Revenue revisions of 1954 as described in Treasury Decision No. 6182 (34). A survey of depreciation methods appeared to be especially promising in that selection of depreciation method was apparently related to policies adopted by regulatory bodies in the handling of depreciation for rate-making purposes. Exemplifying the interest expressed in utility depreciation method were responses such as:

> 1. Accelerated depreciation has been adopted by many utilities, more often in the declining balance (form) than sum-of-the-years-digits. Regulatory bodies are beginning to render

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[a](Continued)

7. Tinsman, R. Hovey. Vice President and Treasurer, Iowa-Illinois Gas and Electric Co., Davenport, Iowa. Information on current problems of utilities. Private communication. 1958.

8. Zahn, V. H. Assistant Comptroller. American Telephone and Telegraph Co., 195 Broadway, New York 7, New York. Information on trends in depreciation, taxes, labor, and related expenses. Private communication. 1958.

decisions on its rate-making effect. In some cases these decisions cause the companies to go back to the straight line method.

2. . . . most utilities are continuing to take straight line depreciation on their books, but are taking for income tax purposes, an accelerated depreciation, either sum-of-the-years-digits or the declining balance method.

3. The Federal Power Commission has ruled that a utility may make offsetting entries between Income and Reserve accounts to "normalize" the Income Statements. This merely means that if the increased tax depreciation makes X dollars less current income tax, X dollars are shown as a reduction of income (Provision for Deferred Income Tax) and the offsetting X dollars are credited to a special reserve. Then when the accelerated depreciation has run out, the process is reversed, and the income statement is at a normal level all through the life of the property involved.

   However, some State Commissions, in determining the rates that a utility can charge its customers are insisting that only actually paid income tax can be considered in the income statements.

   If the Reserve-Provision for Deferred Income Tax method is used to account for the accelerated portion of the annual depreciation, there is no change in the regular annual depreciation charges and the rate-making is not affected.

   However, if a State Commission insists on the "flow through" method, the present consumer gets the benefit of the tax deferment and the utility gambles that the Commission will permit rate adjustments when the deferment has run out.

Perhaps the most dramatic evidence for interest in this topic is contained in the fact that it became a political issue in California. An article appearing in PUBLIC UTILITIES FORTNIGHTLY (36, p. 331) reports it this way:

> Edmund G. Brown, California attorney general, has been aiming at the public utility companies in his recent criticism of the refusal of some utilities to take advantages of accelerated depreciation in determining federal income tax liability. Campaigning for governor of California against U. S. Senator William F. Knowland, Brown, a Democrat, has asked the California commission to compel utility companies to take advantage of accelerated tax depreciation whether they want to or not--so that "tax savings" can be passed on to ratepayers in the form of reduced rates.
>
> The move would involve all of the state's utility companies, but would principally hit telephone companies, including Pacific Telephone and Telegraph Company (a Bell system company), which have not generally used the accelerated depreciation method of determining their federal income tax.
>
> Although the federal statute seems pretty clear in permitting the use of such tax computations in the form of "elections", Brown takes the position that any utility eligible to reduce its taxes by spreading up depreciation deductions should be compelled to do so for the benefit of the ratepayers. It has been informally estimated that Brown's petition to the California commission would involve a total of a billion dollars in all kinds of California utility rates.

Brown defeated Knowland in the 1958 election and is currently governor of California. California utilities have not yet been compelled to use accelerated depreciation methods, however.

The post-1954 litigation verifies the inconsistencies of policy (a) between the various regulatory bodies, and (b) within individual regulatory bodies in the handling of tax deferrals (or savings) arising from adoption of one of the liberalized depreciation methods. The following digest

of decisions appears in Moody's Public Utility Manual (15, 1958, pp. a158-a161). Those listed are representative, not all inclusive, for the years 1957 and in 1958 to date of going to press. Decisions are those of the indicated state's regulatory body.

State	Company	Case number	Date decided
California	Southern Calif. Edison Company	55703	10-15-57

Commission permitted normalization of income taxes as applied to accelerated amortization but not for accelerated depreciation, which problem was still under consideration.

Calif. Elec. Pwr. Co.	56501	4-8-58

6.20% rate of return was computed after allowing flow through treatment of liberalized depreciation.

Illinois	Peoples Gas Light and Coke Co.	44293	5-23-58

No adjustment was made in the reserve for deferred taxes resulting from accelerated depreciation in either expenses or rate base.

Kansas	Empire Dist. Elec. Co.	55.302-11	2-11-58

In its treatment of accelerated depreciation, commission permitted normalization of income taxes, and considered aggregate of the tax deferred to be interest free capital in arriving at an appropriate rate of return.

Kentucky	Kentucky Utility Co.	3324	1-15-58

Deferred taxes were considered on operating expense but accumulations were deducted from the rate base.

Maine	Central Maine Power Co.	1498	3-15-57

. . . and held that only actual taxes paid in the field of accelerated depreciation were allowable although permitting normalization for accounting purposes. As to accelerated amortization, the Commission allowed normalization, distinguishing this situation from accelerated depreciation.

Michigan	Mich. Cons. Gas Co.	D3430-58.1	2-6-58

Federal Income taxes deferred by reason of liberalized depreciation were allowed as an operating expense.

Montana	Mt. States Tel. & Tel. Company	2719	4-30-58

Failure to use accelerated depreciation was commented on unfavorably.

New Jersey	Commonwealth Water Co.	9727	5-8-57

On the matter of accelerated depreciation, Commission considered actual rather than normalized taxes in calculating rate of return.

North Dakota	Montana Dakota Utility Company	5576	1-24-58

It found taxes charged to income but not paid, by reason of liberalized depreciation, to be improper.

West Virginia	Hope Nat. Gas Co.		4-18-58

Only actual taxes paid were allowed in determining revenue requirements.

Wyoming	United Tel. Co.	9148-1	3-24-58

Normalization of income taxes was allowed in determining revenue requirements.

Before considering the specific problems to be investigated or the method of developing some response to these problems, a view into some comparative statistics may be of aid in providing a better understanding of the problems

themselves.

Table 1 provides a comparison of communication and public utility firms with other sources of national income. The transportation industry is also listed and is of some interest here since the problems of accounting and regulation are quite similar for transportation, communication, and

Table 1. National income by industrial origin for 1957[a].

% of total		Billions of dollars
30.9	Manufacturing	112.5
16.4	Wholesale and retail trade	59.6
11.8	Government and govt. enterprises	42.9
10.8	Services	39.4
9.5	Finance, insurance, real estate	34.6
5.4	Contract construction	19.6
4.8	Transportation	17.3
4.5	Agriculture	16.2
3.7	Communications and public utilities	13.3
1.7	Mining	6.2
0.6	Rest of the world	2.2
100.0[b]	National Income	364.0[b]

[a]Source: Survey of Current Business (29, pp. 8, 9)

[b]Figures do not add because of rounding.

public utility firms. In each case there is at least an opportunity for regulatory policy to influence accounting practice; the fact that the preponderance of firms are not regulated in no way minimizes the need for further study.

To provide a consistent comparison, it is necessary to eliminate from the listings of transportation, communication, and public utility firms, those companies which are not privately owned. Examples of non-private ownership are the federal, state, municipal, and cooperative types of firms. Their exclusion is based on the different conditions under which they operate. A federally owned utility, for example, generally is not subject to federal, state, or local taxes. Further, the rates tend to be more artificial since it may be a matter of "policy" for the operating losses of a federal utility to be compensated by other income of the federal government. On the other hand, a rate of return which might be deemed excessive for a privately owned public utility, may be justified by the municipally owned utility on the grounds that the high rate of return exists due to exemption from property taxes, a benefit not extended to the privately owned utility. Most of this nation's transportation, communication, and public utility firms are privately owned; Table 2 shows the proportion of electric utilities distributed within each class of ownership.

The special concern of the privately owned public

Table 2. Production of electric energy by class of ownership for 1957[a].

Class of ownership	Production, in millions of KWHr	% of total
Private	480,828	76.1
Federal	109,177	17.3
Municipal	27,924	4.4
State	10,421	1.7
Cooperative	3,030	0.5
Total	631,380	100.0

[a]Source: Federal Power Commission. See Moody's Public Utility Manual (15, 1958, p. a 11).

utility, communication, and transportation firm with the problems of depreciation accounting and regulation is explained, at least in part, by the large investment which is required. As can be seen in Table 3, public utility and transportation firms, on the average, invest about $3 in assets to produce $1 in annual sales, while for manufacturing, mining and merchandising firms this ratio averages less than $1 in assets to $1 in sales. Depreciation charges and net profits generate the internal capital necessary to continue the large investments required.

Liberalized depreciation methods affect both depreciation charges and federal income taxes; the importance of these costs to public utility, communication, and

Table 3. Corporate sales and assets by groups for 1957[a].

	Sales (in billions of dollars)	Assets
500 largest manufacturing and mining companies	188.3	148.8
50 largest utilities	16.2	52.8
50 largest transportation companies	11.8	29.8
50 largest merchandising firms	30.1	10.1

[a]Source: Fortune (26, pp. 18, 26, 27, 28).

transportation firms can be seen in Table 4. Note, for example, that over 30% of the operating revenue of telephone companies is represented by depreciation charges, federal income taxes, and other taxes.

Five principal questions had become apparent in this early stage of investigation; all were related to the use of liberalized depreciation methods by the regulated firm. The purpose of further research was to answer the following questions:

1. What are the depreciation policies of the regulated firm?

2. How widely used are the liberalized depreciation methods?

3. When liberalized methods are used does a permanent or temporary tax saving result?

Table 4. Selected balance sheet and income statement relationships[a].

	A[b]	B[b]	C[b]	D[b]	E[b]	F[b]
Air carrier	8.1	10.2	C + D = 4.3		0.8	48.0
Electric	9.2	2.3	9.7	10.8	4.0	19.0
Natural gas pipelines	9.1	3.0	6.3	3.5	3.0	20.0
Natural gas distributing utilities	5.0	10.0	8.7	6.4	2.0	20.0
Railroad	5.2	1.9	3.7	6.9	2.8	24.0
Telegraph	5.2	3.3	3.2	3.0	1.6	47.0
Telephone	12.1	4.0	11.9	8.1	3.0	23.0
Water	6.9	1.0	4.7	14.4	6.7	9.0

[a]Sources: See Appendix B.

[b]Column A = Depreciation charges as a % of operating revenues
B = Depreciation charges as a % of gross plant
C = Federal income taxes as a % of operating revenues
D = Other taxes as a % of operating revenues
E = Gross plant per $ of operating revenue
F = Depreciation reserve as a % of gross plant

4. What is regulatory commission policy on liberalized depreciation?

5. Does commission policy affect depreciation policy of the regulated firm?

Questions 1, 2, and 4 were subsequently investigated by survey and the results have been presented in tabular form.

Tables 19 through 24 and Tables 27 and 28 present the author's survey results applicable to questions 1 and 2; Tables 23 and 24 are particularly appropriate to question 1 and Table 21 is particularly appropriate to question 2. Table 18 presents survey experience of a number of sources in response to question 4.

Investigation of and response to question 3 is presented in the section titled: TAX SAVINGS: PERMANENT OR TEMPORARY?

Question 5 has been investigated by (a) comparing policies of firms grouped by state or by state policy, (b) survey information as to why firms did or did not elect a liberalized depreciation method, and (c) observing "split" policies, changing policies and other unusual situations which exist. The response to question 5 is presented in the section titled: COMMISSION POLICY: DOES IT PLAY A ROLE IN THE SELECTION OF A DEPRECIATION METHOD?

Before proceeding with investigation of the principal questions, explanatory material will be presented on the topics of regulation, depreciation, and depreciation accounting. A later section on rate-making is also presented.

REGULATION: HISTORY AND CURRENT PRACTICE[a]

The real origin of the right to regulate is the power belonging by nature or settled habit, which exists in every sovereignty to act for the public good whether such sovereignty be a king or queen acting through Parliament; our nation acting through Congress; our state acting through legislatures; or any country acting through its ruler. Such right to regulate involves certain restrictions on the individual and the use of his property and is sustained when such property is affected with a public interest and when the exercise of such right is necessary for the public welfare.

In England since the period of King John and the Magna Charta (ca. 1215), and in the United States since the earliest colonial times, it has been customary for the sovereignty to regulate ferries, common carriers, hackmen, warehousemen, and others by fixing a maximum charge for services rendered and for property sold.

England's fourteenth century Parliament, recognizing that the quality and price of staple foods were vital to the

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[a]Considerable material presented in this section comes from the National Association of Railroad and Utilities Commissioners (19, 68th, pp. 13-16).

people's welfare, and thereby were affected with a public interest, decreed the size and quality of a mere farthing loaf of bread. The Mayor of the town was clothed with delegated authority to enforce the decree. Discovering the sale of short-weight loaves, he enforced the law. How? The miserable baker was taken for a ride, drawn through the streets on a criminal hurdle, his little farthing loaves festooned about his neck. Since those times there have been many changes in the methods of regulation and enforcement. Social and economic problems have multiplied in volume and complexity, but the basic characteristics of public regulation are still apparent.

In the United States, prior to 1830, there were no large utility companies. Nonetheless, centuries of legislation and court decisions had given the public the right, by common and statute law, to prescribe maximum rates for grist mills, toll bridges, toll roads, ferries, and other enterprises. Such regulation was generally accomplished by ordinances, franchises, and/or licensing.

During the period 1831 to 1865 extensive railway lines, city waterworks, sewer systems, gas lighting systems, and horsedrawn streetcar lines were placed in service. Regulation was accomplished by statutes and franchises until abuses in the railway industry led to the development of more extensive and systematic public regulation. By 1860

seven state railway commissions had been established.

The basic reasons for the right to regulate are most forcefully and vividly expressed by the U. S. Supreme Court in the 1876 Munn vs. Illinois case (94 U.S. 113) where the court says of such property owners (at p. 132): "They stand . . . in the very gateway of commerce and take toll from all who pass."

In 1872 Munn and his partner Scott owned large grain storage warehouses in Chicago. Grain, funneled into and through Chicago via rail and barges from the northwest, west, and southwest, was stored by Munn and Scott in their immense Chicago warehouses. These warehouses were located with the river harbor on one side, the railway tracks on the other, and the grain was run through them from car to boat, or boat to car, as may have been required in the ordinary course of business. Munn and Scott charged rates agreed upon and established by all warehousemen in Chicago. The Illinois Legislature passed a law providing maximum amounts that warehousemen could charge for storing grain in such warehouses. When their prices became subject to regulation by the state, Munn and Scott appealed first to the Supreme Court of Illinois and then to the U. S. Supreme Court. Both courts emphatically upheld the right of regulation by the State. The historic decision was based on the use of private property under circumstances affected with a public interest. Thus

when a man's use of property is such that it becomes affected with a public interest, delegated regulation by and through the sovereignty must prevail in order to protect that public.

Between 1866 to 1900 the United States witnessed rapid development of utility companies furnishing water, gas, electricity, and transportation. Again, abuses led to greater control. The "Granger Laws" to control railways were passed. By 1885, 27 state railroad commissions were established, and in 1887 the Interstate Commerce Commission was formed.

From 1901 to 1915 construction costs remained fairly constant. From 1916 to 1925 the extraordinary rise in construction costs due to World War I forced reproduction costs substantially above original costs. This inflationary period brought on violent differences of opinion as to the proper weight to give original cost and reproduction cost in valuation decisions. The United States Supreme Court continued to reject all valuation formulas, and to uphold the Smyth vs. Ames (169 U.S. 466, 546) rule, that all elements of value must be given such weight as sound judgment determines are "just and right" in each particular case.

Depreciation questions became prominent in the litigation of the period 1926-1930. Depreciation estimates based on inspection were preferred to those based on an assumed average of lives and probabilities. Utilities which had been permitted to make large annual charges to depreciation expense

and yet use only small allowances for depreciation in the rate base found growing opposition to such practices.

The depression had considerable influence in the litigation of the period 1931-1941; new legislation strengthened the regulative powers of commissions.

Legislative bodies, except possibly at the very first, never did have the time or technical knowledge to deal directly with regulatory problems. As these problems multiplied in volume and scope, Congress and legislatures delegated authority to do this work to "administrative bodies," namely, commissions and commissioners. The late Justice Jackson in a dissenting opinion in a recent U. S. Supreme Court case (Federal Trade Commission vs. Ruberoid Company) (1952. 343 U.S. 470, 487, 96 Law ed. 1081, 1094) stated:

> The rise of administrative bodies probably has been the most significant legal trend of the last century and perhaps more values today are affected by their decisions than by those of all the courts, review of administrative decisions apart.

To propose that everything be regulated in all respects is to suggest the police state. Yet the importance of state regulatory bodies was indicated by President Eisenhower when he signed an amendment to the Natural Gas Act saying (see 19, 67th, p. 46): "I shall support state regulation of matters which are primarily of local concern whenever possible and when not contrary to the national interest."

State regulatory commissions now exist in all of the

states except Alaska and carry titles such as Public Service Commission or Public Utilities Commission. About three-fourths of the commissions are composed of three members. In about two-thirds of the states the members are appointed to office and in a majority of states the office carries a six-year term. In a majority of states, the commission exercises jurisdiction over the following types of firms:

1. Electric Light and Power
2. Gas Distribution
3. Street or Interurban Railway
4. Motor Bus
5. Water
6. Telephone and Telegraph
7. Gas Pipeline

Regulation varies from state to state, but the principal controls exercised include control of the following:

1. Rates to be charged consumers and method of determination.
2. Accounting, property records, and restrictions on dividend payments.
3. New security issues.
4. Mergers and combinations.
5. Franchises.

Detail of the jurisdiction, controls, and descriptions of the commission(s) of each state is given in Moody's Public

Utility Manual (15, 1959, pp. a159-a164).

Firms with operations deemed to be interstate commerce are also subject in part or in total to regulation by administrative bodies of the federal government. These regulatory bodies include:

1. Interstate Commerce Commission (ICC)
2. Federal Power Commission (FPC)
3. Federal Communications Commission (FCC)
4. Securities and Exchange Commission (SEC)
5. Civil Aeronautics Board (CAB)

The constitutional authorization for these bodies arises from Article I, Section 8 which authorizes the Federal Government to regulate interstate commerce, saying in part:

> The Congress shall have power. . . to regulate commerce with Foreign Nations, and among the several states, and with the Indian Tribes; . . . "

Congress has specifically delegated this power of regulation through enactment of the Federal Power Act, the Natural Gas Act, the Public Utility Holding Company Act, the Administrative Procedures Act, and similar acts designed to facilitate regulations of firms engaging in interstate commerce. This delegation has also been achieved by Presidential issuance of certain Executive Orders.

The controls exercised by these administrative bodies are similar to those of state regulatory bodies. Perhaps the most publicized is the control exercised over proposals of

abandonment of facilities or routes.

The similarity of control and the need for coordination between state and federal regulatory bodies led to development of an organization whose purpose was advancement of regulation through study and discussion and the promotion of cooperation between, uniformity among, and coordination of, the various regulatory bodies. This organization is known today as the National Association of Railroad and Utilities Commissioners (NARUC).

The first meeting of State Railroad Commissions was held in August of 1874 at Dubuque, Iowa, by commissioners representing Illinois, Minnesota, and Wisconsin. Four more conferences followed and in 1889 at Washington, D. C., an organizational meeting of Railroad Commissioners was called by Chairman Thomas M. Cooley of the Interstate Commerce Commission. Since that time annual meetings have been held by the membership which has grown to include:

1. Interstate Commerce Commission (ICC)
2. Federal Power Commission (FPC)
3. Federal Communications Commission (FCC)
4. Securities and Exchange Commission (SEC)
5. Civil Aeronautics Board (CAB)
6. Public Utility and public service commissioners or deputy commissioners.
7. Officers, who by law exercise regulatory powers

where no commission exists.

8. Certain others as specified in the constitution of NARUC.

Headquarters of the Association is in Washington, D. C.

