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A simulation study of tax timing differences

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A simulation study of tax timing differences

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INTRODUCTION

The term 'timing differences' is defined as "...differences between the periods in which transactions affect taxable income and the periods in which they enter into the determination of pretax accounting income. Timing differences originate in one period and reverse or turn around in one or more subsequent periods..." (1).

Traditionally in financial reporting, income taxes are reported as the last item on the income statement. The purpose being to indicate which portions of the pretax income from operations are passed on to the tax collection agency as income taxes and the remaining portion that is then available for reinvestment or for distribution to shareholders. Therefore, income before taxes on the financial statements historically would be similar to taxable income on the tax return.

In the case of utilities, however, income before income taxes for rate making purpose is usually different than the taxable income reported on income tax return. This occurs because certain amounts can be excluded from taxable income for the year, but cannot be excluded for calculating income before income taxes for rate making purposes. This gives rise to tax timing differences because according to the <u>matching concept</u> of accounting, taxes recorded on income statement for a year should be related (or matched) to the revenues and expenses recorded on the books in the same year. A further explanation of some of the related accounting concepts is given towards the end of this section.

The principal tax timing difference with respect to utilities is created by the use of accelerated depreciation for income tax purpose and straight line depreciation for book or ratemaking purposes. This results in: (a) larger depreciation deductions for tax purposes during the earlier years of property life; and (b) smaller depreciation deductions during the later years. The total amount of depreciation in either method cannot exceed the original cost less salvage of the property.

The tax timing problem caused here due to the use of different depreciation methods for ratemaking and income tax purposes is treated by what have come to be known as flow through and normalization. procedures. Under the flow through procedure, only the taxes actually paid are included in the allowable taxes for cost of service determination. Under the normalization procedure, the allowable taxes are those, that would have been paid had the company used straight line or some other book depreciation method. The difference is treated through a provision for deferred income tax reserve.

To illustrate, consider a hypothetical utility having the following statistics:

Operating revenues	= 2,000,000
All tax deductions except depreciation and interest	= 1,200,000
Interest on debt	= 80,000
Depreciation by straight line method	= 350,000
Depreciation by accelerated method	= 450,000
Income tax rate	= 50%

The income statement under the flow through procedure and the normalization procedure would be:

Flow through:

Operating revenues	= 2,000,000
Operating expenses	=-1,200,000
Interest on debt	=- 80,000
Straight line depreciation	=- 350,000

Taxable income	= 370,000
Tax paid	=- 135,000

Net income for equity	= 235,000
Interest on debt	= 80,000

Total return to capital	= 315,000

Normalization:

Operating revenues	= 2,000,000
Operating expenses	=-1,200,000
Interest on debt	=- 80,000
Straight line depreciation	=- 350,000

Taxable income	= 370,000
Tax paid	= 135,000

	235,000
Provision for deferred taxes	=- 50,000

Net income for equity	= 185,000
Interest on debt	= 80,000

Total return to capital	= 265,000

The $50,000 provision for deferred income taxes is created because the firm uses accelerated depreciation for tax purposes and straight line depreciation for book or ratemaking purposes. The accounting rational for recording the deferred portion of the income tax expense is based on one of two conceptual foundations.

1. The Deferral Concept is based upon the premise that the taxes recorded in the income statement for a year should

be related (or matched) to the revenues and expenses recorded on the books in the same year. The fact that such expenses would be recognized as a deduction for tax purposes in an earlier or later year requires a recording of the cost incurred when the expense is deducted for tax purposes which would be equal to the tax effect of the additional tax deduction. This would "match" tax expense to book Income Before Income Taxes.

2. The Liability Concept is based on the premise that using up tax deductions currently, thereby lowering taxes payable, creates an obligation for higher taxes in the future which should be recorded. Recognition of the obligation in the accounts is consistent with the concept of matching revenue and costs in the income statement. It is a practical approach to showing future obligations in balance sheets even though there may be no immediate "legal liability" to pay the higher taxes.

The principal arguments used by those who assert that a provision for deferred taxes does not constitute a current cost are that income tax expense for the year should only include those taxes legally payable with respect to the tax return applicable to that year, and any provision in excess of taxes payable represents "phantom" taxes.

HISTORICAL BACKGROUND

A historical background is provided in this section to put the evolution of flow through and normalization in proper perspective.

Prior to 1954, tax depreciation allowances were generally based on straight line method, which is designed to spread the cost of the property equally over its estimated useful life. The accelerated depreciation provisions of the Internal Revenue Code of 1954, specifically, section 167(b)(2),(3),and (4), permitted taxpayers to use sum of the years digits and double declining balance methods. This resulted in greater amounts of depreciation in the early years of property life and lesser amounts in later years. Thus only the timing, not the ultimate amount of depreciation was affected. Bulletin F, as issued in 1942 by the Internal Revenue Service, set forth suggested lives for various items of utility property. The lives adopted therein were, in some cases, lower than lives that the regulatory authorities were allowing utilities to use for rate making purposes. Many controversies arose, however, between taxpayers and the Internal Revenue Service because some utilities claimed a life shorter than the Bulletin F lives, based on their "experience." In 1962, the Internal Revenue Service issued revenue Procedure 62-21, which set forth certain "guideline lives". For a taxpayer to be assured that his deduction would not be challanged on audit, it was necessary for him to show that his retirement and replacement policies for a class of assets were consistent with the class life used for that category of assets. In 1971, the Internal Revenue Code Section 167 (m), prescribed "class lives" and Asset Depreciation Range System. This permitted taxpayers to use a depreciation life for tax purposes up to 20% shorter than the prescribed class life. If a particular property had a class life of 20 years, a taxpayer could use a life, as short as 16 years for tax purposes.

In the first decade following the liberalized depreciation allowance, the flow through rate making process was adopted by several state commissions. Between 1954 to 1962, due to fairly stable rate levels, immediate rate decreases often resulted with adoption of flow through techniques. In some instances, this helped utilities avoid rate increases that otherwise would have been justified. As a result approximately one third of the state regulatory commissions in the United States opted for the flow through method. Although the position of the Federal Power Commission (FPC), had been on a normalization basis for accelerated depreciation yet it adopted flow through rate making in the Alabama-Tennessee Natural Gas Company case. In this landmark case (2) the court of appeals for the Fifth Circuit responded to the issue of flow through and normalization by stating that when Congresss enacted section 167 of the Internal Revenue Code of 1954, it did not intend to abridge the authority of federal agencies to make rates in accordance with their usual policies and that a regulated utility:

> ...will never be required to pay higher income tax because of its election to claim liberalized depreciation unless its gross plant declines in dollar value as a result of lower demand or lower plant construction cost. Normalization during a period of growth or stability would force the rate payers to provide funds for a hypothetical tax liabiity that might never become payable or, at the very least, to provide funds many years in advance of the time they are needed...(3).

Alabama-Tennessee operated 140 miles of pipeline from which it served both direct and resale consumers. Its annual reports showed that sales had doubled and net plant had steadily increased in the 1954-1964 period. Four rate increase filings made between 1954 and 1959 had been suspended by the FPC, but had become effective subject to refund. An intervening municipal association introduced evidence through a single witness (his was the only testimony on the subject in the entire proceeding) to show that company's excess of normalized over actual taxes represented tax savings rather than mere tax deferrals. Based on established FPC principles, about two thirds of the proposed rate increases were granted, normalization of income taxes was granted with an allowed return of 1.5 percent on the reserve of deferred taxes.

In 1964, by a bare majority, the commission issued the opinion and order reviewed by the Fifth Circuit. Its findings were, in substance:

a) Use of liberalized depreciation under article 167 produced a permanent reduction of federal income taxes for natural gas enterprises maintaining "a growing or stable plant"; Alabama-Tennessee would maintain such a plant "for the foreseeable future."

b) Congress did not attempt to determine the manner in which such tax benefits should be reflected in rates fixed under the Natural Gas Act; flowthrough would meet the fundamental objective of section 167.

c) Alabama-Tennessee should retain tax balances as a contingency reserve to offset increased taxes which might result from declining tax depreciation deductions, but neither it nor any similarly-situated company was entitled to any return on "deferred tax funds" invested in rate base.

d) Alabama-Tennessee's prospective rates should reflect only the actual taxes payable in the applicable tax year.

The Fifth Circuit held that deferred tax reserves were enforced contributions from customers and, as such, were working capital freed from any charges for interest or dividends. It added that traditional regulation requires investors, not consumers, to provide the capital necessary for utility operations (4). Reviewing courts accepted the FPC's allowance of normalization in Alabama-Tennessee as within the special competency of a regulatory agency, but gave notice that the section 167 was not a congressional mandate to approve normalization for rate making purposes. The Court said

> Since Congress has expressly delegated to the Commission discretionary power to regulate rates in the natural gas industry...it is at least a fair construction of the general statutory purposes and the legislative silence on the concrete situation before us that Congress did not intend to fetter administrative discretion to the point where the Commission would be powerless to prevent a regulated company using section 167 as an excuse to charge excessive rates(5).

The court emphasized congressional intent to permit each federal regulatory agency to exercise an informed discretion in accordance with its usual standards and the peculiar needs of a particular industry. The court mentioned the lack of uniformity among federal agencies which had dealt with the problem, saying "The Civil Aeronautic Board and the Securities and Exchange Commission still permit normalization." On the other hand the Interstate Commerce Commission has ordered flowthrough to income since 1959.

The Court deemed it as "singularly eccentric" that such an important question should be resolved in a small pipeline company's rate proceeding and that the only pertinent testimony came from a single witness presented by the intervening municipal association rather than the Commission. But the Court accepted that these eccentricities did not "rise to the level of fatal defects" and that "what might seem an eccentricity to the court may instead be a pragmatic administrative adjustment to the immensity of the commission's task (6). Though the court did not state that the commission chose tha best procedure for changing a long standing policy, "but that yet so long as the commission remains" within constitutional and statutory limits, it is competent to deal with a policy problem in an adjudicatory proceeding, a rule making proceeding or a special proceeding of the type employed in this case (7). Rate of return on capital was said to be within the commission's sound discretion, the accumulated tax balance had become "consumer contributed capital without specific purpose" and it would be "further anomaly" to require consumers to pay a return on that capital (8).

As a result of Supreme Court's refusal to hear Alabama-Tennessee case, several pipeline companies turned to the flow through technique, and consequently substantial rate reductions followed.

Alabama-Tennessee case was followed by the District of Columbia Circuit in its late 1967 City of Chicago V. Public Service Commission of Wisconsin (9). A holding that, given the premise of a growing or stable plant, there was no basis for rejecting as arbitrary the FPC's conclusion that accelerated depreciation will produce a continuing tax reduction which must "flow through" to consumers of natural gas.

As of August 1, 1964, for rate making purposes, twenty-two agencies permitted normalization of section 167 benefits, fourteen required flow through and thirteen had not ruled on the question.

By 1968, the California and the Connecticut Commissions, which had both earlier adopted flow through rate making, extended mandatory flow through doctrine to subsidiaries of American Telephone and Telegraph company. These subsidiaries had never elected to use accelerated tax depreciation methods. The commissions claimed that the AT & T subsidiaries should have adopted accelerated tax depreciation and, since the rate making prescribed by the commission was flow through, customers' rates would be lower.

In 1969 tax laws were reformed to spur company investment in new plant and equipment. Little debate took place on the flow through and normalization issue, and what appeared innocuous at the time, has since resulted in a major tax break for some public utilities, with a select group of telephone companies gaining an ever increasing supply of what is essentially interest free money.

The total bonanza taken so far by this group of utilities has now soared to an incredible $20 billion, and more than half, 11.3 billion is on the books of just one company (10).

In the 1969 hearings before the House Committee on Ways and Means on the Tax Reform Act, the FPC took the position that accelerated tax depreciation should be repealed with respect to public utilities on the basis that utilities require no incentive to invest. After passage of the 1969 Tax Reform Act, the FPC issued general order 404 on May 15,1970 which permitted utilities to switch to normalization with respect to expansion property installed after 1969. In addition, the Commission also permitted pipeline companies to switch from flow through to normalization with respect to property installed prior to 1970. The FPC's right to switch back to normalization on all property has been upheld in the courts.

California has been one of the more controversial states in regards to flow through and normalization question. The California Public Utilities Commission on July 9, 1958, instituted an investigation on its own motion regarding rate fixing treatment for accelerated depreciation and amortization for all utilities. The purpose of this investigation was to assist the commission in establishing a policy as to the proper treatment of federal income taxes for rate fixing purposes as a charge to the operating expense. On April 12, 1960, the commission issued Decision No. 59926 wherein after numerous citations the following findings and conclusions were reached:

> While the record in this case amply justifies the findings and conclusions which we have just expressed, we desire to point out that judicial authority supports the conclusion at which we have arrived. Prior to the decision by the Supreme Court of the United States in the case of Galveston Electric Co. V. City of Galveston decided on April 10, 1922, there was no established rule, judicial or otherwise, that income taxes of a public utility be charged to operating expense. As a matter of fact, such taxes, as a general proposition, were not permitted to be charged to the operating expense of a public utility. In that particular decision, the Supreme Court, without the citation of any authority whatsoever established the rule that income taxes constituted a lawful charge to the operating expense of a public utility. A few years thereafter, the Supreme Court reaffirmed the rule which it established in the Galveston case by its decision in the case of Georgia R. & Power Co. et al. V. Georgia R. Commission (11). Since that time, it has never been questioned that income taxes constituted a lawful charge to the operating expense of a public utility. However, the decisions in those two cases clearly reveal that only income taxes lawfully assessed by the taxing authority and paid by the public utility would constitute a lawful charge to the operating expense of a public utility. The decision in the Galveston case clearly reveals the strict construction which the Supreme Court placed upon that newly created rule.
> In our opinion, it would be a negation of the rule established by the Supreme Court

> in those two cases to hold that the rate payers of a public utility could be required, in any event, to bear the burden of a charge to the operating expense of a public utility which represented more income taxes than the taxing authority lawfully assessed and were actually paid by the utility. We reject the contention that the operating expense of a public utility may be so burdened.

By this order, the commission adopted flow through of accelerated depreciation benefits for the purpose of fixing rates, as follows:

> It is pertinent to point out that a regulated company enjoys a distinct protection which the unregulated company does not; that is, the regulated company may turn to public authority for the purpose of securing an increase in the price of its services or product, whereas the unregulated company must withstand the rigors of the law of competition. In many instances, the public utility enjoys a monopoly, and the rates which public authority permits it to enjoy must be paid by the consumer without his being aided in any way by the law of competition.
> In this decision we do not reach the matter of the claimed duty of a public utility to avail itself of liberalized depreciation for the purpose of diminishing its income tax liability and thus lessening the burden upon its ratepayers. Surely, a reasonable argument in support of that contention could be made. As a general proposition, it is a matter to be determined in the first instance by the management of a public utility as to whether or not liberalized depreciation will be availed of or whether straight line depreciation will be used.
> Based upon the record in this case and the findings and consclusions in this opinion, we hold that a public utility is not

> lawfully entitled to charge to its operating expense any amount for income taxes in excess of the amount of such taxes which the utility pays. It will be the order of this commission that such treatment will be accorded income taxes for the purpose of rate fixing (12).

