THE EFFECTS OF FEDERAL INCOME TAXES ON CAPITAL BUDGETING

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James Wyatt Edwards

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This is to certify that the

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THE EFFECTS OF FEDERAL INCOME TAXES ON CAPITAL BUDGETING

By

James Wyatt Edwards

AN ABSTRACT OF A THESIS

Submitted to
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ABSTRACT

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By James Wyatt Edwards

The problem examined in this thesis involves the influences of Federal tax provisions on capital budgeting programs of business firms. Substantial financial literature is available in which the theoretical influences of taxes are discussed. Studies have been made examining the effects on investment decisions of income taxation in general, while others have considered only one or a few selected provisions.

The primary objectives of this study are (1) to draw together some of the scattered theoretical aspects of capital budgeting specifically related to income taxes; (2) to examine the practices followed by firms in considering tax provisions in project evaluations; (3) to point out underlying patterns of practices and their consistency with theory and the reasons given to justify such practices, and (4) to provide information that may promote better decision making and efficient use of funds by firms and serve as a guide to future tax policy.

Information was gathered by interviews with top financial and tax officials in forty-four United States corporations, and by reviews of many of the capital budgeting manuals and forms being utilized. A broad cross-section of

industries is represented by the firms visited, and their total capital expenditures during 1965 was approximately $12.5 billion.

The entire investment decision-making process was examined to provide a frame of reference for tax considerations, and the principal finding was that there has been a definite gradual shift toward the use of time-adjusting acceptance criteria for proposal evaluations. Three-fourths of the firms were using discounting techniques for all or some proposal evaluations.

The following general conclusions about the incentive effects of the investment credit, the depreciation guideline system, and the corporate tax cut are discussed in the thesis.

(1) The vast majority of the executives stated that only nominal incentive effects have occurred on individual investment proposals.

(2) The supply of funds effects were generally described as moderate in most firms. These effects suggest at least a partial corroboration of the unshifting results for tax rate reductions discussed by Krzyzaniak and Musgrave.

(3) The size and rates of increase in new capital outlays by the firms in recent years imply that the actual incentive effects may have been somewhat stronger than was acknowledged in the interviews.

Several factors have resulted in the lack of recognition of the possible incentive influences of the tax measures. First, despite widely heralded improvements in the "business investment climate," substantial uncertainties

exist in the minds of the interviewees concerning future tax policy changes. Second, the speed up in tax payments for corporations has dampened enthusiasm about the measures. Third, many firms were in strong or excess liquidity positions when the measures began to take effect. Fourth, the provisions have been selective in nature and implemented gradually. Fifth, the crude evaluation techniques utilized in some firms has precluded a recognition of the incentive value of the measures. Finally, some firms were just beginning to be forced into greater reliance on external funds at the time of the interviews.

Tax policy recommendations were made suggesting that hasty fiscal policy changes should be avoided until the restrictive monetary and fiscal actions already implemented have had time to become operative and dampen the inflationary tendencies in the economy, and that some of the measures be liberalized in the long run to more firmly entrench their incentive value in the business community.

Two chapters in the thesis include a discussion of tax considerations involved in such factors as working capital flows, salvage values, operating and capital losses, effective tax rates, and inflation and other forms of risk. A variety of reasons was given by the numerous firms that do not consider some of these factors, many of which appeared tenuous at best.

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CHAPTER I

INTRODUCTION

The management of invested capital is the universal business problem. It thus encompasses decisions involving market strategy, new product lines, public and labor relations, and research endeavors. These decisions are integral, but subsidiary, issues of management's administration of capital.

A fairly well defined theoretical capital budgeting framework exists in the literature of the academician and researcher. During the last quarter of a century, and particularly within the last decade, the tools of analysis long discussed in academic realms have been applied to the capital budgeting problems of business organizations with an increasing degree of theoretical sophistication.

Capital budgeting is viewed in a broad connotation in this study. It may be defined as the process of forecasting, approving, and monitoring outlays for capital projects. The capital budgeting process exists in all firms. In many organizations the formality and explicitness of the process is of recent venue. This increased emphasis on the planning and control of capital expenditures is closely interrelated with much of the Federal income tax legislation

enacted in recent years. Some of the major legislation aimed at stimulation of investment includes the accelerated depreciation provisions in the 1954 Code, the depreciation guidelines enacted in 1962 and amended in 1964, the investment credit provisions of 1962 and 1964, and the corporate tax rate reductions effected during 1964 and 1965. The broad problem examined in this thesis involves the effects of such Federal income tax provisions on capital budgeting decisions.

Objectives of the Study

The primary objectives of this study are:

(1) to draw together the theoretical aspects of capital budgeting that are specifically related to income tax effects;

(2) carefully to analyze individual firms and examine the objectives of particular practices regarding income tax considerations in capital investment analyses;

(3) to point out underlying patterns of practices which exist, and consistencies or inconsistencies with their objectives and the theoretical aspects of capital budgeting;

(4) to derive conclusions which may

a. assist other firms in choosing methods that may be used with reliance to attain similar objectives,

b. promote more efficient use of funds by firms and resource allocation in the national economy, and

c. serve as a possible guide to public policy in the formulation of future tax programs.

This study should at least partially fill an existing void in the literature. A substantial amount of

theorizing, Congressional testimony, and business literature has been devoted to the expected impact of major tax legislation on corporate investment decisions and resource allocation in the national economy. Several attempts have been made to examine actual effects of some of these legislative provisions. Others have attempted to ascertain whether or not firms have considered taxation effects in a general way in the capital-expenditure decision-making process.[1] Most of these efforts have been splintered in approach, and no attempt has been made to determine the extent to which all major tax considerations have been formally incorporated in the various stages of the capital budgeting process of business enterprises.

A further problem is that no previous attempts have been made to relate many of the practices followed in considering income taxes in the capital budgeting process to the reasons used to justify these practices. Adequate reasons sometimes exist for ignoring certain theoretical aspects of capital budgeting and detailed tax considerations. These reasons and the related practices should constantly be subjected to scrutiny for inconsistencies and outright errors in the investment decision-making process.

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[1]For example, see the excellent study of Donald F. Istvan, Capital-Expenditure Decisions: How They Are Made in Large Corporations, Indiana Business Report No. 33 (Bloomington, Indiana: Bureau of Business Research, Graduate School of Business, Indiana University, 1961).

Approach of the Study

Information for the study has been gathered primarily by personal interviews with top financial and tax officials in forty-four United States corporations, and by reviews of capital budgeting manuals and forms used by many of the firms.[2] A broad cross-section of industries is represented by the firms visited. These industries are listed below.

Airlines
Automotive
Building materials
Capital goods
Chemicals
Communications
Defense
Electrical equipment
Metals
Office machinery
Paper and packaging
Pharmaceutical
Rails
Rubber
Steel
Utilities
Others

Several criteria were utilized in the selection of firms included in the study. Expenditures for plant and equipment by the firms were approximately $11.0 billion in 1964 and $12.5 billion in 1965. This amount represents about one-fourth of the total capital outlays made by U. S. corporations during 1965. Seventeen of the firms are the largest in total asset size in their respective industries.

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[2]The field interviews were held primarily during the summer months of 1965. Subsequent correspondence with some of the executives interviewed has served to corroborate certain information.

Three-fourths of the companies are among the top five in asset size in their industries. Total sales, assets, and net after-tax profits amounted to $115.3, $119.2, and $8.8 billions respectively in 1964 (Table 1-1). The average number of persons employed by these firms during 1964 was approximately 4.3 million (Table 1-1). Other criteria utilized in the selection of firms were such tax factors as substantial investment credit carryforwards, operating losses, realization of capital gains or losses, and the filing of consolidated tax returns.

TABLE 1-1

1964 OPERATING AND FINANCIAL DATA OF 44 FIRMS

	Sales[a]	Total Assets[a]	Net Profit after Taxes[a]	Average Number of Employees
Industrial Firms	$ 89.5	$ 71.1	$ 6.4	3,141,000
Fortune's "Top 500"	$266.5	$224.7	$17.2	10,464,000
Percentage Relationship	33.6%	31.6%	37.2%	30.0%
Summary of 44 Firms				
Industrial firms	$ 89.5	$ 71.1	$ 6.4	3,141,000
Regulated and other firms	25.8	48.1	2.4	1,113,000
Totals	$115.3	$119.2	$ 8.8	4,254,000

Sources: Fortune, LXXII (July, 1965), 149-168; Annual published financial reports of firms.

[a]Figures are in billions of dollars.

Order of Presentation

There are five additional chapters in this thesis. The objectives listed on page 2 have been followed in each chapter. An effort has been made to stipulate the basic theoretical issues involved, with particular emphasis being placed on tax considerations. This effort is followed in each instance by an attempt to outline the patterns of practices observed and to relate them to the reasons given for such practices. Consistencies and inconsistencies between theory, objectives, and practices are set forth and analyzed.

Chapter II includes an examination of various acceptance criteria utilized by the companies visited. This information serves importantly as a frame of reference for subsequent chapters.

Chapter III considers several so-called tax incentive provisions that are included in the Internal Revenue Code. Chapter IV is a discussion of the tax effects involved in a proper determination of the investment outlays necessary for a proposal and the benefits that are expected to result from such outlays.

Chapter V is an examination of certain broader tax aspects of capital budgeting. Several tax factors that are not always related to specific proposals are examined. The elements of risk and uncertainty in the capital budgeting process are also discussed in Chapter V. An attempt is made to indicate that all of the previous refinements involving

income tax factors and the use of mathematical acceptance criteria may be for naught if the element of risk is not given explicit recognition in the decision-making process.

Chapter VI presents a brief summary and a statement of tax policy and other conclusions.

CHAPTER II

MATHEMATICAL ACCEPTANCE CRITERIA

There are two clearly discernible stages in the capital-expenditure decision-making process. The initial stage involves a determination of the necessary investment in a project and the benefits which are expected to result. The second stage concerns the application of mathematical acceptance criteria to the results obtained in the first stage. Income tax considerations permeate both stages of the decision-making process. The typical chronological order of the discussion of these two stages is reversed in this study. The basic theoretical issues and the practices of firms in the use of mathematical acceptance criteria are examined first. This sequence facilitates a more meaningful discussion of the income tax factors that are examined in Chapters III-V. The influences of many of these tax factors on the important acceptance criteria in use are included at various points in these chapters.

A basic mathematical framework is presented in equation form in Appendix A. Most of the mathematical acceptance criteria discussed in this chapter are based on these equations. The framework is modified and expanded as the need arises at various points in later chapters.

No attempt will be made to examine all of the controversial theoretical issues involved in the use of various mathematical acceptance criteria. This is not the primary purpose of this thesis. These issues will be examined only if they can arise as a result of income tax considerations.[1]

The controversy raging over the correct derivation of a firm's cost of capital for use in capital budgeting decisions is skirted entirely in the initial discussion in this chapter. It is assumed that a properly determined cost of capital is available for use. The cost of capital concept is discussed briefly in the theory section on the recovery period criterion in this chapter. The concept is taken up again in Chapters III and V.