DEPRECIATION: FOR FEDERAL INCOME TAX, RATE-MAKING, AND STOCKHOLDERS' REPORTS

In spite of its widespread usage, the word depreciation is often applied loosely and with several meanings:

1. A cost. Simply the annual amortization (write-off) of the cost of a property.

2. A decline in value. The decline being reflected by lower market prices for the aging property.

3. The consumption of usefulness of a property.

4. The difference between the present value of the old property and the present value of a hypothetical new property.

Each meaning is appropriate for some particular purposes and inappropriate for others. Each tends to be a somewhat subjectively determined quantity. Of the preceding approaches to the estimation of depreciation, the write-off-of-cost concept has been the most closely regulated.

Depreciation determinations made for federal income tax purposes must meet the requirements of the U.S. Treasury Department. Depreciation expenses and accruals as used for rate-making purposes are guided by policies of both state and federal regulatory bodies. In preparing stockholder reports, the firm must meet the requirements set forth by the Securities and Exchange Commission.

This type of regulation is no accident. A review of the development of some depreciation rulings will be of aid in understanding the broad effects upon national economy, the need for protection of the public and investor, and the reactions to changes in depreciation policy. Consider first the circumstances which brought on and the reasons for federal income tax changes allowing "liberalized" depreciation methods.

Prior to 1934 the U. S. Treasury permitted taxpayers to set their own depreciation rates; the main restriction was that depreciation charges should cease when the cost of an asset had been written off. The Treasury raised no objection to rates high enough to write off investments well in advance of their retirement from service.

By 1934 the Treasury had become convinced that a statistical approach to physical property mortality was the only sound approach to depreciation practice. Officials believed that depreciation rates should be based on the best available evidence of full service lives and approved of the straight line method used by most taxpayers. The 1934 changes were motivated by these beliefs along with the desire to increase tax revenues by reducing depreciation rates.

Proposals for liberalization of depreciation regulations were made as early as 1944 by President Franklin D. Roosevelt and others. In an address in Chicago, Illinois, on October

28, 1944, President Roosevelt stated (see 11, p. 362):

> I propose that the Government do its part in helping private enterprise to finance expansion of our private industrial plant through normal investment channels.
>
> For example, business, large and small, must be encouraged by the government to expand their plants and to replace their obsolete or worn out equipment with new equipment. And to that end, the rate of depreciation on these new plants and facilities for tax purposes should be accelerated. That means more jobs for the worker, increased profits for the businessman, and lower costs to the consumer.

In 1945 the Treasury approved the declining balance method. The maximum rate was 1½ times the straight line rate, apparently too low to be attractive in most cases.

Little else was done until 1954 to encourage investment by liberalization of tax regulations on depreciation rates for two reasons:

1. The resistance of the Treasury to changes which would undoubtedly result in a temporary (and perhaps permanent) loss in revenue.

2. The inability of taxpayers to show that liberalization was economically sound, and not just a device for reducing taxes.

In 1954 the United States Congress enacted certain revisions to general income tax laws. Among the revisions was the specific approval of two methods of computing depreciation for federal income tax purposes, the sum-of-the-years-digits (SOYD) method and the double declining balance (DDB)

method. The purpose of Congress in enacting these changes is clear. It has said (28, pp. 25-29) that bringing tax depreciation allowances more in conformity with the economic facts of depreciation, would among other things, reduce some of the risks inherent in business investment, encourage more rapid replacement of obsolete plant and equipment, and provide more working capital. It should be noted that Congress was considering general income tax legislation and there is no indication that it was concerned with problems peculiar to the regulation of public utilities.

Testimony before the Congressional committee cited heavier wear and tear in the earlier years of service life, and the impact of technological improvements. It was claimed that since World War II the impact of the latter had been tremendous. L. D. McDonald, Chairman of the Subcommittee on Tax Policy for the National Machine Tool Builders' Association, claimed that the industrial plants of the United States have lagged behind those of other nations in plant modernization. Witnesses argued that the 52% tax rate coupled with an inability under present tax laws to provide adequate depreciation were responsible for the reluctance to replace obsolete equipment. It was further argued that a liberalized tax policy would act as a stimulus to such modernization. As a means of encouraging the accomplishment of this objective Congress limited the application of the liberalized methods

to those properties acquired (new) after December 31, 1953. It is of interest to note that the anticipated loss of revenue from the tax revision amounted to $400 million in fiscal 1955.

Liberalized (accelerated) depreciation is provided for in Section 167 of the Internal Revenue Code of 1954 and is found detailed in Treasury Decision #6182 (34). Section 167 of the Internal Revenue Code of 1954 provides that the declining balance rate may be twice the straight line rate, hence the name, double declining balance.

The sum-of-the-years-digits method is very similar to the double declining balance method in the results it produces. During the early years in the service life of a property both methods result in substantially higher depreciation expense charges than the straight line method. The double declining balance method employs a fixed depreciation rate applied to a declining depreciation base, while the sum-of-the-years-digits method employs a declining depreciation rate applied to a fixed depreciation base.

These two methods are "new" only in the sense of their 1954 approval; both are discussed in some detail by Dr. Roy B. Kester (12, p. 150) in his 1918 edition of Advanced Accounting. The declining balance method has been practiced in this country, and it seems to be (see 19, 67th, p. 430) the method generally employed for income tax purposes in both

Great Britain and Canada.

Prior to the 1954 revision by BIR, public utilities generally employed the straight line method of computing depreciation expense for income tax purposes (19, 64th, p. 287). For many years electric and gas utilities computed depreciation expense for income tax purposes according to the straight line method, but employed other methods for corporate accounting purposes. In general those utilities claimed and were allowed more depreciation expense in their tax returns than they recorded in their corporate books of account. A study (33) by the Securities and Exchange Commission (SEC) for the ten year period, 1930-1939, disclosed that 168 electric and gas utilities charged 53.64% more depreciation for tax purposes than they recorded in their corporate books. The higher allowance for depreciation resulted in consequential tax savings as compared to the taxes which would have been payable, had the allowance for depreciation been equal to that recorded on the books.

To a limited extent the recording of depreciation charges and accumulations may still vary with the purpose, whether the purpose is federal income taxes, stockholder reports, or rate-making proceedings. Within each purpose there is, of course, less than complete latitude in the determination of what depreciation charges and accumulations shall be allowed. The Treasury, through the Internal Revenue Service,

must be reckoned with in the determination of depreciation for federal income tax purposes. Likewise depreciation for stockholder reports must meet with the approval of administrative bodies such as the Securities and Exchange Commission. Depreciation for rate-making purposes is regulated by state commissions and in some cases by federal bodies such as the Federal Power Commission.

Because depreciation determinations can be dependent upon purpose, some problems arise in reconciling these amounts, particularly in the rate-making processes of the public utility. This particular problem is essentially the theme of this investigation; yet it must be made clear at this point that the author is in no way arguing for a consistency in depreciation determinations regardless of purpose. Such a thesis has been advanced elsewhere and is perhaps answered in the general argument of Morris (17, p. 5):

> The reader who finds consistency a harmless enough goal should ponder the following idea; Perhaps consistency is not even desirable since it may be better to be sometimes right than consistently wrong.

Further discussion of current practices is given by the National Association of Accountants (18) and a recent survey of methods used is given by the Federal Power Commission (30). An interesting history of concepts and company depreciation practices has been originated by the American Telephone and Telegraph Company (1). Commission concepts and

practices have been surveyed and presented by Ross (23).

The section which follows illustrates depreciation computations and shows the influence of mortality dispersion, average service life, rate of growth, method of grouping of accounts, and method of allocating depreciation upon depreciation computations.

DEPRECIATION ACCOUNTING

Depreciation accounting is basically a system of allocating to the various years of a property's service, that portion of cost which otherwise is not recoverable (this is the orthodox cost concept; economic depreciation and other forms vary somewhat). The starting point of such allocation is the installed cost of a property and the ending point is the salvage value, if any, of that property. The question of how to proceed from this beginning value to end value has an answer in the various depreciation methods. Oldest and simplest of these is the straight line method which for item accounting results in uniform periodic charges to depreciation expense. Three other methods, the double declining balance method, the sum-of-the-years-digits method, and the interest method (also known as the present worth or sinking fund method) all result in non-uniform periodic charges to depreciation expense with item accounting.

Comparison of the methods on an item basis may be accomplished by use of the following notations:

Let B = installed cost; the original cost plus transportation and installation costs.

B_x = portion of the installed cost which is unallocated to age x.

D_x = depreciation allocation for the xth year.

$\sum_{o}^{x} D$ = accrued depreciation allocation to age x.

i = interest rate per period.

n = probable service life of a property unit; average service life of a group.

x = age of property in years.

V_s = salvage value at end of service life n; sale income or inventory value less cost of removal.

Of the preceding notations three are of particular importance to a comparison. D_x corresponds to the annual depreciation charge, $\sum_{o}^{x} D$ corresponds to the accrued depreciation, and B_x corresponds to net asset value. These are compared in table 5 for the four methods.

For illustration assume the following data:

B = \$32,000

i = 5%

n = 5 years

V_s = \$2,000

The straight line method results in uniform annual depreciation allocations of:

$$D_x = (B-V_s)(\frac{1}{n})$$

$$= \$30,000\ (\frac{1}{5})$$

$$= \underline{\underline{\$6,000}} \text{ per year}$$

and the accrued depreciation at, say age 3, is:

Table 5. Comparison of depreciation methods by general formula.

Method	D_x depreciation allocation for the xth year
Straight line	$(B-V_s)\ (\frac{1}{n})$
Sum-of-the-years-digits	$(B-V_s)\left[\frac{2(n+1-x)}{n^2+n}\right]$
Double declining balance	$B(\frac{2}{n})\ (\frac{n-2}{n})^{x-1}$
Interest	$(B-V_s)\left[\frac{i}{(1+i)^n-1}\right]\left[(1+i)^{x-1}\right]$

$$\sum_{o}^{\bar{x}} D = (B-V_s)(\frac{\bar{x}}{n})$$

$$= \$30,000\ (\frac{3}{5})$$

$$= \underline{\underline{\$18,000}}$$

and the portion of installed cost unallocated at, say age 3, is:

$$B_x = (B-V_s)(\frac{n-x}{n}) + V_s$$

$$= \$30,000\ (\frac{2}{5}) + \$2,000$$

$$= \underline{\underline{\$14,000}}$$

The sum-of-the-years-digits method results in non-uniform depreciation allocations. For years one, two, and three the allocations are:

$$D_x = (B-V_s)\left[\frac{2(n+1-x)}{n^2+n}\right]$$

$$D_1 = \$30,000\left[\frac{10}{30}\right] = \underline{\underline{\$10,000}}$$

$$D_2 = \$30,000\left[\frac{8}{30}\right] = \underline{\underline{\$8,000}}$$

$$D_3 = \$30,000\left[\frac{6}{30}\right] = \underline{\underline{\$6,000}}$$

and accrued depreciation at, say age 3, is:

$$\sum_{o}^{x} D = (B-V_s)(\frac{2xn - x^2 + x}{n^2+n})$$

$$= \$30,000\ (\frac{24}{30})$$

$$= \underline{\underline{\$24,000}}$$

and the portion of installed cost unallocated at, say age 3, is:

$$B_x = (B-V_s)\left(\frac{n^2 + n - 2nx + x^2 - x}{n^2 + n}\right) + V_s$$

$$= \$30,000\ \left(\frac{6}{30}\right) + \$2,000$$

$$= \underline{\$8,000}$$

The double declining balance method results in non-uniform depreciation allocations. For years one, two, and three the allocations are:

$$D_x = B\left(\frac{2}{n}\right)\left(\frac{n-2}{n}\right)^{x-1}$$

$$D_1 = \$32,000\ \left(\frac{2}{5}\right)\left(\frac{3}{5}\right)^0 = \underline{\$12,800}$$

$$D_2 = \$32,000\ \left(\frac{2}{5}\right)\left(\frac{3}{5}\right)^1 = \underline{\$7,680}$$

$$D_3 = \$32,000\ \left(\frac{2}{5}\right)\left(\frac{3}{5}\right)^2 = \underline{\$4,608}$$

and accrued depreciation at, say age 3, is:

$$\sum_0^x D = B\left[1-\left(\frac{n-2}{n}\right)^x\right]$$

$$= \$32,000\left[1-\left(\frac{3}{5}\right)^3\right]$$

$$= \underline{\$25,088}$$

and the portion of installed cost unallocated at, say age 3, is:

$$B_x = B\left(\frac{n-2}{n}\right)^x$$

$$= \$32,000\ \left(\frac{3}{5}\right)^3$$

$$= \underline{\$6,912}$$

The interest methods result in non-uniform depreciation allocations. For years one, two, and three the allocations rounded to the nearest dollar are:

$$D_x = (B-V_s)\left[\frac{i}{(1+i)^n - 1}\right](1+i)^{x-1}$$

$$D_1 = \$30,000\left[\frac{.05}{(1.05)^5-1}\right](1.05)^0 = \underline{\$5,429}.$$

$$D_2 = \$30,000\left[\frac{.05}{(1.05)^5-1}\right](1.05)^1 = \underline{\$5,701}.$$

$$D_3 = \$30,000\left[\frac{.05}{(1.05)^5-1}\right](1.05)^2 = \underline{\$5,986}.$$

and accrued depreciation at, say age 3, rounded to the nearest dollar is:

$$\sum_0^x D = (B-V_s)\left[\frac{(1+i)^x-1}{(1+i)^n-1}\right]$$

$$= \$30,000\left[\frac{(1.05)^3-1}{(1.05)^5-1}\right]$$

$$= \underline{\$17,116}$$

and the portion of installed cost unallocated at, say age 3, rounded to the nearest dollar is:

$$B_x = (B-V_s)\left[\frac{(1+i)^n - (1+i)^x}{(1+i)^n - 1}\right] + V_s$$

$$= \$30,000\left[\frac{(1.05)^5 - (1.05)^3}{(1.05)^5 - 1}\right] + \$2,000$$

$$= \underline{\$14,884}$$

Table 6. Comparison of depreciation methods for B=$32,000, i=5%, n=5 years, and V_s=$2,000[a,b].

Year	1	2	3	4	5
	Depreciation allocations for the xth year				
SL[c]	6,000	6,000	6,000	6,000	6,000
SOYD[d]	10,000	8,000	6,000	4,000	2,000
DDB[e]	12,800	7,680	4,608	2,765	1,659[f]
Int.[g]	5,429	5,701	5,986	6,285	6,599
	Accrued depreciation allocations to age x				
SL	6,000	12,000	18,000	24,000	30,000
SOYD	10,000	18,000	24,000	28,000	30,000
DDB	12,800	20,480	25,088	27,853	29,512[f]
Int.	5,429	11,130	17,116	23,401	30,000
	Portion of installed cost unallocated at age x				
SL	26,000	20,000	14,000	8,000	2,000
SOYD	22,000	14,000	8,000	4,000	2,000
DDB	19,200	11,520	6,912	4,147	2,488[f]
Int.	26,571	20,870	14,884	8,599	2,000

[a]See page 30 for definition of symbols.

[b]Figures rounded to the nearest whole number.

[c]SL = Straight line method.

[d]SOYD = Sum-of-the-years-digits method.

[e]DDB = Double declining balance method.

[f]Before adjustment.

[g]Int. = Interest method (5%).

The calculations for these methods are summarized in Table 6.

From the preceding it can be seen that the liberalized (sum-of-the-years-digits and double declining balance) methods permit the taxpayer to claim relatively higher depreciation expense early in the life of a property and relatively lower depreciation expense late in the life of that property. If accounting were conducted strictly on an item basis as in the example and if income tax rates remained unchanged, a taxpayer could hope for no more than a tax postponement upon election of a liberalized depreciation method.

Not all depreciation accounting is conducted on an item basis. Many firms have mass property accounts for groups of identical or similar properties. Group accounting, of say 10,000 telephone poles, is obviously more efficient than 10,000 separate accounts in which item depreciation practices could be followed.

Properties may be grouped for accounting purposes in a number of ways, the more common of which are listed below:

1. Individual Item. Separate accounts are used for each unit of tangible property having a service life in excess of one year.

2. Vintage Group (also called Original Group). A group of identical or nearly identical units of property, all of which were placed in service in the same year.

3. Continuous Group. A collection of vintage groups of

identical or nearly identical properties for an indefinite span of years.

4. Continuous Classified Group. A collection of continuous groups of similar properties such as hydrants and valves which have similar average lives and mortality dispersions.

5. Continuous Composite Group. A collection of continuous classified groups of property regardless of whether there is a similarity in the units, their average service lives, or their mortality dispersions. Carried to its ultimate, this type of account could be the one account in which all tangible property of a firm is included.

In an unpublished 1958 survey by the author of the 50 largest public utilities in the United States, the majority of firms indicated that their accounts were grouped for depreciation calculations either by continuous classified group or by continuous composite group.

The results of group accounting are not necessarily identical to those of item accounting. Though the maxim stating that the whole must equal the sum of its parts seems appropriate, it does not necessarily hold for group and item accounting. While group accounting is practiced by many firms, it is more common in public utility and transportation firms, for these types are more apt to have large numbers of similar property units such as meters, hydrants, water mains,

telephone poles, regulators, transformers, power lines, ties, tracks, and pumping equipment.

Group depreciation accounting was encouraged if not made mandatory (see 11, p. 395) by the 1934 U. S. Treasury changes which prohibited the so-called "losses on premature retirement" except in very unusual circumstances. The outlawed "loss on premature retirement" is an accounting entry which had been used for properties retired earlier than expected and therefore under-depreciated. Since at least a few such retirements from any large group of similar properties is almost certain, item accounting would almost certainly result in the losses of under-depreciation for the taxpayer. By grouping properties together the taxpayer found the depreciation accruals which fell short due to early retirement of some properties would be offset by the properties which were over-depreciated due to late retirement.

The degree to which group and item accounting produce identical results depends in part upon the mortality dispersion of the units. Mortality dispersion is simply the number of units retired distributed over the various ages at retirement. The Iowa-type curves are one of a number of published sets of various mortality dispersions and are presented by Marston, Winfrey, and Hempstead (13, pp. 419-421). Two mortality dispersions not shown there are of considerable theoretical importance. These are the so-called "square" and

"straight line" types of survivor curves. The survivor curve and frequency curve for both types are shown in Figure 1. The "square" type distribution represents a property group whose retirement is entirely a function of time. In practice there are probably no property groups which actually follow either the "square" or "straight-line" patterns. Nonetheless, they are theoretically important for at least two reasons:

1. Between the extremes represented by the two dispersions lie many actual dispersions. The "square" and "straight-line" types are therefore useful as "limiting" cases.

2. Of all the mortality dispersions the "square" and "straight-line" dispersions are much easier to work with computationally.