The commission decision ordered:

> For the purpose of rate fixing, the commission will not allow a public utility to charge to its operating expense for income taxes any amount in excess of the amount of income taxes lawfully assessed by the taxing authority and paid by said public utility (13).

Most California utilities have used accelerated tax depreciation since the 1950's. These utilities have complied with the commission's Decision No. 59926 and currently have their rates set on a flow through basis. Two major telephone companies, unlike the other major utilities, did not claim accelerated depreciation for filing their income tax returns prior to 1970. On November 6, 1968, in Decision No. 74917, Re Pacific Telephone & Telegraph Co., the commission determined that Pacific Telephone's management was imprudent in not electing to take accelerated depreciation for income tax purposes. The commission concluded that it could not compel the company to take the accelerated depreciation on its federal income tax return, but it held that for purposes of rate fixing Pacific Telephone would be treated as if it had obtained the tax saving of accelerated depreciation and that the saving would be made to flowthrough to the consumers in the form of lower rates. Thus, the commission imputed accelerated depreciation with flow through. Notwithstanding this, Pacific Telephone continued to determine its federal tax liability using straight line depreciation. The Revenue Act of 1971 and the Tax Reduction Act of 1975 have carried forward, in substantially the same form, the conditions limiting the use of accelerated depreciation established in 1969. The Revenue Act of 1971 did, however, expand liberalized tax depreciation benefits to include class life Asset Depreciation Range System (ADR) for post 1970 additions and the class life system (commonly called CLS) which provided shorter lives for 1970 and prior additions. On January 2, 1971, in regard to a rate application of Pacific Telephone, the commission issued Interim Decision No. 77984 in which it held, based on its interpretation of the Tax Reform Act of 1969, that it would compute the company's federal income tax expense for rate making purposes on the basis of accelerated depreciation with normalization. That decision was annuled by the Supreme Court of California in City of San Francisco v. California Public Utilities Commission, supra, with directions to hold further hearings on the tax expense issue. In Decision No. 83162, dated July 23, 1974, the commission again adopted test year normalization for Pacific Telephone. The

California Supreme Court reversed this determination because it found error in the commission's opinion that the annual adjustment method was unavailable because of due process and statutory problems.

Presently, of the 52 regulatory agencies, 43 use normalization, 8 use flowthrough and one uses other method (14).

PRESENT INVESTIGATION AND ITS OBJECTIVES

Since the adoption of accelerated depreciation provisions in 1954, several attempts have been made to study the flow through and normalization question. Various interest groups have presented their point of view from time to time.

A thorough search of public utility related literature and finance and accounting journals revealed several articles in this area (15), (16), (17), (18). However, most of the articles have been written regarding various court decisions. Very few attempts have been made to study the flow through and normalization issues in a systematic manner, with due consideration to factors affecting the choice between flow through and normalization.

Brigham (19), (20), and Brigham and Nantell (21) have discussed results for utility firms operating under the assumption of flow through and normalization.

Most of the extensive studies done in this area have been carried out by various consulting firms for Federal Agencies. Recent reports have been prepared by Arthur Anderson & Company (22) for the Federal Energy Administration and by Peat, Marwick, Mitchell & Company for the Office of Telecommunications Policy (23).

The Arthur Anderson Report presents a study encompassing background analysis of the effects of the inclusion of construction work in progress (CWIP) in the rate base and normalization of all income tax costs of the electric utility industry.

The Peat, Marwick, Mitchell Report is based on a simulation model which is similar to the one used by Brigham. Effect on revenue requirements, income taxes, etc., of flowthrough and normalization is considered.

The models used in these studies, however, suffer from the weakness of failing to consider several important factors, as described below.

No attempt has been made in these studies to properly generate hypothetical property accounts. During the life of a property, its rate of growth and mortality characteristics change; additions to the plant have to be made as required to replace retirements from each vintage and to maintain the plant balance as specified by the rate of growth. None of the models seems to give any attention to this, and, therefore, depreciation expenses as calculated in the previous studies are open to question.

In all instances, salvage has been ignored by assuming its value as zero. As a result of rapid inflation of labor costs and environmental concerns, cost of removal has significantly increased, resulting in negative salvage values in the range of -20% to -60% of the original cost.

Inflation has not been considered in any of these studies.

The current practice of tax depreciation calculation in the utility industry is based on Asset Depreciation Range system, which is significantly different from the depreciation system used in the previous studies.

As is apparent from the above discussion, previously performed studies, though helpful in shedding some light on the question of flow through and normalization have failed to use a comprehensive model with proper calculation procedures for calculation of input parameters. In this perspective, the objectives of this study are:

To model the behavior of a regulated firm in order to study the effect of flow through and normalization policies on different financial variables of interest. These variables are: revenue requirements, income taxes, cash flow, interest coverage, return to equity, and utility rates.

To perform a simulation of the model by generating a hypothetical utility plant account to study the effect of the following on different financial variables.

a) Varying mortality dispersion patterns.

b) Varying salvage values.

c) Varying growth rates.

d) Different depreciation methods/procedures for book purposes, i.e., straight line equal life group, straight line average life, and accelerated method of depreciation.

To compare representative streams of revenue requirements, tax payments, and cash flows on some common basis.

RELATED CONCEPTS

In order to put the problems discussed in this dissertation in their proper perspective, the following discussion of relative terminology, concepts, and procedures is presented.

Mortality Dispersion

The percentage or number of an original installation that would be remaining in service as of any age is the mortality characteristic of an industrial group. This basic trait of the group is known as its mortality dispersion and it is normally represented either in tabular form as a life table or graphically as a survivor curve. A description of survivor curves now follows.

Survivor curves

Survivor curves show the number of units of a given original group which are surviving in service at a given age. The ordinate to the curve at any age gives the percentage (or the number) of the original number of units which still survive in service. The abscissa is normally measured in years. The original survivor curve is the curve drawn through these points calculated from the original data without adjustment. Since this original survivor curve is generally irregular it may be smoothed to produce a smoothed survivor curve, sometimes referred to as an adjusted curve.

While many fitting techniques are available to smooth and extend survivor curves, a convenient approach is to match the observed incomplete survivor curve to members of a set of typical survivor curve shapes known as the Iowa Type Curves.

One important feature of the Iowa Curves is the location at which the greatest portion of the original placement is retired, termed the mode. If the mode occurs to the left of the average service life, the dispersion is described as left moded. The left moded curves of the Iowa System are designated by the letter L. The number subscript indicates the extent of dispersion. Thus an L 3 curve is left moded and more widely dispersed than an L 5.

A right moded curve has a modal age greater than mean and is designated by R. The degree of dispersion is indicated by the numerical subscript. If the mode corresponds with the average service life, the dispersion is symmetrical, a characteristic of the S types. The O type curves have the mode at or near the origin.

In total, the Iowa Type Curves, now number 22, i.e., seven symmetrical, five right modal, six left modal, and four original modal. These curves are descriptive of various types of industrial property retirement dispersion patterns, mathematically described in terms of the Pearson frequency curve family, but with parameters established empirically from the analysis of a wide range of actual retirement experience.

Depreciation Accounting

Depreciation expense is a key variable to be calculated in the model, a brief description of related concepts along with various methods for calculating book depreciation is given here.

Proper management of any company requires periodic comparison of expense versus revenues. Readily determinable recurring expenditures for rent, light, heat, wages, etc., are charged as an expense in the year (or other accounting period) in which they are incurred. Many of the assets of the company, however, are relatively long-lived and their years of providing a useful service (thereby generating revenues) span many accounting periods. If these long lived investments were charged as an expense, either on an initial installation or at the end of their useful life, there would be a distortion in the comparison of revenues and expenses. The simplest or most logical way to prevent this distortion is to distribute the cost of property in a reasonable and consistent manner to all the accounting periods related to its use in providing service. This is called depreciation accounting.

Item or group accounts

Separate property accounts may be kept for individual units or composite properties such as a building or a large piece of machinery. These are known as item accounts. More frequently the records for similar or like units are gathered together into a single account and handled on a group basis. If a new account is opened for each year's installations, the property in the account constitutes a vintage group. When similar or like units of all ages are grouped together, the account is termed a continuous group or "open-end" account. This last form is by far the most common.

The principal difference between item and group depreciation is based upon mortality dispersion. Actually, there is no dispersion in the item account since the unit is 100 per cent surviving until its retirement drops the figure immediately to zero. In a group account a mortality pattern will probably develop in which some units will be retired quite early and others will remain in service a much longer time. Under the item method the annual depreciation charge is based upon the expected probable life of the property unit so that the unit's cost will be recovered completely by the date of retirement. Under the group method the annual charges are based upon a representative average life which is a function of the mortality dispersion expected of the property. The depreciation charges are continued in behalf of the group until the last unit is retired.

The depreciation base for the group property is not a constant, as is the case for item procedure. If one is working with a vintage, the base continually decreases because retirements occur. If one is working with a continuous property account, the base may remain constant (replacement equals retirements, a condition of no growth), or the account balance may grow or decline.

A third difference occurs when one observes the depreciation reserve account balance at the end of each year for a period of years. The account will be adjusted frequently during the life history of the vintage for the property retired and for the salvage received, if any.

Allocation techniques

Ideally, depreciation should be accomplished according to the consumption of a plant's capacity to produce. However, it is extremely difficult to get a valid measure of the expiration of service capacity. Consequently, the accountant assumes the annual decrease follows one of three patterns. They are, first, a straight line, second, a curve indicating decreasing annual increments, and, third, a curve showing increasing annual increments. These assumptions were all originally conceived for item depreciation but they have been applied to group accounts with fairly satisfactory results. However, the graphical interpretation of a straight line or a particular curve are not appropriate when the methods are applied to continuous or "open-end" accounts because the additions and retirements change the depreciation base, and, hence, the relative size of the successive annual charge.

Straight line   The average life procedure for the straight line assumption is by far the most common method in use today. It is equally applicable to item or group accounts. The depreciation rate is a constant for any given measure of service life and salvage value:

Straight line rate = (1-s)/ Probable or average life

where s is the ratio of estimated salvage and depreciation base, and the probable life is used for item accounting and the average life for the group computation. The concept of a straight line allocation suggests equal annual accruals. This is the case for the depreciation of a single unit since the charge, d, for any year, x, is given by:

d(x) = (Item depreciation rate) (Depreciation base).

For group properties the expression for the annual accrual at any age, x, becomes:

d(x) = (Group depreciation rate)(Average fixed asset balance, year x).

The average fixed asset balance is assumed to be one-half the sum of the account's beginning and ending balances for the year. This calculation appropriately allows a half-year's charge for those units retired or added to the property during the year. It is to be noted that the variable nature of a continuing asset balance prevents the equal annual accruals normally expected of a straight line method.

Since the group rate given above is a function of the expected average service life, it is obvious that those units retiring before average life will not be fully depreciated when they are removed from service. Likewise, those remaining longer than average life will be over depreciated. However, if the estimate of average life is correct, the total original cost of the group will be fully recovered as the last unit is retired.

The method which will fully depreciate each unit at the time of its retirement is termed as the unit summation or equal life group method. To compute the annual depreciation expense by the straight line equal life group method, the complete survivor or mortality dispersion of the property should be known. This is necessary since the units at any specified age within the property group will be expected to have varying lives dependent upon the dispersion. Likewise, each length of life will have a different straight line rate. Hence, the appropriate depreciation rate for any age is a weighted average of all the individual straight line rates necessary within the group.

The complexities of the rate determination have considerably limited the use of this method to date. Major telephone companies are moving towards adopting equal life group method, however. Winfrey (24), and Hempstead (25) have presented an explanation of the methodology.

Decreasing annual charge The principal allocation techniques in this category are double declining balance and sum of the years digits method. In the double declining balance method the depreciation rate is twice the straight line rate and is applied to the undepreciated book balance at beginning of year for which the charge is desired.

In the sum of the years digits method the depreciation rate is calculated by first finding the remaining life of the account and then dividing this by the sum of the years digits of the remaining life.

Rate Base Determination

The rate base is comprised principally of the net (or depreciated) valuation of the public utility's tangible property, composed of plant and equipment used and useful in serving the public. In addition, the rate base includes an allowance for working capital and, depending on the circumstances, may also include amounts for the overhead cost of organizing the business, intangibles, and going concern value.

It should be noted that the key issue in the determination of the rate base is the valuation of the public utility's plant and equipment. This is important because of two reasons: the valuation of plant and equipment is the largest component part of the rate base and the particular valuation method adopted can affect the size of this major component.

Original cost, replacement cost, and fair value have been proposed as the correct sum to be recovered through the depreciation charges.

Original cost

Original cost rate base is defined as the total investment cost of constructed and acquired property when first devoted to public service less depreciation.

The main disadvantage of original cost is that changes in the value of money are ignored; the property under consideration is normally paid with dollars having different purchasing power. Thus the actual cost rate base does not succeed perfectly in its principal purpose, which is to determine a meaningful cost of tangible property for rate making purposes.

This method, however, is fully compatible with the concept of cost depreciation.

Replacement cost

This is a measure of the cost of duplicating the existing plant at present prices, less depreciation. Other definitions are:

Reproduction cost is the estimated cost of reproducing substantially the identical property as of the date specified.

Replacement cost is the estimated cost of replacing the service of the existing property of any type to achieve the most economical and preferred service, but at prices as of the date specified.

Trended cost is obtained by multiplying the original cost of each item of property by the ratio of the appropriate cost indexes for the two periods concerned.

One of the main arguments in support of this approach is that original cost depreciation charges are not enough to replace the old equipment when it is retired. Rising costs make any accrued funds inadequate. Another contention is that the low depreciation charges result in overstated profits and, subsequently, too high tax assessments.

The major objection to replacement cost is essentially the same as that expressed against the value basis. This is simply that the cost of production should reflect the actual expenses incurred. The depreciation charge is not made, fundamentally, to supply new plant but rather to allocate the investment in the present plant to operating expense.

Fair value

Fair value is determined by considering essentially the actual cost of the property, the present cost of construction which is generally termed reproduction cost new, and other matters, generally taken to represent various intangibles. Each of these elements is to be given such weight as may be just and reasonable in each case (26).

Critics of the fair value method refer to the lack of guidelines, to the idea that the procedure can be characterized as the huddle method, and the result agreed to be the fair value is "often unexplainable in precise economic terms."