Table 2-1 presents a tabulation of the number of firms in the study that are utilizing various mathematical acceptance criteria as their primary measures of the economic worth of capital projects. The number of firms using the criteria for supplementary purposes or for particularly important or special projects is also presented in Table 2-1. The executives of some companies could not, or would not, indicate that a single criterion was more important for decision-making purposes than one or more others. This reluctance on the part of such executives results in more than one criterion being listed as primary for certain firms

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[1]For a general discussion of the time and size disparity problems in investment decisions see J. Lorie and L. J. Savage, "Three Problems in Capital Rationing," Journal of Business, XXVIII (October, 1955), 229-39.

and the totals not amounting to the number of companies visited.

TABLE 2-1

UTILIZATION OF MATHEMATICAL ACCEPTANCE CRITERIA BY 44 FIRMS INTERVIEWED

Criteria	Totals	Used as a Primary Criterion	Used as a Supplement to Primary Criteria	Criterion Used for Major or Special Proposals[a]
TIME-ADJUSTING	33	19	3	11
Net Present Worth	2	1	1	
Internal Yield	26	13	2	11
Uniform Annual Charge	5	5		
MAPI	1	1		
RATES OF RETURN	27	19	8	
RECOVERY PERIOD	34	19	14	1
PERCENTAGE OF SALES	6	1	5	
OTHER MEASURES	1	1		

[a]Major proposals involve large dollar outlays or projects of particular importance to firms. Special proposals involve leasing arrangements and other projects which are viewed as warranting an evaluation by other than the primary criteria used for smaller conventional proposals.

The criteria are discussed in the rest of this chapter in the following format: net present worth (PW), internal yield (IY), uniform annual charge (UAC), the Machinery and

Allied Products Institute formula (MAPI), so-called accounting or book rates of return (ROR), recovery period (RP), return on sales (ROS), and others. The letters in parentheses in the previous sentence are utilized in subsequent discussion to facilitate brevity. The theoretical precepts of each of the measures is discussed first. This discussion is followed by an examination of the practices found regarding each measure and the reasons given by the executives interviewed for such practices.

The first three criteria listed are the time-adjusting approaches generally used for project evaluations. They are general theoretically correct methods available to determine the desirability of investment alternatives over their expected economic lives.[2] The net present worth and internal yield measures are first discussed briefly from a theoretical viewpoint. Since their use is usually so closely allied, the practices of the firms that utilize these two measures are discussed together. The theory and practices regarding the uniform annual charge approach are discussed following the net present worth and internal yield sections.

Net Present Worth--Theory

The formulation for the present worth concept is set forth in the mathematical framework in Appendix A. To illus-

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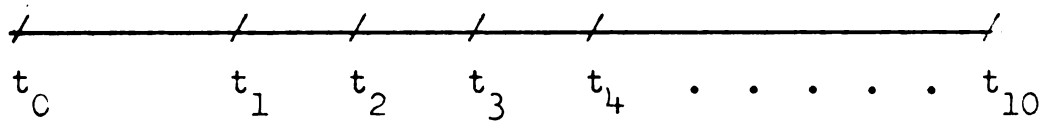
[2]The MAPI formula that is discussed in a later section of this chapter is a theoretically sound approach to evaluations for replacement-type proposals and does involve some discounting elements. Also, the total wealth concept that is presented in Chapter III is a generally correct measure of economic desirability.

trate the net present worth approach, consider the following hypothetical situation.

Illustration II-1

Assume a project requires an initial investment of $20,000 at time zero, that annual net cash benefits of $2,981 are expected for ten years, and that the cost of capital is expected to be 7%. The time scale below shows the cash flow pattern hypothesized.



The present worth of the expected cash inflows for the period t_0 through t_{10} amounts to $20,937. Calculations for Illustration II-1 and other illustrations in subsequent chapters are shown in Appendix B. The net present worth of the proposal is $937 ($20,937 - $20,000). This amount can be interpreted as follows. If $20,937 is borrowed at the specified cost of capital rate of 7% and the $937 is paid immediately to the firm's shareholders, exactly enough funds will remain available to liquidate the debt and the financing charges over the life of the project. Since the present worth of the expected net cash benefits exceeds the initial investment outlay, the internal yield on the project must be greater than the company's cost of capital rate. This fact is discussed in the next section.

Internal Yield--Theory

Another theoretically sound approach to project evaluations is variously called the Profitability Index, Interest Rate of Return, Discounted Cash Flow Return, Investors Method, and the Internal Yield. The latter term is used in this study.

The internal yield (IY) on a proposal is generally defined as the discount rate which equates all cash inflows and outflows to a zero sum at the present date. The typical approach to determining the IY is to use the same discounting procedure utilized previously in the NPW derivation. Two or more trial and error discount rates are required in most instances. It was noted in the preceding section that the IY on the proposal being considered must be higher than 7% since the NPW exceeds zero. When a 9% discount rate is used a negative NPW of -$869 is obtained. This result implies that 9% discount rate must be higher than the true yield on the proposal. The yield can be approximated by interpolating linearly between the results which were obtained for the 7% and 9% rates. The true yield on this proposal is exactly 8%, as is shown in the calculations presented in Appendix B for Illustration II-1.

The internal yield represents the maximum rate a firm can pay for the use of its funds and not lose on a project. This rate is usually interpreted as the return on each unit of capital outstanding for each period of a project's life.

Each cash inflow is thus viewed as representing a return on the capital outstanding for the period, and the remainder as a return of the capital invested.

Net Present Worth and Internal Yield--Practice

Table 2-1 indicates that a total of thirty-three of the firms interviewed are using time-adjusting procedures either as a primary criterion or for certain types of decisions. Five of the nineteen companies using these methods as the primary analytical tool follow the UAC approach that is discussed in the next section. Only one firm utilizes NPW as the primary criterion and this is in conjunction with IY as a supplementary guide. One other firm uses NPW as a supplement to the IY in the decision-making process. Table 2-1 shows that twenty-six companies are using the IY approach and half of them use it as their primary evaluation criterion. The other thirteen firms use IY as the primary criterion for special or major projects only, or as a supplement to other techniques.

The fact that a method is used as the primary criterion in a firm does not necessarily imply it is used on all investment projects. Most companies make some decisions on the basis of competitiveness, need, and postponeability. Only a few of the companies interviewed use the discounting procedures for all proposals processed through the capital budgeting framework. Several others indicated these techniques are used for all but a few rela-

tively small dollar-sized proposals. Most of the remaining companies use NPW or IY primarily in the evaluation of large major expansion or research type proposals. Several of these firms are phasing out the use of other currently accepted non-discounting evaluation criteria.

The preceding remarks indicate that a gradual, but distinct, shift is occurring toward the use of relatively sophisticated capital budgeting techniques in many of the firms interviewed. One of the primary benefits of a statement of findings in a study such as this is the delineation of the practices followed in the use of certain analytical techniques, under given conditions, at a particular point in time, and with definite objectives in mind. It is then possible for others to evaluate and examine the findings and determine whether such approaches or modifications thereof might be useful for their decision-making purposes.

All of the factors that are weighed by all of the firms in their individual decision-making processes could not possibly be determined or catalogued. The rest of this section is an effort to consider the most important general factors that influence many of the firms in their capital budgeting analyses. These factors provide important background information for specific tax effects discussed later, and are based on the comments offered by the company executives, examination of capital budgeting manuals and forms, published financial reports, and general external conditions.

Nature of Industry and Competition

Approximately one-third of the companies that were visited indicated that the highly competitive nature of their respective industries dictates many investment decisions. The executives interviewed in these firms generally feel that the cost and effort involved in the use of the discounting techniques are not warranted for these kinds of investment decisions. Other companies interviewed in the study, often representing the same industry, gave this fierceness of competition as the main reason for the use of discounting techniques. This latter group of firms feel that competition "makes it imperative that decisions be made with the best and most sensitive criteria available regardless of the pre-disposition toward certain proposals before the evaluation process is begun." Competitive pressures often dictate the general direction or broad investment programs a firm must move toward. These pressures do not dictate nearly so frequently the choice of one of several alternative ways of achieving a pre-determined goal. It is in the choices between alternatives that many income tax provisions become most important and that time-adjusting acceptance criteria are most useful. This distinction between broad investment programs and the alternative ways of achieving them must not be clouded by arguments about competitive pressures on the former and not on the latter.

In all but one of the industries represented in the study at least one firm was visited that uses a time-

adjusting technique for at least the major investment decisions that are made. Only two companies were interviewed in this particular industry. These companies may not be representative of the problems involved in capital-expenditure analyses in their industry.

Complexity of Data Estimates

Several of the executives that were interviewed said, "there is no justification in glorifying figures by the use of new-fangled techniques, and especially when tax complexities are involved." A statement was usually made to the effect that it is more desirable to use rough approximations of economic worth and concentrate efforts on the risks inherent in estimating the cash flows relating to a proposal than to glorify the figures with the discounting measures. These statements are based on a mis-interpretation of what is accomplished by the use of time-adjusting techniques in their most basic form. These techniques do not generally adjust for risks related to the possible variabilities of tax effects or other cash flow estimates for investment proposals. Estimates for distant years are often subject to large errors in variability and are discounted more than early year estimates by the NPW and IY methods, but the discounting is due entirely to the time value of money. The errors in variability in distant years are due to changing tax laws, problems in forecasting sales volumes, pricing patterns, wage pressures, market shares, and a multitude of

other factors. These errors can be considered in NPW and IY analyses through the use of special techniques discussed in Chapter V. These techniques are not a part of NPW and IY in their most basic form. It is these basic forms that are being rejected by firms in favor of more crude evaluation criteria.

If the firms that have rejected the discounting techniques are in fact vigorously concentrating on the individual cash flow estimates, the most difficult part of the decision-making process is being accomplished. A judicious application of NPW or IY could strengthen the evaluation procedures in these firms without glorifying their carefully derived estimates at all.

Characteristics of Investment Proposals

Different types of investment proposals often involve different specific income tax provisions. For example, replacement projects have certain characteristics that require careful evaluations in the estimation of tax effects on the benefits expected and on necessary investment outlays. Some of these characteristics are discussed later in this chapter in the section on the MAPI formula, and in the next three chapters involving specific income tax factors. The argument was raised in some firms that the net present worth and internal yield measures are not readily adaptable to some of the tax complexities involved in making replacement type decisions. These arguments cannot be refuted

without a complete review of each firm's entire capital budgeting program and all of their individual complexities. Executives in other firms nevertheless offered the opposite contention. The latter group of executives feel that in their firms the time-adjusting techniques are being used effectively regardless of the nature of the investment decisions and tax factors involved.