One or the other of the mortality dispersions shown in Figure 1 has been used in preparing Tables 7 through 14. The tables have been prepared to show how group accounting is accomplished and also to illustrate how depreciation charges, reserve, and ratio of reserve to asset balance are affected by:

1. Mortality dispersion of the property units.

2. Average service life of the property units.

3. Rate of growth or decline (if any) in the value new of property units in service.

4. Taxpayer's method of grouping accounts: by item, vintage group, continuous group, continuous classified group,

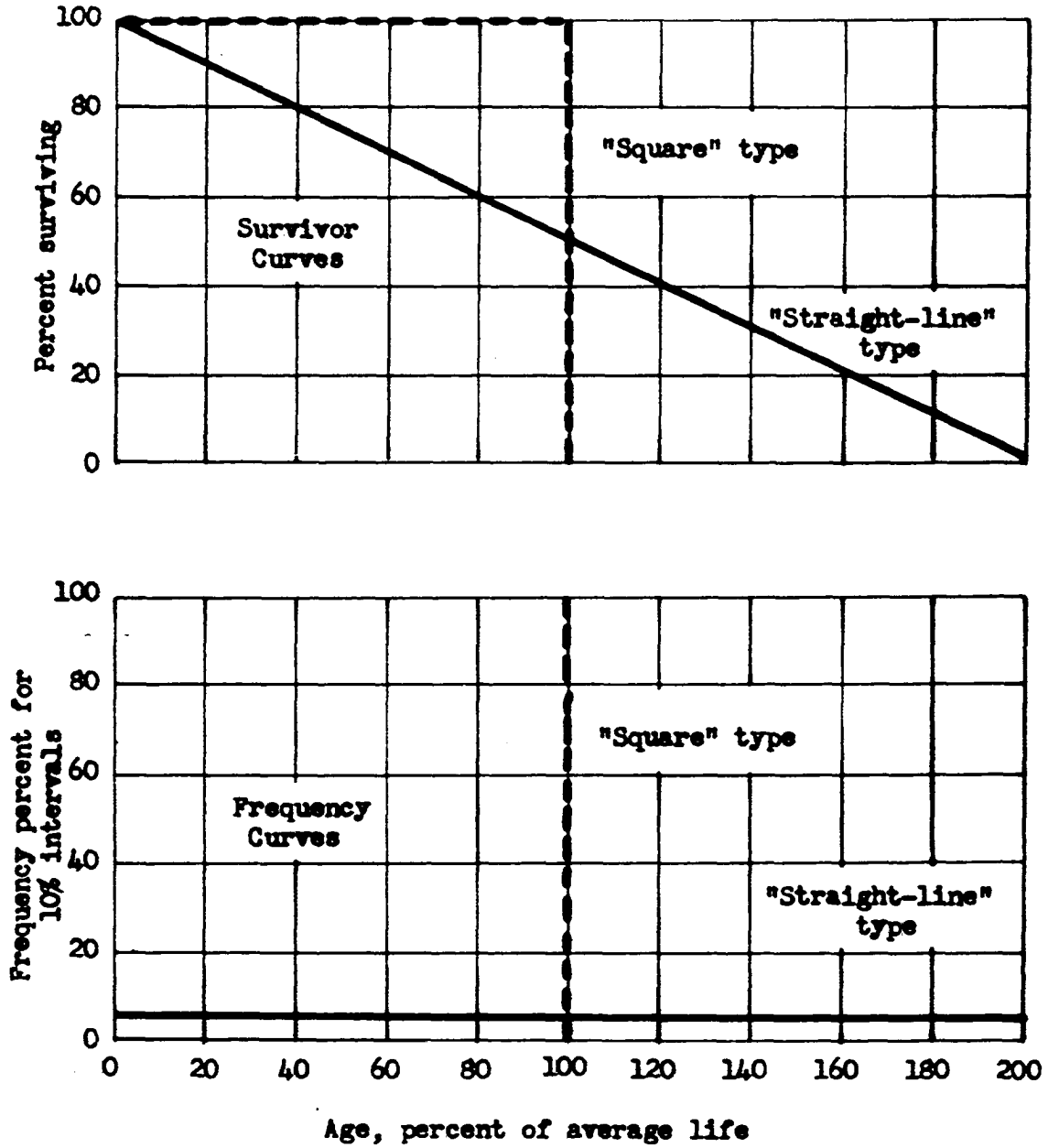

Figure 1. "Straight-line" and "square" type survivor and frequency curves

or continuous composite group.

5. Taxpayer's method of allocating depreciation: straight line, sum-of-the-years-digits, double declining balance, or other.

Computation instructions for the tables are given below. In each table a constant depreciation rate (the reciprocal of average service life of the property units) has been used. This corresponds to assumption of average life procedure for the calculations.

Column Computations in Tables 7 Through 14

Use the symbol C for column, so "C.2" means "column 2". The "a" columns are based on the conventional assumption of uniform or midyear acquisitions. The "b" columns are based on the first-of-the-year assumption.

C.1 = original data.

C.2 = C.3-C.4 accumulated as of January 1.

C.3 = original data.

C.4 = original data.

C.5a = C.2 + $\frac{1}{2}$(C.3-C.4).

C.5b = C.2 + C.3 + $\frac{1}{2}$(C.4).

C.6 = C.5 divided by average service life.

C.7 = C.6-C.4 accumulated as of January 1.

C.8 = $\frac{1}{2}$(C.7 this year + C.7 next year) divided by C.5.

C.9a = $(\frac{C.2-C.7}{C.2})$ (average service life).

C.9b = $(\frac{C.2+C.3-C.7}{C.2+C.3})$ (average service life).

C.10 = C.13-C.4 accumulated as of January 1.

C.11a = C.2-C.10.

C.11b = C.2 + C.3 - C.10.

C.12 = from IRS (34, p. 22) based on C.9.

C.13a = (C.11)(C.12) + $\frac{1}{2}$(C.3) (rate based on average service life).

C.13b = (C.11)(C.12).

C.14 = $\frac{1}{2}$(C.10 this year + C.10 next year) divided by C.5.

C.15 = C.19 last year - $\frac{1}{2}$(C.4).

C.16 = C.5 - C.15.

C.17 = $\frac{2}{n}$.

C.18 = (C.16)(C.17).

C.19 = C.19 last year + C.18-C.4.

C.20 = $\frac{1}{2}$(C.19 this year + C.19 last year) divided by C.5.

Each of the property groups in Tables 7 through 14 have stabilized. A stabilized property group may be defined by any of the following concepts:

1. A stabilized property group undergoing a 0% rate of growth is a continuous group in which the value new of property additions is exactly equal to the value new of property retirements and will continue to be so forever.

Table 7. Depreciation of a continuous property group having a square survi digits methods. Annual rate of growth is 0%.[a]

C.1	C.2	C.3	C.4	C.5a	C.6	
Year	Balance Jan. 1	Additions July 1	Retirements during year	Average asset balance	SL amount @ 20%	SI
1961	0	100	0	50	10	
1962	100	100	0	150	30	
1963	200	100	0	250	50	
1964	300	100	0	350	70	
1965	400	100	0	450	90	
1966	500	100	100	500	100	
1967	500	100	100	500	100	
1968	500	100	100	500	100	
1969	500	100	100	500	100	
1970	500	100	100	500	100	
1971	500	100	100	500	100	
.	.	.	.	.	.	
.	.	.	.	.	.	
.	.	.	.	.	.	
∞	500	100	100	500	100	

[a]Figures rounded to nearest whole number.

Table 8. Depreciation of a continuous group property having a straight line su
years-digits methods. Annual rate of growth is 0%.[a]

C.1	C.2	C.3	C.4	C.5b	C.6	C.7
Year	Balance Jan. 1	Additions Jan. 1	Retirements during year	Average asset balance	SL amount @ 20%	SL res Jan.
1961	0	100	10	95	19	0
1962	90	100	20	180	36	9
1963	170	100	30	255	51	25
1964	240	100	40	320	64	46
1965	300	100	50	375	75	70
1966	350	100	60	420	84	95
1967	390	100	70	455	91	119
1968	420	100	80	480	96	140
1969	440	100	90	495	99	156
1970	450	100	100	500	100	165
1971	450	100	100	500	100	165
1972	450	100	100	500	100	165
1973	450	100	100	500	100	165
1974	450	100	100	500	100	165
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
∞	450	100	100	500	100	165

[a]Figures rounded to the nearest whole number.

oup property having a straight line survivor curve and an average service life of five y
ate of growth is 0%.[a]

+	C.5b	C.6	C.7	C.8	C.9b	C.10	C.
ments ng r	Average asset balance	SL amount @ 20%	SL reserve Jan. 1	SL reserve as a % of asset balance	Remaining life	SOYD reserve Jan. 1	Unrec Ja
)	95	19	0	5	5.0	0	10
)	180	36	9	9	4.8	23	16
)	255	51	25	14	4.5	60	21
)	320	64	46	18	4.3	106	23
)	375	75	70	22	4.1	153	24
)	420	84	95	25	3.9	199	25
)	455	91	119	28	3.8	241	24
)	480	96	140	31	3.7	274	24
)	495	99	156	32	3.6	297	24
)	500	100	165	33	3.5	311	23
)	500	100	165	33	3.5	316	23
)	500	100	165	33	3.5	318	23
)	500	100	165	33	3.5	320	23
)	500	100	165	33	3.5	321	22
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
)	500	100	165	33	3.5	321	22

e number.

verage service life of five years by the straight line and sum-of-the-

C.9b Remaining life	C.10 SOYD reserve Jan. 1	C.11b Unrecovered Jan. 1	C.12 Rate	C.13b SOYD amount	C.14 SOYD reserve as a % of asset balance
5.0	0	100	0.3333	33	12
4.8	23	167	0.3429	57	23
4.5	60	210	0.3600	76	33
4.3	106	234	0.3739	87	40
4.1	153	247	0.3905	96	47
3.9	199	251	0.4063	102	52
3.8	241	249	0.4130	103	57
3.7	274	246	0.4205	103	59
3.6	297	243	0.4286	104	61
3.5	311	239	0.4375	105	63
3.5	316	234	0.4375	102	63
3.5	318	232	0.4375	102	64
3.5	320	230	0.4375	101	64
3.5	321	229	0.4375	100	64
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
3.5	321	229	0.4375	100	64

Table 9. Depreciation of a continuous property group having a square survivor curve digits methods. Annual rate of growth is +10%.[a]

C.1	C.2	C.3	C.4	C.5a	C.6	C.7
Year	Balance Jan. 1	Additions July 1	Retirements during year	Average asset balance	SL amount @ 20%	SL reserve Jan. 1
1961	0	100	0	50	10	0
1962	100	110	0	155	31	10
1963	210	121	0	271	54	41
1964	331	133	0	398	80	95
1965	464	146	0	537	107	175
1966	610	161	100	641	128	282
1967	671	177	110	705	141	310
1968	738	195	121	775	155	341
1969	812	214	133	853	171	375
1970	893	236	146	938	188	413
1971	983	259	161	1032	206	455
1972	1081	285	177	1135	227	500

[a]Figures rounded to nearest whole number.

e survivor curve and an average service life of five years by the straight line an

t	C.7 SL reserve Jan. 1	C.8 SL reserve as a % of asset balance	C.9a Remaining life	C.10 SOYD reserve Jan. 1	C.11a Unrecovered Jan. 1	C.12 Rate	a
	0	10	5.0	0	0	0.3333	
	10	16	4.5	17	83	0.3600	
	41	25	4.0	65	145	0.4000	
	95	34	3.6	143	188	0.4286	
	175	43	3.1	246	218	0.4844	
	282	46	2.7	376	234	0.5294	
	310	46	2.7	427	244	0.5294	
	341	46	2.7	476	262	0.5294	
	375	46	2.7	526	286	0.5294	
	413	46	2.7	580	313	0.5294	
	455	46	2.7	639	344	0.5294	
	500	46	2.7	703	378	0.5294	

erage service life of five years by the straight line and sum-of-the-years-

rve of alance	C.9a Remaining life	C.10 SOYD reserve Jan. 1	C.11a Unrecovered Jan. 1	C.12 Rate	C.13a SOYD amount	C.14 SOYD reserve as a % of asset balance
	5.0	0	0	0.3333	17	17
	4.5	17	83	0.3600	48	26
	4.0	65	145	0.4000	78	38
	3.6	143	188	0.4286	103	49
	3.1	246	218	0.4844	130	58
	2.7	376	234	0.5294	151	63
	2.7	427	244	0.5294	159	64
	2.7	476	262	0.5294	171	65
	2.7	526	286	0.5294	187	65
	2.7	580	313	0.5294	205	65
	2.7	639	344	0.5294	225	65
	2.7	703	378	0.5294	248	65

Table 11. Depreciation of a continuous property group having a sy digits methods. Annual rate of growth is -10%.[a]

C.1	C.2	C.3	C.4	C.5a	C.6
Year	Balance Jan. 1	Additions July 1	Retirements during year	Average asset balance	SL amo @ 20
1961	0	1000	0	500	100
1962	1000	909	0	1455	291
1963	1909	826	0	2322	464
1964	2735	751	0	3111	622
1965	3486	683	0	3828	766
1966	4169	621	1000	3980	796
1967[b]	3790	564	909	3618	724
1968	3445	513	826	3289	658
1969	3132	467	751	2990	598
1970	2848	424	683	2719	544
1971	2589	386	621	2472	494
1972	2354	350	564	2247	449

[a]Figures rounded to the nearest whole number.

[b]Group does not truly undergo 10% decline until 1967.

, having a square surviver curve and an average service life of five y
·10%.[a]

:	C.6	C.7	C.8	C.9a	C.10
ıge :t ıce	SL amount @ 20%	SL reserve Jan. 1	SL reserve as a % of asset balance	Remaining life	SOYD reserve Jan. 1
)0	100	0	10	5.0	0
;5	291	100	17	4.5	167
:2	464	391	27	4.0	618
.1	622	855	37	3.4	1272
:8	766	1477	49	2.9	2052
)0	796	2243	54	2.3	2895
.8	724	2039	54	2.3	2750
)9	653	1854	54	2.3	2548
)0	598	1686	54	2.3	2336
.9	544	1533	54	2.3	2132
'2	494	1394	54	2.3	1942
;7	449	1267	54	2.3	1767

1967.

life of five years by the straight line and sum-of-the-years-

	C.10	C.11a	C.12	C.13a	C.14a
ng	SOYD reserve Jan. 1	Unrecovered Jan. 1	Rate	SOYD amount	SOYD reserve as a % of asset balance
	0	0	0.3333	167	0
	167	833	0.3600	451	17
	618	1291	0.4000	654	32
	1272	1463	0.4474	780	47
	2052	1434	0.5088	843	59
	2895	1274	0.5897	855	69
	2750	1040	0.5897	707	73
	2548	897	0.5897	614	74
	2336	796	0.5897	547	75
	2132	716	0.5897	493	75
	1942	647	0.5897	446	75
	1767	587	0.5897	404	75

Table 12. Depreciation of a continuous property group having a straight line surv years-digits methods. Annual rate of growth is -10%.[a]

C.1	C.2	C.3	C.4	C.5b	C.6	C.7
Year	Balance Jan. 1	Additions Jan. 1	Retirements during year	Average asset balance	SL amount @ 20%	SL reserve Jan. 1
1961	0	1000	100	950	190	0
1962	900	909	191	1714	343	90
1963	1618	826	274	2307	461	242
1964	2170	751	349	2747	549	429
1965	2572	683	417	3047	609	629
1966	2838	621	479	3220	644	821
1967	2980	564	536	3276	655	986
1968	3008	513	587	3228	646	1105
1969	2934	467	633	3085	617	1164
1970[b]	2768	424	676	2854	571	1148
1971	2516	386	614	2595	519	1043
1972	2288	350	559	2359	472	948
1973	2079	319	508	2144	429	861
1974	1890	290	462	1949	390	782
1975	1718	263	420	1771	354	710
1976	1561	239	382	1609	322	644
1977	1418	218	347	1463	293	584
1978	1289	198	315	1330	266	530

[a]Figures rounded to the nearest whole number.

[b]Growth is -10% beginning in 1970.

up having a straight line survivor curve and an average service life of five
wth is -10%.[a]

6b	C.6	C.7	C.8	C.9b	C.10	C.
rage set ance	SL amount @ 20%	SL reserve Jan. 1	SL reserve as a % of asset balance	Remaining life	SOYD reserve Jan. 1	Unrec Ja
950	190	0	5	5.0	0	1(
714	343	90	10	4.8	233	1!
307	461	242	15	4.5	582	1!
747	549	429	19	4.3	976	1!
047	609	629	24	4.0	1354	1!
220	644	821	28	3.8	1697	1'
276	655	986	32	3.6	1946	1!
228	646	1105	35	3.4	2095	1!
085	617	1164	37	3.3	2146	1!
154	571	1148	38	3.2	2088	1!
095	519	1043	38	3.2	1932	9
159	472	948	38	3.2	1774	8
144	429	861	38	3.2	1622	7
149	390	782	38	3.2	1479	7
171	354	710	38	3.2	1347	6
109	322	644	38	3.2	1225	5
163	293	584	38	3.2	1114	5
130	266	530	38	3.2	1013	4

erage service life of five years by the straight line and sum-of-the-

C.9b Remaining life	C.10 SOYD reserve Jan. 1	C.11b Unrecovered Jan. 1	C.12 Rate	C.13b SOYD amount	C.14 SOYD reserve as a % of asset balance
5.0	0	1000	0.3333	333	12
4.8	233	1576	0.3429	540	24
4.5	582	1862	0.3600	670	34
4.3	976	1945	0.3739	727	42
4.0	1354	1901	0.4000	760	50
3.8	1697	1762	0.4130	728	57
3.6	1946	1598	0.4286	685	62
3.4	2095	1426	0.4474	638	66
3.3	2146	1255	0.4583	575	69
3.2	2088	1104	0.4706	520	70
3.2	1932	970	0.4706	456	71
3.2	1774	864	0.4706	407	72
3.2	1622	776	0.4706	365	72
3.2	1479	701	0.4706	330	72
3.2	1347	634	0.4706	298	73
3.2	1225	575	0.4706	271	73
3.2	1114	522	0.4706	246	73
3.2	1013	474	0.4706	233	73

Table 13. Depreciation of a continuous property group having a square survivor curve and an average service life of ten years by the straight line method. Annual rate of growth is + 10%.[a]

C.1	C.2	C.3	C.4	C.5a	C.6	C.7	C.8
Year	Balance Jan. 1	Additions July 1	Retirements during year	Average asset balance	SL amount @ 10%	SL reserve Jan. 1	SL reserve as a % of asset bal.
1961	0	100	0	50	5	0	5
1962	100	110	0	155	16	5	8
1963	210	121	0	271	27	21	13
1964	331	133	0	398	40	48	17
1965	464	146	0	537	54	88	21
1966	610	161	0	691	69	142	26
1967	771	177	0	860	86	211	30
1968	948	195	0	1046	105	297	33
1969	1143	214	0	1250	125	402	37
1970	1357	236	0	1475	148	527	41
1971	1593	259	100	1673	167	675	42
1972	1752	285	110	1845	185	742	42
1973	1927	314	121	2024	202	817	42
1974	2120	345	133	2226	223	898	42
1975	2332	380	146	2449	245	988	42

[a]Figures rounded to nearest whole number.

Table 14. Depreciation of a continuous property group having a straight line Annual rate of growth is 0%.[a]

C.1	C.2	C.3	C.4	C.5	
Year	Balance Jan. 1	Additions Jan. 1	Retirements during year	Average asset balance	Avera b depr
1961	0	100	10	95	
1962	90	100	20	180	
1963	170	100	30	255	
1964	240	100	40	320	
1965	300	100	50	375	
1966	350	100	60	420	
1967	390	100	70	455	
1968	420	100	80	480	
1969	440	100	90	495	
1970	450	100	100	500	
.	.	.	.	.	
.	.	.	.	.	
.	.	.	.	.	
∞	450	100	100	500	

[a]Figures rounded to nearest whole number.

y group having a straight line survivor curve and an average life of five years by the double d

h	C.15	C.15	C.16	C.17	C.18	
ements ing ar	Average asset balance	Average reserve before depreciation	Net depreciable balance	Rate	Allowable depreciation	DI Dec de
)	95	0	95	40%	38	
)	180	18	162	40%	65	
)	255	58	197	40%	79	
)	320	102	218	40%	87	
)	375	144	231	40%	92	
)	420	181	239	40%	96	
)	455	212	243	40%	97	
)	480	234	246	40%	98	
)	495	247	248	40%	99	
)	500	251	249	40%	100	
	.	.	.	.	.	
	.	.	.	.	.	
	.	.	.	.	.	
0	500	251	249	40%	100	

age life of five years by the double declining balance method.

0.17	0.18	0.19	0.20
Rate	Allowable depreciation	DDB reserve Dec. 31 after depreciation	DDB reserve as a % of asset balance
40%	38	28	53
40%	65	73	54
40%	79	122	57
40%	87	169	59
40%	92	211	61
40%	96	247	62
40%	97	274	62
40%	98	292	62
40%	99	301	60
40%	100	301	60
.	.	.	.
.	.	.	.
.	.	.	.
40%	100	301	60

2. A stabilized property group undergoing a 0% rate of growth is a continuous group in which the value new of property renewals (either additions or retirements) is constant and equal to the value new of property units in service divided by the average life.