A survey of current practices reveals that out of 52 regulatory agencies, 35 use original cost method of valuation and 12 use fair value base. Remaining agencies use other methods (14).

Original cost basis, was therefore, used in rate base calculations in this study.

Salvage

The precise meaning of salvage as related to an account varies considerably, and often depends upon the particular regulatory agency involved. Generally speaking, however, the salvage of a unit is usually interpreted to be the net cash flow at retirement.

Gross salvage, in the Federal Communications Commissions System of Accounts, is defined as "the amount received for property retired, if sold, or if retained for reuse, the amount at which the material recovered is chargeable to Account 122 'Materials and Supplies' or other appropriate account." Cost of removal is defined as "the cost of demolishing, dismantling, removing, tearing down or otherwise disposing of plant and recovering the salvage including the cost of transportation and handling incident thereto. Net salvage is obtained by subtracting cost of removal from gross salvage.

In noncapital intensive industries, net salvage is usually assumed to be zero, gross salvage is treated as current operating revenue and cost of removal is treated as current operating expense. Until recent years, for utilities also, overall cost of removal historically has been approximately equal to gross salvage, resulting in a net salvage of zero.

Substantial changes have recently occurred in the magnitude of and the relationship between gross salvage and cost of removal. Although gross salvage has increased, even larger increases in the cost of removal or cost to return the environment to a natural state are the major factors causing negative salvage. The physical operating system discussed can be classified into two types, and the method of dealing with negative salvage may vary with the system being considered. One type is the system comprised of many relatively small parts which are continuously retired and replaced. Service connections are an example. In this continuous system the cost of removal is spread over the years. A second type is an expensing facility which will be retired as a single unit at the end of its service life. A nuclear electric plant representing a significant fraction of a company's generating power is an example of this large unit system. A major pipeline built by a company formed specifically for that purpose is another example of a large unit system. In these cases most of the cost of removal is a single, major expense occurring at the end of service life.

Some typical anticipated salvage ratios are (27):

Gas distribution	
Mains	-40% to -60%
Meter installations	-150%
Regulation station structures	-50% to -100%
Electric	
Electric services	-40%
Nuclear generating structures	-25%
Reactor plant equipment	-25%
Telephone	
Station connections	-19%
Pole lines	-26%
Aerial wire	-18%

There are two concepts for the recovery of salvage related expense:

1. Customer should pay for services received when they are received.
2. Capital should not be recovered before it has been spent.

Since negative salvage is a cost of providing service, the customer should bear that cost when the service is consumed. This means that the customer should be charged this expense before the expense is incurred by the utility. Many regulatory agencies now allow accrual rates with a negative salvage. One notable exception is Pennsylvania, where it is illegal to charge customers before the expense is incurred. Both of these concepts have a great deal of fundamental appeal, and would be reasonable in creating a policy. Salvage costs occur at the end of the service life of the property, and it seems clear these costs should be allocated to the services provided by the property. Accepted practice is to consider the capital to be recovered as the investment less positive net salvage, and this practice is consistent with concepts listed above. Negative salvage, however, defies these concepts, as it appears to be impossible to develop a method of depreciation which is consistent with both concepts. If the net salvage is negative but never zero, the practical consequences of choosing which concept to violate are small. As negative salvage increases, this dilemma becomes important.

Various methods of recovering negative salvage

A general description of various methods of recovering negative salvage is provided in this section.

Negative salvage in depreciation rate If a forecast of the probable net salvage ratio for each account is known, then negative salvage can be included in the depreciation rate by modifying the depreciation rate by the factor (1-s), where s is the salvage ratio. The depreciation base used to calculate annual depreciation charges is the same as customary depreciation base, the cost of the plant in service as of January 1, December 31, or average for the year.

Similar results will be obtained if the depreciation base is modified by the factor (1-s) and then rates based solely on life (whole life, or remainig life) are used. If this procedure is employed then the negative salvage is paid for by the current users of service at the time of service. The timing of payment is such that users pay before capital is spent.

Expense salvage Because of the difficulty in finding basic data regarding salvage and cost of removal, there is a tendency for people to try to justify the concept of expensing. One popular justification for expensing rests on the statement that since gross salvage and cost of removal tend to offset each other the net effect on a company wide basis is small and the accuracy of the provision for the depreciation reserve as a whole would not be endangered. This argument is, of course, of little merit in extraordinary circumstances where gross salvage and cost of removal do not offset each other, such as in the case of the removal of a pipe line or the decommissioning of a nuclear plant.

If negative salvage is expensed in the year incurred, there is no effect on rate base, users pay for the capital when it is spent.

Amortize over 5 years at retirement The negative net salvage incurred in a particular year is amortized during a period of few years, say five. There is no effect on the rate base, users pay after capital is spent. It would be desirable to have major items which are experiencing a negative salvage identified, but as a practical matter, the account could be a continuous one.

Funded reserve A separate reserve for net salvage is set up for each account which appears to be experiencing a negative salvage. The maintenance of such reserves would bring some of the problems of adequacy into the open and provide an avenue for adjustment, positive or negative, upon retirement to meet the actual salvage and cost of removal elements of the ccst of service.

Because the expense for salvage is identified, it would be possible to decrease the rate base during the service life. Under this method, users pay for salvage before capital is spent, the total payments will be less if the fund draws interest.

Without further discussion of the relative merits of each option, or the philosophy of rate-making possibly involved in each option, it is proposed, for the purpose of this study, to include negative salvage in depreciation accrual rates.

Negative Salvage in Tax Depreciation

The foregoing discussion has been in terms of book depreciation. Tax depreciation is a law unto itself in more than one way and any similarity between book and tax aspects of gross salvage and cost of removal are becoming coincidental.

Under the ADR provisions for tax depreciation, only positive salvage values affect depreciation calculations, cost of removal is expensed in the year incurred.

Capital Structure and Cost of Capital

The overall cost of capital can be measured by the expected return on a portfolio of the firm's financing instruments:

$$Ic = Id(d) + Ie(1-d)$$

where

Ic = overall cost of capital

Id = cost of debt capital

Ie = expected rate of return on the firm's stock

d = debt ratio

This, of course assumes that there are only two kinds of financing instruments, debt and common equity. But the weighting principle remains the same if there are others, such as preferred stock, subordinate debentures, convertible securities, etc.

It should be emphasized, in passing, that in a period of rising interest rates this procedure can result in the computation of an over all rate of return on invested capital lower than the financing rate on new high quality bond offerings. At the same time, the inflationary trends that are an important cause of high interest rates result in a progressive widening of the difference between reproduction cost or fair value and original cost of utility plant, and between depreciation charges that would keep pace with higher replacement costs and the actual depreciation based on original cost.

The inequities to the bondholders and to the owners of the business resulting from an inflationary environment permeate the financial world but are nowhere more rigidly built into the price making procedure and price (rate) structure than among regulated utilities. Even in fair value jurisdictions, the higher value placed on a plant investment than the original cost is offset at least partially by a downward adjustment of the allowed rate of return on common equity. These problems have of course been subjects of discussion in rate proceedings and court decisions for decades. If significant inflationary trends persist, as it appears that they will, with consequent continuing high interest rates, some of the methods suggested to offset the effects of inflation, such as economic depreciation and variable interest rates on debt instruments, may have to be adopted.

In approaching the rate of return on common equity, the starting point for decades has been the Supreme Court decision in the famous Hope case, where the Court said:

> From the investor or company point of view it is important that there be enough revenue not only for operating expenses but also for the capital cost of the business.... By that standard the return to

> the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital (28).

The great many number of Court cases before and after the Hope decision would lead to the interpretation that the Court was speaking of the return on capital invested in utility property "used and useful in the business," and was saying that this return should be commensurate with the return on capital invested in property used and useful for the conduct of other business of comparable risk. This capital investment can only be measured by the book value, assuming that prudent investment policies have been followed. The real argument with respect to capital investment should be measured at original cost, or at a "fair value" that would take into account the higher reproduction costs which result from inflationary trends.

Regulatory agencies-- and rate of return witnesses have in determining commensurate rate of return often turned to a comparison with other utilities as the enterprises most obviously having corresponding risks. But this comparison of rate of return on common equity of one utility with a group of utilities suffers from the danger especially acute in these times- of circular reasoning. That is, there is the danger of concluding that a regulated utility should earn what other regulated utilities earn, when in fact all are suffering from the same malady in an inflationary period--tardiness in the filing before regulatory agencies of higher rate schedules, and a serious lag by those agencies in granting adequate rate relief.

The electric utilities and the telephone companies are not unique among American business in the degree of stability experienced in revenues (sales) and earnings, that is, the degree of business risk. A number of industrial companies have as high or even a higher degree of stability in earnings. In using the word stability in this context, an unvarying flatness is not meant. What is important here is steadiness in the growth of earnings. This characteristic is held by a number of industrial companies, particularly by those catering directly to everyday consumer needs-- needs, that the consumer judges to be as essential as is at least some part of the supply of electric energy and telephone service. These nonregulated companies do not have a monopoly but they have demonstrated over a period of years that they can successfully meet and often beat the competition.

Wills (29) has developed a projection of the cost of debt and equity capital, based on a study of regulated and unregulated firms, according to this survey, debt and equity costs for a utility firm are of the order of 7% and 13% respectively. Similar values have been used in several utility ratemaking cases decided in 1976 - 1977 (14).

Differential Cost of Capital

It has been claimed that flow through companies have a higher cost of capital than normalized companies. This is based on the statistical studies (30), which show that investors recognize the difference in the quality of earnings between those companies that normalize and those that flow through. The higher cost of capital is compensation to investors for the greater risk inherent under flow through accounting. It has been suggested that if this differential cost is indeed recognized by commissions and built into service rates, then investors should be indifferent to the choice of accounting methods. However, if the differential is not recognized and allowed for, then flow through firm's stock price will decline, and, depending on the magnitude of this decline, the firm is likely to have difficulty attracting capital. The debt capital cost is also claimed to be higher for flow through companies.

REGULATED UTILITY MODEL

Projected future results are used by both the utility company in making requests for regulatory changes and by utility commissions in making decisions about these choices and their future impacts on utility investment and utility rates. The basic operating mechanism used to achieve a projection of future result is a model.

In recent years, several economic models of the behavior of regulated public utilities have been proposed by economists. Various models are briefly discussed here.

A basic model used in analyzing the behavior of public utilities was developed by Averch and Johnson(A-J) (31). This now standard model presents a static view of a profit maximizing monopolist who faces a given demand curve for the single product he produces, perfect markets for the two inputs (labor and capital) he uses in producing that product, and an explicit constraint on the rate of return he can earn. This last element of the regulated firm's environment- the "fair rate of return" constraint- requires that the firm's net revenue (its gross revenue minus its operating costs), should not exceed a fixed percentage (the fair rate of return) of the value of the firm's capital stock net of depreciation (rate base). The fair rate of return is bounded above by the return the firm would earn if it were able to maximize profits unconstrained, and it is bounded below by the market cost of capital.

In the A-J model, the price setting function of regulatory commission, which is central to the working of regulation has been some what lost in the rate of return constraint. Instead, the regulators tell the firm what price it can charge, and this price is presumably determined on the basis of some fair rate of return calculations. As a public utility, the firm must then meet demands at the set price. The regulatory process, not the direct action of the market, adjusts this price upward or downward according to whether the firm is earning less or more than the fair rate of return.

Also, A-J model's completely static view of the regulated firm and the regulatory process limits the model's ability to encompass some regulatory issues. Once the firm in the model chooses its optimal position, specifically, its inputs of capital and labor (for them output and price follow from the production and demand relationships), it remains at that position forever. In making this choice of inputs, the firm is assumed to treat capital and labor symmetrically, namely, as perfectly variable factors whose levels are to be chosen for once and for all. There is no scope for growth or depreciation of the capital stock over time.

The static vision of the model, stems in part from its assumption that production conditions are fixed and that input prices do not vary. The model assumes that the fair rate of return constraint obtains as an equality at every point in time. The model states that if the fair rate of return is s percent, then the firm's net revenues are always exactly s percent of its rate base. This is incompatible with the observed fact that during some periods some regulated firms apparently earn more than what has been decided as the fair return thereby giving rise to pressure from regulators for these firms to lower the prices charged for their services, while other regulated firms earn less than the fair rate, giving rise to permission from regulators for these firms to raise their prices.

Bailey and Coleman (32) have incorporated lag in the A-J model. In their paper, the effect of a regulatory lag on the firm's allocation of resources is found to be (for large enough lags) a reduction of any incentive to overcapitalize which is contrary to A-J conclusion that the firm has an incentive to overcapitalize. Authors state that under continuous regulation, the firm has no preference among efficient or inefficient methods of operation, so long as the methods permit revenues to cover costs. When lags are introduced, authors show that the firm will be driven to a point of efficient (minimum cost) production. Thus, authors conclude that regulatory lag can have positive economic effects.

Klevorick (33) suggested basing production function on labor and accumulated research instead of labor alone. In particular, the new model proposed here considers the firm's operations in a dynamic context, with the firm looking to the future in making today's decisions, and it incorporates the interplay between the regulatory agency and the firm. The model captures the price-setting role of the regulators, and it encompasses the phenomenon of regulatory lag. The uncertainty associated with the occurrence of rate reviews is modeled by positing that reviews occur stochastically through time. And, although the treatment of the issue is rather simplistic, the model does incorporate technical change generated by the regulated firm's program of research and development. The regulated firm's optimal policy is characterized, and the implications this optimal policy has for two traditional issues in regulatory economics, the input efficiency of regulated firms and the effect of regulatory lag on research and development are examined.

These models have made landmark contribution to the theory of regulation by emphasizing how rigorous methods can be used to draw illuminating conclusions in an area in which historical description and impressionistic discussion has until recently played a preponderant role in the literature.

The purpose of this research is to measure the effect of alternative policies of depreciation on different financial variables of the firm. The various models discussed above, do not, because of their complicated nature, easily lend themselves to simulation. Therefore, a simpler model is developed in this section. This model is based on the rules of accounting and ratemaking established by the regulatory agencies. This obviates the need for including a set of behavioral assumptions in the model. The model comprises of a logical set of equations. As such it constitutes a set of identities and does not attempt to represent a theory that can be refuted.

Development of Model

A financial model is developed here to measure the impact of various alternative depreciation methods on key financial variables over time. The degree of complexity of any model is dependent, among other factors, on both the quantity and intricacy of the variables being analyzed. The financial variables that are significantly affected by alternative depreciation methods are

a) Rate base

b) Revenue requirements

c) Income taxes

d) Accumulated deferred income taxes

e) Depreciation reserve

f) Cash flow

g) Interest coverage

h) Utility rates

The model has been kept manageable by making simplifying assumptions where accuracy is not significantly sacrificed.