Financial Position

Many of the executives in companies that are not utilizing the time-adjusting criteria indicated that an important factor in the reluctance to do so was that their companies were not in dire financial straits at the time of the interviews. They further indicated that the analytical tools currently in use would be adequate until their high profitability and liquidity positions change substantially. Several comments about such reasoning should be made. First, some of the companies interviewed were in dire financial difficulties. These companies used their poor financial positions as a reason for not using the time-adjusting criteria. Apparently every proposal accepted would result in such high savings because of gross inefficiencies in the past that it was felt there was little need to make use of rigorous financial evaluations. The possible circularity in these arguments should be apparent. Conceivably a firm could use a highly liquid cash position as an excuse for "not needing to" adopt new tools of analysis, and subse-

quently revert to an extreme capital rationing position and again "not need to" make sophisticated analyses for capital investment proposals. The need for appropriately determining the profitability of capital projects does not change with the economic or financial position of a firm. Additional profits may be foregone through lax evaluations irrespective of a firm's current position. Second, the financial positions of the companies using the discounting techniques for investment decisions fell along the entire spectrum of extreme liquidity through capital rationing. This fact appears partially to corroborate the preceding point. Finally, it would seem a particularly desirable use of part of the excess funds held by some firms would be an implementation of a more sophisticated analytical process to spend other excess funds in future periods.

Educational Issues

Another important reason given for not using the time-adjusting tools of analysis was educational in nature. Many of the individuals involved in the investment decision-making process claim these criteria are difficult to calculate and implement. These same individuals often stated that most tax factors are too difficult to consider in project analyses. These are not comments to be taken lightly since most of the firms utilizing time-adjusting techniques indicated it was a slow, evolutionary, and often painful process to change from the use of other types of

analyses. Only a few companies did not encounter these difficulties when such tools were first implemented. The executives of these firms stipulated that when a formal capital budgeting program was initiated it was felt that the educational process might as well be relatively complete to begin with. These firms started their formal programs with the use of time-adjusting techniques calculated on an after-tax basis. This approach is the opposite of the one taken by some of the companies visited. Some of these latter firms have started their formal programs by using only crude before-tax measures and expect to utilize more sophisticated approaches in a few years. The danger in this viewpoint is the possibility that the cruder tools will become entrenched, and make the introduction of discounting procedures more painful or difficult to implement than if they were introduced at the outset.

Personnel Orientation

This problem is related to the discussion in the preceding section. The personnel involved in the computational and judgmental phases of capital investment decisions varies quite widely, and depends on the nature of the firm, the administrative organization, management philosophy, and many other considerations. Personnel with engineering and recent academic business backgrounds are often involved in the initial computational and screening phases of decisions

to accept or reject proposals. Many of these quantitatively oriented people seem fairly well inclined toward acceptance or use of properly introduced analytical techniques. Although practices vary widely between companies, personnel such as supervisors, plant managers, and middle and upper management are often less inclined toward accepting the use of new mathematical criteria.

Lack of time is one of the most important factors that influences the reluctance of some industrial personnel to scrutinize new evaluation methods. Tremendous demands on the time of these people stem from a variety of sources, and result in a natural tendency to push new ideas off to the periphery when business conditions are good. However, much of the time problem in calculating the IY and NPW measures has been substantially eliminated by short-cut techniques and through the use of computers. Many of the firms employing the time-adjusting methods indicated that computer programs are being utilized and are designed to produce after-tax yields under varying circumstances. Although the use of computers often seems to be pointed to as a panacea for every problem faced by business firms, there is no denial that many of the firms visited have utilized them to substantially enhance the effectiveness of certain phases of the capital-expenditure decision-making process. Irrespective of the widespread use of computers, a number of firms indicated that the computational time was well spent even if conventional trial-and-error calculations

are necessary for determining internal yields. The argument that it is too costly and difficult for most personnel to make after-tax present worth and yield calculations for capital projects has little substance. This fact is particularly true if viewed in terms of the substantial costs and efforts expended to correctly determine estimated benefits and investment outlays for new projects. The incremental costs necessary to subject these carefully derived estimates to time-adjusting techniques may be the most profitable outlays a firm can make.

Future Plans

Several of the executives interviewed indicated they were currently considering a switch to the use of the IY method. They expect to evaluate only major proposals on this basis initially. The method will then be gradually extended to other types of proposals. This kind of approach is quite workable. As more personnel become involved with the use of a new technique, the barriers to resistance and prejudices for other criteria can be gradually dissipated. The possibility of employee consciousness of important basic income tax factors can be greatly enhanced under such circumstances.

Some of the reasons for the utilization of NPW and IY were offered in the preceding pages as rebuttals to some of the comments generally given by firms which are not using these methods. The principal reasons mentioned in the firms

visited for the use of these evaluation measures are summarized below.

(1) They represent theoretically correct measures of the economic worth of capital projects.

(2) Each method emphasizes the time dimension in evaluations and is sensitive to irregular cash flow patterns.

(3) They are understandable and relatively easy to apply despite statements to the contrary.

(4) The cost of capital is a relevant and important part of both approaches.

(5) Both measures can be utilized effectively regardless of the nature of the proposal being evaluated.

(6) The measures are especially sensitive to income tax provisions that may influence investment decisions.

The relative merits of these two measures have been discussed prolifically in the literature. Some special assumptions are required for both measures to evaluate properly certain types of capital budgeting proposals.[3] Some of these problems will be noted in the discussion of specific tax factors in Chapters III-V.

Uniform Annual Charge--Theory

A third theoretically sound acceptance criterion is a method which determines an equivalent uniform annual

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[3]See the comprehensive work of A. J. Merrett and A. Sykes, The Finance and Analysis of Capital Projects (New York: John Wiley & Sons, Inc., 1963), especially Ch. V; and H. Bierman and S. Smidt, The Capital Budgeting Decision (New York: The Macmillan Co., 1960), especially Ch. III.

charge for all outlays related to a capital project. This approach is variously called uniform annual charge, annual capital charge, annual level premium, annual revenue requirement, sinking fund return, and others depending on how it is computed. The method is widely discussed in the literature of engineering economics.[4] The two variants found in the field interviews are discussed briefly below. They are called the capital recovery charge and the sinking fund return variants. The ideas are not at all new when closely examined, and it is strange that they have not received more attention in the literature of financial management.

The theory behind the uniform annual charge (UAC) method is as follows. Over the life of an asset several types of costs must be recouped including the initial investment, expected annual operating costs, and a charge for the minimum return which can be earned from an alternative investment. These costs frequently are incurred in an irregular pattern over a project's economic life. The UAC method attempts to simplify some of the time-adjusting calculations involved in the evaluations of capital-expenditure proposals. The measure results in a determination of the equivalent uniform annual net cash benefit which will

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[4]See George A. Taylor, Managerial and Engineering Economy (Princeton, New Jersey: D. Van Nostrand Company, Inc., 1964). This author argues vigorously throughout his text that UAC is worthy of consideration as the major criterion for evaluation of alternative investment proposals.

recover the amount invested plus a minimum required return over an asset's expected life.

Capital Recovery Variant

The capital recovery variant involves the use of equations developed in Appendix A. Illustration II-1 shown on page 12 for the NPW criterion is continued in the following discussion. The illustration assumed an initial investment of $20,000, expected net cash benefits of $2,981 for ten years, and a cost of capital of 7%. The UAC for such a project amounts to $2,848. This figure is derived in Appendix B and should be interpreted as follows. Uniform annual net cash receipts of $2,848 are necessary to recover exactly the initial outlay of $20,000 if the firm's cost of capital is 7% as hypothesized. Each of the receipts of $2,848 would represent a 7% return on the capital outstanding each year and the balance would be considered a return of capital. Since the net receipts expected from the proposal amount to $2,981 annually the UAC criterion would indicate that acceptance of the project is justifiable. The same decision was reached using the NPW and IY criteria.

This variant of UAC does not depend on the actual capital recovery pattern being uniform. It merely results in the determination of an "equivalent" uniform annual cash flow series which can be mathematically equal to any expected flow patterns that would result in the recovery

of the capital invested and the minimum rate of return over the period specified. The method is essentially an annualizing process which can restate an irregular cash flow series into a mathematically equivalent uniform present worth series for convenience in the analysis of capital projects.

Sinking Fund Return Variant

The sinking fund variant of the UAC criterion is based on the so-called annuity method of depreciation. Depreciation of an asset is calculated by this method by determining the series of equal annual payments or deposits which are necessary to repay the principal amount plus interest over the expected life span of the project. Since the deposits are viewed as being made into a sinking fund with none of the investment being recovered until the termination of the asset's life, interest must be paid each year on the total initial outlay. The formulation of the concept of a sinking fund in Appendix A is used in Appendix B to derive the same uniform annual charge of $2,848 since the variants are only alternative interpretations of what the amount should represent.

According to the capital recovery variant part of each $2,848 represents a recoupment of the initial investment and is received each year. This procedure results in smaller annual interest charges and larger annual capital recovery charges as the life of the asset approaches termi-

nation. The sinking fund return variant views each $2,848 as representing level annual amounts for capital and interest of $1,448 and $1,400 respectively, none of which is deemed receivable until the termination of the asset's life. Both variants correctly indicate the proposal should be accepted since anticipated annual receipts amount to $2,981.

The UAC method has been shown to produce the same results as IY and NPW for the proposed investment discussed in the preceding pages. The relationships between the UAC method and NPW and IY are set forth in considerable detail elsewhere and only two points need to be mentioned here.[5]

First, all three of these evaluation criteria are based on the concept of "equivalence" which underlies all mathematics of finance and engineering economics. Second, each of the methods consider the cost of capital or required minimum return of a firm in the evaluation of capital-expenditure proposals. NPW states future net cash benefits in "equivalent" present worth terms by discounting them at the expected cost of capital rate. The equivalent present worth of these benefits is then compared with the necessary investment outlay for a project. The IY of a project is the interest rate which equates the investment outlay with the

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[5]See Merrett and Sykes, pp. 165-168. Also see Eugene L. Grant and W. Grant Ireson, Principles of Engineering Economy (4th ed.; New York: The Ronald Press Company, 1964), pp. 97-99.

"equivalent" present worth of the future cash benefits expected. The rate derived is then directly comparable with the firm's cost of capital. The UAC method states all expected outlays, both initial investment and future operating costs, in terms of an "equivalent" uniform annual series discounted at the cost of capital.

Uniform Annual Charge--Practice

Five of the companies visited in the field study use some modification of the UAC approach (see Table 2-1). All of these companies are in regulated industries.

Regulated companies are required to provide public services for the lowest prices possible as long as a "fair return" is earned to pay to the suppliers of capital. These requirements have resulted in regulated firms being extremely cost and price conscious. Most of these firms would view the preceding example from a "revenue requirements" standpoint. The project evaluated would need to meet an annual revenue requirement of $2,848 to be economically viable. However, there is nothing unique about the evaluation of such a project that should result in the UAC method being ignored by other firms. The method can be just as useful for non-regulated companies as it can for those that are regulated.[6]

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[6]See the following recent article that presents arguments for a UAC variant. Lee C. Raney, Karsten A. Rist and Henry A. Wiebe, "The Equivalent Annual Amount Method--A New Approach to Investment Analysis," N.A.A. Bulletin--Management Accounting, XLVI (April, 1965), 25-35.