3. A stabilized property group undergoing a rate of growth other than 0%, is a continuous group in which the excess (deficit) of the value new of property additions over (under) the value new of property retirements is just sufficient to maintain the stated rate of growth forever.

4. A stabilized property group is a continuous group in which the ratio of depreciation reserve to asset balance has become and will remain constant forever.

The most universal of these definitions is the fourth, since it permits testing of stabilization for non-zero growth rates and involves a constant ratio rather than a changing amount as in the third definition. This ratio of depreciation reserve to asset balance appears as column 8, 14, and 20 for the straight line, sum-of-the-years-digits, and double declining balance methods, respectively.

Because the tables have been composed of integers and the average service life used is fairly small, the time at which stabilization occurs is not accurately observed. In Table 7, for example, when the straight line method is used, the property group has stabilized by the year 1966; when the

sum-of-the-years-digits method is used, the property group does not meet the stabilization "test" until 1969.

Further discussion and computations for stabilized property groups are provided in Winfrey's work (38 and 39).

The influence of mortality dispersion upon depreciation charges, reserve, and ratio of reserve to asset balance can be seen by comparing the depreciation amounts resulting for the square type dispersions with those of the straight line dispersions. Compare Tables 7, 9, and 11 with Tables 8, 10, and 12, respectively. Note that as a property tends to the square type dispersion, (a) the annual depreciation charge prior to stabilization is higher, (b) the depreciation reserve is continuously greater, and (c) the ratio of depreciation reserve to asset balance is continuously greater. As noted earlier, the calculations were based on a constant depreciation rate as would be used with the average life procedure. Where depreciation rates are computed by the remaining life procedure, it is possible that mortality dispersion effects (a), (b), and (c) noted above will diminish. The remaining life procedure, though thoroughly practical, is difficult to demonstrate since the remaining life of any property group is infinitely variable, at least in the theoretical illustration.

The average service life used in Tables 7 through 12 is five years. For a property undergoing neither growth nor

decline the depreciation reserve (after stabilization) as a per cent of the asset balance is unaffected by the average service life. Average service life does however produce variations in the growing or declining property group. This can be seen by comparing Table 13 where average service life is ten years, with Table 9 where average service life is five years. Note that as average service life increases, the impact of growth (or decline) of a property group increases.

Average service life and the annual rate of growth (or decline) of a property have considerable impact upon the depreciation charges, reserve, and ratio of reserve to asset balance. The basic reason for this is simply that both factors influence the average age of units in service. To show this, consider a continuous property group having the square type mortality dispersion and:

Let n = average service life, in years

K = one plus the annual rate of growth (decline) as a decimal ratio

K-1 = annual rate of growth (decline) as a decimal ratio

y = number of units in service at any age

x = remaining life, in years. (For the square type survivor curve, x + attained age = n; for all other types, x + attained age > n)

so that:

$$y = K^x$$

The average remaining life of the units in service can be found by computing the first moment about the y-axis and dividing by the total number of units in service.

Compute the total number of units in service, T:

$$T = \int_0^n K^x dx = \frac{K^n - 1}{\ln n}$$

Compute the first moment about the y-axis, M_1:

$$M_1 = \int_0^n xK^x dx = \frac{1}{\ln K} \left(nK^n - \frac{K^n - 1}{\ln K}\right)$$

Compute the average remaining life of the units in service, R:

$$R = \frac{M_1}{T} = \frac{nK^n - \frac{K^n - 1}{\ln K}}{K^n - 1}$$

When the annual rate of growth is zero:

$$K - 1 = 0$$

$$K = 1$$

The limits of R as K approaches 1 are more conveniently found through the following substitutions:

as $K \longrightarrow 1$, $\ln K \longrightarrow 0$

let $\ln K = a$

then $e^a = K$

and $e^{na} = K^n$

Evaluate:

$$\lim_{a \to o} R = \frac{ne^{na} - \frac{e^{na} - 1}{a}}{e^{na} - 1}$$

by differentiating numerator and denominator:

$$\lim_{a \to o} R = \frac{ane^{na} - e^{na} + 1}{ae^{na} - a}$$

again differentiating numerator and denominator:

$$\lim_{a \to o} R = \frac{n^2ae^{na}}{nae^{na} + e^{na} - 1}$$

again differentiating numerator and denominator:

$$\lim_{a \to o} R = \frac{n^2e^{na} + n^3ae^{na}}{2ne^{na} + n^2ae^{na}}$$

divide through by ne^{na}:

$$\lim_{a \to o} R = \frac{n + n^2a}{2 + na}$$

and:

$$\lim_{a \to o} R = \frac{n}{2}$$

which is:

$$\lim_{K-1 \to o} R = \frac{n}{2}$$

and the average remaining life and/or average age when expressed as a percentage of average service life must be simply 50%, for any value of n when the mortality dispersion is of the square type. Thus the average age, and hence depreciation reserve and ratio of reserve to asset balance are independent of average service life for a property with an

annual rate of growth of 0% and a square type mortality dispersion.

The average age of units in service corresponds to the depreciation reserve as a per cent of asset balance. The percentage just derived, 50%, corresponds to the stabilized ratio appearing in column 8 of Table 7. The stabilized ratios appearing in column 8 of Table 9, 11, and 13 may also be verified by evaluating:

$$R = \frac{nK^n - \frac{K^n - 1}{\ln K}}{K^n - 1}$$

or:

$$R = \frac{nK^n}{K^n - 1} - \frac{1}{\ln K}$$

when:

$$K = 1.10$$

$$n = 5$$

which yields:

$$R = \frac{5(1.6105)}{0.6105} - \frac{1}{0.09531}$$

$$= 13.190 - 10.492$$

$$= 2.698$$

The average age of units in service, D, as a per cent of average service life is found by:

$$D = \frac{n-R}{n}$$

which for the preceding is:

$$D = \frac{5 - 2.698}{5}$$

$$= 0.46$$

This result corresponds to the stabilized ratio appearing in column 8 of Table 9.

When:

$$K = 0.90$$

$$n = 5$$

then:

$$R = \frac{5(0.5905)}{-0.4095} + \frac{1}{0.10536}$$

$$= -7.210 + 9.491$$

$$= 2.281$$

and:

$$D = \frac{5 - 2.281}{5}$$

$$= 0.54$$

This result corresponds to the stabilized ratio appearing in column 8 of Table 11.

When:

$$K = 1.10$$

$$n = 10$$

then:

$$R = \frac{10(2.5937)}{1.5937} - \frac{1}{0.09531}$$

$$= 16.275 - 10.492$$

$$= 5.783$$

and:

$$D = \frac{10 - 5.783}{10}$$

$$= 0.42$$

This result corresponds to the stabilized ratio appearing in column 8 of Table 13.

A final factor in influencing depreciation charges, reserve, and the ratio of reserve to asset balance is the depreciation method employed. Compare the results of the straight line depreciation method with those of the sum-of-the-years-digits method in Tables 7 through 12. In each case the sum-of-the-years-digits method produces greater annual depreciation charges early in the life of the property. Whether the later depreciation charges will be greater, the same, or less than those of the straight line method, depends upon whether the property group undergoes growth, stays constant, or declines. In any case, use of the sum-of-the-years-digits method always produces greater total (accumulated) depreciation charges than the conventional method.

The double declining balance method, unlike other methods, does not require that an estimate of salvage value be made for a property at the time of installation. In practice this simplifies the problem of estimating future values; in a hypothetical illustration, the practice presents complications because there are a number of ways of adjusting for salvage realized. Properties depreciated in vintage

groups rather than in continuous groups are adjusted for under-depreciation when the last property unit is retired. This and other alternatives are available; in practice a firm may find the availability of such alternatives to be desirable. Table 14 illustrates one application of the double declining balance method; others are possible.

Table 15 compares some of the data derived in Tables 7 through 14.

Table 15. Depreciation reserve as a per cent of asset balance for stabilized property groups shown in Tables 7 through 14; for average service life of five years.

Annual rate of growth	Mortality dispersion				
	Square		Straight line		
	Depreciation method		Depreciation method		
	SL[a]	SOYD[b]	SL[a]	SOYD[b]	DDB[c]
+10%	46[d]	65	28	56	--
0%	50	70	33	64	60
-10%	54	75	38	73	--

[a]SL = Straight line

[b]SOYD = Sum-of-the-years-digits

[c]DDB = Double declining balance

[d]For n = 10, the per cent is 42.

In summary, it has been shown that annual depreciation charges, accumulation of these charges in the depreciation reserve, and the ratio of depreciation reserve to asset balance are dependent upon:

1. Mortality dispersion of the property units.

2. Average service life of the property units.

3. Rate of growth or decline (if any) in the value new of property units in service.

4. Taxpayer's method of grouping property accounts: by item, vintage group, continuous group, continuous classified group, or continuous composite group.

5. Taxpayer's method of allocating depreciation: straight line, sum-of-the-years-digits, double declining balance, or other.

The preceding factors are all of importance to any firm, particularly because alteration of the depreciation allocations influences the federal income tax payable. The influence of these factors has been illustrated, but not mathematically derived; nonetheless a summary of these influences is in order.

1. The square-type mortality dispersion produces the highest ratio of depreciation reserve to asset balance. As the survivor curve tends toward the straight line dispersion, the ratio decreases. (See Table 15.)

2. The average service life does not alter the

depreciation reserve or ratio of reserve to asset balance for a stabilized property group with a 0% rate of growth. For a growing (declining) property group, the ratio of depreciation reserve to asset balance decreases (increases) as the average service life increases. (Compare column 8 of Tables 9 and 13.)

3. The higher the rate of growth (decline) of a continuous property group, the lower (higher) will be the ratio of depreciation reserve to asset balance. For a continuous property group undergoing growth (decline), the annual depreciation charges after stabilization of the group will always be higher (lower) for properties depreciated by the sum-of-the-years-digits method than for those depreciated by the straight line method. (See Table 15.)

4. When liberalized rather than straight line methods of computing depreciation are applied to an item or to a vintage group of property, the resulting charges to depreciation are relatively higher during the early years of a property and relatively lower during the later years of that property.

When liberalized rather than straight line methods of computing depreciation are applied continually to all items or all vintage groups, or applied to continuous, continuous classified, or continuous composite groups of property, the results can be different from those obtained for an item or

for a vintage group of property.

5. The sum-of-the-years-digits method applied to a continuous property group can:

a. Continuously result in higher depreciation charges than would result from the straight line method, providing the property group is growing, and regardless of mortality dispersion or average service life. (Compare columns 6 and 13 of Table 9 or Table 10.)

b. Temporarily result in higher depreciation charges and then in the same charges as would result from the straight line method, providing the property group undergoes no growth or decline, and regardless of mortality dispersion or average service life. (Compare columns 6 and 13 of Table 7 or Table 8.)

c. Temporarily result in higher depreciation charges and then in continuously lower charges than would result from the straight line method, providing the property group is declining, and regardless of mortality dispersion or average service life. (Compare columns 6 and 13 of Table 11 or Table 12.)

The higher depreciation charges which can occur when properties are depreciated by the sum-of-the-years-digits method reduce the amount of federal income tax payable. The nature of these "tax savings" and whether they are permanent or temporary are investigated in the section which follows.

TAX SAVINGS: PERMANENT OR TEMPORARY?

At the outset it should be noted that the tax effect of liberalized (accelerated) depreciation charges permitted in Section 167 of the 1954 code must be distinguished from the tax effect of accelerated amortization charges permitted in Section 168. The latter results in tax reductions for a definite five-year period and is normally expected to be followed by a period of higher tax payments. In contrast liberalized depreciation results in tax reductions for an indefinite period of time which may be very long, in fact, may be infinite in duration.

Although it has been shown that for a single item of property the higher annual charges for depreciation in the early years of service life will be followed by reduced charges, a different picture is presented when a liberalized method is applied to the group accounting of a property consisting of a large number of similar units as is characteristic of a utility plant. Some of the analyses which have been made are quoted in the material which follows.

In a study by the National Association of Railroad and Utilities Commissioners (19, 67th, pp. 424-521), the Committee on Accounts and Statistics made calculations using the double declining balance method, an average life of 10 years,

an Iowa-type R-2 survivor curve, and varying the plant by using first a vintage group, then a group with a 5% per year rate of growth, then a static group, and finally a plant declining at a rate of 5% per year. The calculations became the basis of the following statements by NARUC (19, 67th, p. 446):

> 1. For a single generation of property, after one-half or less of the average service life, the annual accruals under the declining balance method become less than the corresponding accruals under the straight line method. So with a single generation of property, tax benefits accruing early in life will be offset by higher tax payments later.
>
> 2. For a growing property depreciation accruals will always be greater under the declining balance method. Therefore tax benefits will continue.
>
> 3. For a property with stabilized age distribution and zero growth, annual accruals under the declining balance method will be greater than those of the straight line method for about 1½ times the average life period. Thereafter accruals will be equal. Tax benefits for this condition will continue therefore only during that period of about 1½ times the average life.
>
> 4. For a declining gross plant the accruals under the declining balance method become less than those of the straight line before the property has attained a stabilized age distribution. Here tax benefits will occur during the first half of the period required to attain a static age distribution. After that, the savings are gradually offset by the higher tax payments which later occur.

This last conclusion, that ". . . After that, the savings are gradually offset by the higher tax payments which later occur" is borne out by the examples in the preceding section. In columns 7 and 10 of Table 11 and/or 12

it can be seen that the depreciation reserve (which is the accumulation of annual depreciation charges less retirements) of the straight line method approaches, but is always less than that of the sum-of-the-years-digits method. The ratio of depreciation reserve to asset balance is constant after stabilization and is always higher for the sum-of-the-years-digits method than for the straight line method; therefore only when the asset balance reaches zero could the two reserves be equal; the asset balance never reaches zero for finite periods of time. This means that early savings will be less than offset by the higher tax payments which later occur, assuming that the taxpayer's marginal income tax rate remains unchanged. Should this assumption not hold, results can vary, as will be discussed later.

Mr. Willard F. Stanley says (25):

> . . . if a taxpayer should make the same expenditures for new property each year, assuming the additions have the same composite life expectancy, the total amount of deductions for tax depreciation with respect to all such property additions will never in any year fall below the total amount of depreciation which would be deductible under the straight line method.
>
> If annual expenditures for expansion go up in each year (year after year) instead of remaining level, then rapid depreciation will show a constant advantage over straight line depreciation forever.

The Accounts and Finance Department of the Public Service Commission of Wisconsin, in an analysis of the sum-of-the-years-digits method states (19, 67th, p. 440):

> On a continuing property basis but with no growth (i.e., additions just equal retirements), the annual depreciation under the digits method and straight line method will become equal. . . . Further, if property is growing, the depreciation under the digits method will at all times be greater than the allowance under the straight line method.

The Washington Public Service Commission, in referring to the tax savings concludes (35):

> In no legitimate sense may they be considered tax deferrals as was done in the case of the 60 month write-off granted firms making capital investments under the "Certificates of Necessity" provisions during World War II and the Korean War. These provisions were completely different in principle, in that the additional depreciation charges were for a definite period of time. The accelerated depreciation under the new tax law has not a definite period and the savings will be permanent.

Professor Robert Eisner states (5, p. 71):

> It should be clear from the foregoing evidence that the new methods of depreciation authorized in the Internal Revenue Code of 1954, and particularly the years digits method offer management the opportunity to make considerably increased annual depreciation charges for an indefinite period and, consequently, very great tax savings. Moreover, contrary to erroneous general belief, these tax savings will be permanent. . . at least as long as the law remains in effect. In no legitimate sense may they be considered tax deferrals.

The statements by Eisner and the Washington Public Service Commission go too far in assuming that use of liberalized depreciation methods guarantees some permanent savings. While the permanent savings may be likely, there is no certainty whatever to guarantee this result. To prove this, simply consider conditions under which permanent

savings will not result:

1. If liberalized methods are applied to an item or to a vintage group of property and if the taxpayer's marginal income tax rates are relatively higher in the later years of property life.

2. If liberalized methods are applied continually to all items or all vintage groups, or applied to continuous, continuous classified, or continuous composite groups of property and if a negative rate of growth is accompanied by relatively higher marginal income tax rates for the taxpayer in the later years of property life.

During the later years of a unit, vintage group, or continual property undergoing a negative rate of growth, the straight line method produces greater depreciation charges than the liberalized methods. When coupled with increasing marginal income tax rates for the taxpayer, use of a liberalized method leads to early tax saving which are more than offset by higher tax payments later and the result is a permanent loss. The taxpayer's marginal income tax rate could be relatively higher during the later years of a property for any of three reasons:

1. The federal income tax rates might be increased.

2. The taxpayer's net income could increase to an extent sufficient to place incremental income in a higher tax bracket.

3. The taxpayer could sustain losses in one or more of the early years, thus placing the taxpayer in what is essentially a 0% tax bracket.

These possibilities are far from remote, especially in light of the long periods of time being considered.

The need for a generalized analysis regarding use of the liberalized methods should be apparent. Factors which can influence whether liberalized methods result in permanent gain, temporary deferral, or permanent loss, and the magnitude and timing of such, are:

1. Mortality dispersion of the property units.

2. Average service life of the property units.

3. Rate of growth or decline (if any) in the value new of property units in service.

4. The future course of the taxpayer's marginal income tax rate.

5. Taxpayer's method of grouping property accounts by unit, vintage group, continuous group, continuous classified group, or continuous composite group.

6. Taxpayer's method of allocating depreciation: straight line, sum-of-the-years-digits, double declining balance, or other.

In most cases the taxpayer can exert little control over the first four factors, and much control over the last two. In electing among the various alternatives, one of the

factors influencing the taxpayer is the federal income tax which must be paid during the future years. An analysis of how elections affect the future federal income taxes of the taxpayer follows.

If liberalized rather than straight line methods of computing depreciation are applied to a unit or a vintage group of property, the result will be:

1. A permanent saving if the taxpayer's marginal income tax rates are relatively lower in the later years of property life, regardless of mortality dispersion average service life, and rate of growth.

2. A temporary deferral if taxpayer's marginal income tax rates are constant, or if fluctuating rates exactly offset gains and losses. This is true regardless of rate of growth. The mortality dispersion and average service life affect only the duration of the deferral.

3. A permanent loss if the taxpayer's marginal income tax rates are relatively higher in the later years of property life, regardless of mortality dispersion, average service life, and rate of growth.

If liberalized rather than straight line methods of computing depreciation are applied continually to all units or all vintage groups, or applied to continuous, continuous classified, or continuous composite groups of property, the result will be:

1. A permanent saving if:

a. The rate of growth is non-negative, and regardless of mortality dispersion, average service life, and the taxpayer's marginal income tax rates, except that the tax rate must be greater than zero.

b. The rate of growth is negative and the taxpayer's marginal income tax rate is constant, regardless of mortality dispersion and average service life. (The saving tends to zero as time approaches infinity.)

c. The taxpayer's marginal income tax rates are relatively lower in the later years of property life, and regardless of mortality dispersion, average service life, and rate of growth.

2. A temporary deferral if the effects of a negative rate of growth are exactly offset by relatively higher marginal income tax rates for the taxpayer occurring in the later years of property life. This is true regardless of the mortality dispersion and average service life.

3. A permanent loss if the effects of a negative rate of growth are more than offset by relatively higher marginal income tax rates for the taxpayer occurring in the later years of property life.

A concept necessary to the proper evaluation of alternatives is the time value of money. If a "present value" of money is recognized, even the deferral of taxes has some

positive value. Moreover, even what is described in the foregoing as a permanent loss must be reviewed in this light. Thus if use of a liberalized depreciation method postpones the payment of $100 in taxes today, and 10 years later, because of higher tax rates, the payment turns out to be $120, recognition of the time value of money may well lead to the conclusion that such apparent "loss" is actually worthwhile. The interest concept places use of the liberalized methods of depreciation in an even more favorable light than was presented earlier.

Consider next the trends in net plant of privately owned public utilities and transportation companies as shown in Table 16 and Figure 2.

Table 16. Annual rate of growth of net plant for selected industries.