The major assumptions made in the model are listed below.

a) Demand is perfectly inelastic.

b) Revenues earned at all times are equal to revenue requirements. Thus, there is no consideration of regulatory lag.

An explanation of these assumptions now follows.

Price elasticity

Price elasticity of demand is a measure of the responsiveness of amount demanded to a percentage change in price.

Because price and quantity will be changing in opposite direction, elasticity of demand will be negative. When the demand for a product is relatively inelastic (that is, when it has an elasticity of less than one), a price reduction leads to a proportionately smaller increase in the quantity sold. The total amount spent of the product and hence the seller's total revenues drop. If demand is relatively elastic, a change in price includes a proportionately greater change in quantity demanded, and the seller's total revenues will increase with a drop in price. Unitary elasticity of demand exists when the percentage changes in price and quantity are equal, so that total revenue remains constant with a change in price.

The elasticity of demand for a product is closely related to the availability of substitutes. If a product has many readily available substitutes, elasticity will be high. The elasticity of demand for a single type or brand of products will be higher than the elasticity of demand for the group of which this good is a part.

Further, elasticity of demand will tend to be higher for a good with many uses than for one with a single function. As the price of a multi use good declines, individuals extend their consumption of it to new uses, thereby increasing the quantity purchased.

In a utility setting, only a few of the demands are responsive to price changes, e.g., whereas local telephone service has relatively low price elasticity, touch phones, extension phones, toll calls and data transmission service have higher degrees of elasticity. Similarly, residential demand for electric power for lighting is inelastic, but power for space heating is elastic.

In view of the limited amount of price elasticity faced by the utility industry and because of the problem of the determination of elasticity for different utility services, price elasticity will not be included in the model. The results will be generally applicable as most of the services are not significantly affected by price elasticity.

Regulatory lag

Regulatory lag is the period required to adjust rates after a utility company's rate of return has deviated from its target return.

Joskow (34) has shown that the determination of the allowed rate of return in a formal regulatory hearing depends on a variety of factors including

a) The presence or absence of cost of capital testimony supporting the firm's request.

b) The presence or absence of interveners presenting conflicting testimony

c) An appreciation by the commissions of the adverse effects of regulatory delay during periods of high inflation.

In a rate case, a target rate of return is determined and then service rates sufficient to cover all allowable costs including depreciation and income tax are set. Due to fluctuation in expenses and demand, realized rates of return tend to depart somewhat from the target rate. A zone of reasonableness is thus set and rates can fluctuate with in this zone without triggering a rate hearing. However, if the changes are persistent in one direction, the realized return will break the upper and lower bounds, thus causing a rate case, and a new rate schedule will have to be prescribed.

Regulatory lag is the time between the piercing of the control limits and the effective date of the new rates and it is composed of two elements. The recognition lag, consisting of the time, commission staffs, utility company management and consumer groups take in order to recognize that the observed deviates are not a result of temporary business fluctuations and like. The action lag, or the interval needed to schedule a hearing, file testimony, hold the hearing, reach a decision, and put a new set of rates into effect.

If rates are unduly delayed, the cost of capital will rise, thereby increasing the burden on future tax payers. Worse yet, inadequate earnings may lead some utilities to the inability to raise capital. Inadequate financing, in turn, may lead to inadequate facilities and the spectre of brownouts and blackouts. Stated otherwise, the manner in which a regulatory agency manages its case load has a bottom line effect on a regulated utility and the service it provides to its customers.

Joskow (34) cites three procedural changes that have been helpful in reducing the length of the regulatory delay since 1971:

a) temporary rate increase

b) Automatic fuel cost adjustments

c) Use of data for a future test year rather than data from previous years.

A survey of various rate cases reported (14) indicates that the practice of providing interim or temporary rate increases varies between commissions. However, majority of commissions granted interim rate increases, in many instances, amount being equal to the initial rate increase requested by the utility firms. This practice would seem to ameliorate the effects of regulatory lag. Some effects of regulatory lags would still be felt; however, for the purpose of this study, regulatory lags have been ignored.

A Model of Utility Firm

An analytical model is developed here to measure the effects of flow through and normalization.

Public utility ratemaking under regulation is basically a two step process: first, the utility's cost of service is determined; second the utility is authorized to charge for its service under schedules of rates, which on an anticipated volume of business, will produce total revenues about equal to the cost of service. The cost of service of a public utility is defined as the sum total of (35):

1. Proper operating expenses: this mainly includes the cost of labor, maintenance, materials and supplies and various services during the accounting period when the benefits of these services are realized. Depreciation, amortization, certain property losses, taxes and return to investors are not included as operating expenses.
2. Book depreciation expense.
3. Taxes: these are simply the actual taxes paid.
4. A reasonable return on the net valuation of property used and useful in serving the public. This is obtained by multiplying the allowed rate of return by the net or depreciated valuation of utility property.

All these costs must be collected as revenues from the firm's customers. Thus the revenue requirements for a particular year are given by:

Revenue requirements
= operating expenses
+ depreciation expense
+ taxes
+ (allowed rate of return) (rate base)

For the purpose of this investigation, revenue requirements will be defined as net of the operating expenses, i.e.,

$$RR = Db + T + Ic\ X \qquad (1)$$

where

RR = revenue requirements net of operating expenses

Db = depreciation expense for book purpose

Ic = allowed rate of return

X = Rate base

Now, both tax depreciation and interest expense are tax deductible.

Let

Dt = tax depreciation

Id = imbedded cost of debt

d = debt ratio

t = income tax rate

Assuming that debt is paid off in the same time pattern that the asset is depreciated, so that interest expense is Id d X.

Thus, the taxes paid are

$$T = t(RR - Dt - Id\ d\ X) \qquad (2)$$

Using the flow through procedure where only taxes paid are considered, then solving equations (1) and (2)

$$RR = [(Ic - t\ Id\ d)X + Db - t\ Dt]/(1-t) \qquad (3)$$

$$T = [(Ic - Id\ d)X + Db - Dt]t\ /(1-t) \qquad (4)$$

When the firm uses the same depreciation method for both book and tax, we have Db = Dt, and equation(1) and (2) simplify to

$$RR = (Ic - t\ Id\ d)X/(1-t) + Db \qquad (3a)$$

$$T = (Ic - Id\ d)X\ t/(1-t) \qquad (4a)$$

If a firm uses accelerated depreciation for tax purposes but not for book purposes then Dt>Db in the early years of the life of an asset, and Dt<Db in the later years. Thus, taxes are lower in the earlier years and higher in the later years than if straight line depreciation were used for book and tax purposes. However, the total amount of taxes paid over the life of the asset is the same, irrespective of the tax depreciation method used. Therefore, with the use of accelerated depreciation method, taxes are deferred. Under flow through method of accounting, no reserve for deferred tax reserve is included in the revenue requirements. Under normalization method, by contrast, a reserve account is created. The reserve account represents funds collected from

customers which the company may use in any way they deem fit; i.e., they represent funds upon which the company does not have to pay a return and, therefore, should not be allowed to earn a return. There are two ways in which these reserve accounts may be handled in the revenue requirement equation under the normalization procedure. Two prominent methods of treating these reserve accounts are:

a) Rate base adjustment: deduct the reserve from the rate base as otherwise constituted, and
b) Rate of return adjustment: do not deduct the reserves from the rate base as otherwise constituted, but in calculating the overall cost of capital include the reserves in the capital structure at zero cost.

Lamp and Hempstead (36) have shown that if the rate base less reserve just equals the stated book value of the total capitalization then fair return from alternative a is the same as fair return from alternative b. The alternative used in this model is a, because of the ease of formulation.

Under normalization

$$RR = Ic\ Y + Db + Tn \qquad (5)$$

where, Y is the reduced base given by

$Y = X - N$, and $N = t(Dt - Db)$

The same method of depreciation has to be used for calculating depreciation charges and taxes for book purposes. Therefore, Tn in equation (5) is given by

$$Tn = t(RR - Db - Id\ d\ X) \qquad (6)$$

Or, Tn can be written as

$$Tn = t(RR - Dt - Id\ d\ X) + t(Dt - Db) \qquad (7)$$

Substituting $T = t(RR - Dt - Id\ d\ X)$, from equation (2) in

$$Tn = T + t(Dt - Db)$$

Therefore, equation (5) can be rewritten as

$$RR = Ic\ Y + Db + T + t(Dt - Db) \qquad (8)$$

For normalization, $T = t(RR - Dt - Id\ d\ Y)$. Solution of this with (8) yields for a normalized firm

$$RR = (Ic - t\ Id\ d)\,Y/(1-t) + Db \qquad (3b)$$

$$T = (Ic - Id\ d)\,Y\ t/(1-t) + t(Db - Dt) \qquad (4b)$$

A description of the various variables required for simulation is now given.

Normalization Reserve

The normalization reserve NR, at any point in time is the accumulated tax deferral due to using accelerated depreciation and ADR for tax purposes. It must be equal to zero by the time all plant is retired since eventually all plant is retired and eventually all taxes must be paid.

The normalization reserve, NR, can be expressed as

$$NR = t(Dt - Db)$$

Rate Base Under Normalization

The rate base under normalization, Y, is generally considered to be gross plant less the book depreciation reserve and less the normalization reserve. Of course, there are other allowable items in the rate base such as materials and supplies and cash working capital, etc.; however, for comparison purposes these can be excluded.

Rate base under normalization assumption is given by

$$Y = X - NR$$

Effect on Customers

One quantity of interest to customers is the annual revenue requirements of the utility. Revenue requirements for BM-EM, F, and N are given by (considering tax deductibility of the cost of remeoval):

$$BMRR = (Ic - t\ Id\ d)X/(1-t) + Db + CR\ t/(1-t)$$

$$FRR = [(Ic - t\ Id\ d)X + Db - t\ Dt - t\ CR]/(1-t)$$

$$ANRR = (Ic - t\ Id\ d)Y/(1-t) - CR\ t/(1-t) + Db$$

In order to study the effect of various depreciation methods on customers, one possible way is to use some one parameter criterion like present worth for comparing time series of cash flows. The present worth of revenue requirements for BM-BM, F, and N is given by

$$PBMRR = BMRR/(1+i)^n$$

$$PFRR = FRR/(1+i)^n$$

$$PANRR = ANRR/(1+i)^n$$

Effect on Tax Collectors

A tax collection agency like the Federal Treasury would be interested in the annual tax payments by the utility. Taxes for BM-BM, F, and N are given by

$$BMT = (Ic - Id\ d)\ X\ t/(1-t) - CR\ t/(1-t)$$

$$FT = [(Ic - Id\ d)X + Db - Dt - CR]t/(1-t)$$

$$ANT = (Ic - Id\ d)Y\ t/(1-t) + t(Db - Dt) - CR\ t/(1-t)$$

Once again, present worth method is used to compare the prospective streams of annual tax payments. The present worth of taxes for BM-BM, F, and N is given by

$$PBMT = BMT/(1+i)^n$$

$$PFT = FT/(1+i)^n$$

$$PANT = ANT/(1+i)^n$$

Effect on Firm

If the firm chooses to minimize the revenue requirements, then its interests coincide with those of the customers. Normally, however, the firm would be interested in maximizing cash flow (i.e., after tax cash flow), which is obtained by subtracting tax payments from revenue requirements.

Cash flows for BM-BM, F, and N are given by

$$BMC = BMRR - BMT$$

$$FC = FRR - FT$$

$$ANC = ANRR - ANT$$

Present worths of these cash flow patterns are given by

$$PBMC = BMC/(1+i)^n$$

$$PFC = FC/(1+i)^n$$

$$PANC = ANC/(1+i)^n$$

Effect on Bond Holders

Bonds have assigned quality ratings which reflect the probability of the bond's going into default.

Although the rating assignments are judgmental, they are based on both qualitative and quantitative factors, some of which are listed below

1. Debt/assets ratio
2. Time interest earned ration
3. Times fixed charges covered ratio
4. Stability of sales and earnings
5. In case of a regulatory company, could an adverse regulatory climate cause the company's economic position to decline

The quantity used here to compare the effect on bond holders of various policies is interest coverage or times interest earned ratio. This is the ratio of pre-tax earnings to interest expense, and is taken as some sort of inverse measure of the risk that earnings will fail to cover interest expense, even though this risk is usually very small. Pre-tax earnings are used because taxes are computed after subtraction of interest expense.

Yearly interest coverage values for BM-BM, F, and N are given by

BMICOV = (Ic X + BMT)/Id d X

FICOV = (Ic X + FT)/Id d X

In the case of normalization, the revenues collected to add to the normalization reserve are included in the pre-tax earnings. The interest expense is calculated on the reduced rate base Y, interest coverage under normalization is given by

ANICOV = (Ic Y + ANT + NF)/Id d Y

Effect on Equity Holders

One quantity of interest to equity holders might be the after tax cash flow which is obtained by subtracting income tax payments and operating costs from operating revenues.

In a utility setting, under the assumptions of the model developed here, operating revenues are the same as revenue requirements. Since operating costs have been ignored in the model, the after tax cash flow can be obtained by subtracting income tax payments from revenue requirements.

Based on this criterion, equity holders' interests will coincide with those of the firm.

Utility Rates

Utility rates bear a close relationship to the capital cost per unit of gross plant. It may be supposed that for a fixed unit price, revenue requirement is proportional to the gross plant. The assumptions made are: (1) constant returns to scale, (2) perfectly inelastic demand, (3) complete equality between revenue requirement and revenues, and (4) utility provides a single service with a single unit price.

Utility rates are obtained by dividing revenue requirements by that year's gross plant. Utility rates are given by

BMUR = BMRR/tgross Plant

FUP = FRR/Gross Plant

ANUR = ANRR/Gross Plant

where

BM-BM = same method for book and tax depreciation

F = Flow through firm

N = Normalized firm

Ic = cost of capital

Id = cost of debt capital

Ie = cost of equity capital

d = debt ratio

t = tax rate

Db = book depreciation

Dt = tax depreciation

CR = cost of removal

X = rate base for flow through

Y = rate base under normalization

NR = deferred tax reserve

BMRR = revenue requirement for BM-BM

FRR = revenue requirement for F

ANRR = revenue requirement for N

BMT = tax paid for BM-BM

FT = tax paid for F

ANT = tax paid for N

BMICOV = interest coverage for BM-BM

FICOV = interest coverage for F

ANICOV = interest coverage for N

BMUR = utility rates for BM-BM

FUR = utility rates for F

ANUR = utility rates for N

i = customers' discount rate

PBMRR, PFRR, PANRR, etc., stand for present worth of revenue requirements for BM-BM, F, and N respectively.

THE SIMULATION PROCEDURE

The empirical analysis performed in this study is based on the results of a simulation procedure that projects the values of key financial and economic variables eighty years into the future. In this section, simulation procedure used in this investigation is described.

Simulation, one of the most widely used tools of management science has been defined by Naylor (37).