MAPI System--Theory

Another theoretically sound acceptance criterion is the formulation provided by the Machinery and Allied Products Institute (MAPI) under the direction of George Terborgh. Terborgh and his associates have directed their efforts toward developing and refining a mathematical formulation for use in replacement type capital-expenditure decisions.[7] This formula includes all of the major quantifiable factors which can be objectively derived for decision-making purposes.

The purpose of the MAPI system is to determine the economic benefits which may be expected to accrue to a firm if an existing asset is replaced in the current period rather than one year hence. These benefits are expressed in both absolute dollar amounts and in relative terms. The relative expression is called an "urgency rating" or "next-year rate of return." The formula can be utilized to facilitate annual evaluation of all replaceable facilities. The proper use of the resultant urgency ratings will promote the most efficient allocation of limited funds to replacement type capital-expenditure proposals.

There are five basic factors needed for the next-year return derivation. These factors are: (1) net investment;

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[7]George Terborgh, Business Investment Policy (Washington, D.C.: Machinery and Allied Products Institute, 1958).

_____, Dynamic Equipment Policy (New York: McGraw-Hill Book Co., Inc., 1949).

(2) next-year operating advantage; (3) next-year capital consumption avoided; (4) next-year capital consumption incurred; and (5) income tax adjustments. These factors have been summarized by Terborgh as follows.[8]

> (1) Net investment. This is the installed cost of the project, less any investment released or avoided by it. The released investment equals the present disposal value of the assets that would be retired by the project. The avoided investment equals capital additions to existing assets required in its absence.
>
> (2) Next-year operating advantage. This is the sum of revenue increases and cost decreases resulting from the project, as compared with the operating results that would be obtained next year in its absence.
>
> (3) Next-year capital consumption avoided. This is the loss of disposal value from holding for another year the assets that would be retired by the project, plus the next-year allocation of capital additions required in its absence.
>
> (4) Next-year capital consumption incurred. This is the amount by which the remaining use value of the project at the end of next year will be below its cost.
>
> (5) Next-year income-tax adjustment. This is the net increase in the income tax liability that is expected to result next year from the new project.

An example based on an illustrative case presented by Terborgh is outlined on the next page.[9] A capital consumption charge is deducted from the total after-tax operating advantage expected for the coming year to determine the amount available as a return on investment and the MAPI urgency

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[8]Terborgh, Business Investment Policy, pp. 60-61.

[9]Ibid., pp. 153-157.

I. REQUIRED INVESTMENT

(1) Installed Cost of Project	$6,124
(2) Disposal Value of Assets to be Retired	- 400
(3) Net Investment Required (1 - 2)	$5,724

II. NEXT-YEAR ADVANTAGE FROM PROJECT

A. Operating Advantage

(4) Net Increase in Revenues	$ 500
(5) Net Decrease in Operating Costs	+ 2,910
(6) Next-Year Operating Advantage (4 + 5)	$3,410

B. Non-Operating Advantage

(7) Next-Year Capital Consumption Avoided-- Decline of Disposal Value during Year	+ 200

C. Total Advantage

(8) Total Next-Year Advantage from Project (6 + 7)	$3,610

III. COMPUTATION OF MAPI URGENCY RATING

(9) Total Next-Year Advantage after 50% Income Tax	$1,805
(10) MAPI Chart Allowance for Capital Consumption	- 214
(11) Amount Available for Return on Investment (9 - 10)	$1,591
(12) MAPI URGENCY RATING 100 x (11 ÷ 3)	27.8%

rating. This capital consumption charge should not be construed as an amortization of part of the cost of the asset. It represents the anticipated next-year decline in the present worth of the service potential of the project. The determina-

tion of this decline in present worth depends on explicit assumptions regarding after-tax earnings patterns, asset lives, salvage value, and a capitalization rate. Charts are published by MAPI which incorporate different earnings patterns and capitalization rates. The capitalization rate used in the above example is 8.25% and is based on a debt-equity ratio of 1:3, a 3% after-tax interest rate on debt, and a 10% after-tax equity return. The $214 capital consumption charge was derived from a MAPI chart based on the preceding assumptions and a 50% income tax rate. The next-year rate of return on Terborgh's illustration is 27.8%. This rate would be compared with other replacement proposals to determine its relative "degree of urgency."

MAPI System--Practice

Only one of the firms interviewed in the study uses the MAPI formulation for decision-making purposes. The company does not use the 8.25% capitalization rate because of the nature of its capital structure. The executives interviewed said the firm has a large number of asset replacement proposals and has found the MAPI system very useful in evaluating such alternatives. The firm has had relatively few difficulties involving employee mis-understandings of the method. This argument is often made against the use of the MAPI formula.

This company utilizes the internal yield approach for proposals that do not involve asset replacements. This

approach to the overall capital-expenditure evaluation process is quite sound. The MAPI criterion that is particularly applicable to replacement proposals is used for their evaluations, and the IY method is used for evaluations for which it is well suited.

Most of the firms interviewed indicated that they were aware of the existence of the MAPI system, but have rejected its use for a variety of reasons. Other than the problem of employee mis-understandings mentioned above, the principal reason was that the method is not applicable for evaluations of non-replacement type projects. This point is generally true and the MAPI personnel specifically warn that the formula is a model for replacement decisions and should not be used for all proposals. It seemed that in several firms a thorough evaluation of the merits of the MAPI system had not been made. This is unfortunate since the formula and charts developed by MAPI represent an excellent addition to the analytical tools available for asset replacement decision-making purposes.

Rates of Return--Theory

An approach commonly utilized by business firms for the evaluation of capital-expenditure proposals is the so-called rate of return on investment measure (ROR). The variations of this method are quite numerous. Each of the variants attempts to compare a book profit figure with some

approximation of the capital invested in a project, but none of them explicitly considers the time value of money in the decision-making process.

The basic variants of the ROR approach found in use in the firms visited are listed below.

(1) Average annual return on initial investment

(2) Average annual return on average investment

(3) Yearly returns on book value

One point should be made clear at the outset regarding this evaluation measure. Very few of the firms visited are computing the variants exactly as is done in the examples in the following pages. There are thus a multitude of variants of the variants.

Illustration II-2

Figure 2-1 presents data for two proposals currently being considered by a firm. Proposal G requires a current investment outlay of $220,000 and has an expected life of ten years. This proposal has estimated net cash benefits after taxes (NCBAT) of $10,000 in year 1. These benefits are expected to increase by $10,000 annually through year 10. Proposal H requires the same outlay and has the same expected economic life as Proposal G. The NCBAT predicted for year 1 amounts to $73,000. These benefits are expected to diminish by $8,000 annually through year 10. A 50% income tax rate is expected, and both proposals have zero salvage estimates at the end of year 10. It

is further assumed for the sake of simplification that losses on individual projects cannot be offset against gains on other projects and that loss carryback and carryover provisions are not available. These factors are discussed in Chapter V.

The internal yields approximated in Appendix B are 15% and 16.8% for Proposals G and H respectively. If funds are assumed to be limited and the proposals are conflicting and independent, the IY approach would dictate the acceptance of H as the more desirable investment. A comparison of this result with the decision based on the three ROR variants will give some indication of their possible usefulness and correctness as measures of profitability.

Initial Investment Variant

Proposal G has a total book profit of $330,000 over its economic life and Proposal H has a total profit of $150,000 (Figure 2-1). Based on the annual average profits of $33,000 and $15,000 and the identical amount of initial investment of $220,000, Proposal G has the higher rate of return. The rates are 15% and 6.7% for G and H respectively. This method would result in a choice of Proposal G which is the opposite of the result given by the IY approach.

The fundamental fallacies in this ROR variant are the failure to consider the timing of expected benefits, and a mis-interpretation of what the annual cash inflows represent.

Figure 2-1. Illustration of Rates of Return

Year	(1) Book Value	(2) Depre-ciation	(3) NCBAT	(4) After Tax Income	(5) 4 ÷ 1 Yearly ROR
PROPOSAL G:					
0	$220,000.	--	--	--	--
1	198,000.	$22,000.	$10,000.	$(12,000.)	(5.5%)
2	176,000.	22,000.	20,000.	(2,000.)	(1.0%)
3	154,000.	22,000.	30,000.	8,000.	4.5%
4	132,000.	22,000.	40,000.	18,000.	11.7%
5	110,000.	22,000.	50,000.	28,000.	21.2%
6	88,000.	22,000.	60,000.	38,000.	34.5%
7	66,000.	22,000.	70,000.	48,000.	54.5%
8	44,000.	22,000.	80,000.	58,000.	87.9%
9	22,000.	22,000.	90,000.	68,000.	154.5%
10	--	22,000.	100,000.	78,000.	354.5%
	TOTALS	$220,000.	$550,000.	$330,000.	716.8%
PROPOSAL H:					
0	$220,000.	--	--	--	--
1	198,000.	$22,000.	$73,000.	$51,000.	23.2%
2	176,000	22,000.	65,000.	43,000.	21.7%
3	154,000.	22,000.	57,000.	35,000.	19.9%
4	132,000.	22,000.	49,000.	27,000.	17.5%
5	110,000.	22,000.	41,000.	19,000.	14.4%
6	88,000.	22,000.	33,000.	11,000.	10.0%
7	66,000.	22,000.	25,000.	3,000.	3.4%
8	44,000.	22,000.	17,000.	(5,000.)	(7.6%)
9	22,000.	22,000.	9,000.	(13,000.)	(29.5%)
10	--	22,000.	1,000.	(21,000.)	(95.4%)
	TOTALS	$220,000.	$370,000.	$150,000.	(22.4%)

Return on Initial Investment

ROR = Average Annual after Tax Income ÷ Initial Investment

Proposal G ROR = $\frac{\$330,000 \div 10}{\$220,000}$ Proposal H ROR = $\frac{\$150,000 \div 10}{\$220,000}$

ROR = 15.0% ROR = 6.8%

Return on Average Investment

ROR = Average Annual After Tax Income ÷ Average Investment

Proposal G ROR = $\frac{\$ 33,000}{\$110,000}$ Proposal H ROR = $\frac{\$ 15,000}{\$110,000}$

ROR = 30.0% ROR = 13.6%

Each inflow represents in part a return on the capital outstanding during each particular period. The remaining amount is a return of a portion of the initial investment. The timing of the cash flow pattern is discussed in further detail below.

Average Investment Variant

The second major variant of ROR in use attempts to recognize the fallacy of including the total investment in measuring a rate of return. This attempt is often made by dividing the initial investment by two to determine the "average" amount which will be in use over the proposal's life. Figure 2-1 shows Proposals G and H have average rates of return of 30% and 13.6% respectively. As should be expected, this approach also results in the erroneous acceptance of Proposal G. The respective rates are merely doubled by determining a so-called "average" investment for the proposals. While this variant may be some improvement over the preceding one, it is subject to most of the same basic fallacies and a few of its own which are unique.

Yearly Book Value Variant

The other principal approach to a determination of ROR attempts to recognize the influence that profits in specific years can have on proposal evaluations, and the problem of a change in the amount of investment involved each year. This is typically done by calculating yearly rates of return based

on book values. Figure 2-1 includes the yearly rates of return for Proposals G and H. These figures are virtually meaningless under most circumstances. They are seldom measures of comparability or profitability. Such nonsensical rates as 354.5% and -95.4% shown in Figure 2-1 often result. It is difficult to discern how these figures could be very useful for project evaluations over a period of years.