Industry	Beginning in	Average annual rate of growth
Air carrier	1945	30%
Natural gas pipeline	1944	18½%
Telephone	1935	6½%
Electric	1937	5%
Water	1935	4½%
Railroad	1935	1 3/4%
Telegraph	1935	-2½%

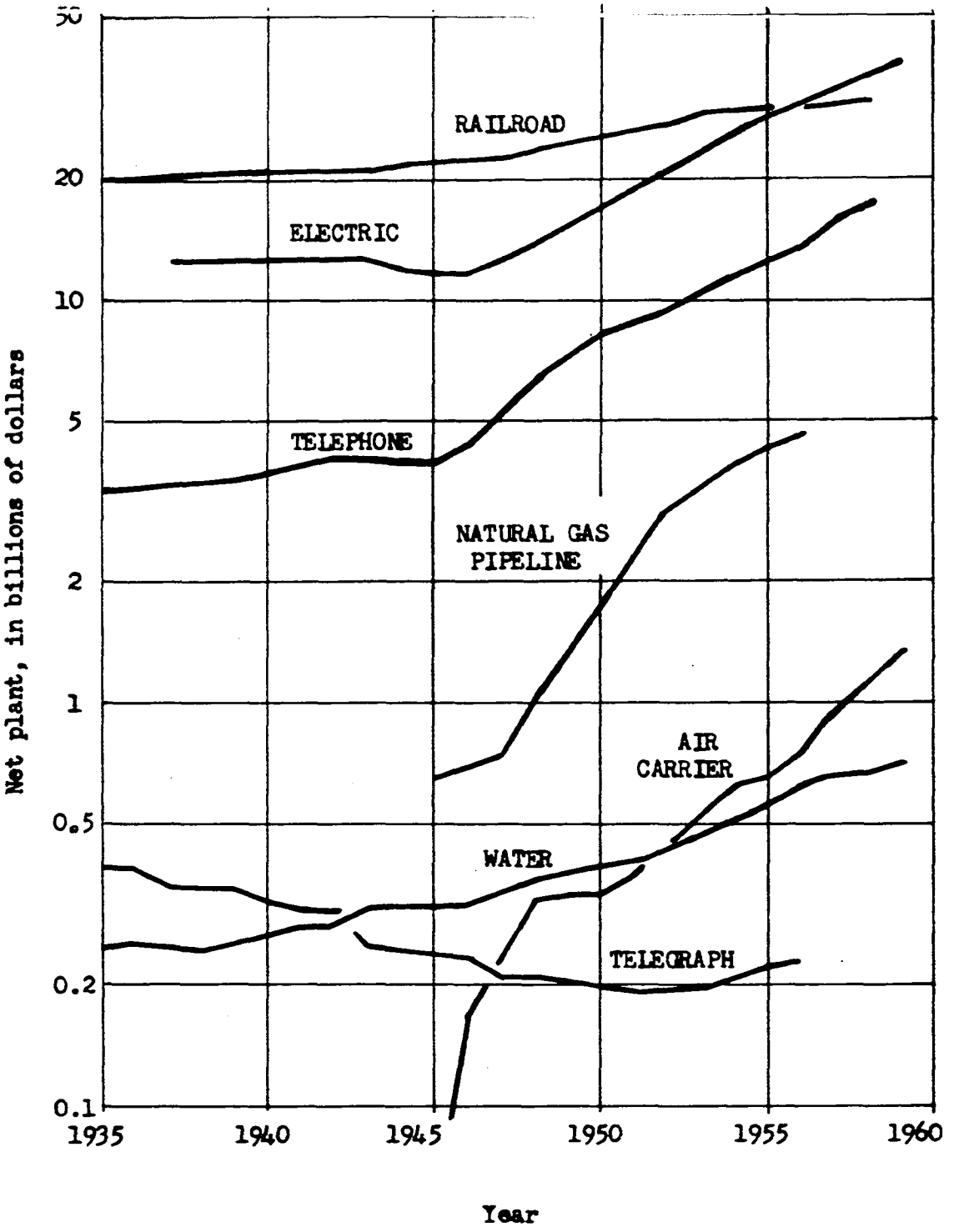

Figure 2. Net plant for privately owned public utilities and transportation companies

The sources of the data above and for Figure 2 appear in Appendix B.

The trend of federal income tax rates on corporate income have been erratic, mostly due to the sporadic appearance of an "excess profits" additive during the World War II and Korean War emergencies. The present tax rates are 30% on all corporate profits and a 22% surtax on all corporate profits in excess of $25,000.

Consideration of the trends in net plant and federal income tax rates upon corporations, coupled with the already favorable (to liberalized depreciation) conditions indicated earlier lend strong support to the conclusion that for a firm adopting one of the liberalized depreciation methods, the chances of a permanent gain are much greater than the chances of a permanent loss.

The non-regulated firm which elects to use a liberalized depreciation method can distribute, at its own discretion, the consequential gain or loss among its present and future consumers, employees, and stockholders; this discretion may be influenced by decisions and policies of competing firms and more generally by the competitive system. The regulated firm finds the discretion (as to how to distribute the gains or losses resulting from use of liberalized depreciation methods) lies largely with the regulatory bodies. To explain how this happens it is necessary to first explain the rate-making

process and then two widely-used regulatory methods of handling tax savings.

THE RATE-MAKING PROCESS

The alteration of rates charged by a regulated public utility may come about in two general ways. If the rates charged appear to be less than adequate, a public utility may seek rate increases through the appropriate channels. The public, represented by interested parties, may likewise feel rates to be exorbitant and may seek rate decreases through these same channels. Their action is more often simply in the form of oral and written protests with the action being taken by representatives from the governing bodies. The particular procedure in which a rate change is sought depends upon the regulations of the state and municipality within which the utility operates. The procedure also depends upon whether the regulatory body is a state or federal agency. A typical procedure, by no means the only one, is given below:

1. Petition, for a hearing, the governing body of the municipality in which services are provided and in which a rate change is sought. A city council is often the governing body to which such petitions should be brought. If the services provided are not within the geographic boundaries of a municipality, the petition may go directly to the regulatory commission of the state.

2. In the hearing the utility and the public present

data to support (or challenge) the claimed need for a rate change. This data is generally scrutinized in considerable detail to protect the public from exorbitant rates and to protect the utility from confiscatory rates. The governing body uses any and all information presented to reach conclusions as to what, if any, rate change will be allowed. The change granted may be less than requested. If the utility and the public are satisfied with the determination, the matter will be pursued no further.

3. When dissatisfied with the final result of the determination, the dissatisfied party will next approach either the regulatory commission of the state or the state courts. The procedure varies from state to state. Once into the courts the proceedings are conducted in much the same manner as any civil litigation. Either party, public or utility, can proceed with appeals through the usual court system up to and including the United States Supreme Court.

The arithmetic of the rate-making process is simple. It is problems of determination that makes the litigation of cases a very time-consuming affair. Nonetheless, no explanation of the rate-making process could be complete without presenting some notion of the actual computation of utility rates. Table 17, page 86, presents a simplified version of the rate-making process.

The first step in the determination of rates to be

charged by a utility for the services it provides is to determine the rate-base. Rate-base of a public utility is commonly determined as the value of all properties used and useful in the production of the firm's services. Rate-base is established by a regulatory body which reviews, considers, and weighs the various indicators of value such as original cost and replacement cost. The rate-base includes the value of all tangible assets (used and useful in the business), and generally includes an allowance for working capital and intangible assets. The value of net plant (including working capital) as shown on the balance sheet of a utility firm provides a rough guide to rate-base. The final determination of rate-base represents the basis upon which some rate of return will be allowed.

The second step in rate determination is establishing a rate of return. In most cases regulatory bodies have allowed a rate of return between 6% and 8%. The specific rate allowed is influenced by many factors such as the national economy, the debt-equity ratio of the firm, and current costs of capital. Next the allowed net operating income is found by multiplying rate-of-return times the rate-base. This allowed operating income (profit) is checked against the requirements to meet debt and preferred stock obligations. If the residue left to common stock is reasonable, no further adjustments will be made.

The third step is the determination of allowed operating revenue (sales). This is facilitated by reversing the ordinary order of items of an income statement. The first item to be included is the allowed operating income, determined in the previous step. To this the estimated federal (and state and local) income taxes are added. Next, the depreciation expense and other allowed expenses are added. The result is allowed operating revenue. In practice, many questions arise in determining depreciation and other expenses to be allowed. Allowed depreciation expense may differ from what is used by the company in either its computation of federal income taxes or its stockholder reports. Other expenses to be allowed may raise considerable controversy. How much advertising expense is reasonable? Should maintenance expenses be allowed on the basis of past experience or proposed expenditures? Should depreciation expense be allowed on stand-by capacity units, the need for which is seriously questioned? These are only a few of the problems which make the litigation process a good deal more time consuming and complicated than the example considered here.

When allowed operating revenue has been determined, there remains one step, that of establishing for the various classes of consumers rates which provide the allowed operating revenues. The proposed rate schedule is generally submitted to the regulatory body by the utility. If approved the rate

schedule will go into effect as of the date determined in the proceedings. In practice there can be considerable question in the determination of new rate schedules. Regulatory bodies have become very concerned with "price-tilting" efforts of natural gas companies which have sought to meet competition for industrial users by making a greater differential in the prices charged to residential versus industrial consumers.

Of the many important questions raised in the foregoing material only one will be pursued at some length. That question has to do with the allowance for depreciation expense and for federal income taxes. Although federal income taxes might seem the least controversial of expenses to be allowed, such has not proven to be true since the 1954 introduction of liberalized depreciation methods.

The problem arises as follows. In the early years of the life of a depreciable property, use of the liberalized depreciation methods produce annual charges to depreciation which are greater than those computed by the conventional straight line method. As a result, the taxable income and federal income tax are reduced in this early period; in later years the situation is (perhaps) reversed with reduced charges to depreciation expense leading to increased taxable income and federal income tax. As shown earlier, use of a liberalized depreciation method rather than the straight

line method can result in a permanent gain, a simple deferral of taxes, or a permanent loss.

In any case, during the early years of the life of a depreciable property, use of a liberalized depreciation method will result in a reduction in federal income taxes. The handling of these tax savings has posed a problem to regulatory commissions; their reactions have not been uniform.

"FLOW THROUGH" AND "NORMALIZE" TREATMENTS

Some state regulatory commissions have insisted that only actually paid federal income taxes be allowed in computation of allowed operating revenue. This policy has been called the "flow through" treatment since theoretically the savings flow through to the consumer via relatively lower rates for service. One of the states which prescribes this treatment is Pennsylvania. Critics of the "flow through" treatment say it is inconsistent to use depreciation expense computed by the straight line method together with the federal income tax payment resulting from use of accelerated depreciation computations. A second criticism has been that all benefits "flow through" to the present consumer with no benefit to the stockholder, and perhaps at the expense of the future consumer.

The regulatory commissions of other states have insisted federal income taxes in excess of those actually paid be allowed in computation of allowed operating revenue. This policy has been called the "normalize" treatment since the allowed depreciation expense, net operating income, and federal income tax are adjusted to the amounts which would have resulted from straight line depreciation. This is accomplished by adding to federal income tax actually paid,

the amount required (deferred federal income tax) to "normalize" such tax. Account titles such as "Deferred Federal Income Tax" are used and the amounts are accumulated from year to year in surplus or reserve accounts such as "Reserve for Deferred Federal Income Tax". Handling of this reserve in the rate case is generally accomplished in one of three ways.

a. One method (prescribed in Ohio and other states) is to simply neglect the reserve. Critics state that such policy passes on all benefits to the stockholders with rates unchanged from the conventional situation.

b. A second method is to reduce the rate-base (see line 6, Table 17) by the amount of "Reserve for Deferred Federal Income Tax". This is the approach taken in the state of Wisconsin. Critics argue that this passes on the benefits to consumers without providing any benefit to the stockholder, and that comparability is lost, for example, is the fair return on a rate-base so established still 6% to 8%?

c. In the third method, the amount of the reserve is considered interest-free capital (see line 12, Table 17) in checking the adequacy of the return to holders of common stock. Kansas and other states have followed this method. As shown later, the method can produce somewhat more subjective results. Whether this is desirable or not depends in

part upon the degree to which a critic feels flexibility is an advantage.

An illustration of each of these treatments may be of aid in clarifying their differences. Assume that the public utility whose financial data appears in Table 17 wishes to determine the rates which would result if it chooses to use a liberalized depreciation method instead of the straight line depreciation used in computation of the data. What changes in the data and consequently in the rates charged to consumers would result?

Assume the data shown is constant from year to year except for:

1. Actually paid federal income tax which will be less during the early years in which accelerated depreciation is applied, and more in the later years.

2. Deferred federal income tax which will be the difference between actually paid federal income tax and line 13 of Table 17.

3. Reserve for deferred federal income tax which will be an accumulation of the annual amounts of deferred federal income tax.

If use of a liberalized depreciation method results in a $6 million reduction in federal income taxes paid, treatment under each of the methods is as follows:

Flow Through Only actually paid income taxes of $13

million will be allowed in line 13. Allowed operating revenue, line 16, will be reduced by $6 million. This 4% reduction "flows through" to the present consumer in the form of a 4% reduction in rates. In subsequent years, if and when actually paid tax is higher, the increase is borne by the future consumer.

Normalize

a. No change in rates. "Normalized" tax of $19 million is allowed in line 13. Deferred taxes accrue in a surplus or reserve account. In subsequent years, if and when actually paid taxes are higher the difference is taken from the surplus or reserve account.

b. Same as above except that rate-base, line 6, is reduced by the accumulated tax deferral, $6 million this year. Via allowed net operating income this reduction (6% of $6 million = $360,000) affects operating revenues resulting in savings apparently to be passed on to the consumer, of 0.24%. The accumulation of tax deferral can be expected to produce further rate decreases for a number of years until the accumulation begins to decline. The effects upon present consumer, future consumer, and stockholder are indeterminate.

c. Same as a, except that the accumulated tax deferral is considered as interest-free capital in line 12. The immediate effect of such treatment is not clear. Much flexibility in interpretation is available. If the addition

of $6 million interest free capital means that a newly computed return on common stock of 10.39% is no more than adequate, rates will be unchanged, and effectively c is identical to a. On the other hand if the $6 million interest-free capital means an amount on which 10% return is not to be applied, then via allowed net operating income, the allowed operating revenue would be reduced by $600,000 and a decline in rates of 0.40% would be the result. This latter interpretation would be less beneficial to the stockholder and more beneficial to the present consumer than b above.

In either b or c above the accumulation of deferred federal income tax after a number of years can become large relative to the annual amount of same. Inspection of Table 17 reveals that either of the treatments will result in lower rates to the consumer than those calculated under the "flow through" treatment when the ratio of accumulated deferred federal income tax to annual deferred federal income tax becomes large. For b this ratio is $\frac{1}{\text{Rate-Base-Rate-of-Return}}$ generally, or 16.7 for the example in Table 16. For c the ratio is $\frac{1}{\text{Accepted yield on common stock}}$ generally, or 10.0 for the same example.

Table 17. Arithmetic of the rate-making process.

Step 1a	Balance Sheet data may be rough guide to Rate-Base.
Step 1b	Above data is at original cost. Court or commission generally gives due consideration to reproduction cost, reviews each component, then establishes Rate-Base of date X.
Step 2a	Rate-Base-Rate-of-Return is usually established as 6-8%.
Step 2b	Multiplication of (6) by (7) yields: Allowed Opera
Step 2c	Check to determine whether distribution yield is sufficient to Common. Range accepted is generally 8-15%. Return to Common in (11) is 10.0%.
Step 3	Use Reversed Income Statement to determine Allowed Operating Revenues of date X. Review each expense item.
Step 4	Establish rates among classes of service necessary to produce Allowed Operating Revenues. This is generally done by company, subject to Commission approval.

[a]See accompanying pages.

nay be -Base.	Gross Plant (Incl. working cap.) Depreciation Reserve Net Plant
iginal cost. generally gives reproduction component, then se of date X.	Gross Plant Depr. Reserve Rate-Base
eturn is usually	R-B-R-O-R

5) by (7) yields: Allowed Operating Income

whether distribu- cient to Common. nerally 8-15%. (11) is 10.0%.	Bonds--$200 million @ 4½% Preferred Stock--$40 million @ 5% Available to Common--$160 mil. @ ? Interest-free Capital--0 Allowed Net Operating Income
Statement to erating Revenues each expense item.	Allowed Operating Income (8) Federal Income Tax Depreciation Expense Other Operating Expenses Allowed Operating Revenue
g classes of produce Allowed This is generally ject to Commission	Residential 2 billion KWH @ $0.025 Commercial 2 billion KWH @ $0.020 Industrial 4 billion KWH @ $0.015 Allowed Operating Revenue (16)

	Millions of $	Line number
working cap.)	500	(1)
ve	100	(2)
	400	(3)
	270	(4)
	120	(5)
	450	(6)[a]
	.06	(7)
	27	(8)
n @ 4½%	9	(9)
40 million @ 5%	2	(10)
n--$160 mil. @ ?	16	(11)
tal--0	0	(12)[a]
rating Income	27	
Income (8)	27	
	19	(13)[a]
se	16	(14)
penses	88	(15)
ng Revenue	150	(16)
ion KWH @ $0.025	50	(17)
on KWH @ $0.020	40	(18)
on KWH @ $0.015	60	(19)
ng Revenue (16)	150	

COMMISSION POLICY: DOES IT PLAY A ROLE IN THE SELECTION OF A DEPRECIATION METHOD?

As noted earlier, the purposes of this study include determination of regulatory commission policy on liberalized depreciation, and investigation of its effect, if any, on the depreciation policies of regulated firms.

Regulatory commission policy has been indicated in at least three ways:

1. Surveys distributed directly to commissions asking specifically for a statement of their policies regarding the handling of tax savings resulting from use of the liberalized depreciation methods. This type of survey has been conducted by the National Association of Railroad and Utilities Commissioners (19, 69th, pp. 185-186), and more recently by D. L. Griffen and is reported in Table 18 in columns N and G, respectively.

2. Published state commission actions, particularly where the actions have been upheld in court proceedings. These are reported, in part, in column P.

3. Surveys distributed to utility firms asking specifically for a statement of commission policy regarding the handling of tax savings resulting from use of the accelerated

Table 18. State commission policy on treatment of taxes deferred by reason of liberalized depreciation[a].

	N[b]	G[c]	P[d]	S[e]		N	G	P	S
Alabama				2,3	Montana				
Alaska					Nebraska	3	1		
Arizona	4	4			Nevada	3	3		
Arkansas	3				New Hampshire	1	1	1	1
California			1	4	New Jersey	2,3	1	1	1,2
Colorado	2	2			New Mexico	2,3	2,3	3	
Connecticut	1	1		4	New York	4			4
Delaware	1				N. Carolina	1	4		4
D. C.		4			North Dakota	2,3	4	1	4
Florida	2	2		2,3	Ohio	3	3	3	3
Georgia	3	3	3	3	Oklahoma		2,3	2,3	
Hawaii		3			Oregon	4	4		
Idaho	3	2,3			Pennsylvania	1	1	1[f]	1
Illinois	3		3	3	Rhode Island				4
Indiana	2		3[fg]	3	S. Carolina	3			
Iowa	2			3	South Dakota	4	4		
Kansas	3		3[h]		Tennessee	1	1		
Kentucky			3[i]	2	Texas				
Louisiana	3	3	3[j]		Utah	4	4		
Maine		1	1[f]		Vermont	4	4		3
Maryland	2			4	Virginia	2	2		3
Massachusetts	3	3		3	Washington	4	4		
Michigan	3	3	3[h]	3	West Virginia		2,3	1	3
Minnesota					Wisconsin		3	3	3
Mississippi	4	4			Wyoming	2	3	3	
Missouri	3	3	1[k]	3					

[a]Key: 1 = Tax saving allowed to "flow through" and affect earnings; 2 = "Normalize" tax savings by credit to Restricted Surplus; 3 = "Normalize" tax savings by credit to a Special Reserve; 4 = No policy established by commission.

[b]Column N = NARUC survey (19, 69th, pp. 185-186).