> Simulation is a numerical technique for conducting experiments on a digital computer, which involves certain types of mathematical and logical relationships necessary to describe the behavior and structure of a complex real-world system over extended periods of time.

In a financial simulation as is constructed here, it is necessary to develop the relations that exist between the various variables. The financial model developed in the previous section represents these relationships.

A description of the input values required for the simulation is given below.

1. The key problem in this section was to generate a hypothetical property account given a certain average service life, dispersion pattern, growth, and inflation.

This was accomplished by using a computer program, Plant Generator Model (PGM), developed by Erbe(38). This program generates hypothetcal property accounts and is capable of simulating the life of a property account over a period of years. During its life, the rate of growth and mortality characteristics of the property involved may be altered to approximate real life conditions. The program begins with an initial plant installation and simulates the retirements that will be experienced. Additions to plant are made as required to replace retirements from each vintage and to maintain the plant balances as specified by the rate of growth. The rate of growth is sampled from a normal distribution with a mean as specified and a standard deviation equal to ten percent of the specified mean. The property account may contain either unit or dollar figures. Accounting on a unit basis merely records the number of items of property as they are added or retired. Accounting by monetary totals expresses additions, retirements, and plant balances as dollar values. The units of property are priced for accounting purposes at the time of their retirement. This distinction is, necessary because of inflation which is accounted for by the PGM.

Simulation of retirements may be accomplished by either random value (Monte Carlo) or expected value techniques.

By drawing a series of random numbers, the entire retirement experience is simulated. Expected value simulation of retirements assumes that the property will behave as prescribed by the dispersion specified for the property. The retirements from any vintage at a given point in time are determined by multiplying the original installations by the value of the retirament density function for the age of the vintage at that point in time. As previously stated, the retirements are priced at the time of retirement. Value at retirement is chosen by randomly selecting a price within the acceptable range about the mean price. The price is adjusted for the effects of inflation at the time of retirements.

The vintages comprising a given account are assumed to be independent and uniform. Thus, the retirements of a given vintage will not be affected by the units in the plant from other vintages. The ages at retirement for the units within a given vintage are not, however, independent of each other. Retirement of a unit at a given age is contingent upon its not having been retired at any other age.

The parameters which remain constant throughout the life of the account are the type of simulation desired, the original number of units at time of installation and the limits of price variation and the limits of price variation and the rate of inflation. Parameters such as dispersion, average service life and growth rate of the plant balance may be altered independently at any time during the life of the account. The output from PGM program consists of a complete description of each vintage that enters the plant. It provides the balance in the vintage and retirements for each age interval after the original installation. The gross additions, retirements, and plant balances for the total plant are included with the output for each separate vintage. For the purpose of this study, PGM program was used to determine yearly additions, retirements, and plant balances for different values of inputs.

2. The income tax rate for this study was assumed to be 48%. One simulation was performed at 35% income tax rate to observe the results of a reduction in tax rate.

3. The percentage of total capitalization that is debt capital was assumed to be 50% for all periods reflecting the assumption that debt ratio stays the same.

4. Debt and equity capital costs were assumed to be 7% and 13% respectively. In order to observe the effect of an increasing pattern of cost of capital, the simulation program provides an option with which the cost of equity and debt capital increases by 1% each year for the period of simulation. Also, to study the effects of a differential cost of capital for the flowthrough firm, its cost of debt and equity capital is increased by 5% and 8% respectively.

5. Inflation was assumed to be 6%, for the simulation with inflation, cost of debt and equity capital are increased to 8% and 15% respectively.

6. Three rates of discount have been used to determine the present worth of yearly streams of revenue requirements, tax payments, and cash flow. It is always a problem to determine the time value of money for customers, it is expected, however, that rates of 3.8%, 8.5%, and 13.2% will provide a reasonable representation of discount rate.

Overview of Computer Program

A general description of the computer program is provided in this section.

SUBROUTINE SLD

This subroutine is used to calculate yearly accruals based on straight line average life procedure. The input required here is yearly values of plant balances and average service life. Based on this information, this subroutine calculates depreciation accruals, net book and depreciation reserve values.

SUBROUTINE SLELG

Depreciation accruals for straight line equal life group method are calculated in this module. The inputs required here are yearly additions and percentage survivors for a particular survivor curve. Based on the survivor curve yearly depreciation rates are calculated. Each year's additions are treated as vintages and depreciation charges for a particular year's vintage are calculated by multiplying that year's depreciation rate by the dollar amount of vintage.

The total amount of depreciation charge for a particular year is obtained by summing up for that year the depreciation charges for various vintages.

SUBROUTINE SOYD

Yearly depreciation rates, in this method are calculated on the sum of the years digits remaining life method. Depreciation charges for a year are calculated by multiplying yearly average plant balance by remaining life rate for that year.

SUBROUTINE ADR

ADR depreciation charges are calculated on vintage basis. The method used here calculates the first two year's depreciation charges of a vintage by the double declining balance method. From year three on the accruals are calculated by sum of the years digits method on a remaining life basis. Once again, the total depreciation charge for a particular year is obtained by summing up for that year the depreciation charges for various vintages.

Yearly cost of removal is calculated based on the survivor curve for the property.

SUBROUTINE ANALYSIS

Year by year values of various financial parameters are calculated in this module. Revenue requirements, cash flow, tax payments, interest coverage, return to equity, and unit capital costs are calculated here for different methods of book depreciation and ADR for tax depreciation. The program also calculates present worth of revenue requirements, tax payments, and cash flow at three different interest rates which can be specified for each run.

SUBROUTINE PRINT5

This subroutine prints the results of simulation study in a tabular form. A set of five tables is printed for each combination of book and tax depreciaion methods. With three methods of book depreciation, 15 tables are generated for each simulation run.

The titles of the tables are :

1. Effect on Customers
2. Effect on Tax Collector
3. Effect on Utility Firm
4. Effect on Bond Holders
5. Utility Rates

These tables are based on yearly values of revenue requirements, tax payments, cash flow, interest coverage, and utility rates respectively.

A description of the various sets of input values used in the simulation phase follows:

SET 1

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 50%, Id = 7%, Ie = 13%, t = 48%

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = L0, R3, S5

SET 2

g =12% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 50%, Id = 7%, Ie = 13%, t = 48%

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = L0, R3, S5

SET 3

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 50%, Id = 7%, Ie = 13%, t = 48%

Salvage = -40%, ASL = 20 years, Inflation = 0%

Dispersion Pattern = L0, R3, S5

SET 4

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 40%, Id = 7%, Ie = 13%, t = 48%

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = R3

SET 5

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 40%, Id = 7%, Ie = 13%, t = 35%

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = R3

SET 6

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 50%, Id = 7%, Ie = 13%, t = 35%

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = R3

SET 7

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 50%, Id = 8%, Ie = 15%, t = 48%

Salvage = zero, ASL = 20 years, Inflation = 6%

Dispersion Pattern = R3

SET 8

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 50%, Id = 7%, Ie = 13%, t = 48%

Cost of debt and equity increase by 1% each year.

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = R3

SET 9

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80

d = 50%, Id = 7%, Ie = 13%, t = 48%

Differential cost of capital for flowthrough firm

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = R3

SET 10

g = 6% for Yr. 2 - 35, decay from thereond = 50%, Id = 7%, Ie = 13%, t = 48%

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = L0, R3, S5

SET 11

g = 0% for Yr. 2 - 80

d = 50%, Id = 7%, Ie = 13%, t = 48%

Salvage = zero, ASL = 20 years, Inflation = 0%

Dispersion Pattern = R3

RESULTS AND DISCUSSIONS

This study seeks to describe the influence of flow through and normalization on the evolution in time of revenue requirements and other financial variables for a utility firm. Effects of different mortality dispersion patterns, varying growth rates, different salvage values, etc., on different financial variables are considered.

The very nature of this study is such that an attempt to summarize the results would tend to suffer from the risk of loss of vital information; on the other hand presenting approximately 225 tables would be extremely cumbersome, voluminous, and somewhat meaningless. The approach taken, therefore, is to provide summary results which are included in Appendix A. A further summary of these results along with an explanation is presented in this section to provide background for a cohesive discussion of results which follows later on.

Results

In the brief summary presented below, Set 1 has been used as a base set for comparison purposes.

Set 1

For all three dispersion patterns and all three book depreciation methods revenue requirements under flow through (FRR) are initially less than those under normalization (ANRR). After a turn around time FRR becomes more than ANRR.

Tax payments, cash flow, and unit capital costs follow a pattern similar to revenue requirements. Interest coverage under flow through (FICOV) is, during early years, less than that under normalization (ANICOV), during later years of life of the account FICOV is greater than ANICOV.

Set 2

The variable altered in this set is the growth rate.

For growth rates of 12%, FRR is always less than ANRR, once the plant reaches a situation of zero growth, ANRR becomes less than FRR. Tax payments, cash flow, and unit capital costs follow a pattern similar to revenue requirements.

Interest coverage follows the same pattern as the base set.

Set 3

In the presence of a negative salvage in account, FRR is initially less than ANRR, than becomes more, and finally is less. FICOV is usually higher than ANICOV.

Set 4

Debt ratio is altered in this set.

Reducing debt ratio to 40% from the base value of 50% results in increased revenue requirements, income taxes, and cash flow under both methods. On present worth basis the results obtained are similar to the case when debt ratio is 50%.

Interest coverage is increased under both flowthrough and normalization.

Set 5

Income tax rate is changed in this set.

If the income tax rate is reduced to 35%, tax payments and interest coverage decrease for both flow through and normalization. Revenue requirements and cash flow exhibit a pattern similar to the base case.

Set 6

The income tax rate and debt ratio are changed in this set.

Revenue requirements, taxes, and cash flow exhibit a pattern similar to the base set. Interest coverage is increased under both flow through and normalization.

On a present worth basis the results obtained are similar to the base case.

Set 7

The variable altered in this section is inflation.

When inflation is introduced along with a growth rate, turn around occurs several times for revenue requirements, taxes, and cash flow.

Interest coverage for flow through is less than that for normalization.

Set 8

A pattern of increasing debt and equity cost yields results similar to the base set.

Set 9

When a differential cost of capital is used for the flow through firm, turn around point occurs earlier than the base case. Revenue requirements, income taxes, and cash flow increase for flow through and stay the same for normalization. Interest coverage for flow through is increased, and is more than that under normalization in the later years.

Set 10

In this set the plant experiences a growth till year 35, and then additions are stopped and decay of plant is permitted. Revenue requirements, taxes, cash flow, and interest coverage exhibit the same behavior as that of the base case. During years of decay, the interest coverage under flow through is larger than normalization.

Set 11

When plant is allowed to have only a zero growth, i.e., a condition of constant plant balance, then revenue requirements, taxes, and cash flow exhibit a pattern similar to the base case. Interest coverage under flow through and normalization are very similar in value to each other.

Discussion

The criteria used in this study to compare the effect of flow through and normalization were: (1) present worth comparison of revenue requirements, income taxes, and cash flow for the period of simulation, (2) observation of yearly behavior pattern of various financial variables over time.

An examination of the simulation results revealed that the choice between normalization and flow through on a present worth basis is invariably different depending on the interest rate used. Results based on this criterion, therefore, have not been discussed and have been left to the confines of the detailed summary results provided in Appendix A.

The discussion provided here is based on an observation of the yearly behavior pattern and is limited to revenue requirements. The reasons for discussing only the revenue requirements are: (1) since the beginning of debate on flow through and normalization, revenue requirements have been the main cause of concern, (2) simulation results obtained, genrally speaking, exhibit a similarity between patterns of revenue requirements, income taxes, and cash flow.

Within this framework, an attempt is made below to discuss the results with some degree of generality. Because of a complete lack of explicit choices, some bias is bound to be incorporated in the following discussion. It is suggested, therefore, that the following be studied in light of the detailed summary so as to avoid misconstruction.

Effect of Mortality Dispersion Patterns

For conditions of growth in the account of the order of 6%, it is observed that there are several turn around points (when flow through revenue requirements become more than normalization revenue requirements) for less dispersed properties and usually just one for more dispersed properties. Examples of less dispersed properties are buildings, structures, etc., whereas telephone poles and other small item accounts are examples of more dispersed properties.

One possible reason for this lies in the way deferred tax reserve builds up for properties exhibiting different dispersion patterns. The less dispersed properties have a greater concentration of retirement frequencies in the region of average life, and their spread, or standard deviation, is therefore less than that of curves with lower modes. This results in a surging nature of additions for less dispersed properties, thereby reducing revenue requirements under flow through in the years following these large additions. Gradually, this effect is outweighed by an increase in deferred tax reserve giving rise to another turn around point.

The indication, therefore is, that for properties having more dispersion, revenue requirements under flow through are more than those under normalization; flow through, therefore, would appear to be inferior to normalization for such properties. However, for properties having less dispersion, the choice is somewhat unclear.

Effect of Growth

The amount of growth in plant account has a considerable effect on the pattern of revenue requirements under flow through and normalization.

For growth rates of the order of 6%, a turn around point occurs early in the life of the account, this behavior has been explained in the preceding section.

When growth rate are increased to 12%, almost identical pattern of results is obtained for different dispersion patterns. Revenue requirements under flow through are always less than those under normalization, for the periods of growth.

The indication is that for high growth rates of the order of 12%, flow through appears to be superior to normalization. At low growth rates the choice is influenced by dispersion pattern of the property under consideration.

Effect of Inflation

The phenomenon of inflation has been incorporated in the program by pricing additions at inflated costs. Further, it is assumed that units retired are replaced by the same number of identical units. This is a critical assumption because in certain situations of technological improvements this may not be so.

Within this framework, introduction of 6% inflation along with a 6% growth rate yields results which are similar to the case when growth rate is of the order of 12%.

Because units retired are replaced at inflated dollars, whenever a major retirement takes place the subsequent replacements would create a surging effect as discussed previously, giving rise to more turn around points.

The conclusion in this case is the same as that for the case of 12% growth. Flow through appears to be superior to normalization. This may vary in real life situations, depending on the rate of inflation and its effect on retirement policy.

Effect of Negative Salvage

A utility company as a whole perhaps would have net salvage around zero. However, for a particular account this may not be true. As stated earlier, certain accounts do experience high negative salvage. Introduction of negative salvage in account yields results which are quite different from the case when salvage is zero. The revenue requirements for all dispersion patterns are initially less for flow through, then less for normalization, and again less for flow through. A possible explanation is given below.

Under conditions of growth, with a zero salvage, the tax depreciation amount is more than book depreciation amount each year. This gives rise to a continuously increasing deferred tax reserve. This, however, is not the case when a negative salvage is introduced in the account.