Rates of Return--Practice

Table 2-1 indicates a total of twenty-seven firms utilize some variant of ROR in their capital-expenditure decision-making process. Nineteen firms use this approach as a primary criterion and eight use it to supplement other criteria being employed. Some of the firms in the latter category are in the process of phasing out the use of ROR entirely.

Initial Investment Variant

Slightly less than one-half of the firms using ROR employ this variant. Several of the executives in these firms indicated the approach is considered a measure of profitability and comparability for ranking alternative investment proposals. The validity of this assertion depends on how closely the measure approximates the results determined by the internal yield criterion. The following comments are a condensation of a more detailed consideration of this line

of reasoning set forth by Merrett and Sykes.[10]

The relationship between this variant of ROR and the true internal yield depends on the length of an asset's life, the nature of its cash flow and book profit patterns, and the discount rate involved.

Consider first the simple assumption of a constant annual net cash benefits pattern and no salvage value for a proposal being evaluated. The ROR for such a proposal will normally underestimate the IY, with the general exception being assets with relatively long lives extending beyond forty years. The rates of return for proposals with after-tax internal yields in the 6-10% range and expected economic lives of ten to twenty years usually underestimates the IY by 40-50%. Such a large margin of error can often result in an incorrect ranking or choice between proposals.

If uneven cash flows are expected this ROR variant can either substantially overestimate or underestimate the true yield. The results depend on the direction and rate of change in the net cash benefits pattern. The initial investment variant generally discriminates against short-lived assets and assets with short payback periods when cash flow patterns are changing. This discrimination results from assigning the same weight in the evaluation process to all cash flows regardless of the date received. The paradox of

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[10] Merrett and Sykes, pp. 220-226.

this situation is that a payback criterion will result in a higher and higher ranking for a project as its cash inflows are accelerated to earlier years. This same acceleration will result in the ROR variant increasing the discrimination against the project in favor of longer-lived or longer paying-out projects being considered. Most of the firms using ROR variants also utilize payback calculations for evaluating proposals. These firms may frequently obtain contradictory results from their two primary acceptance criteria.

Several companies calculate an average return on initial investment for a period shorter than the expected economic life of a proposal, such as five, eight, or ten years. Although this effort to emphasize the near term and to discount the more distant cash flows may be worthwhile, the difficulties mentioned above are still not resolved successfully. Averaging the annual cash flows still results in discrimination between proposals, and the initial investment issue is skirted. In addition, even though the distant flows are heavily discounted by the theoretically correct methods the flows for this period should not be ignored completely as occurs in the above ROR variation. The discussions in the next three chapters will show that such a practice could be particularly troublesome when terminal working capital flows, receipts from salvage, and other income tax factors are involved in investment proposals.

Average Investment Variant

Approximately one-fourth of the firms visited use this variant of ROR. The factors influencing the extent to which this variant approaches the true internal yield of a project are the same as those outlined above, but the directions of discrimination are typically the opposite and the true yield is normally overestimated. This ROR variant raises the likelihood that a firm will accept proposals that have prospective yields below the cost of capital.

Yearly Book Value Variant

Six of the firms visited compute a return for the first year of operations based on initial year investment. This procedure may under special circumstances be a proper measure of ranking proposals for comparability, but it does not measure profitability. A few other firms pick an expected typical year following the project's shakedown period and either relate the annual profit to the capital outstanding that year or to initial total investment. To the extent that these figures are actually representative of the total life span of the proposal these measures may be used for comparability purposes. True profitability is not measured because the time value of money is ignored. However, it is doubtful that project comparability will always yield correct ranking using these techniques. The cyclical nature of the operations of some of the firms and industries represented may often preclude any single year from being representative of

the results that can be expected for the entire economic life of many capital projects.

One of the reasons cited for using the ROR variants is the belief that they measure profitability. This is a basic fallacy under most circumstances and has been refuted time after time, but the idea still persists. The examples in this thesis indicate once again that this method just is not a measure which can generally be used reliably to determine profitability for capital projects.

Probably the principal advantage cited for the use of ROR in the firms visited is the concept's simplicity. This contention is a gross oversimplification. The special assumptions necessary for the variants of ROR to always result in correct accept-or-reject decisions just do not square with reality. The principal disadvantage of the method is its apparent simplicity. The actual computations can be simplified by ignoring numerous factors, but this will not alter the basic concept and the inherent rigid assumptions that are necessary for correctly determining these so-called rates of return.

Several of the executives representing firms that utilize one of the ROR variants complained that some of the criticisms leveled at the method are not valid because projects are not usually ranked in the way textbook or business periodical examples often imply. This point may be the reason that the flaws of ROR are not more readily discernible

in practice. Very few companies actually "ladder" all proposals at one point in time for the approaching investment period. They should not necessarily be expected to do so. The interviews revealed that most proposals are initially considered in conceptual form only. In the early stages of the decision-making process an accept decision is often tentatively made with the expectation of final approval and expenditure of funds for the project occurring later in the year. As other proposals arise during the year they may or may not be presented to certain levels of management depending on the circumstances. This approach is also as should be expected. No firm or its personnel is endowed with perfect foresight. The point at issue is that any acceptance criteria used should give consistent and correct results over a period of time regardless of the level of personnel making the decision, and irrespective of the particular items involved in the individual proposals being evaluated. These results cannot generally be expected from the use of rate of return calculations. It may be that the reason some firms do not yet recognize the possible existence of erroneous or discriminatory elements is because the normal decision-making process occurs continuously throughout the year.

Several of the firms that were visited utilize an ROR criterion computed on a before-tax basis. Although the examples in the succeeding chapters will indicate some of the discriminatory elements which can result from this kind

of approach, one comment is relevant at this point. The rigid assumptions mentioned earlier regarding the use of ROR as a profitability measure preclude any such claim for the method if it is computed on a before-tax basis. It still can be a measure of comparability, but the necessary circumstances and assumptions make the likelihood rather remote.

Recovery Period--Theory

The financial manager of a business firm has been aptly depicted as sitting on the horns of a two-pronged dilemma--maintaining a sufficient reservoir of cash to meet currently recurring obligations and putting funds to work to maximize the present worth of future earnings.[11] The acceptance criteria discussed thus far in this study have been mainly concerned with the latter objective of profitability. The liquidity objective is usually emphasized by firms through the use of a payback or recovery period criterion. The traditional definition of this criterion stresses the necessary time period required for a firm to recoup the investment in a new project. The following illustration will facilitate discussion of the recovery period measure.

Illustration II-3

Assume the initial outlay expected for a new asset is $50,000 at time zero. Annual net cash benefits of

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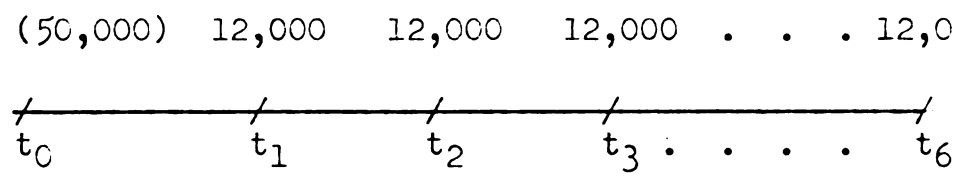
[11]Robert W. Johnson, Financial Management (2d ed.; Boston: Allyn and Bacon, Inc., 1962), p. 20.

$12,000 are expected for six years. This information is shown on the time scale below.



The time period that is necessary to recover the $50,000 investment is 4.17 years. Calculations are shown in Appendix B. This acceptance criterion shows over what period of time the investment in a project is at risk. The RP computation should be based on the same cash flow concept utilized for the three correct profitability measures discussed earlier in this chapter. The RP criterion is not a measure of profitability. Proposals can be ranked in terms of liquidity if the criterion is correctly computed.

The RP measure is usually cited as a way of determining how long it will be before a firm has broken even, or is as well off as it was before a proposal was adopted. The project in the preceding example will usually be said to have "paid out" in 4.17 years if the expectations are correct, but there is a fundamental error in this approach to the recovery period. One crucial element of cost is ignored in the computation. Recurring cash disbursements for operating outlays and the initial investment are the costs which must be recouped to break even according to the traditional view. However, before a firm can truly be said to have broken even

on a project some consideration must be given to its expected cost of capital. Two basic views may be taken in regard to the cost of capital. The amount of profits foregone by not investing elsewhere is one approach that can be taken to derive a firm's cost of capital. This view is called the "lending rate" or opportunity cost of capital concept. Alternatively, the explicit costs that must be paid to the suppliers of capital can also be taken into account in project evaluations. This "borrowing rate" concept of the cost of capital opens the door to many of the ramifications of financial leverage.[12] However, the issue of leverage is skirted here and a common equity cost of capital is assumed for the purpose of continuing the discussion of Illustration II-3.

By assuming a common equity cost of capital of 10%, a recovery period of 5.7 years results for Illustration II-3. Calculations are shown in Appendix B. This approach to the recovery period certainly casts a different light on project evaluations. Whereas the traditional approach yielded a relatively favorable RP of 4.17 years, the 5.7 years period resulting from consideration of the cost of capital should cause a much closer look at the proposal in view of its 6-year life. It has been suggested that this approach to a recovery period could be used to gain top management's

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[12]For a lengthy and comprehensive example of this version of the recovery period and some of the influences of financial leverage see Merrett and Sykes, pp. 200-209. Both the lending and borrowing rate approaches are used in subsequent examples in this thesis in conjunction with the "progressive" recovery period approach that is discussed on pp. 48-49.

acceptance of the internal yield or some other discounting measure.[13] If a firm is currently using the traditional RP approach, the first step would be the introduction of "RP plus interest or the cost of capital." It is then only a short step to show that the internal yield is the rate a firm earns for a recovery period equal to the length of a project's life, and that the excess of this yield over the cost of capital indicates profitability. The yield for the proposal in Illustration II-3 is approximately 11.5%. The proposal may alternatively be viewed as though the firm will break even over a six-year period if the cost of capital is 11.5%.

Recovery Period--Practice

Thirty-four of the firms included in the study use some measure of RP for evaluating capital-expenditure proposals (Table 2-1). Nineteen of these firms utilize the approach as a primary criterion. Most of the other companies use RP to supplement one of the discounting techniques or an ROR variant being used.