[c]Column G = Griffen, D. L. Assistant Professor of Industrial Engineering, Iowa State University, Ames, Iowa. Survey information on commission policy. Private communication. 1959.

[d]Column P = Published state commission action. (See 19, 70th, p. 422.)

(Footnotes continued on next page.)

depreciation methods. This type of survey has been made by the author and is reported as column S in the table.

A minor variation in commission policy exists in the accounting for "normalized" taxes. In some states it is credited to a restricted surplus while in others it is credited to a special reserve. The accountants do not regard this problem as a small one, nor is there a consistent attitude toward it, witnessed by (37, p. 871):

> Whether tax deferrals should be charged to expense and credited to a reserve account, or whether they should be credited to restricted surplus, was by far the most important part of the discussion which occupied an entire days hearings, September 17, 1957, before the FPC. It was the position of the natural gas companies, in general, and of F. M. Beatty, in particular that crediting the reserve account should be mandatory and not optional. Beatty, representing the accounting firm of Arthur Andersen and Co., stated the argument this way: ". . . we feel the right to deduct depreciation under our present law is a valuable right and when this right is being used up, the cost of doing so

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(Continued)

[e]Column S = Survey by G. W. Smith.

[f]Commission action in rate case upheld in court proceeding.

[g]On December 24, 1957, restricted surplus treated was revoked and deferred tax account was prescribed.

[h]Deferred tax treated as interest free capital in finding rate of return.

[i]Reserve deducted from rate base.

[j]Applicability of order to accelerated depreciation is not entirely clear.

[k]Commission referred to prior accounting orders permitting normalization but did not specifically revoke them.

> should be reflected in the accounts of the company--in order to match the tax benefits resulting from higher depreciation with the costs that create such benefit. The utilization of such rights is what happens when a company elects to take more depreciation for tax purposes than it records on the books.
>
> . . . Certainly it should not be optional as to whether or not you record a cost, and such optional treatment can only be confusing to the readers of the financial statements and result in an overstatement of earnings in those cases where the cost is not recognized."
>
> Replying to Beatty, A. J. G. Priest, on behalf of the Edison Electric Institute, pointed out that the electric utilities have no objection to the use of the reserve method if that is the one natural gas companies prefer. He contended however that the restricted surplus technique is just as consistent with sound accounting principles. He also gave evidence to his statement that the weight of opinion in the accounting profession is against the position taken by Beatty. He also noted that the firm of Price, Waterhouse, & Company had submitted a statement to the FPC indicating that of 30 regulatory commissions submitting rulings on tax that the treatment therein of tax savings were about equally divided between the Reserve and Surplus methods. The arguments stemmed from the desire of the FPC to enforce the adoption of the reserve method of treating the tax saving.

Further discussion of the advantages and disadvantages of the various treatments is contained in (3, 4, 6, 7, 8, 9, 10, 20, and 22) a number of articles. An excellent discussion of the treatments is given by the National Association of Railroad and Utilities Commissioners (19, 70th, pp. 413-445).

Two surveys of the practices followed present an interesting comparison since one is a survey of industry use,

and the other is a survey of state regulatory commission policy. The survey by F. M. Beatty (7, p. 34) was tabulated from 175 stockholder reports for the year 1956:

No disclosure	20
Accelerated depreciation not used	2
Credit to deferred tax	89
Credit to appropriated surplus reserve	4
Credit to accrued taxes	12
Credit to reserve for depreciation	4
Credit to surplus, appropriated or restricted	27
Credit to income	17

Greater detail of the above is available in the source indicated.

A survey by the Federal Power Commission and reported by the National Association of Railroad and Utilities Commissioners (19, 69th, p. 185) (and also reported in 2, p. 954) is summarized below:

Tax saving and expenses reduced	6
*Tax deferred credited to restricted surplus	10
*Tax deferred credited to a special reserve	16
No policy on deferred taxes	8

*Three states have duplicate listings here.

The variance of regulatory policy can be seen in the foregoing. Even for the firm operating in a state where

clear policy exists there are problems; one of these is the regulation of stockholder reports with regard to the liberalized depreciation matter.

On December 31, 1958, the Securities and Exchange Commission issued (see 19, 71st, p. 237) a "Notice of Intention to Announce Interpretation of Administration Policy". The proposed statement will prohibit the designation of accumulated tax credits as earned surplus, or its equivalent, or as a part of equity capital, regardless of whether disclosure is contained in footnotes or in the certificate of the accountant. This prohibition would apply whenever the amounts involved are material. The usual tests of materiality are 5%. A study by Goodbody and Company indicates (see 24, p. 405) that the great majority of electric utilities have tax benefits averaging more than 10% of the total per share common stock earnings. The proposed statement also requires that current income be charged with an amount equal to the tax reduction in order that its income be not overstated in earlier years and understated in later years. In April of 1959, the Securities and Exchange Commission held two days of hearings in which the widely divergent views upon the proposed statement were presented.

The variance of regulatory policy and accounting methods, the close control of stockholder reports, and the more cumbersome arithmetic of the liberalized methods have by no

means aided the popularity of the new methods. In addition the regulated firms in "flow through" states are in a position to lose much and gain nothing. The general position of the regulated firm in this respect is perhaps best expressed by an executive who writes:

> However some State Commissions, in determining the rates that a utility can charge its customers, are insisting that only actually paid taxes can be considered in the income statements . . . the present consumer gets the benefit of the tax deferment, and the utility gambles that the Commission will permit rate adjustments when the deferment has run out.

The regulated firm cannot divorce the rate-making question from the federal income tax question. If the regulated firm chooses a liberalized depreciation method subsequent to a rate proceeding, it by no means escapes the problems of rate-making. In Pennsylvania Public Utility Commission v. Peoples Natural Gas Company, the Commission states (21, 17PUR 3d, p. 359):

> . . . first, . . . the utility is on notice of the commission's position in the Manufacturers' (Heat and Light) case that minimization of taxes by way of acceleration of depreciation constitutes a tax saving, not a tax deferral, which must enure to the benefit of the consumer. Secondly, any action of the utility in the exercise of the option would be reflected in its annual report. The reflection of excessive earnings could lead to commission investigation of rates.

With a position so firm and clear it is surprising to find that even in the "flow through" states there are some regulated firms which have adopted the liberalized methods.

The experience of Bangor Hydro-Electric Company provides at least a partial answer to the question of why utilities may adopt liberalized depreciation methods even in states advocating the "flow through" policy. The Maine Public Utility Commission in a finding dated December 30, 1958 (21, 26 PUR 3d, pp. 489-496), held that failure of the company to use accelerated depreciation in the test year constituted an abuse of managerial discretion which would place an unfair burden upon its customers. The Commission proceeded to compute revenue requirements to reflect use of accelerated depreciation even though the company had used the conventional computation of depreciation. The company had, as a matter of fact, reverted to the straight line method following an earlier decision of the Maine Commission (see Central Maine Power Company, 21, 17 PUR 3d, p. 452). One of the three commissioners dissented in the decision, saying that the action was contrary to the inherent rights of management and beyond the legal scope of the commission.

Stanley (24, p. 410) reports that the New York Commission presents a similar intention, and notes that chief executives and top officers of utilities operating in states where such conditions prevail might subject themselves to personal liability from suits of stockholders if they fail to adopt liberalized depreciation methods. Commissioner Spencer B. Eddy of the New York Commission has probably relieved some

of the anxiety in stating (19, 71st, p. 468):

> There will be no penalty for companies which continue to use straight line depreciation for tax purposes.

In this respect, apparently the New York policy differs from that of Maine.

The case of Maine is extreme; though the threat of enforced adoption of liberalized methods has been made elsewhere, the threat has not been carried out. For the most part regulatory influence has been more subtle.

The influence of the rate-making policies of regulatory commissions upon the utility's decision to (not) adopt a liberalized depreciation method for federal income tax purposes can be shown in a number of ways. In Appendix A it can be seen that commission policy can encourage a utility (see limitations as to size, type, and locale) to forego the intended benefits of liberalized depreciation. This was shown by comparing the percentage of utilities adopting liberalized methods in states grouped according to commission policy. In states where either the "flow through" or "other" policies are followed, a smaller percentage (statistically significant at the 95% confidence level) of firms have adopted liberalized depreciation methods, when compared to the firms where the policy is to "normalize" depreciation charges for rate-making purposes.

The author's survey results as to the percentage of

utility firms adopting liberalized depreciation methods for federal income tax purposes, about 73%, may be compared to the results of a study by Goodbody and Company (see 24, p. 406) in which 78% of 110 electric utilities indicated use of the liberalized methods.

More specifically the survey reveals six states in which a significantly (95% confidence level) smaller percentage of utility firms use liberalized depreciation methods. The response of utilities within these states, to the question of whether or not a liberalized depreciation method is used for federal income tax purposes was:

State	Yes	No
California	2	4
Minnesota	0	4
Missouri	2	4
North Carolina	0	4
Pennsylvania	4	10
Wisconsin	4	5

The above responses were compared with the responses of the industrial firms of all states, assuming such to be a representative sampling of the unregulated population.

In response to the question "If you do not use either SOYD or DDB for federal income tax purposes, why not?" 16 of the 29 responding utilities blamed commission policy, lack of policy, or uncertainty as to the application of policy.

Still further evidence of the influence of commission policy exists in the public record of at least four companies which abandoned the liberalized depreciation methods coincident or nearly so with rate proceedings:

1. Housatonic Public Service Co., Docket No. 9515 (21, 22 PUR 3d, p. 2) January 22, 1958, in Connecticut.

2. Raytown Water Co., Case No. 13,773, March 20, 1958, in Missouri (21, 22 PUR 3d, p. 556).

3. Cumberland and Allegheny Gas Co. (21, 28 PUR 3d, p. 99), in Maryland and West Virginia.

4. Equitable Gas Co. (21, 25 PUR 3d, p. 535), in Pennsylvania.

Three of the utilities surveyed, not including the above, also have reverted to the straight line methods. Five of the utilities surveyed have "split" policies; that is, for property located in "normalize" policy states a liberalized method is used and where property is located in a "flow through" or "other" policy state, liberalized methods are not used. Because the responders to the survey have been assured that their replies will be held confidential, the names of these eight firms cannot be revealed.

By way of summary, the evidence supporting the contention that "Regulatory rate-making policy can discourage a utility from adopting a liberalized depreciation method for federal income tax purposes" is as follows:

1. Utilities in "flow through" (or "other") policy states have adopted liberalized methods in a smaller percentage (statistically significant at the 95% confidence level) of cases than have utilities in "normalize" states.

2. Utilities in six states when analyzed on a state-by-state basis were found to have adopted liberalized depreciation methods in a smaller percentage (statistically significant at the 95% confidence level) of cases than have the industrial firms of all states.

3. Sixteen of 29 utilities explain their non-use of liberalized methods by blaming commission policy, lack of policy, and uncertainty as to the application of policy.

4. At least seven utilities have abandoned liberalized methods coincident or nearly so with rate proceedings.

5. At least five utilities have "split" policies, using liberalized methods for properties located in "normalize" policy states, and conventional methods in "flow through" and "other" policy states.

SUMMARY AND CONCLUSIONS

In 1954 Congress authorized certain revisions to the federal income tax regulations including allocation of depreciation by newly-approved "liberalized" methods. The intent of Congress was to stimulate new investments toward modernization by means of the tax savings resulting from use of the liberalized methods.

"Tax Savings" have been the cause of controversy, and especially for the regulated public utility. Whether these savings are temporary or permanent, whether the eventual result will be a gain, deferral, or loss, and the magnitude and timing of such are all dependent upon the following factors:

1. Mortality dispersion of the property units.

2. Average service life of the property units.

3. Rate of growth or decline (if any) in the value new of property units in service.

4. The future course of the taxpayer's marginal income tax rate.

5. Taxpayer's method of grouping property accounts: by unit, vintage group, continuous group, continuous classified group, or continuous composite group.

6. Taxpayer's method of allocating depreciation: straight line, sum-of-the-years-digits, double declining balance, or other.

Even though ultimate gain, deferral, or loss is dependent upon all of the preceding factors, the compound interest concept, the trend in the rate of growth of utility firms, and the trend in federal income tax rates lend strong support to the conclusion that for firms adopting one of the liberalized depreciation methods, the chances of a permanent gain are much greater than the chances of a deferral or permanent loss.

There has been keen interest in the "new" methods, particularly as they are or are not applied by public utilities. The industrial firm which elects to use a liberalized depreciation method can distribute, at its own discretion, the consequential gain or loss among its present and future consumers, employees, and stockholders; this discretion may be influenced by decisions and policies of competing industrial firms and more generally by the competitive system. The regulated public utility finds the discretion (as to how to distribute the gains or losses resulting from use of liberalized depreciation methods) lies largely with the regulatory bodies. The regulation varies from state to state and hence, so does the distribution of gain or loss among present and future consumers, employees, and

stockholders.

Policies of the various regulatory bodies, with regard to the rate-making treatment of liberalized depreciation, can be classified into three groups:

1. The "flow through" policy as used in Pennsylvania where only the actually paid federal income tax is allowed in rate determination.

2. The "normalize" policy as used in Ohio where actually paid federal income tax plus the amount required to "normalize" earnings is allowed in rate determination.

3. Other policies not described above such as those of regulatory bodies which have exhibited no clear-cut policy, have been revising policies, or have not stated their policy. California is somewhat typical of the states in this group.

Evidence to support the contention that "Regulatory rate-making policy can discourage a utility from adopting a liberalized depreciation method for federal income tax purposes" comes from several sources including a survey by the author (see Appendix A) which show that:

1. Utilities in the "flow through" (or "other") policy states have adopted liberalized depreciation methods in a smaller percentage (statistically significant at the 95% confidence level) of cases than have utilities in the "normalize" policy states.

2. Utilities in California, Minnesota, Missouri, North

Carolina, Pennsylvania, and Wisconsin, when analyzed on a state-by-state basis were found to have adopted liberalized depreciation methods in a smaller percentage (statistically significant at the 95% confidence level) of cases than have the industrial firms of all states.

3. Sixteen of 29 utilities explain their non-use of liberalized methods by blaming commission policy, lack of policy and uncertainty as to the application of policy.

4. At least seven utilities have abandoned liberalized methods coincident or nearly so with rate proceedings.

5. At least five utilities have "split" policies, using liberalized methods for properties located in "normalize" policy states, and conventional methods in "flow through" and "other" policy states.

It should be noted that the author's survey was limited to firms whose:

1. 1957 annual operating revenues (sales) were in excess of $3 million.

2. Revenues (sales), at least in part, were derived through the sale of their product or service within the United States, including the new states Alaska and Hawaii.

The survey of utility firms was further limited to electric and gas distributing firms.

Other results of the survey include the following findings:

1. About 75% of the 95 responding industrial firms and about 73% of the 219 responding electric and gas distributing utility firms use a liberalized depreciation method when computing depreciation allocations for federal income tax purposes.

2. No relationship was found between the size of a firm (as measured by annual operating revenues) and (a) response rate, or (b) the decision to adopt a liberalized method.

The long run effect of a regulatory body decision to adopt the "flow through" policy or to fail to adopt a clear-cut policy is to take away from both consumer and stockholder what may and probably will be a real cash benefit. Even the employees can be ultimately affected to the extent that their wages and working conditions are related to the relative success of their employer.

It is ironic that the majority of persons affected, stockholders, consumers, and employees, are residents of the very state which supports the action of its regulatory commission. In Pennsylvania, for example, what is the ultimate result of the commission's "flow through" policy? Instead of passing benefits on to the present consumer, as proponents would argue, it in fact denies the probable benefits of liberalized depreciation in most cases. Of the 14 Pennsylvania utilities surveyed, only four use liberalized depreciation. If this is a reasonable estimate of the usage by all

Pennsylvania utilities, then in 71% of the cases the probable benefits of liberalized depreciation are denied all of the groups concerned, in order that in the remaining 29% of cases the immediate benefits may be distributed solely to the present consumer. This reality can hardly be consistent with any "best interests of the people of the state" motive. Defense, if any, of existing policy at a practical level could only take the highly dubious standpoint that denial of a probable benefit to the utility would produce higher tax revenues for the United States Treasury and thereby benefit the country as a whole. Unfortunately this is inconsistent with the aims of Congress in enacting the 1954 tax law revisions.

It is apparent that in a number of cases the policies of state regulatory commissions should be reviewed and revised so as to no longer discourage utility firms from using liberalized depreciation methods. This is particularly true in California, Minnesota, Missouri, North Carolina, Pennsylvania, and Wisconsin. Although the survey fails to reveal a statistically significant smaller percentage of firms adopting liberalized methods in any of the other states, the observed percentage is low enough (50% or fewer) to warrant review, if not revision of commission policy in the District of Columbia, Kansas, Maryland, New Mexico, North Dakota, Rhode Island, Utah, Virginia, and Wyoming. Because the

foregoing states exemplify all three of the major types of commission policy, it should be clear that the review and revision must include not only commission policy, but also clear-cut definition and example in the application of policy. The need for interchange of information and experience, coupled with the need for more consistency than presently exists, suggest that a group effort, particularly that of the National Association of Railroad and Utilities Commissioners, will be required to improve the present status of policies on liberalized depreciation. The cooperative efforts of utilities and commissions in bringing about changes is required; it seems these changes should produce rate-making policies which are:

1. Designed so as to avoid discouraging a public utility firm from adopting a liberalized method for the computation of depreciation for federal income tax purposes.

2. Clearly defined and consistently applied.

3. Reasonable in the distribution of the gains or losses resulting from use of liberalized methods; the groups which must be considered are the present and future consumers, stockholders, and employees.

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APPENDICES

APPENDIX A

Surveys, reports, and personal communications cited earlier demonstrated considerable interest in liberalized depreciation, particularly as it applies to public utilities. For this reason the author, in July of 1958, began a study of public utility and industrial firms located within selected states. The results of this preliminary study indicated that a nationwide survey would be of value in further developing the central issue, liberalized depreciation. The preliminary study was also of considerable value in determining the classes of firms to which survey questionnaires should be distributed. Two limitations were introduced:

1. The survey was limited to firms whose 1957 annual operating revenues were in excess of $3 million and to firms whose revenues, at least in part, were derived through the sale of its product or service within the United States, including the new states, Alaska and Hawaii. These limitations were introduced because:

a. The intent is national, not international distribution.

b. Earlier study by the author indicated a considerably lower rate of response for firms having annual operating revenues of less than $3 million.

c. The smaller firms are more difficult to trace. Some are closely controlled and do not report financial data to the usual sources; this makes the gathering of information such as address and revenues, more difficult to obtain.

d. While the addition of smaller firms to the survey might add, say 40% to the number, their addition to the total dollars represented might add only 3 or 4%.

e. Selection of depreciation method for the smaller firms may be based on somewhat different factors, since there is:

(1) Less at stake

(2) An inclination toward the status quo

(3) A less specialized staff to aid in technical problems of accounting. In fact, some of the smaller firms may find the gain from use of liberalized depreciation methods is more than offset by increased costs in accounting and rate-making.

f. The problem of weighting is relieved to some degree. The ratio of largest to smallest firm, in terms of annual operating revenues is 170 to 1, rather than, say 17,000 to 1. While this is by no means a solution to those who feel responses ought to be weighted in terms of dollars, rather than firms, at least the magnitude of the problem is

reduced.

2. The survey of utility firms was limited to electric and gas distributing firms for several reasons:

a. In most cases, railroads, airlines, and gas pipeline companies operate in more than one state and are centrally regulated by a federal rather than state body in their depreciation practices.

b. The telephone, telegraph, and water industries are each dominated by one firm, the decision of each, when weighted in dollars, would far outweigh the combined dollar weighting of all competitors.

c. A growing number of street railway and intra-city bus lines are not privately owned. Even those which are in many cases have financial problems which may be dominant factors in the decisions as to depreciation practices.

It was the author's original intent to survey all utility firms meeting the preceding limitations of size, type, and locale. The survey did not achieve this aim. Some holding companies and some utilities operating in more than one state were not surveyed because:

1. Holding companies and controlling companies presented various means of response. Some could only give a composite response for their entire operation which might include four or more subsidiary firms. With others the opposite was true; responses were separated by the particular

subsidiary.