As stated earlier, the current ADR tax regulations do not permit recovery of expense for negative salvage by increasing the depreciation accrual for tax purposes. Cost of removal incurred in any year has to be expensed in that year for tax purposes. For book depreciation purposes, however, companies have several choices, one popular one being to increase the depreciation accrual by either increasing depreciation rate or rate base. Depending upon the type of depreciation method and property dispersion being used, the book depreciation accruals will gradually become more than tax depreciation accruals resulting in a negative deferred tax reserve.

For more dispersed properties, the deferred tax reserve turns negative at a slower rate than for less dispersed properties, and, therefore, the effect on revenue requirements, cash flow, etc., is relatively more noticeable in less dispersed properties.

Based on the results obtained from this study it seems that the number of years for which revenue requirements are less for flow through than for normalization is relatively great; flow through, therefore, appears to be favorable.

Effects of Various Depreciation Methods/Procedures

The depreciation method/procedure is entwined in the model in such a way that it is difficult to isolate the effects of various depreciation methods on the behavior of revenue requirements under flow through and normalization.

The deferred tax reserve builds up at a slower rate for straight line method equal life group procedure and sum of the years digits method than for straight line method and average life procedure. Depending upon the dispersion pattern under consideration, the turn around point would seem to occur earlier for straight line method average life procedure and later for straight line method equal life group procddure and sum of the years digits method.

Sensitivity Analysis

Limited sensitivity analysis was conducted to determine how changes in the values of the economic variables affect the output variables of interest. The economic variables whose values were altered are debt ratio and income tax rate.

It was observed that a decrease in debt ratio to 40% from the base figure of 50% increases revenue requirements, taxes, and cash flow for both normalization and flow through. The relative magnitude of numbers, however, stays the same.

It appears, therefore, that a decrease in debt ratio does not affect the comparison between flow through and normalization based on the relative magnitudes of revenue requirements under the two methods.

A reduction in the tax rate does not create any noticeable difference in the relative magnitudes of the various variables under flow through and normalization.

One quantity that has not been discussed here is the interest coverage. Interest coverage is generally less for flow through than for normalization. In case of negative salvage the result is reversed.

CONCLUSIONS

The simulation study disclosed the following general indications. It will be understood that the conclusions stated here were derived within the framework of the model and with conditions and qualifications detailed in the text.

1. The revenue requirements for a utility firm using accelerated tax depreciation are at first less under flow through than normalization, resulting in lower unit capital costs for flow through; after an interval, however, revenue requirements will increase causing unit capital costs to increase for flow through, and hence rate increases will be required to maintain the rate of return. This interval, termed as turn around time, is dependent upon the dispersion pattern, the growth rate, and the method used for book depreciation.

2. The turn around point occurs earlier for straight line average life and later for straight line equal life group and the sum of the years' digits method.

3. For growth rates of 6%, the turn around point occurs early in the life of the account. For a growth rate of 12%, revenue requirements under flow thro only after the property reaches a condition of zero growth.ugh are always less than those under normalization, the turn around point occurs

4. For the period of growth, interest coverage is less under flow through than under normalization. Once the account reaches stability, this is not necessarily the case as there are years when this quantity is higher under flow through.

5. When 6% inflation as modeled in the text is introduced along with a 6% growth rate, revenue requirements exhibit a behavior somewhat similar to the case when growth rate is 12%. Inflation, however, gives rise to more turn around points.

6. The presence of negative salvage in the account has a very noticeable effect on the choice between flow through and normalization. The results obtained are quite different from the case when zero salvage is considered. The revenue requirements at first are less under flow through, then become more than flow through, and finally for a relatively long period of simmulation are less under flow through than normalization. The quantity "times interest earned" is, however, more for flow through than normalization.

In summary, based on the results obtained from this study, it is difficult to make an explicit recommendation in regards to either flow through or normalization. For growth rates of 6%, normalization appears fo be superior to flow through based on the criteria detailed in the text. For 12% growth or a combination of 6% growth with 6% inflation flow

thrcugh appears to be favorable. In case of a negative sal-
vage of the order of 40%, flow through seems to be favorable.

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APPENDIX A: SUMMARY OF SIMULATION RESULTS

SET 1

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 50%, Id = 7%, Ie = 13%, t = 48%
Salvage = zero, ASL = 20 years, Inflation = 0%
Dispersion Pattern = L0, R3, S5

L0

SL_AV_LIFE

REVENUE_REQUIREMENTS

YR. 1 - 10 FRR < ANRR, Yr. 11 - 80 FRR > ANRR

	BMFR	FRR	ANRR
PW AT 3.8%	272099	240346	218376
PW AT 8.5%	56842	47522	47194
PW AT 13.2%	24757	19641	21113

TAX_PAYMENTS

YR. 1 - 13 FT < ANT, Yr. 13 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	73061	41308	36875
PW AT 8.5%	15529	6210	8273
PW AT 13.2%	6867	1752	3761

CASH_FLOW

YR. 1 - 9 FC < ANC , YR. 10 - 80 FC > ANC

	BMC	FC	ANC

PW AT 3.8%	199038	199038	181501
PW AT 8.5%	41312	41312	38921
PW AT 13.2%	17886	17886	17352

FICOV < ANICOV

FOR ALL YEARS

SL_ELG

REVENUE_REQUIREMENTS

YR. 1 - 80 FRR < ANRR , YR. 11 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	240787	221420	208615
PW AT 8.5%	52740	47288	47109
PW AT 13.2%	23933	20977	21842

TAX_PAYMENTS

YR. 1 - 13 FT < ANT , YR. 14 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	56288	36920	36768
PW AT 8.5%	12420	6967	8270
PW AT 13.2%	5673	2737	3761

CASH_FLOW

YR. 1 - 10 FC < ANC , YR. 11 - 80 FC > ANC

FICOV < ANICOV FOR ALL YEARS

SOYD

REVENUE REQUIREMENTS

YR. 1 - 10 FRR < ANRR , YR. 11 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	234548	222031	21346
PW AT 8.5%	52670	48868	48732
PW AT 13.2%	24263	22050	22686

TAX PAYMENTS

YR. 1 - 12 FT < ANT , YR. 12 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	51165	38648	36752
PW AT 8.5%	11723	7921	8269
PW AT 13.2%	5503	3290	3761

CASH FLOW

YR. 1 - 8 FC < ANC , YR. 9 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	183383	183383	176717
PW AT 8.5%	40946	40946	40462
PW AT 13.2%	18760	18760	18925

FICOV < ANICOV FOR ALL YEARS

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 - 80 FRR < ANRR , YR. 9 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	235826	214173	197762
PW AT 8.5%	49945	43306	42751
PW AT 13.2%	22241	18196	19358

TAX PAYMENTS

YR. 1 - 10 FT < ANT , YR. 11 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	59052	37398	33507
PW AT 8.5%.	12914	5997	7492
PW AT 13.2%	5914	1869	3438

CASH FLOW

YR. 1 - 7 FC < ANC , YR. 7 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	176775	176775	164254
PW AT 8.5%	37309	37309	35259
PW AT 13.2%	16327	16327	16327

FICOV > ANICOV FOR YR. 65 - 74 AND LESS FOR OTHERS.

SL ELG

REVENUE REQUIREMENTS

YR. 1 - 8 FRR < ANRR , YR. 8 - 80 FRR < ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	229617	210305	195758
PW AT 8.5%	49131	42975	42723
PW AT 13.2%	22070	18463	19499

TAX PAYMENTS

BMT FT ANT

YR. 1 - 9 FT < ANT , YR. 10 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	55751	36459	33490
PW AT 8.5%	12297	6140	7492
PW AT 13.2%	5627	2065	3438

CASH FLOW

YR. 1 - 7 FC < ANC ,YR. 8 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	173846	173846	162268
PW AT 8.5%	36834	36834	34321
PW AT 13.2%	16443	16443	16061

YR. 68 - 74 FICOV > ANICOV AND LESS IN OTHER YEARS.

SOYD

REVENUE REQUIREMENTS

YR. 1 - 7 FRR < ANRRB , YR. 7 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	203684	197548	192868
PW AT 8.5%	45960	43751	43654
PW AT 13.2%	21528	20044	20470

TAX PAYMENTS

YR. 1 - 8 FT < ANT , YR. 8 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	40694	34557	53447
PW AT 8.5%	9504	7295	7490
PW AT 13.2%	4606	3122	3438

CASH FLOW

YR. 1 - 7 FC < ANC , YR. 7 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	162990	162990	159421
PW AT 8.5%	36456	36456	36163
PW AT 13.2%	16921	16921	16921

YR. 67 - 75 FICOV > ANICOV AND IS LESS IN OTHER YEARS.

S5

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 - 8 FRR < ANRR; 9 - 21 FRR > ANRR; 22 - 26 FRR< ANRR

27 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	227876	208224	193320
PW AT 8.5%	48451	42049	41781
PW AT 13.2%	21680	17869	18964

TAX PAYMENTS

YR. 1 - 9 FT < ANT; 10 - 21 FT > ANT; 22 - 28 FT < ANT

29 - 80 FT > ANT.

	BMT	FT	ANT
PW AT 3.8%	56082	36430	32923
PW AT 8.5%	12352	5950	7332
PW AT 13.2%	5703	1893	3365

CASH FLOW

YR. 1 - 7 FC < ANC; 8 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	171794	171794	160396
PW AT 8.5%	36098	36098	34450

PW AT 13.2%	15976	15976	15599

YR. 15 - 16 AND 66 - 74 FICOV < ANICOV

SL_ELG

REVENUE_REQUIREMENTS

YR. 1 - 8, FRR < ANRR; 9 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	226855	207586	192988
PW AT 8.5%	48321	42038	41777
PW AT 13.2%	15986	15986	15619

TAX_PAYMENTS

YR. 1 - 9 FT > ANT; 10 - 20 FT > ANT; 22 - 28 FT <

ANT;

29 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	55544	36274	32919
PW AT 8.5%	12255	5973	7332
PW AT 13.2%	5663	1922	3365

CASH_FLOW_

YR. 1 - 7 FC < ANC; 8 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	1717311	171311	260068
PW AT 8.5%	36065	36065	34444

PW AT 13.2%	15986	15986	15619

YR. 15 - 16 AND 66 - 74 FICOV > ANICOV

SOYD

REVENUE REQUIREMENTS

YR 1 - 6 FRR < ANRR; 7 - 21 FRR > ANRR; 22 - 28 FRR < ANRR

29 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	197403	192558	188785
PW AT 8.5%	44572	42656	42750
PW AT 13.2%	20933	19593	19978

TAX PAYMENTS

YR. 1 - 7 FT < ANT; 8 - 21 FT > ANT; 22 - 30 FT < ANT

31 - 41 FT > ANT; 42 - 49 FT < ANT; 50 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	55544	36274	32919
PW AT 8.5%	12255	5973	7332
PW AT 13.2%	5668	1922	3365

CASH FLOW

YR. 1 - 7 FC < ANC; 8 - 80 FC > ANC

	BMC	FC	ANC

PW AT 3.8%	141859	141859	155866
PW AT 8.5%	36683	36683	35238
PW AT 13.2%	17671	17671	16613

FICOV > ANICOV FOR YR. 12 - 19 AND 61 - 75

SET 2

g =12% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 50%, Id = 7%, Ie = 13%, t = 48%
Salvage = zero, ASL = 20 years, Inflation = 0%
Dispersion Pattern = L0, R3, S5

L0

SL_AV_LIFE

REVENUE_REQUIREMENTS

YR. 1 - 59 FRR < ANRR; 60 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	4066733	3628262	339194
PW AT 8.5%	390957	329477	329824
PW AT 13.2%	77081	61401	65984

TAX_PAYMENTS

YR. 1 - 60 FT < ANT; 61 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	1099944	661474	647624
PW AT 8.5%	107207	45728	61128
PW AT 13.2%	21412	5731	11936

CASH_FLOW_

YR. 1 - 59 FC < ANC; 59 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	2966788	2966788	2144289

PW AT 8.5%	283749	283749	268696
PW AT 13.2%	55670	55670	54047

YR. 69 - 78 FICOV < ANICOV

SL_FLG

REVENUE_REQUIREMENTS

YR. 1 - 59 FRR < ANRR; 60 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	3697341	3407136	3277010
PW AT 8.5%	365873	328644	329429
PW AT 13.2%	74518	65442	68109

TAX_PAYMENTS

YR. 1 - 60 FT < ANT; 61 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	901190	610984	645851
PW AT 8.5%	87949	50721	61076
PW AT 13.2%	17768	8691	11935

CASH_FLOW_

YR. 1 - 59 FC < ANC; 59 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	2796150	2796150	2631158
PW AT 8.5%	277923	277923	268352
PW AT 13.2%	56750	56751	56173

YR. 71 - 74 FICOV > ANICOV

SOYD

REVENUE REQUIREMENTS

YR. 1 - 59 FRR < ANRR; 60 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	3578875	3463744	3362389
PW AT 8.5%	364109	341954	341165
PW AT 13.2%	75444	68892	7078I

TAX PAYMENTS

YR. 1 - 60 FT < ANT; 61 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	785644	670509	644590
PW AT 8.5%	81164	59010	61040
PW AT 13.2%	17089	10537	11937

CASH FLOW

YR. 1 - 59 FC < ANC; 59 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	2793232	2793232	2712298
PW AT 8.5%	282945	282944	280124
PW AT 13.2%	58354	58354	58848

YR. 61 - 78 FICOV > ANICOV

THE RESULTS FOR R3 AND S5 FOLLOW THE SAME PATTERN

SET 3

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 50%, Id = 7%, Ie = 13%, t = 48%
Salvage = -40%, ASL = 20 years, Inflation = 0%
Dispersion Pattern = LO, R3, S5

R3

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 - 8 FRR < ANRR; 9 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	279630	298356	289251
PW AT 8.5%	59007	59261	58969
PW AT 13.2%	25901	24604	25380

TAX PAYMENTS

YR. 1 - 9 FT < ANT; 10 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	64314	829908	78007
PW AT 8.5%	14026	14280	16358
PW AT 13.2%	6330	5032	7058

CASH FLOW

YR. 1 - 8 FC < ANC; 9 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	215366	215366	211244

PW AT 8.5%	44980	44980	42610
PW AT 13.2%	19571	19571	18327

YR. 11 - 80 FICOV > ANICOV

SL ELG

REVENUE REQUIREMENTS

YR. 1 FRR < ANRR; 2 - 28 FRR > ANRR; 29 - 80 FRR < ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	235843	271859	275585
PW AT 8.5%	53265	58932	58851
PW AT 13.2%	24748	26502	26403

TAX PAYMENTS

FT AND ANT ARE QUITE SIMILAR, WITH SEVERAL FLUCTUATIONS BETWEEN THE VALUE

	BMT	FT	ANT
PW AT 3.8%	40831	76846	77856
PW AT 8.5%	9674	15341	16354
PW AT 13.2%	4658	6412	7057

CASH FLOW

YR. 1 FC < ANC; 2 - 27 FC > ANC; 28 -80 FC < ANC

	BMC	FC	ANC
PW AT 3.8%	195012	195012	197727

PW AT 8.5%	43591	43951	4249M
PW AT 13.2%	20090	20090	19349

YR. 2 - 80 FICOV > ANICOV

SOYD

REVENUE REQUIREMENTS

YR. 1 FRR < ANRR; 2 - 23 FRR > ANRR; 24 - 80 FRR < ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	188404	251549	269559
PW AT 8.5%	49297	60460	60460
PW AT 13.2%	24538	28378	27680

TAX PAYMENTS

YR. 1 FT < ANT; 2 - 32 FT > ANT; 33 - 80 FT < ANT

	BMT	FT	ANT
PW AT 3.8%	12020	75165	7758M
PW AT 8.5%	5954	17118	16345
PW AT 13.2%	3732	7522	7058

CASH FLOW

YR. 1 FC < ANC; 2 - 20 FC > ANC; 21 - 80 FC < ANC

	BMC	FC	ANC
PW AT 3.8%	176384	176834	191971
PW AT 8.5%	43343	43343	44100

PW AT 13.2%	20806	20806	20622

FICOV > ANICOV UPTO YEAR 63 AND THEN IT TURNS NEGATIVE.