Two of the companies interviewed explicitly include a charge in the recovery period computation which is considered to be an approximation of their cost of capital. One firm utilizes a weighted average "borrowing rate" concept. Another firm that uses RP as its primary criterion includes

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[13] Ibid., pp. 208-209.

what is essentially an opportunity cost of capital in evaluating projects. This firm calls the measure a "progressive" payback calculation. As stated in the instructions manual of this firm, the following question is raised in evaluating alternatives: "What is the minimum time we have to operate with the new project in order to get our investment back, and in addition, earn a return on the unrecovered portion of it at our objective earnings rate?" Tables have been prepared by this company to show the mathematical correlation between the traditional RP computed on a pre-tax basis and the "progressive" recovery period. These tables allow project originators to determine quickly what the approximate "progressive" RP will be without making all of the necessary computations. The firm has effectively incorporated uneven cash flow problems resulting from working capital changes, accelerated depreciation, investment credit allowances, and other factors into the correlation tables. A "mixed progressive payback" calculation can be derived when assets with varying lives are included in a broad capital investment program that is being evaluated. This modification of the theoretical approach to RP that was discussed in the preceding section has proven quite flexible according to the controller of this firm. The method combines some elements of the discounting procedures, and provides information about project recovery periods while remaining relatively free of computational problems.

Several of the firms visited consider the cost of debt financing in their determination of when a new project is expected to break even. Several other firms utilizing the RP method consider an imputed cost of equity funds when large projects are evaluated. Executives in the rest of the companies in which RP is used as an acceptance criterion stipulated that financing is an entirely separate problem and should be treated as such in evaluating capital-expenditure proposals. The latter approach is definitely erroneous. Solutions to the problems of making optimal investment decisions and obtaining the optimal sources of funds must be derived simultaneously. These solutions have not yet been generally derived in the theory or practice of financial management. Irrespective of how it is computed, some charge for a firm's cost of capital is necessary for a proper determination of the recovery period of a new project. The computational simplicity resulting from excluding such a charge may be attained only at the price of errors in decision making and lower profits.

Certain inconsistencies exist in practice in the consideration of the cost of capital in RP calculations. The firms mentioned in the preceding paragraph that consider only equity costs are clearly in error unless no financial leverage is being employed in their capital structures. Several firms consider some costs of capital in evaluating foreign projects, but ignore the factor entirely for domestic investments. This calculation places a penalty

on investing in foreign countries, and is not a proper procedure for handling the higher degree of risk inherent in such projects as was contended by some firms.

The recovery period approach is often considered to be a measure of risk in the evaluation of alternatives. The only risk measured is of a catastrophic nature, and from which a project would cease operations entirely after the recovery period. This kind of risk exists in certain industries where there is a high degree of potential obsolescence, and in some foreign countries where politically unstable governments exist. A further evaluation of the RP approach as a measure of risk is set forth in Chapter V.

Several proponents of RP stipulated that the measure approaches the true yield of a project under certain conditions, and is a short cut to approximating profitability. If a proposal results from a short pre-revenue stage, has a relatively constant cash benefits pattern, and a life that extends beyond ten years, the reciprocal of the traditional RP is a relatively close approximation of IY. This relationship is altered somewhat when the cost of capital is considered in project evaluations. Furthermore, when a project has the characteristics listed above that are necessary for the traditional RP to be a short cut the calculations of IY and NPW are also moderately easy to derive. Except for the "progressive" modification discussed at length above, the RP criterion does not offer any material assistance in the

evaluation of capital-expenditure proposals that cannot be almost as readily determined through the utilization of the discounting techniques.

Return on Sales

The executives interviewed in two of the firms included in the study stated that a percentage return on sales is an important criterion. This measure is the primary mathematical acceptance criterion in one of the firms visited (Table 2-1). The same firm also utilizes an average rate of return on initial investment and the traditional recovery period method in the evaluation process, but these criteria are weighed less heavily than the return on sales computation. Executives in both of the companies indicated the terminology and emphasis in their particular industry was on sales, and they felt the return on sales measure properly indicates profitability.

A consideration of profit in relation to sales dollars has definite major flaws. The primary error results from ignoring the time value of money in the evaluations of capital-expenditure proposals. This factor is certainly not insignificant as two executives contended. The second crucial flaw is that one of the two determinants of a project's profitability is ignored. Profitability of a capital-expenditure proposal depends on the operating margin on sales and the turnover rate(s) of the asset(s) involved.

To the extent that differences in asset turnover rates exist for various kinds of investment proposals in the firms utilizing this approach, substantial errors may be made in deciding between profitable uses of funds for capital projects.

Other Measures

An unusual criterion was found in use in one of the firms visited in the field study. The measure is based on an effort to recognize the high degree of technical efficiency which exists in many of the operating divisions of the firm. Although the criterion appears to be quite useful as a basis for comparability of technical efficiency between divisions, it does not measure the profitability of capital-expenditure projects. Two important errors are apparent from a profitability measurement viewpoint. The time value of money is intentionally ignored in the use of the criterion. The executive interviewed in this firm stated that the internal yield approach is being used in two of its operating divisions, but that this discounting approach has not resulted in the acceptance of any proposals that would not have been accepted anyhow. This argument cannot be refuted, but it is not necessarily germane. The relevance of this comment depends on the extent to which projects would be accepted irrespective of the nature of the acceptance criterion in use.

The other fundamental error in the measure results from a failure to relate the benefits calculated for a project to the total assets from which they are expected to result. This criticism was also leveled against the return on sales measure discussed in the preceding section.

Summary

The purpose of this chapter has been four-fold. First, the theoretical basis for each of the mathematical acceptance criteria found being used by the firms interviewed was discussed briefly. Second, the number of firms in the study which use the various criteria was set forth in Table 2-1. Third, the general patterns of reasons given by the firms regarding utilization of each criterion have been stated. Fourth, an effort has been made to relate theory to practice and the reasons for practice, and to point out consistencies and inconsistencies between their interrelationships.

Three theoretically correct general measures of profitability were discussed initially in the chapter. These measures are: net present worth, internal yield, and uniform annual charge. It was noted that the latter method has perhaps received insufficient attention in financial management literature. The other acceptance criteria discussed included the MAPI formula, so-called Rates of Return, Recovery Period, and Return on Sales.

The principal finding stated in the chapter was the gradual, but distinct, shift toward the utilization of the time-adjusting or discounting acceptance measures available. Three-fourths of the firms in the study are currently using one of these methods, and several others are considering changing to them in the near future. More than forty percent of the firms visited are utilizing a discounting technique as a primary evaluation criterion. Most of the other firms are using the internal yield approach as a criterion for major or special projects, and expect the usage to spread to other types of proposals eventually. The internal yield method was decidedly favored by the firms in the study over the other theoretically correct measures.

The principal reasons given by firms for not utilizing the time-adjusting methods at all, or at least more extensively, were stated and evaluated. These reasons are related to the degree of competition in the various industries, the quality of the quantitative data in the capital-expenditure proposals, capital rationing and excess liquidity conditions experienced by the firms, and educational and orientation problems with personnel. Upon critical evaluation, most of these reasons were found to lack substance or were inconsistent with other practices followed by the firms.

The MAPI system was discussed briefly, but was found in use in only one firm. One of the principal reasons for the technique's lack of popularity seems to be an insuffi-

cient evaluation of its relative merits by the firms in the study.

Three so-called rate of return variants were discussed and criticized. Although over sixty percent of the firms are using one of these variants, some of the interviewees stated they are phasing out their current usage of the technique. The variants were shown to discriminate against the very projects often most desired by business firms--short-lived assets and others with short recovery periods.

The recovery period method was found to be widely used, but appears to be losing some of its stature. The traditional view of a recovery period was challenged in the chapter, and a "progressive" measure found in use in one firm was suggested as a more desirable analytical tool.

Two other criteria which do not measure profitability were discussed briefly in the chapter. Both of the criteria ignore the time value of money, and also fail to relate total project benefits to the total assets being used to generate them.

CHAPTER III

FEDERAL INCOME TAX INCENTIVE PROVISIONS

The first major effort by the U. S. Congress to provide business firms with an incentive to invest in plant and equipment after the Korean War was the passage of new laws allowing accelerated depreciation of the cost of long-lived assets. The 1954 revision of the Internal Revenue Code included the first formal allowance of two new methods of depreciation--the sum-of-year's digits and declining-balance procedures. It was not until eight years later that other important measures were enacted to provide additional investment incentives. These later measures were the investment credit provisions of 1962 as amended in 1964, the guideline depreciation system introduced in 1962, and the income tax rate reductions effected in 1964 and 1965.[1] The incentive effects of the three recent measures on

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[1]An additional 20% first-year depreciation allowance became available in 1958 under Code Section 179, but was primarily for the benefit of small firms and was not considered important by any of the firms visited. For a discussion of this provision see 1965 Federal Tax Course (New York: Commerce Clearing House, Inc., 1964), pp. 1141-1143. Another less important incentive measure is Code Section 167 (f), which allows a firm to ignore up to 10% of an asset's cost in estimating salvage value to calculate annual depreciation. This provision is discussed briefly in Chapter IV of this thesis.

individual capital projects are first discussed separately in the pages that follow. The possible combined theoretical incentive impact is then examined for various hypothesized cases. These sections are followed by an indication of the practices found in the field interviews and the reasons related by firms for following the practices. Prior to considering the effects of accelerated depreciation on individual investment projects the possible incentive influences of a greater supply of investable funds stemming from the three newer incentive provisions are examined. A theoretical approach for incorporating the supply of funds effect into the decision-making process is also set forth.

The Tax Saving Concept

Income tax provisions have a dual impact on the economic evaluations of capital-expenditure proposals. First, nearly all tax provisions influence the amount of net cash benefits resulting from investment projects. This influence gives rise to the concept of a tax saving. Second, the timing of net cash flows resulting from investment outlays varies significantly depending on different income tax provisions and circumstances encountered by business firms. The crucial importance of timing is examined later in this chapter.

Federal income taxes in the United States are based on taxable income rather than gross income. Current operating disbursements are deductible from gross receipts in the

derivation of taxable income, and income taxes are determined annually by applying the tax rate to taxable income.

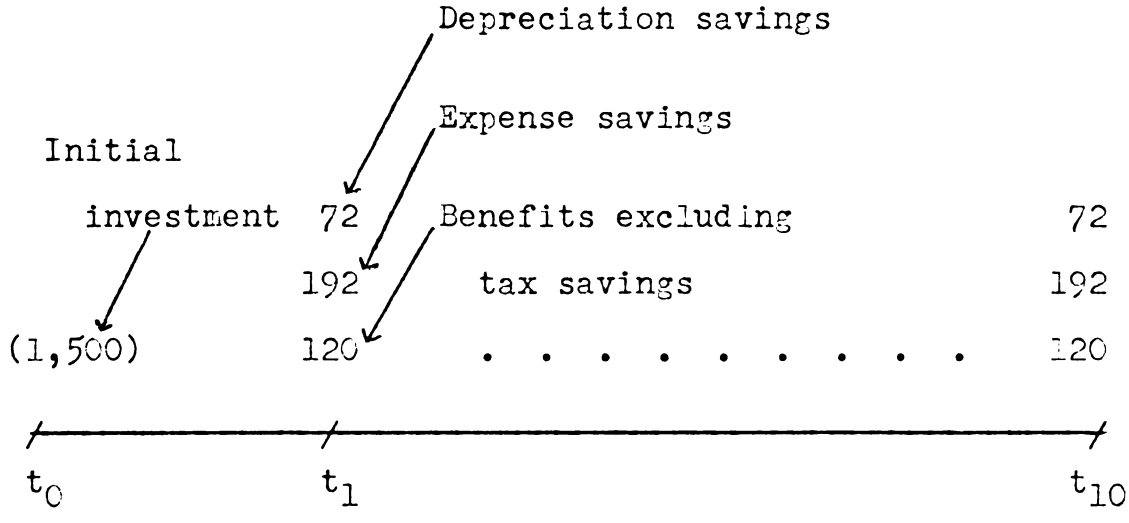
Illustration III-1

Assume estimated gross receipts and disbursements for a project amount to $1,000 and $400 respectively for a certain period of years, and that the tax rate to be applied is 48%.