2. Some firms operate in more than one state. Some could give responses on a state by state basis as was necessary for classification purposes. Other firms had a dominant portion of their operations confined to a single state and were so classified.

The list and addresses of utility companies surveyed was obtained from Moody's (15, 1958). Of the 221 utilities surveyed, 151 are also listed by the Federal Power Commission in Statistics of Electric Utilities in the United States (31) and/or Statistics of Natural Gas Companies (32). The companies listed by the Federal Power Commission, but not contacted in the survey were eliminated for one or more of the following reasons:

1. Annual operating revenues were less than $3 million in 1958.

2. Company is a part of another utility company, either holding or operating.

3. Company is a natural gas pipeline rather than distribution company by definition of the Federal Power Commission.

4. Company operations encompass too many states to adequately relate their policy to a specific regulatory commission.

Sixty-nine utilities not listed by the Federal Power

Commission were included; 61 of these are natural gas distributing companies which have only intra-state operations and do not report to the Federal Power Commission.

Based on the compilations made by Moody's (15, 1959, pp. a87-a95) and the Federal Power Commission (31 and 32) the author estimates that the 221 utilities surveyed represent no less than 85% of the utility firms meeting the preceding limitations as to type, size, and locale.

The 120 industrial firms contacted in the survey were selected by use of a table of random numbers which was then used with Moody's index (14, 1958, p. xi). Where firms, because of subsidiaries or other names, were listed more than once, only the parent company number would cause the firm to be contacted. Only about one in six numbers provided the name of a company meeting the limitations of size and locale. On the basis of the company name drawing experience (yield = 120 out of 711 = 16.9%) and the total number of firms listed (14,609), it is estimated that there are (16.9% of 14,609 = 2,469) about 2,500 industrial firms of the specified size and locale. From this it is estimated that the survey of 120 industrial firms was distributed to slightly less than 5% of the indicated population.

The questionnaire distributed to utility firms was somewhat different than that distributed to the industrial firms. The questionnaire and accompanying letters appear on the

pages which follow.

The questionnaires were distributed to 221 utility firms and 120 industrial firms. Replies were received from 145 utility firms and 57 industrial firms.

Since all of the questions of policy other than the question of using liberalized depreciation were "riders" in a sense, all follow-up efforts were directed solely to the question of whether or not, for federal income tax purposes, a firm was using a liberalized depreciation method. By reducing the scope of the follow-up questionnaire it was hoped that the response rate would be improved. This proved to be true.

Before distributing a follow-up questionnaire, the financial statements of the non-responders appearing in Moody's (15, 1958) were investigated. Notes to the financial statements of 29 utility firms made clear whether or not the liberalized methods were being used. This left a total of 47 utilities and 63 industrials for which no response was yet available.

The follow-up questionnaire was simply a single sheet containing both letter and question. Self-addressed envelopes were provided. The follow-up questionnaire appearing on page 122 was distributed to the 110 utility and industrial firms for which no response had yet been obtained.

The follow-up questionnaire was responded to by 45 of

IOWA STATE UNIVERSITY
of Science and Technology
AMES, IOWA

Department of Industrial Engineering

Dear Sir:

I am conducting a survey of depreciation practices of industrial and public utility firms on a national basis. It is hoped that this survey will provide useful information and it is anticipated that the results of the survey will be submitted to a journal such as Public Utilities Fortnightly for publication so that it may be of benefit to the industry as a whole.

The responses of individual firms are absolutely confidential; only the tabulated number of firms answering yes, no, etc., will ever be published. A code number on the accompanying questionnaire is provided to facilitate grouping of responses. Two copies of the questionnaire are enclosed, one for your file and one which you may return in the enclosed self-addressed envelope.

Your cooperation is greatly appreciated.

Yours truly,

G. W. Smith
Assistant Professor

GWS/jm

Encl.

QUESTIONNAIRE

A. General Information

1. List states in which your company has income producing operations.

2. Check type or types of services provided by your company.
   - ☐ a. Electric
   - ☐ b. Gas
   - ☐ c. Water
   - ☐ d. Telephone

3. What is the current annual operating revenue of your company.

   _____

B. Depreciation Data

1. Check depreciation procedure(s) used by your company.

Procedure Used	Rate Making	Federal Inc. Tax	Stockholder Report
a. Average Life	—	—	—
b. Unit Summation	—	—	—
c. Unit of Production	—	—	—
d. *Other (specify)	—	—	—

*No special notation regarding emergency 5 year write-off needs to be made.

2. Check depreciation method(s) used by your company for post-1953 additions.

	PURPOSE		
Methods Used	Rate Making	Federal Inc. Tax	Stockholder Report
a. Straight Line	—	—	—
b. Sum of Digits	—	—	—
c. Double Decl. Bal.	—	—	—
d. Interest (Sinking Fund)	—	—	—
e. Other (specify)	—	—	—

3. If you do not use either SOYD or DDB methods (see ques. B-2) in reporting depreciation for Federal Income Tax purposes, why not?

4. What technique(s) for estimating mortality distribution and/or company life tables are employed by the company?

__ a. Iowa-type Survivor Curves
__ b. Forecast method
__ c. Similated plant balance
__ d. Kimball's "h" system
__ e. Orthogonal polynomial
__ f. Gompertz - Makeham
__ g. Turnover method
__ h. Other (specify)

C. Capital Expenditures

1. Which technique of comparison do you use for new investments to answer the question, "Will it pay?"

__ a. Compare estimated "Rate of Return" with minimum as set by company policy of _____%.
__ b. Compare annual costs of alternatives
__ c. Compare the estimated "Pay-off" period with minimum as set by company policy of _____ years.
__ d. Compare adverse minimum as outlined in MAPI procedures by use of:
(1) MAPI chart
(2) Service-Life formula
(3) Gradient formula
__ e. Other (specify)

D. General

1. In what problem (s) of public utilities today can further research be of greatest aid? (Particularly in valuation, rate-making, regulation, pricing policies, depreciation, taxes, litigation)

QUESTIONNAIRE

A. General Information

1. List the state(s) in which your firm is principally engaged in its operations (such as manufacturing or mining).

B. Depreciation Data

1. Check the depreciation procedure(s) used by your company.

Procedure Used	Federal Inc. Tax	Stockholders Report
a. Average Life	_____	_____
b. Unit Summation	_____	_____
c. Unit of Production	_____	_____
d. *Other (specify)	_____	_____

*No special notation regarding emergency 5 year write-off needs to be made.

2. Check the depreciation method(s) used by your company for post-1953 addition.

Method Used	Federal Inc. Tax	Stockholders Report
a. Straight Line	_____	_____
b. Sum-of-Years-Digits (SOYD)	_____	_____
c. Double Declining Balance (DDB)	_____	_____
d. Interest (Sinking Fund)	_____	_____
e. Other (specify)	_____	_____

3. If you do not use either SOYD or DDB for federal income tax purposes, why not?

4. Annual charges to depreciation expense account for what % of your annual expenses? (Before Federal Income Tax)

C. Capital Expenditures

1. Which technique of comparison do you use for new investments to answer the question, "Will it pay?"

_____ a. Compare estimated "Rate-of-Return" with minimum as set by company policy of _____%.

_____ b. Compare annual costs of alternatives.

_____ c. Compare the estimated "Pay-off" period with minimum as set by company policy of _____years.

_____ d. Compute adverse minimum as outlined in MAPI procedures by use of:

(1) MAPI chart _____
(2) Service-Life formula _____
(3) Gradient formula _____

_____ e. Other (specify)

D. General

1. In what problem(s) of industrial firms today can further research be of greatest aid? (Particularly in replacement economy, depreciation problems, pricing policies, taxes, litigation etc., - <u>not</u> in the sense of product design and development.)

IOWA STATE UNIVERSITY
of Science and Technology
AMES, IOWA

Department of Industrial Engineering

Dear Sir:

I am completing a survey of depreciation practices of public utility and industrial firms which was begun some time ago. The sample provided in the earlier survey has proven adequate in number for all but one of the questions. That question requires a response rate of about 90% in order to determine statistically significant differences (if any) in the various groupings.

The responses of individual firms are absolutely confidential; only the tabulated number of firms responding yes, no, etc, will ever be published. A code number on this letter is provided to facilitate grouping of responses.

You may respond by simply checking yes or no at the bottom of this form and returning it in the enclosed envelope.

Your cooperation is greatly appreciated.

Yours truly,

G. W. Smith

G. W. Smith
Assistant Professor

Question: When computing depreciation charges for Federal Income tax purposes, does your firm ever use either of the "liberalized" methods (Sum-of-the-Years-Digits and Special Declining Balance) for properties purchased since January 1, 1954?

Yes ( )

No ( )

the 47 utilities and 30 of the 63 industrials. The responses regarding use (Yes) and non-use (No) of liberalized depreciation methods have been grouped in a number of ways and are shown in Tables 19 through 22.

Table 19. Two classifications of survey results for utilities by the size of firm.

1957 annual operating revenues in millions of dollars	No response	Yes	No
3 to 31.6	0	80	30
Exactly 31.6[a]	0	1	0
Over 31.6	2	78	30
Totals	2	159	60
1957 annual operating revenues in millions of dollars			
3 to 31.5		79	30
Exactly 31.5[b]		1	0
Over 31.5		79	30
Totals		159	60

[a]Median size of all utilities surveyed = $31.6 million.

[b]Median size of all utilities responding = $31.5 million.

The responses of the utility firms to the question of liberalized depreciation have been classified in Table 19 according to annual operating revenues. Table 19 provides insufficient basis for a relationship between (a) the size of

a firm, and (b) their decision on adoption of a liberalized depreciation method. The number of non-responders, 2, is so small that there is insufficient data with which to determine whether a correlation exists between size of a firm and its likelihood of responding to a questionnaire.

Table 20. Two classifications of survey results for industrials by the size of firm.

1957 annual operating revenues in millions of dollars	No response	Yes	No
3 to 24.9[a]	12	36	12
Over 24.9	13	35	12
Totals	25	71	24
1957 annual operating revenues in millions of dollars			
3 to 24.5		36	11
Exactly 24.5[b]		0	1
Over 24.5		35	12
Totals		71	24

[a]Median size of all industrials surveyed = $24.9 million.

[b]Median size of all industrials responding = $24.5 million.

The responses of the industrial firms to the question of liberalized depreciation have been classified in Table 20 according to annual operating revenues. Table 20 provides

insufficient basis for a relationship between (a) the size of a firm and (b) their decision on adoption of a liberalized depreciation method. The non-responders are too evenly distributed to provide a basis for determining whether a correlation exists between size of a firm and its likelihood of responding to a questionnaire.

Using Table 18 on page 88, one may group the states into three categories, according to state commission policy:

"Flow Through" policy:

1. Connecticut
2. Maine
3. New Hampshire
4. New Jersey
5. Pennsylvania
6. Tennessee

"Normalize" policy:

1. Colorado
2. Florida
3. Georgia
4. Idaho
5. Illinois
6. Indiana
7. Iowa
8. Kansas
9. Kentucky
10. Louisiana
11. Massachusetts
12. Michigan
13. Nevada
14. New Mexico
15. Ohio
16. Oklahoma
17. Virginia
18. Wisconsin
19. Wyoming

Policy not stated, not clear, under study, and other:

1. Alabama	14. Nebraska
2. Alaska	15. New York
3. Arizona	16. North Carolina
4. Arkansas	17. North Dakota
5. California	18. Oregon
6. Delaware	19. Rhode Island
7. D. C.	20. South Carolina
8. Hawaii	21. South Dakota
9. Maryland	22. Texas
10. Minnesota	23. Utah
11. Mississippi	24. Vermont
12. Missouri	25. Washington
13. Montana	26. West Virginia

The responses of utility firms have been grouped in Table 21 according to state commission policy as shown in the foregoing. Industrial firms are not regulated as to the handling of tax savings and are shown as the "No Regulation" group in Table 21.

For statistical analysis of the information presented in Table 21,

Let W = the number of "yes" responses

n = the number of responding firms

$p = \frac{W}{n}$ = the decimal ratio of "yes" responses to total responses

q = 1-p = the decimal ratio of "no" responses to total responses

Table 21. Classification of survey results for all firms by state commission policy.

Group number	State policy	Yes	No	% Yes
1	"Flow through"	22	13	62.86
2	"Normalize"	84	20	80.77
3	"Other"	53	27	66.25
4	"No regulation"	71	24	74.74
	Totals	230	84	73.25

N = the number of firms in the universe, within the defined limits of the survey.

And use the subscripts 1, 2, 3, and 4 to denote the group, so for example:

W_1 = the number of "yes" responses in group 1

And use the subscripts $_U$ and $_I$ for utilities and industrials, respectively.

It was estimated earlier that questionnaires were distributed to no less than 85% of the utility firms meeting the limitations of size, type, and locale. This same percentage may hold true for each of the three subgroups; in the interests of conservatism, let the estimate for any subgroup be taken as a minimum of 75%, for computation of variances of the subgroups.

This means:

$$0.75 \leq \frac{n_1}{N_U}$$

$$0.75 \leq \frac{n_2}{N_U}$$

$$0.75 \leq \frac{n_3}{N_U}$$

The sample of industrial firms was estimated as 5% of the appropriate population. For percentages this small, the sample size factor, $(1-\frac{n}{N})$, used in the computation of variance, is generally neglected. That procedure has been adopted here.

The variance of any of the groupings can be computed by the formula:

$$\text{Variance of } p = (1-\tfrac{n}{N})(\tfrac{pq}{n})$$

and so for group 1, 2, 3, and 4, respectively:

$$\text{Var. } p_1 = (0.25) \left[\frac{(0.6286)(0.3714)}{35} \right] = 0.001,667,59$$

$$\text{Var. } p_2 = (0.25) \left[\frac{(0.8077)(0.1923)}{104} \right] = 0.000,373,37$$

$$\text{Var. } p_3 = (0.25) \left[\frac{(0.6625)(0.3375)}{80} \right] = 0.000,698,73$$

$$\text{Var. } p_4 = (1) \left[\frac{(0.7474)(0.2526)}{95} \right] = 0.001,987,30$$

The groups may be tested for significant differences by the formula:

$$\frac{p_1 - p_2}{\sqrt{\text{Var. } p_1 + \text{Var. } p_2}}$$

The result is the number of standard deviations. When the result is $|1.96|$ the confidence level is 95%. Throughout the analysis, the 95% confidence level has been used to test for significant differences. It is a commonly used level and its basic meaning is that chances are 95 out of 100 that the hypothesis being tested could not have occurred by chance.

Compare groups 1 and 2:

$$\frac{p_1 - p_2}{\sqrt{\text{Var. } p_1 + \text{Var. } p_2}}$$

$$= \frac{0.8077 - 0.6286}{\sqrt{0.000,373,37 + 0.001,667,59}}$$

$$= \frac{0.1791}{0.045,177}$$

$$= \underline{3.96}$$

Since this value is greater than 1.96 the survey results in groups 1 and 2 are significantly different at the 95% confidence level. The confidence level obtained by using tables for the area under the normal curve is more than 99.99%.

Compare groups 2 and 3:

$$\frac{p_2 - p_3}{\sqrt{\text{Var. } p_2 + \text{Var. } p_3}}$$

$$= \frac{0.8077 - 0.6625}{\sqrt{0.000,373,37 + 0.000,698,73}}$$

$$= \frac{0.1452}{0.033,903}$$

$$= \underline{4.28}$$

Since this value is greater than 1.96, the survey results in groups 2 and 3 are significantly different at the 95% confidence level. The confidence level obtained by using tables for the area under the normal curve is more than 99.99%.

This same test fails to reveal significant differences in any of the other pairings of the four groups.

In Table 22 the responses of utility firms have been grouped according to state. The table is followed by analysis used to show a statistically significant difference in responses for some of the states.

Results of the survey of industrial firms indicate that about 75% of the non-regulated firms have adopted one of the liberalized methods of computing depreciation for federal income tax purposes. Using this response as an independent estimate of what utility response would be were it free of the influence of the regulatory body, the probability that a "yes" response will occur exactly W times in a state from which n responses were gained, is given by:

$$p(W) = \binom{n}{W} p^{W} (1-p)^{n-W}$$

where

$$\binom{n}{W} = \frac{n!}{W!\,(n-W)!}$$

The probability that the responses of the utilities of certain states could have resulted purely by chance is less than 0.05. These states are given in the following computations

Table 22. Classification of survey results for utility firms by state.

State		Yes	No	State		Yes	No
1.	Alabama	3	0	27.	Montana	1	0
2.	Alaska	--	--	28.	Nebraska	1	0
3.	Arizona	2	0	29.	Nevada	2	0
4.	Arkansas	2	1	30.	New Hampshire	1	0
5.	California	2	4	31.	New Jersey	7	0
6.	Colorado	3	0	32.	New Mexico	0	2
7.	Connecticut	5	2	33.	New York	12	0
8.	Delaware	1	0	34.	North Carolina	0	4
9.	D. C.	1	1	35.	North Dakota	1	1
10.	Florida	3	1	36.	Ohio	11	1
11.	Georgia	5	0	37.	Oklahoma	3	2
12.	Hawaii	2	0	38.	Oregon	4	0
13.	Idaho	1	0	39.	Pennsylvania	4	10
14.	Illinois	8	0	40.	Rhode Island	0	1
15.	Indiana	7	0	41.	South Carolina	1	0
16.	Iowa	5	1	42.	South Dakota	2	0
17.	Kansas	2	3	43.	Tennessee	3	0
18.	Kentucky	3	1	44.	Texas	7	3
19.	Louisiana	6	1	45.	Utah	0	2
20.	Maine	2	1	46.	Vermont	2	0
21.	Maryland	0	1	47.	Virginia	1	1
22.	Massachusetts	11	0	48.	Washington	3	1
23.	Michigan	8	0	49.	West Virginia	1	0
24.	Minnesota	0	4	50.	Wisconsin	4	5
25.	Mississippi	3	0	51.	Wyoming	1	2
26.	Missouri	2	4				
					Totals	159	60

of probability. For all other states the computed probability is greater than 0.05, hence a larger sample would be needed to show statistically significant differences (if they exist). For those other states, testing at the 95% confidence level fails to show statistically significant differences,

and therefore the computations are not given.

A statistically significant difference in the response of utilities operating in the following states is shown below:

Minnesota)
) both have 0 "yes", 4 "no" responses.
North Carolina)

$$p(0) = (0.25)^4$$
$$= \underline{\underline{0.0039}}$$

Pennsylvania has 4 "yes" and 10 "no" responses; the probability of no more than 4 "yes" responses is given by:

$$p(0,1,2,3,4) = (0.25)^{14} + 14(0.23)^{13}(0.75) + 91(0.25)^{12}(0.75)^2 + 364(0.25)^{11}(0.75)^3 + 1001(0.25)^{10}(0.75)^4$$
$$= 0.000,000,00 + 0.000,000,16 + 0.000,003,02 + 0.000,036,61 + 0.000,302,05$$
$$= \underline{\underline{0.0003}}$$

Wisconsin has 4 "yes" and 5 "no" responses; the probility of no more than 4 "yes" responses is given by:

$$p(0,1,2,3,4) = (0.25)^9 + 9(0.25)^8(0.75) + 36(0.25)^7(0.75)^2 + 84(0.25)^6(0.75)^3 + 126(0.25)^5(0.75)^4$$
$$= 0.000,004 + 0.000,103 + 0.001,236 + 0.008,652 + 0.038,933$$
$$= \underline{\underline{0.0489}}$$

California)
) both have 2 "yes", 4 "no" responses; the
Missouri)

probability of no more than 2 "yes" responses is given by:

$$p(0,1,2) = (0.25)^6 + 6(0.25)^5(0.75) + 15(0.25)^4(0.75)^2$$
$$= 0.000,244 + 0.004,395 + 0.032,959$$
$$= \underline{\underline{0.0376}}$$

Massachusetts has 11 "yes" and 0 "no" responses:

$$p(11) = (0.75)^{11}$$
$$= \underline{\underline{0.0422}}$$

New York has 12 "yes" and 0 "no" responses:

$$p(12) = (0.75)^{12}$$
$$= \underline{\underline{0.0317}}$$

In addition to the question of whether a firm was using one of the liberalized depreciation methods for federal income tax purposes, the survey questionnaire contained other questions of interest in the field of engineering valuation. As stated earlier, responses to the first questionnaire were received from 145 of 221 utilities and from 57 of 120 industrial firms. In some cases not all of the questions were answered while in other cases a firm has more than one response to a question. These survey results are given in Table 23.