R3

SL_AV_LIFE

REVENUE_REQUIREMENTS

YR. 1 - 6 FRR < ANRR; 7 - 49 FRR > ANRR; 50 - 80 FRR < ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	227493	252839	249940
PW AT 8.5%	49254	50625	50393
PW AT 13.2%	22343	21413	21884

TAX_PAYMENTS

YR. 1 - 7 FT < ANT; 8 - 75 FT > ANT; 76 - 80 FT < ANT

	BMT	FT	ANT
PW AT 3.8%	44171	69518	64495
PW AT 8.5%	10325	11695	13145
PW AT 13.2%	4982	4052	5614

CASH_FLOW

YR. 1 - 5 FC < ANC; 6 - 46 FC > ANC; 47 - 80 FC < ANC

	BMC	FC	ANC
PW AT 3.8%	183321	183321	185444
PW AT 8.5%	38929	38929	37247
PW AT 13.2%	17361	17360	1627[illegible]

YR. 1 - 9 FICOV < ANICOV; 10 - 80 FICOV > ANICOV

YR. 1 - 37 FINV > ANINV; 38 - 80 FINV < ANINV

SL ELG

REVENUE REQUIREMENTS

YR. 1 - 5 FRR < ANRR; 6 - 42 FRR > ANRR

43 - 80 FRR < ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	218801	247424	247134
PW AT 8.5%	48102	50539	50353
PW AT 13.2%	22104	21787	22082

TAX PAYMENTS

YR. 1 - 6 FT < ANT; 7 - 74 FT > ANT; 75 - 80 FT < ANT

	BMT	FT	ANT
PW AT 3.8%	39581	68204	64470
PW AT 8.5%	9460	11896	13144
PW AT 13.2%	4643	4326	5614

CASH FLOW

YR. 1 - 6 FC < ANC; 7 - 40 FC > ANC; 41 - 80 FC <ANC

	BMC	FC	ANC
PW AT 3.8%	179216	179216	182663
PW AT 8.5%	38642	38642	37720.
PW AT 13.2%	17460	17460	16468

YR. 1 - 8 FICOV < ANICOV; 9 - 80 FICOV > ANICOV

YR. 1 - 20 FINV > ANINV; 21 - 80 FINV < ANINV

SOYD

REVENUE REQUIREMENTS

YR. 1 FRR < ANRR; 2 - 21 FRR > ANRR; 22 - 80 FRR < ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	142893	206115	229403
PW AT 8.5%	39820	51053	51149
PW AT 13.2%	20764	24570	23678

TAX PAYMENTS

YR. 1 FT < ANT; 2 - 39 FT > ANT; 40 - 80 FT < ANT

	BMT	FT	ANT
PW AT 3.8%	-2939	60281	64273
PW AT 8.5%	2780	14013	63138
PW AT 13.2%	2466	6271	5614

CASH_FLOW

YR. 1 FC < ANC; 2 - 19 FC > ANC; 20 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	145833	145833	165129
PW AT 8.5%	37039	37039	38010
PW AT 13.2%	18298	18298	1806J

FICOV TURNS NEGATIVE.

SIMILAF RESULTS ARE OBTAINED FOR S5

SET 4

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 40%, Id = 7%, Ie = 13%, t = 48%
Salvage = zero, ASL = 20 years, Inflation = 0%
Dispersion Pattern = R3

SL_AV_LIFE

REVENUE_REQUIREMENTS

YR. 1 - 7 FRR < ANRR; 8 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	253541	231888	211196
PW AT 8.5%	53819	46911	45815
PW AT 13.2%	24015	19970	20808

TAX_PAYMENTS

YR. 1 - 8 FT < ANT; 9 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	70860	49208	40850
PW AT 8.5%	15498	8580	9221
PW AT 13.2%	7097	3052	4280

CASH_FLOW

YR. 1 - 7 FC< ANC; 8 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	182681	182681	170345
PW AT 8.5%	38331	38331	36594

PW AT 13.2%   16918   16918   16528

YR. 1 - 66 FICOV < ANICOV; 67 - 75 FICOV > ANICOV

RESULTS FOR SLELG AND SOYD ARE SIMILAR

SET 5

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 40%, Id = 7%, Ie = 13%, t = 35%
Salvage = zero, ASL = 20 years, Inflation = 0%
Dispersion Pattern = R3

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 FRR < ANRR; 2 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	224015	212675	200175
PW AT 8.5%	47371	43490	42683
PW AT 13.2%	21056	18733	19142

TAX PAYMENTS

YR. 1 - 8 FT < ANT; 2 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	41335	29997	25513
PW AT 8.5%	9040	5160	5525
PW AT 13.2%	4140	1815	2490

CASH FLOW

YR 1 FC < ANC; 2 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	182680	182680	174190
PW AT 8.5%	38311	38331	37137

PW AT 13.2%   16918   16918   16654

YR. 67 - 75 FICOV > ANICOVHSIMILAR RESULTS FCR SLELG AND SOYD METHODS

SET 6

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 50%, Id = 7%, Ie = 13%, t = 35%
Salvage = zero, ASL = 20 years, Inflation = 0%
Dispersion Pattern = R3

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 FRR < ANRR; 2 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	211221	199881	187803
PW AT 8.5%	44573	40692	40141
PW AT 13.2%	19777	17452	18003

TAX PAYMENTS

YR. 1 - 10 FT< ANT; 11 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	34446	23108	19737
PW AT 8.5%	75333	3653	4340
PW AT 13.2%	3450	1125	1955

CASH FLOW

YR. 1 FC < ANC; 2 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	176775	176775	168066
PW AT 8.5%	37039	37039	35801
PW AT 13.2%	16327	16327	16047

YR. 67 - 75 FICOV < ANICOV

SIMILAR RESULTS ARE OBTAINED FOR SLELG AND SOYD METHODS

SET 7

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 50%, Id = 8%, Ie = 15%, t = 48%
Salvage = zero, ASL = 20 years, Inflation = 6%
Dispersion Pattern = R3

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 - 8 FRR < ANRR; 9 - 17 FRR > ANRR; 18 - 61 FRR < ANRR;

62 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	4134253	3596576	3546797
PW AT 8.5%	321577	273454	278677
PW AT 13.2%	53561	44038	46944

TAX PAYMENTS

YR. 1 - 62 FT < ANT; 63 - 78 FT > ANT; 79 - 80 FT < ANT

	BMT	FT	ANT
PW AT 3.8%	1065622	527945	630861
PW AT 8.5%	841145	35992	50498
PW AT 13.2%	14279	4756	8598

CASH FLOW

YR. 1 - 7; FC < ANC; 8 - 19 FC > ANC; 20 - 28 FC < ANC;

29 - 31 FC > ANC; 32 - 60 FC < ANC; 61 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	3068631	3068631	2915935
PW AT 8.5%	237462	237462	228178
PW AT 13.2%	39282	39282	38346

FICOV IS ALWAYS LESS THAN ANICOV

SL_ELG

REVENUE_REQUIREMENTS

YR. 1 - 8 FRR < ANRR; 9 - 16 FRR > ANRR; 17 - 28 FRR < ANRP;

29 FRR > ANRR; 30 - 61 FRR < ANRR; 62 - 80 FRR > ANRF

PW AT 3.8%	4072357	3591492	3544167
PW AT 8.5%	318363	274760	279359
PW AT 13.2%	53269	44585	47231

TAX_PAYMENTS

YR. 1 - 10 FT < ANT; 11 - 13 FT > ANT; 14 - 62 FT < ANT;

63 - 78 FT > ANT; 79 - 80 FT < ANT

	BMT	FT	ANT
PW AT 3.8%	1019330	538467	630620
PW AT 8.5%	81703	37470	50500
PW AT 13.2%	13829	5144	8598

CASH FLOW

YR. 1 - 7 FC < ANC; 8 - 29 FC > ANC; 30 - 60 FC < ANC;

61 - 8C FC > ANC

FICOV < ANICOV

SET 8

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 50%, Id = 7%, Ie = 13%, t = 48%
Cost of debt and equity increase by 1% each year.
Salvage = zero, ASL = 20 years, Inflation = 0%
Dispersion Pattern = R3

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 - 8 FRR < ANRR; 9 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	298071	276418	243939
PW AT 8.5%	57455	50536	48463
PW AT 13.2%	24035	19990	20747

TAX PAYMENTS

YR 1 - 9 FT < ANT; 10 - 80 FT > ANT

PW AT 3.8%	78706	57054	45295
PW AT 8.5%	15283	8365	8968
PW AT 13.2%	6481	2436	3800

CASH FLOW

YR. 1 - 7 FC < ANC; 8 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	219364	216634	198634
PW AT 8.5%	42172	42172	39464
PW AT 13.2%	17554	17554	16946

YR. 67 - 75 FICOV > ANICOV

SL_ELG

REVENUE_REQUIREMENTS

YR. 1 - 8 FRR < ANRR; 9 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	288171	268859	240083
PW AT 8.5%	56219	50063	48220
PW AT 13.2%	23769	20162	20838

TAX_PAYMENTS

YR. 1 - 9 FT < ANT; 10 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	74261	54949	45267
PW AT 8.5%	14535	8379	8967
PW AT 13.2%	6208	2601	3800

CASH_FLOW

YR. 1 - 9 FC < ANC; 10 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	213909	213909	194746
PW AT 8.5%	41684	41684	39252
PW AT 13.2%	17560	17560	17038

YR. 67 - 75 FICOV > ANICOV

SOYD

REVENUE REQUIREMENTS

YR. 1 - 6 FRR < ANRR; 7 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	245263	239216	230051
PW AT 8.5%	51132	48932	48324
PW AT 13.2%	22797	21313	21618

TAX PAYMENTS

YR. 1 - 7 FT < ANT; 8 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	53824	47687	45189
PW AT 8.5%	11137	8928	8956
PW AT 13.2%	5007	3523	3800

CASH FLOW

YR. 1 - 6 FC < ANC; 7 - 80 FC >ANC

YR 67 - 75 FICOV > ANICOV

SET 9

g = 6% for Yr. 2 - 60; g = 0% for Yr. 61 - 80
d = 50%, Id = 7%, Ie = 13%, t = 48%
Differential cost of capital for flowthrough firm
Salvage = zero, ASL = 20 years, Inflation = 0%
Dispersion Pattern = R3

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 - 6 FRR < ANRR; 7 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	235823	227262	200480
PW AT 8.5%	49954	45680	43004
PW AT 13.2%	22241	19344	19400

TAX PAYMENTS

YR. 1 - 8 FT < ANT; 9 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	59049	44337	35679
PW AT 8.5%	12914	7296	7725
PW AT 13.2%	5914	2401	3484

CASH FLOW

YR. 1 - 5 FC < ANC; 6 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	176773	182924	164800

PW AT 8.5%	37030	38384	35278
PW AT 13.2%	16327	16943	15915

YR. 64 - 80 FICOV > ANICOV

SL_ELG

REVENUE_REQUIREMENTS

YR. 1 - 6 FRR < ANRR; 7 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	229614	222790	198476
PW AT 8.5%	49131	45506	42975
PW AT 13.2%	22070	19567	19541

TAX_PAYMENTS

YR. 1 - 7 FT < ANT; 8 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	55771	43136	35666
PW AT 8.5%	12296	7390	7725
PW AT 13.2%	5672	2578	3484

CASH_FLOW

YR. 1 - 5 FC < ANC; 6 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	173843	179653	162814
PW AT 8.5%	36834	38115	35250
PW AT 13.2%	16398	16988	16056

YR. 64 - 80 FICOV > ANICOV.

SOYD

REVENUE REQUIREMENTS

YR. 1 - 2 FRR < ANRR; 3 - 80 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	203691	207266	195595
PW AT 8.5%	45960	45767	43907
PW AT 13.2%	21528	20952	20512

TAX PAYMENTS

YR. 1 - 4 FT < ANT; 5 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	40696	40032	35622
PW AT 8.5%	9504	8321	7774
PW AT 13.2%	4606	3550	3480

CASH FLOW

YR. 1 FC < ANC; 2 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	162994	167233	159972
PW AT 8.5%	36456	37446	36813
PW AT 13.2%	16921	17401	17027

YR. 61 - 80 FICOV > ANICOV

SET 10

g = 0% for Yr. 2 - 35, decay later ond = 50%, Id = 7%, Ie = 13%, t = 48%
Salvage = zero, ASL = 20 years, Inflation = 0%
Dispersion Pattern = L0, R3, S5

SL_AV_IIFE

REVENUE_REQUIREMENTS

YR. 1 - 9 FRR < ANRR; 10 - 50 FRR > ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	111830	99199	90127
PW AT 8.5%	43950	36690	36582
PW AT 13.2%	23376	18529	19941

TAX_PAYMENTS

YR. 1 - 13 FT < ANT; 14 - 50 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	30010	17739	15547
PW AT 8.5%	12015	12015	4735
PW AT 13.2%	6484	1643	3556

CASH_FLOW

YR. 1 - 9 FC < ANC; 10 - 50 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	81819	81819	74580
PW AT 8.5%	31935	31935	30122

PW AT 13.2%	16886	16886	16385

YR. 40 - 43 FICOV > ANICOV.