The after-tax net cash benefits will equal $312, and are calculated as shown in Appendix B. If taxes had been based on gross income the net cash benefits would have amounted to $120. It is thus apparent that a tax saving of $192 results from the deductibility of cash disbursements for operating expenses. This saving can be derived by multiplying the 48% tax rate times the $400 disbursement. The federal government is accordingly viewed as sharing in the fortunes of business firms only to the extent that receipts are not offset by disbursements for current expenses.

The concept of a tax saving needs to be taken one step further. Depreciation of long-lived assets is also allowable as a deduction for Federal income tax purposes. If the illustration above is continued by assuming the receipts and disbursements are related to an asset costing $1,500 with an expected useful life of ten years, and no salvage value is expected to exist, the annual net cash benefits after income taxes would amount to $384.

The cash flow pattern for this capital project is shown on the following time scale, and the separate tax savings are shown for both the depreciation and cash expense deductions. This type of presentation will prove useful in subsequent discussion about tax depreciation policies of business firms.



The concept of a tax saving and certain related timing consequences provide the bases for the discussion of all of the income tax factors examined in the remainder of this thesis. The basic concept set forth in the preceding paragraphs will be elaborated on and expanded throughout much of the discussion in subsequent chapters. A mathematical formulation of the tax saving concept is presented in Appendix A.

Investment Credit--Theory

The Revenue Act of 1962 as amended in 1964 allows a credit against the annual Federal income tax of up to 7% of

the cost of a corporation's investment in "Section 38" property acquired in taxable years ending after 1961.[2] Section 38 property essentially includes tangible personal depreciable or amortizable property that is used as an integral part of the business operations of a firm. Although up to $50,000 of the cost of used Section 38 property may qualify for the credit each year, the provision relates primarily to new asset acquisitions. Buildings and structures, except elevators and escalators, are explicitly excluded from qualifying as Section 38 property. Property used predominantly outside the United States does not qualify, except for certain transportation service equipment.

The credit is allowable for the first year that the property is placed in service, but is limited to the amount of the total tax liability or $25,000 plus 25% of the liability if it exceeds $25,000 for the year. If the credit exceeds the maximum limit for a given year it may be carried back three years and over five years with certain limitations.

The full 7% credit is allowable only on assets with tax lives of eight years or longer.[3] Two-thirds of the credit is allowable for assets with lives of six but less than eight years, whereas one-third of the credit is allowable for assets with lives of four but less than six years.

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[2] Ibid., pp. 613-615.

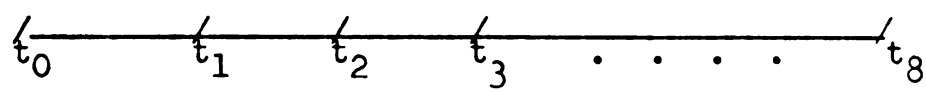
[3] Only 3/7 of the credit is allowable for Section 38 acquisitions by public utility companies.

The relative influence of the investment credit on individual proposals depends on several factors that are discussed throughout the thesis. The primary factors are the pre-tax earnings pattern of an asset, its depreciable life, the method of depreciation used, any expected salvage value, the size of the income tax rate, and how the asset is to be financed. A series of cases hypothesized by George Terborgh includes financing considerations, and is summarized in a later section of this chapter.[4] A single example of the influence of the investment credit on the desirability of a new proposal will suffice for current purposes. The example is based on the assumption that no financial leverage exists in the capital structure of the hypothetical firm.

Illustration III-2

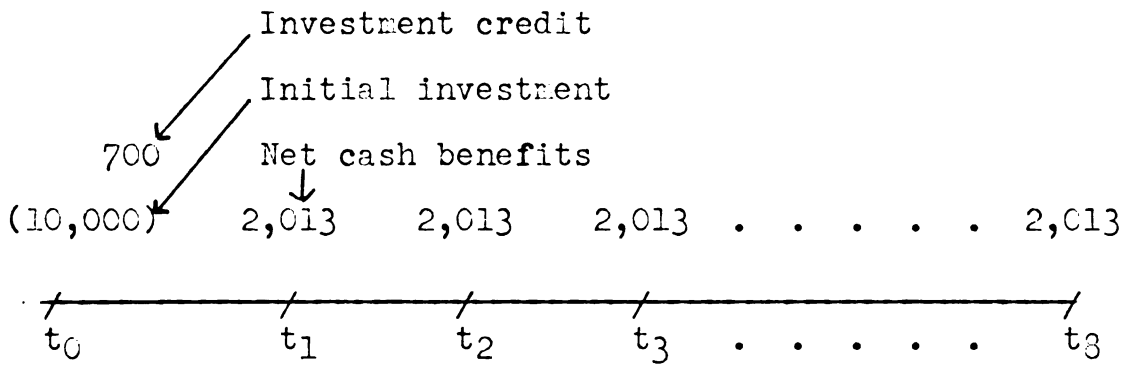
Assume the net cash benefits for a proposal requiring an initial investment of $10,000 are estimated as shown below on the time scale. To illustrate the influence of the credit under the conditions that existed at the time it was first enacted into law, a 52% income tax rate is assumed.

(10,000) 2,013 2,013 2,013 2,013



[4] George Terborgh, Incentive Value of the Investment Credit, The Guideline Depreciation System, and the Corporate Rate Reduction (Washington, D.C.: Machinery and Allied Products Institute and Council for Technological Advancement, 1964).

The internal yield on this proposal is exactly 12%, and is calculated in Appendix B. Assume next that the asset qualifies fully for the 7% investment credit, and that this amount is treated as an immediate cash inflow as shown on the time scale below.



Because of the $700 investment credit the yield will now amount to approximately 14.2%, or an improvement of about 18% over the original yield. This enhancement is certainly substantial, and especially if the project being evaluated is otherwise of marginal desirability. Even if the benefit of the credit is not recognized until the end of the first year of operation of the asset the yield is still nearly 14%.

The traditional and progressive recovery periods for the project are approximately 5.0 years and 7.5 years if no consideration is given to the investment credit. By considering the investment credit as an immediate cash inflow the new recovery periods are 4.6 years and 6.5 years. The calculations shown in Appendix B are based on a 10% cost of

capital. These improvements are roughly 7% and 13% respectively.

One additional point regarding the investment credit is relevant at this juncture. If an asset is not held for the entire eight-year period some portion of the 7% credit that has been taken must be repaid to the government following the year of asset disposition. The repayment equals the difference between the credit taken and the amount that would have been allowed if the computation had been based on the shorter period. If it is expected at the outset that the firm will not keep the asset for the entire eight-year period, the full credit should be taken and a negative cash flow should be included in the calculation for the repayment expected following the year of anticipated disposal. If the asset is disposed of as predicted, the firm will have returned some portion of the credit without being charged interest by the government for the period involved. If the asset is subsequently kept beyond the eight years, the firm will have been able to obtain the full benefit of the 7% credit. This benefit is not obtainable retroactively after it has been determined that the asset life has been underestimated and that only a portion of the credit was taken.

Corporate Tax Rate Reduction--Theory

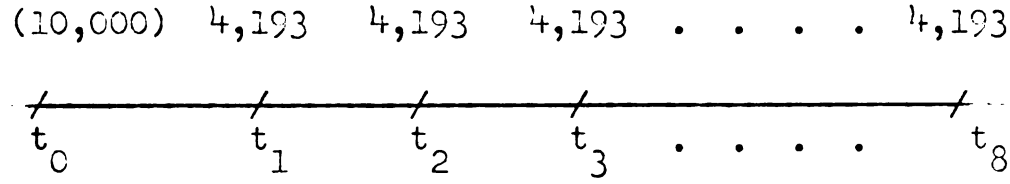
The Revenue Act of 1964 provided for a two-step reduction in the corporate income tax rates. Prior to

January 1, 1964, the normal rate on all taxable income was 30% and the surtax rate was 22% on all taxable income over $25,000. The combined statutory rate on all taxable income over $25,000 was thus 52%. For tax years beginning on or after January 1, 1965, the normal rate is 22% on all taxable income and the surtax rate is 26% on all taxable income over $25,000. Comparable rates for 1964 were 22% and 28% respectively.

Since nearly all of the firms included in the study had sizable taxable incomes, the rates used for "before" and "after" comparisons in subsequent illustrations are 52% and 48%. It is recognized that the effective tax rates are often less than these percentages because of operating and capital losses, state and foreign taxes, consolidated returns, and many other factors. Several of these factors are discussed in Chapter V.

Illustration III-3

Assume the cash flows shown on the time scale below are on a pre-tax basis. If these cash flows are reduced by a tax rate of 52%, the annual cash benefits amount to $2,013. It was mentioned in the preceding section that the internal yield on this cash flow pattern equals 12%.



If the pre-tax flows of $4,193 are reduced by the 48% income tax rate effective for 1965 and thereafter, the yield is roughly 14.4%. This improvement in yield is comparable to the results calculated for the investment credit allowance on the project. The after-tax net cash benefits amount to $2,180 annually. After giving effect to the income tax rate reduction of 4%, the traditional and progressive versions of the recovery period measure are 4.6 years and 6.5 years. The latter calculation is based on a 10% cost of capital. The size of the improvements from the tax rate reduction are also comparable to the results obtained from the investment credit in the illustration on page 62. All calculations are shown in Appendix B.

A note of caution is needed at this point. It was stated in the preceding section that the influence of each of the incentive provisions depends on several factors. In the results derived by Terborgh's illustrations shown in a subsequent section the investment credit has a much greater incentive influence on individual proposals than the tax rate reduction and the new guideline procedures combined. The principal reasons for the differing results are the declining earnings and depreciation patterns assumed by Terborgh. These assumptions substantially change the relative impact of the three incentive provisions, and provide excellent examples of the dangers in generalizing about their influences. Every business firm should evaluate each project

and the influence of the different incentive provisions on that project relative to other investment outlets, each of which may have similar or entirely different characteristics. Terborgh's illustrative cases are no less or more valid than those assumed here.[5]

Before proceeding to a discussion of the guideline system, one additional comment about the impact of the income tax rate reduction is needed. The rate reduction applies to all taxable income from existing as well as new asset acquisitions. The relative ranking of a new asset versus an asset currently in use may not change substantially from the rate reduction. The absolute net cash benefits after taxes from both assets will increase, but it must not be assumed that the substantial improvement in the internal yield of the new proposal assures its acceptance. Furthermore, the greatest influence from the tax rate reduction undoubtedly results from the increased supply of funds made available for investment by reducing the necessary tax outlays on all taxable income. This factor is examined in a later section of this chapter.