For the question, "If you do not use either SOYD or DDB for federal income tax purposes, why not?" the responses for the utilities which do not use either method were as follows:

16 - Commission policy or uncertainty as to commission policy.

Table 23. Depreciation procedures indicated by 145 utility firms.

Procedure used	Purpose		
	Rate making	Federal income tax	Stockholder report
Average life[a]	136	137	133
Unit summation	4	4	4
Unit of production	7	7	8
Composite rate	3	4	3
Other - not specified	0	1	3
No response	4	2	5
Totals	154	155	156

[a]Includes "Remaining Life" procedure.

7 - Advantages doubtful - accounting cost would be higher.

3 - Methods merely defer liability.

1 - History of operating losses.

1 - 60-month amortization on most new properties.

1 - Present ratepayer gains while future ratepayer and stockholder loses.

11 - No response.

Many of the firms indicated they were still studying the possibility of using one of the liberalized methods. The responses from which the foregoing listing was obtained follows:

Table 24. Depreciation methods indicated by 145 utility firms.

Method used	Purpose		
	Rate making	Federal income tax	Stockholder report
Straight line[a]	129	39	127
Sum-of-the-years-digits[b]	1	33	1
Double declining balance[b]	3	73	6
Interest (sinking fund)	10	0	10
Composite	1	1	1
By order of SEC	1	0	1
Other - not specified	0	1	2
No response	4	0	2
Totals	149	147	150

[a]Thirty-nine utilities use only the straight line method for federal income tax purposes. Many of the firms using liberalized methods also use the straight line method for older properties; this latter group of firms is not included in the total of 39.

[b]Two utilities reported use of both the sum-of-the-years-digits and the double declining balance methods of computing depreciation for federal income tax purposes.

Studies are continuing, especially in relation to rate treatment by state regulatory authorities, and a final policy decision has not yet been made.

The Commission requires that taxes computed under these methods be utilized in the rate base for rate determination. Also we feel that the SOYD and DDB methods merely defer tax liability.

Chiefly because of the uncertainty of regulatory attitudes.

We subscribe to the theory that to take the immediate tax advantage only delays the ultimate day of reckoning and may result in difficult and costly inequities in future years.

Cash savings in the first few years were not sufficient to justify a change in method.

Under consideration for 1958 property additions.

Prefer not to defer tax and create delayed liability.

Questionable advantage and higher accounting cost.

We already have a favorable rate of depreciation for tax purposes; or lack sufficient records to identify retirements by years.

Uncertainty of consequences due to conflicting and unstable treatments by regulatory authorities.

Advantages are not commensurate with the risks associated with the uncertainties as to how the law will be administered. Studies are continuing.

Increased costs resulting from inflation produces pressures on both management and regulatory bodies to pass through to the customers the tax savings resulting from the use of either the DDB or SOYD methods. Because of this possibility the company does not use either of these methods. It does not propose to pass on to future generations costs which should be charged to the present generation.

Insignificant difference.

Because of a conflict in Commission rate-making practices.

Normalization of income taxes is not allowed for rate-making purposes.

Major capital additions installed by the company through 1958 were covered by necessity certificate permitting 60-month accelerated amortization. The company is giving consideration to the use of accelerated depreciation on major capital additions

in reporting depreciation for FIT, but no final decision has been reached.

The Commission does not allow normalization of accelerated depreciation.

Commission has not permitted normalizing of tax expense when accelerated depreciation is used.

Commission does not permit normalization of tax expense.

A Flow Through procedure is prescribed by the Commission.

We have used accelerated depreciation in the past. Due to the present thinking of our commission we are reverting to straight line depreciation in 1960.

For rate making purposes, regulatory commission considers only actual tax liability.

We have not felt the advantages offset the disadvantages, however, we are continuing to study this annually.

We are convinced that the immediate benefits will be passed on to current rate payers at the expense of the rate payers or the stockholders of the future.

The additional depreciation realized would not justify the additional expense involved in segregating the properties and maintaining a separate retirement record by years. Any change from SOYD for tax purposes has to be approved by the Commissioner of Internal Revenue.

Regulatory treatment not certain enough and benefits are problematical.

Regulatory treatment not clearly defined.

We are contemplating adopting the DDB method next year. A history of net operating losses has made earlier adoption of accelerated depreciation unwise.

Table 25. Techniques for estimating mortality distribution and/or company life tables indicated by 145 utility firms.

Number of firms	Technique employed
72	Iowa-type survivor curves
32	Forecast method
24	Similated plant balance
5	Kimball's "H" system
10	Orthogonal polynomial
3	Gompertz-Makeham
11	Turnover method
10	Judgment and/or expert estimates
13	Other (no more than two users each)
9	None used
20	No response

The responses of 145 utility firms to the question, "In what problem(s) of public utilities today can further research be of greatest aid? (Particularly in valuation, rate-making, regulation, pricing policies, depreciation, taxes, litigation)" are given below. The author has classified responses to indicate the frequency of comments about particular topics. A number of firms simply named topics from the list which followed the question:

Table 26. Capital expenditure techniques of comparison used by 145 utility firms.

Number of firms	Technique used
72	Compare estimated "Rate of Return" with minimum as set by company policy of ___%.
	Number of firms / Per cent used: 53 — 6-7; 6 — More than 7; 1 — "Various"; 12 — No response
46	Compare annual costs of alternatives.
21	Compare estimated "Pay-off" period with minimum as set by company policy of ___ years.
	Number of firms / Years used: 8 — 2-4; 2 — 5 or more; 2 — "Various"; 1 — Economic life; 8 — No response
0	Compare adverse minimum as outlined in MAPI procedures.
8	Capital expenditures are sometimes necessary even if they will not pay for themselves; the company then simply chooses the most economical method.
11	Other (no more than 2 users of each)
14	No response

Number of firms	Topic
12	Valuation
17	Rate making
13	Regulation
4	Pricing policies
13	Depreciation
15	Taxes
2	Litigation
36	No response

Many firms went into more detail of the problems which they felt were most urgent. These problems and the number of firms indicating such problems are given below:

15 - The need for regulatory authorities to recognize current replacement cost (or reproduction cost) or fair value in lieu of original cost in valuing utility plant for rate-base purposes.

14 - Problems of inflation including the preceding, the problems of attrition, capital exhaustion, and unfair depreciation allowances. Also the need for a higher rate of return due to inflation.

13 - Rate and amount of return adequate to secure new funds at the present cost of money.

12 - Economic depreciation, particularly with the rapid rise in replacement costs.

10 - Accelerated depreciation and amortization policies and problems for accounting, federal income tax, and rate-making purposes.

8 - Public versus privately owned utilities; unfair competition because of tax concessions, and unregulated nature of publicly owned utilities.

6 - Regulatory lag and delays. Citation of case pending four years.

5 - Property taxes too high as compared with industrial firms and publicly owned firms. The need for study of means of more equitable valuations.

4 - Cost allocation to the various classes of consumers and also to the various geographic areas.

4 - Salvage values; problems of estimation, current vs. ultimate, negative values, cost of retiring, and treatment of salvage values for regulatory and federal income tax purposes.

Other suggestions included the need for:

1. Improved price indexes.

2. Establishment of standards of procedure in valuation surveys. Where a large portion of a utilities property is underground there should be some acceptable basis for sampling.

3. Development of greater off-season loads.

4. Improved methods of regulation which will be faster

and cost less.

5. Pricing and other policies designed to improve load factor.

6. Cost control through electronic data processing or other means.

7. Financial policies: dividends, capital structure, etc.

8. Studies of the problems of future of new energy sources and consequent obsolescence of present utility plant.

9. Studies of service lives; bi-modal curves, comparison of smoothing retirement ratios, retirement frequencies, smoothing by eye, similated plant balance, etc.

10. Tabulation and statistics on rate-making decisions and handling of expense items.

11. Pricing policies--allocation of expense items between transmission and distribution companies.

12. Method of regulating natural gas producers.

13. Legal and traditional approaches are no longer realistic; there is a need for a better and up-to-date plan to prevent unrecouped losses.

14. Educating the public utility management, and state commissions on the subject of rate-making.

15. Method of valuation and development of formula to arrive at fair value of property.

16. Determination of Rate of Return in a manner to take

into account efficiency or inefficiency of management in operation of the business.

17. Formula for evaluating capital expenditures in inflationary times.

18. Study of the pricing of gas to distributor companies. Pipeline prices are among the most volatile in any industry.

19. Standards of service--peak, storage, etc., to be supplied.

20. Clarification of return, rate of return, and cost of capital problems, and eliminate confusion and misunderstanding as to the exact import and relationships.

21. Study of the effect of regulatory commission accounting requirements upon utility financial reports and securities as compared to industrial companies not required to comply with such requirements.

22. Review of the United States Supreme Court's decision in the "Memphis" case.

23. Public education in utility economics.

24. Study in the development of atomic power and its probable obsolescence effect on plant facilities now being used.

For the question, "If you do not use either SOYD or DDB for federal income tax purposes, why not?", the responses for the industrials which do not use either method were as

Table 27. Depreciation procedures indicated by 57 industrial firms.

Procedure used	Purpose	
	Federal income tax	Stockholder report
Average life[a]	52	52
Unit summation	3	3
Unit of production	2	2
Other - not specified	1	1
Totals	58	58

[a]Includes "Remaining Life" procedures.

Table 28. Depreciation methods indicated by 57 industrial firms.

Method used	Purpose	
	Federal income tax	Stockholder report
Straight line[a]	11	20
Sum-of-the-years-digits[b]	20	16
Double declining balance[b]	33	24
Totals	64	60

[a]Tabulated only where straight line method is used exclusively. Many of the firms using liberalized methods also use the straight line method for older properties; this latter group of firms is not included in the totals 11 and 20.

[b]Seven industrials reported use of both the sum-of-the-years-digits and double declining balance methods of computing depreciation for federal income tax purposes.

follows:

No response - 2

Volume of additions and new investments is not large enough to warrant a separate method of computation.

Depreciation expense represents such a small portion of total operating expense. However, recent action by IRS requiring salvage values on buildings as well as machinery has re-opened the question and we are currently considering changing to which ever method will allow us maximum deduction over the next few years.

Tax benefits gained in early stages would be lost in later years since replacement and obsolescence are not major factors in this particular industry.

Not enough to be gained over a period of a few years. Greater tax savings in the first few years could lead toward very little depreciation expense to be deducted in future years of possibly higher profits and also possibly higher taxes.

Prefer using one overall method; IBM setup.

Lack of consistency in depreciation provision between prior and subsequent 1954 capital expenditures.

We prefer to distribute our overhead costs evenly. SOYD and DDB results in uneven charges which benefit some years at the expense of others.

The responses of 57 industrial firms to the question, "In what problem(s) of industrial firms today can further research be of greatest aid? (Particularly in replacement economy, depreciation problems, pricing policies, taxes, litigation, etc., -- not in the sense of product design and development)", are given below. A number of firms simply named topics from the list which followed the question.

Table 29. Depreciation expense as a per cent of annual expenses for 57 industrial firms.

Depreciation expense / Annual expense	Number of firms
1-2%	3
2-3%	9
3-4%	9
4-5%	5
5-6%	2
6-7%	2
7-8%	2
8-9%	3
9-10%	1
10-11%	1
15%	1
No response	19
Total	57

Number of firms	Topic
6	Replacement economy
5	Depreciation problems
3	Pricing policies
8	Taxes
1	Litigation
27	No response

Table 30. Capital expenditure techniques of comparison used by 57 industrial firms.

Number of firms	Technique used
10	Compare estimated "Rate of Return" with minimum as set by company policy of ___%.
	Number of firms / Per cent used: 2 / Varies; 2 / 10; 3 / Over 10
20	Compare annual costs of alternatives.
17	Compare the estimated "Pay-off" period with minimum as set by company policy of ___ years.
	Number of firms / Per cent used: 4 / Varies; 2 / 2; 2 / 3; 2 / 5; 2 / 10 or more
3	Compute adverse minimum as outlined in MAPI procedures.
4	Other (no more than one user of each).
14	No response

Some firms went into more detail of the problems which they felt were most urgent. These comments follow:

Economic Depreciation

Capital Replacement

Realistic Replacement Depreciation

Revision of Bulletin F

Replacement economy as affected by government controls.

Organization

Management practice

Personal development

Avoidance of internal politics

Standard treatment of depreciation by the various states in determining state income tax liability.

Practical evaluation of expenditures for new facilities.

Pricing problems, particularly ill-conceived "loss leader", liquidation, or "break-in" prices which tend to reduce whole markets to marginal levels.

Need for a more realistic pricing policy which takes into account probable future costs of replacement at an amount significantly higher than costs incurred in prior years.

Reduction of tax rates to provide greater incentive for risking investment capital.

How to accurately and readily determine the proper time to replace machine tools with a maximum of benefit to the company and a minimum of time and effort.

Development of pricing policies that will maximize profits while being competitive.

Development of University courses, which will come closer to executive training for those students who will enter the business field, rather than specialization in particular fields of business.

State taxation of interstate commerce. For instance, in New York state the sales factor of the three factor allocation formula is based on where the merchandise is applied to the order. In most other states sales are based on destination. Therefore a manufacturing corporation selling from New York into California is taxed twice on the same sales.

There is too little known or published on the replacement life of equipment in a world of creeping inflation.

Financial reporting versus cost accounting and the variations because of tax considerations in the accounting.

Economic obsolescence studies.

APPENDIX B

Notes to Tables and Figures

Notes to Figure 2, Table 4, and Table 16 are given below.

Air carrier

Data is from the Civil Aeronautics Board (27; 1947, p. 46; 1952, p. 48; 1957, p. 41; 1959, p. 60). Net plant is (net) figure for "Building and ground equipment" plus "Flight Equipment" and not including "Working Capital and Other" for all air carriers. 1957 net plant of air carriers is distributed as follows:

Certified air carriers		98.6%
1. Domestic trunk operations	78.0%	
2. Foreign and overseas	18.2%	
3. Local and helicopter	2.4%	
Non-certified air carriers		1.4%
Total		100.0%

The largest of the air carriers as measured by 1956 net plant was United Air Lines with 18.4% of the total.

Electric

Data is from Moody's (15, 1958 ed., p. a17; 1960 ed., p. a18). Net plant is "Utility plant less reserve", a net figure for privately owned electric utilities of Class A and B, defined by the Federal Power Commission (FPC) as those having total annual operating revenues in excess of $250,000. The FPC lists 268 such companies in 1957 (31, pp. 701-704). In 1957 privately owned electric utilities produced 76% of the total United States production. 1957 net plant of Pacific Gas and Electric was 6.2% of the total for privately owned Class A and Class B electric utilities in the United States.

Gas pipeline

Data is from Moody's (15, 1958, pp. a75-a77). Net plant is "Net Plant" for natural gas pipeline companies. These are defined by the Federal Power Commission (32, p. vii) as:

> . . . companies having transmission line mileage in excess of 250 miles and sales for resale in excess of 50 percent of total sales. Also included are certain natural gas storage companies and companies which although not entirely meeting the foregoing criteria, have the characteristics of pipeline companies.

Of the 93 companies determined to be natural gas companies within the meaning of the Natural Gas Act, the FPC classified 41 as "natural gas pipeline companies". The number of

companies reporting to the FPC has increased; their jurisdiction, though not all inclusive, is explained in part in Moody's (15, 1958, p. a75) where it is noted:

> In January 1950, U. S. Supreme Court upheld the FPC claim to authority over the East Ohio Gas Co., which operates within the state of Ohio and thereby confirmed that the FPC's authority was not restricted to companies operating in more than one state. In 1951 the FPC claimed it had no jurisdiction over the gas producing companies, but in May 1953 the U. S. Court of Appeals ruled, in the Philipps Petroleum case, that companies engaged in production and gathering of natural gas are subject to regulation by the Commission. This decision was upheld by the Supreme Court. Efforts to amend the Act to free producers from direct FPC regulation resulted in passage of the Harris-Fulbright Bill in 1956, but this was vetoed by President Eisenhower. In 1957 similar legislation was being studied by the House of Representatives Committee prior to being introduced to Congress.

The growing jurisdiction of the Federal Power Commission (FPC) can be seen in the operating revenue for reporting natural gas pipelines which in the ten year period, 1946 to 1956, have gone from one-fourth to one-half the total for the natural gas industry.

New plant of natural gas pipelines in 1956 was 77.9% that of all natural gas companies reporting to the FPC. Using this, construction expenditures, and the operating revenue as criteria, the following proportions have been estimated for the composition of gas industry net plant.

FPC Natural Gas Pipelines	35%
FPC Natural Gas - Other	10%
Non FPC Natural Gas	45%
Mixed Gas	8 1/3%
Manufactured Gas	1 1/3%
Liquified Gas	1/3%
Total	100%

The 1956 net plant of Tennessee Gas Transmission Company was the largest for a single firm and amounted to 5.8% of the estimated total or 16.4% of the natural gas pipeline total.

Railroad

Data is from Moody's (16, 1958, pp. a5, a6, and a38). Net plant is "Investment in transportation property", a gross figure (the only available) for combined Class I roads, defined by the Interstate Commerce Commission (ICC) as those having total annual operating revenues in excess of $1,000,000. Total number of Class I roads was 150. The 1956 net plant of the Pennsylvania Railroad Co. was 8.0% of the total for Class I roads.

Telegraph

Data is from Moody's (15, 1958, pp. a80-a82; 1960, pp. a94-a95). Net plant is "Investment in plant and equipment" less "Depreciation and amortization reserve" for wire-telegraph and ocean-cable carriers only. Radio-telegraph carriers have a net plant equal to 10% or less of that shown, and have been omitted because data is not complete.

The five carriers included have annual operating revenues in excess of $50,000. The 1956 net plant of Western Union Telegraph Company amounted to 88.5% of the total for the five carriers.

Telephone

Data is from Moody's (15, 1958, pp. a79-a80; 1960, p. a93). Net plant is "Investment in telephone plant" less "Depreciation and amortization" for the class A telephone carriers, defined by the Federal Communications Commission (FCC) as those having annual operating revenues in excess of $250,000. 1955 net plant of American Telephone and Telegraph Co. amounted to 94.3% of the total for the 53 Class A telephone carriers.

Water

Data is from Moody's (15, 1958, pp. a83-a84; 1960, pp. a97-a98). Net plant is computed for the years 1946 through 1957 by dividing the ratio of operating income (after income taxes) to operating revenue by the ratio of operating income to net plant, thus yielding the ratio of net plant to operating revenue, as follows:

Year	Net Plant / Operating Revenue
1946	6.23
1947	6.15
1948	6.20
1949	6.13
1950	6.30
1951	5.85
1952	5.77
1953	5.80
1954	5.81
1955	5.98
1956	6.05

In order to estimate a net plant for the period 1935 through 1945 a constant ratio of net plant to operating revenue of 6.20 has been assumed for those years. This estimated ratio is the average ratio for the years 1946 through 1950.

The ratios of net plant to operating revenues are then multiplied by the operating revenues to obtain the net plant.

As noted in Moody's (15, 1958, p. a83) no industry statistics are available covering industry operations as a whole. Data is compiled from reports of a selected group of companies.

Further account in Moody's (15, 1958, p. a82) states:

> According to the American Water Works Association the water industry today represents a capital investment of almost 6 billion dollars. . . . It is reported that municipal water works comprise more than 80% of the 13,000 water plants in the United states. There are no figures available to show the proportion of volume output by municipal and privately owned systems. . . .

1956 net plant of the American Water Works Company is about 41% of the total for the selected group.