SET 11

g = 0% for Yr. 2 - 80d = 50%, Id = 7%, Ie = 13%, t = 48%
Salvage = zero, ASL = 20 years, Inflation = 6%
Dispersion Pattern = R3

SL AV LIFE

REVENUE REQUIREMENTS

YR. 1 - 6 FRR < ANRR; 7 - 80 FRR < ANRR

	BMRR	FRR	ANRR
PW AT 3.8%	367559	337007	303341
PW AT 8.5%	182190	157029	155532
PW AT 13.2%	122861	100449	106871

TAX PAYMENTS

YR. 1 - 7 FT < ANT; 8 - 80 FT > ANT

	BMT	FT	ANT
PW AT 3.8%	91818	61268	50202
PW AT 8.5%	47165	22004	27095
PW AT 13.2%	32702	10290	18820

CASH FLOW

YR. 1 - 5 FC < ANC; 6 - 80 FC > ANC

	BMC	FC	ANC
PW AT 3.8%	275740	275733	253139
PW AT 8.5%	135024	135024	128437

PW AT 13.2% 90158 90158 88051

YR. 1 - 11 FICOV < ANICOV; 12 - 21 FICOV > ANICOV;

22 - 34 FICOV < ANICOV; 35 - 43 FICOV > ANICOV;

61 - 63 FICOV > ANICOV

APPENDIX B: SAMPLE COMPUTER OUTPUT

CUSTOMERS POINT OF VIEW

YEAR	BMRR	FRR	ANRR
1	1809.2737	886.1050	1732.4656
2	2089.5652	1484.6501	1962.4285
3	2137.4736	1561.9712	1962.4548
4	2189.3516	1644.3660	1968.9907
5	2245.6279	1732.2415	1982.5522
6	2306.8948	1826.0952	2003.8167
7	2374.2056	1926.5835	2033.8862
8	2448.2952	2034.3711	2073.5371
9	2530.3525	2150.2583	2123.9707
10	2621.2034	2274.9727	2186.0146
11	2722.1523	2409.4299	2260.9453
12	2834.3438	2554.6128	2349.8633
13	2959.8733	2711.8403	2454.7561
14	3099.8232	2882.2346	2576.6033
15	3256.3696	3067.2175	2717.4124
16	3432.1812	3268.5654	2879.6101
17	3628.9512	3487.9456	3064.6487
18	3849.5935	3592.7266	3263.9199
19	4096.5039	3845.9285	3489.9827
20	4370.1641	3987.6230	3731.8184
21	4671.5000	4280.4141	4000.6152
22	4998.6797	4463.6914	4283.2852
23	5348.7578	4798.8555	4587.6094
24	5718.0664	5024.2969	4899.1953
25	6102.2617	5400.5547	5225.0156
26	6497.1445	5665.4023	5550.6953
27	6902.1289	6080.0078	5887.2773
28	7316.9492	6383.1641	6224.4102
29	7744.2969	6837.0391	6576.2695
30	8187.9102	7181.5664	6936.1563
31	8651.1875	7679.4961	7318.5898
32	9138.5742	8071.1836	7717.1719
33	9654.0117	8619.6875	8146.5508
34	10202.8125	9065.9375	8600.7695

CUSTOMERS POINT OF VIEW

YEAR	BMRR	FRR	ANRR
50	26004.3359	23149.1563	21940.6641
51	27563.3750	24542.3281	23248.3555
52	29216.0469	26019.3711	24635.0781
53	30964.4492	27585.3438	26102.3242
54	32815.7656	29244.4609	27656.5117
55	34778.0938	31003.4453	29304.7891
56	36857.2383	32867.0430	31051.9570
57	39063.5781	34843.0430	32907.1406
58	41403.0234	36936.7695	34875.0000
59	43884.9453	39156.2500	36963.4922
60	46518.2617	41508.1797	39179.9648
61	45932.7461	42345.7109	38296.0195
62	44994.3984	42214.8594	37126.4063
63	44146.2891	42098.4883	36107.9180
64	43390.9805	41995.8242	35236.5313
65	42731.3477	41907.5352	34508.3633
66	42169.1641	41832.3320	33918.1523
67	41705.5313	41770.0352	33459.8789
68	41339.0273	41718.0000	33124.9023
69	41070.9141	41674.7734	32907.0313
70	40898.1602	41636.9375	32795.7500
71	40818.2109	41600.4063	32780.8828
72	40826.7422	41560.5000	32850.4609
73	40916.5508	41510.3125	32989.6719
74	41080.4414	41442.5469	33183.6797
75	41306.0938	41347.2109	33412.7656
76	41581.0273	41213.3203	33657.0938
77	41886.3516	41026.6211	33890.8906
78	42203.5234	41022.9102	34109.8438
79	42509.4883	40947.5898	34285.8477
80	42780.7383	41032.8633	34411.6836

PW AT 3.80% = 235826.44	214173.94	197762.75
PW AT 8.50% = 49954.60	43036.72	42751.77
PW AT 13.20% = 22241.47 .	18196.36	19358.38

TAX COLLECTORS POINT OF VIEW

YEAR	BMT	FT	ANT
1	584.7649	-338.4041	75.9141
2	590.5369	-14.3785	228.3049
3	596.9150	21.4124	232.0217
4	604.0881	59.1019	238.0598
5	612.1792	98.7924	246.5647
6	621.3635	140.5639	257.6936
7	631.9897	184.3674	271.6062
8	644.2761	230.3518	288.5010
9	658.6133	278.5188	308.5706
10	675.2637	329.0327	332.0276
11	694.6602	381.9370	359.0916
12	717.1663	437.4346	390.0254
13	743.4929	495.4592	425.0964
14	773.9805	556.3911	464.6265
15	809.3792	620.2263	508.9104
16	850.6052	686.9890	558.3105
17	898.2004	757.1941	613.2634
18	953.1724	696.3049	599.9736
19	1016.3359	765.7590	658.5901
20	1087.7690	705.2236	649.4646
21	1167.7131	776.6282	712.7664
22	1255.3716	720.3821	708.9031
23	1349.5071	799.6050	778.1274
24	1448.6223	754.8518	780.7856
25	1550.9600	849.2498	857.1016
26	1654.7991	823.0571	867.3735
27	1759.7749	937.6497	951.7014
28	1865.6167	931.8345	970.3472
29	1973.1650	1065.9084	1063.3835
30	2083.6553	1077.3154	1090.9514
31	2198.1711	1226.4841	1193.1714
32	2318.1860	1250.7905	1230.1152
33	2444.9587	1410.6379	1341.8169
34	2580.2498	1443.3782	1388.3113
35	2728.0010	1607.1162	1509.4036
36	2885.5146	1711.4058	1602.6099
37	3054.6694	1817.9924	1700.6448
38	3236.3992	1926.6738	1803.5256
39	3431.1694	2038.0234	1911.4519
40	3639.2166	2152.7410	2024.5884

TAX COLLECTORS POINT OF VIEW

YEAR	BMT	FT	ANT
53	7842.3750	4463.2656	4261.9375
54	8310.4609	4739.1484	4518.6563
55	8806.6172	5031.9688	4791.3086
56	9332.1992	5342.0000	5080.3086
57	9890.2227	5669.6797	5386.8750
58	10482.0000	6015.7383	5711.5273
59	11110.0742	6381.3711	6055.6055
60	11776.7617	6766.6758	6419.6602
61	11392.1250	7805.0781	6663.0820
62	11040.2422	8260.6953	6644.3789
63	10722.2031	8674.3945	6642.9531
64	10438.9609	9043.7969	6655.5547
65	10191.5977	9367.7734	6679.5859
66	9980.7813	9643.9375	6711.4883
67	9806.9180	9871.4102	6748.3320
68	9669.4766	10048.4414	6786.2383
69	9568.9375	10172.7891	6821.4844
70	9504.1563	10242.9219	6849.9063
71	9474.1719	10256.3594	6866.9063
72	9477.3711	10211.1211	6867.8125
73	9511.0508	10104.8086	6847.2266
74	9572.5078	9934.6094	6799.5156
75	9657.1250	9698.2344	6718.5039
76	9760.2266	9392.5117	6597.5391
77	9874.7227	9014.9844	6429.3594
78	9993.6641	8813.0430	6344.6094
79	10108.4023	8546.4922	6212.3398
80	10210.1211	8462.2344	6162.8203

PW AT 3.80% =	59050.52	37398.11	33507.83
PW AT 8.50% =	12914.97	5997.17	7492.66
PW AT 13.20% =	5914.35	1869.35	3438.29

FIRMS POINT OF VIEW

YEAR	BMC	FC	ANC
1	1224.5088	1224.5090	1656.5515
2	1499.0283	1499.0286	1734.1235
3	1540.5586	1540.5586	1730.4331
4	1585.2634	1585.2639	1730.9309
5	1633.4487	1633.4490	1735.9875
6	1685.5313	1685.5313	1746.1230
7	1742.2158	1742.2158	1762.2800
8	1804.0190	1804.0193	1785.0361
9	1871.7393	1871.7395	1815.4001
10	1945.9397	1945.9399	1853.9871
11	2027.4922	2027.4929	1901.8538
12	2117.1775	2117.1782	1959.8379
13	2216.3804	2216.3811	2029.6597
14	2325.8428	2325.8435	2111.9768
15	2446.9905	2446.9912	2208.5020
16	2581.5759	2581.5764	2321.2996
17	2730.7507	2730.7515	2451.3853
18	2896.4211	2896.4216	2663.9463
19	3080.1680	3080.1694	2831.3926
20	3282.3950	3282.3994	3082.3538
21	3503.7869	3503.7859	3287.8489
22	3743.3081	3743.3093	3574.3821
23	3999.2507	3999.2505	3809.4819
24	4269.4414	4269.4414	4118.4063
25	4551.3008	4551.3047	4367.9141
26	4842.3438	4842.3438	4683.3203
27	5142.3516	5142.3555	4935.5742
28	5451.3320	5451.3281	5254.0625
29	5771.1289	5771.1289	5512.8828
30	6104.2539	6104.2500	5845.2031
31	6453.0156	6453.0117	6125.4180
32	6820.3867	6820.3906	6487.0547
33	7209.0508	7209.0469	6804.7305
34	7622.5625	7622.5586	7212.4570
35	8068.1367	8068.1367	7591.4336
36	8541.9609	8541.9570	8031.8789
37	9047.8555	9047.8516	8506.0039
38	9588.1602	9588.1602	9016.1953
39	10164.4336	10164.4375	9563.3984

FIRMS POINT OF VIEW

YEAR	BMC	FC	ANC
53	23122.0742	23122.0781	21840.3867
54	24505.3047	24505.3125	23137.8555
55	25971.4766	25971.4766	24513.4805
56	27525.0391	27525.0430	25971.6484
57	29173.3555	29173.3633	27520.2656
58	30921.0234	30921.0313	29163.4727
59	32774.8711	32774.8789	30907.8867
60	34741.5000	34741.5039	32760.3047
61	34540.6211	34540.6328	31632.9375
62	33954.1563	33954.1641	30482.0273
63	33424.0859	33424.0938	29464.9648
64	32952.0195	32952.0273	28580.9766
65	32539.7500	32539.7617	27828.7773
66	32188.3828	32188.3945	27206.6641
67	31898.6133	31898.6250	26711.5469
68	31669.5508	31669.5586	26338.6641
69	31501.9766	31501.9844	26085.5469
70	31394.0039	31394.0156	25945.8438
71	31344.0391	31344.0469	25913.9766
72	31349.3711	31349.3789	25982.6484
73	31405.5000	31405.5039	26142.4453
74	31507.9336	31507.9375	26384.1641
75	31648.9688	31648.9766	26694.2617
76	31820.8008	31820.8086	27059.5547
77	32011.6289	32011.6367	27461.5313
78	32209.8594	32209.8672	27765.2344
79	32401.0859	32401.0977	28073.5078
80	32570.6172	32570.6289	28248.8633

	BMC	FC	ANC
PW AT 3.80% =	176775.88	176775.81	164254.86
PW AT 8.50% =	37039.63	37039.55	35259.11
PW AT 13.20% =	16327.12	16327.01	15920.09

EFFECT ON BOND-HOLDERS

YEAR	BMICOV ANICOV	FICOV
1	4.5714	1.8651
2	4.5714	2.8154
3	4.5714	2.9186
4	4.5714	3.0249
5	4.5714	3.1338
6	4.5714	3.2449
7	4.5714	3.3572
8	4.5714	3.4701
9	4.5714	3.5821
10	4.5714	3.6925
11	4.5714	3.7997
12	4.5714	3.9028
13	4.5714	3.9995
14	4.5714	4.0895
15	4.5714	4.1708
16	4.5714	4.2417
17	4.5714	4.3023
18	4.5714	4.1094
19	4.5714	4.1488
20	4.5714	3.9685
21	4.5714	3.9973
22	4.5714	3.8409
23	4.5714	3.8729
24	4.5714	3.7504
25	4.5714	3.7958
26	4.5714	3.7098
27	4.5714	3.7706
28	4.5714	3.7134
29	4.5714	3.7832
30	4.5714	3.7435
31	4.5714	3.6136
32	4.5714	3.7821
33	4.5714	3.8462
34	4.5714	3.8161
35	4.5714	3.8671
36	4.5714	3.8739
37	4.5714	3.8774
38	4.5714	3.8777
39	4.5714	3.8754

UTILITY RATES

YEAR	BMUR	FUR	ANUR
1	0.1810	0.0886	0.1733
2	0.1972	0.1401	0.1852
3	0.1903	0.1391	0.1747
4	0.1839	0.1381	0.1654
5	0.1779	0.1373	0.1571
6	0.1725	0.1365	0.1498
7	0.1674	0.1359	0.1434
8	0.1629	0.1354	0.1380
9	0.1588	0.1350	0.1333
10	0.1552	0.1347	0.1294
11	0.1521	0.1346	0.1263
12	0.1494	0.1346	0.1238
13	0.1472	0.1348	0.1220
14	0.1454	0.1352	0.1208
15	0.1441	0.1357	0.1202
16	0.1433	0.1364	0.1202
17	0.1429	0.1374	0.1207
18	0.1430	0.1335	0.1213
19	0.1436	0.1348	0.1223
20	0.1445	0.1318	0.1234
21	0.1457	0.1335	0.1248
22	0.1471	0.1314	0.1260
23	0.1485	0.1332	0.1274
24	0.1498	0.1316	0.1283
25	0.1508	0.1334	0.1291
26	0.1514	0.1321	0.1294
27	0.1518	0.1337	0.1295
28	0.1518	0.1324	0.1291
29	0.1516	0.1338	0.1287
30	0.1512	0.1326	0.1281
31	0.1507	0.1338	0.1275
32	0.1502	0.1326	0.1268
33	0.1497	0.1336	0.1263
34	0.1492	0.1326	0.1258
35	0.1490	0.1335	0.1256
36	0.1487	0.1335	0.1254
37	0.1486	0.1334	0.1253
38	0.1486	0.1334	0.1253
39	0.1486	0.1334	0.1254