Depreciation Guidelines and Rules--Theory

The rules governing the depreciation guideline system are set forth in Revenue Procedure 62-21 which was introduced

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[5]One exception to this comment has already been noted. Terborgh considers the influence of financial leverage in the evaluation of investment proposals.

by administrative action in 1962.[6] Guideline lives are specified for approximately seventy-five broad classes of assets. These rules and guidelines supersede the detailed listings of individual asset lives in old Bulletin F. The guidelines do not supersede existing arrangements or previously established procedures by firms that prefer to continue their use. Depreciation within the guideline classes is determined on a group or composite basis rather than on individual assets.

The principal objectives of the guidelines were to shorten asset lives for tax depreciation purposes and to simplify the vast amount of record-keeping for individual assets.

A "reserve ratio test" is also included in Revenue Procedure 62-21. This test requires a determination of whether individual firms are utilizing appropriate rates for calculating tax depreciation on assets in each guideline class. The depreciation reserves for guideline classes are compared with, or tested against, the total cost of the assets to determine if their percentage relationship falls within certain test ranges that have been pre-determined by the tax authorities. This test was supposed to have been applied after three years of guideline use. The application of the test has not yet occurred and has currently been post-

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[6] 1965 Federal Tax Course (New York: Commerce Clearing House, Inc., 1964), pp. 1109-1137. The guideline procedures are discussed extensively in this source.

poned indefinitely.

Whereas the investment credit allowance applies evenly to the cost of Section 38 acquisitions by business firms,[7] and the tax rate reduction enhances after-tax income of all assets in existence and being evaluated, the guideline system has a widely varying incentive impact. Although the average reduction in depreciable tax lives was approximately 15% for all U. S. firms, many companies received practically no benefits because their existing rates were already below the guidelines. Other firms have benefited greatly as is elaborated on in the practice section below. It is thus once again imperative to recognize the dangers in generalizing about the influences of the incentive provisions. The following illustration indicates the influence of the guidelines only on the relationships hypothesized and should not be generalized.

Illustration III-4

Assume that in 1961 a firm was considering the acquisition of an asset costing $14,300 that was expected to provide estimated annual cash benefits of $1,820. Assume further the income tax rate was 52%. A zero salvage value estimate was expected, and straight-line depreciation was to be used for

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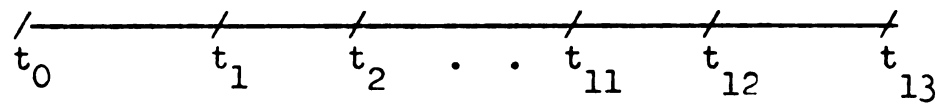
[7]This comment is subject to the qualifications mentioned on page 61.

tax purposes. The cash flow pattern which would result from these assumptions is shown below.

(14,300) 1,820 1,820 . . 1,820 1,820 1,820



The internal yield on the proposal is 8.1%. The progressive and traditional recovery periods are 11.8 years and 7.9 years respectively. The progressive measure is based on a cost of capital rate of 7%.

Assume next that the depreciation guideline procedures have just been made available, and that the tax life for the class to which this asset belongs has been shortened to eleven years. This reduction is roughly equal to the 15% average for all U. S. firms that was mentioned on the previous page. Since the economic life of the asset has been hypothesized as thirteen years and the tax life is now eleven years, the depreciation allowances over the guideline life will be increased. The higher depreciation allowances for the guideline years result in zero allowances in t_{12} and t_{13}. Cash benefits would then amount to \$1,924 and \$1,248 for the periods t_1 through t_{11} and t_{12} through t_{13} respectively.

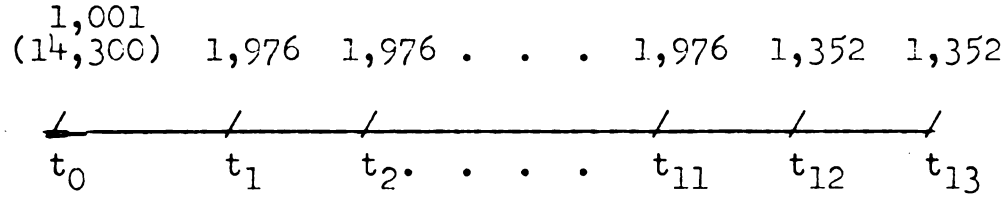
The internal yield on the project is 8.5% and is a relative improvement of only 5% over the 8.1% yield determined before the guideline procedures were being considered. Calculations for the project are shown in Appendix B.

The preceding illustration indicates that the guidelines may have decidedly less incentive effects on evaluations

of capital-expenditure proposals than the investment credit and tax rate reduction. As is discussed in the guidelines practice section later in this chapter however, these results do not necessarily hold for individual firms or even asset classes within firms.

Combination of Incentive Value--Theory

The cash flow pattern for the preceding illustration is shown below, and is based on the additional assumptions of a 48% tax rate and the availability of the 7% investment credit. The investment credit is shown as a positive cash inflow at t_0 and amounts to $1,001.



After giving consideration to all three incentive provisions, the internal yield on the proposal is approximately 10.4%. This represents over a 29% improvement from the initial yield of 8.1%. It was shown in the preceding section that approximately 5% of this improvement is attributable to the guideline provision. This fact indicates the significance of the relative influence of the investment credit and the tax rate reduction on the hypothesized figures.

The two recovery periods are approximately 6.7 years and 9.4 years after giving consideration to the incentive measures. The improvements are 15% and 20% for the tra-

ditional and progressive methods respectively. Whereas the progressive RP of 11.8 years exceeded the guideline tax life prior to considering any incentive measures, a greater margin of safety now exists that could be the deciding factor in eventual acceptance of the project.

Since the preceding results relate only to a single asset, they cannot be generalized to apply to all new alternatives being considered by a firm. A series of hypothetical cases is examined in the next section, but is considered in terms of another mathematical acceptance criterion that has not been discussed in previous pages.

MAPI-CTA Study--The Equity Rate of Return Criterion

A concise statement of the possible incentive values of the three tax provisions being discussed was completed recently by George Terborgh of the Machinery and Allied Products Institute.[8] This section is a summary of the findings by Terborgh in his analysis of a series of illustrative cases involving individual capital-expenditure projects.

The test of the incentive value employed in the study is "the increase in the after-tax return on equity investment that results from the application of the tax measure (or combination of measures) in question."[9] Terborgh has argued for years that the after-tax equity rate of return is the most relevant acceptance criterion to utilize in the

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[8]Terborgh, Incentive Value of the Investment Credit, pp. 12-17.

[9]Ibid., p. 12.

evaluation of alternative investment proposals. He has been joined more recently by other writers who make a strong case for the validity of this approach.[10] This author concurs with the view that financial leverage should be given explicit recognition in the evaluation of individual capital projects.

All of the examples considered thus far in this study have ignored the element of financial leverage in investment decisions and only the returns on all-equity cases have been examined. Terborgh's illustrations are reproduced in Figure 3-1, and consider both the all-equity case and a series of cases assuming a 1:2 debt/equity ratio.

Figure 3-1 illustrates the changes which would result from considering each of the incentive provisions separately, and in total, if a 10% equity rate of return is initially assumed for all projects. Further important assumptions regarding the illustrative cases are listed below.[11]

The important conclusions stated by Terborgh are essentially as follows.[12]

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[10]See Merret and Sykes, pp. 122-130.

[11]Terborgh, p. 13. The principal assumptions are: (1) the pre-tax earnings of the assets decline at a constant rate to zero at the end of their service lives; (2) there are no terminal values for capital projects; (3) sum-of-year's digits depreciation is used; (4) a 52% tax rate exists; (5) the investment credit is a cash inflow at t_0; (6) interest charges on debt are 5% annually; and (7) an average service-life reduction of 15% is assumed for guideline calculations.

[12]Ibid., pp. 16-17.

Figure 5-1. MAPI-CTA Study of Tax Incentives

CHART 1

After-Tax Equity Returns Yielded (1) By the Investment Credit, (2) By Guideline Depreciation, (3) By the Tax Rate Reduction, and (4) By All Combined; When the Return With None of Them Is Exactly 10 Percent

(All-Equity Capital)

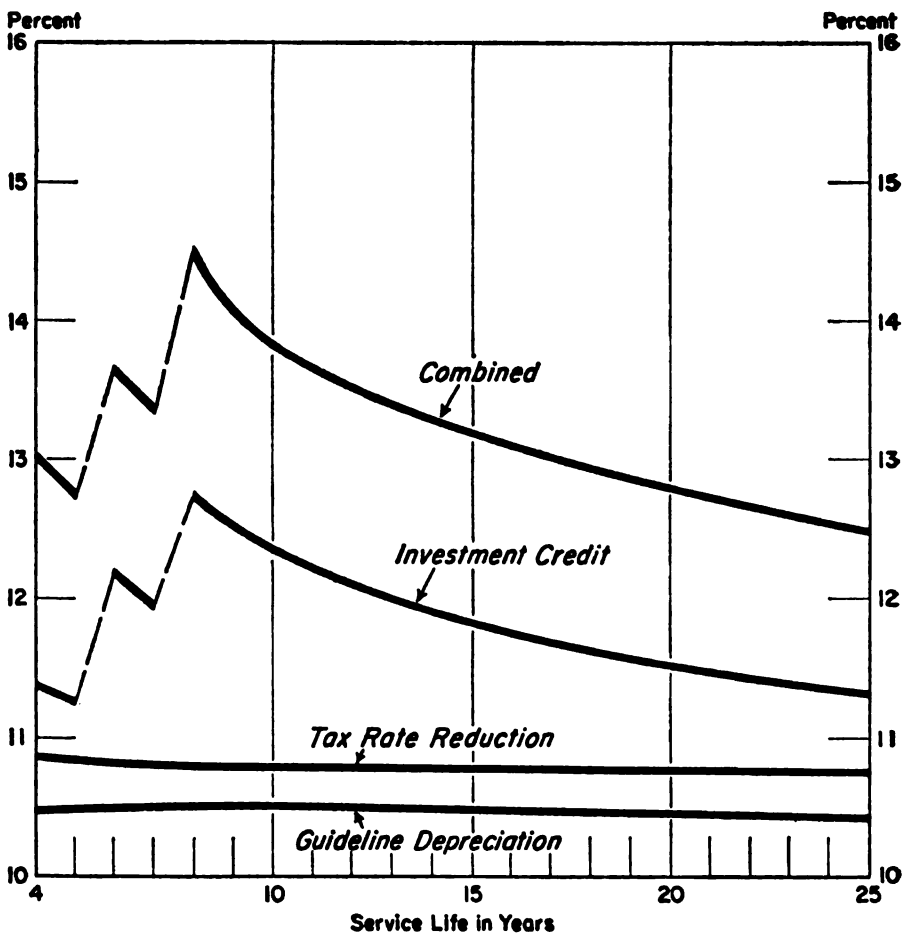
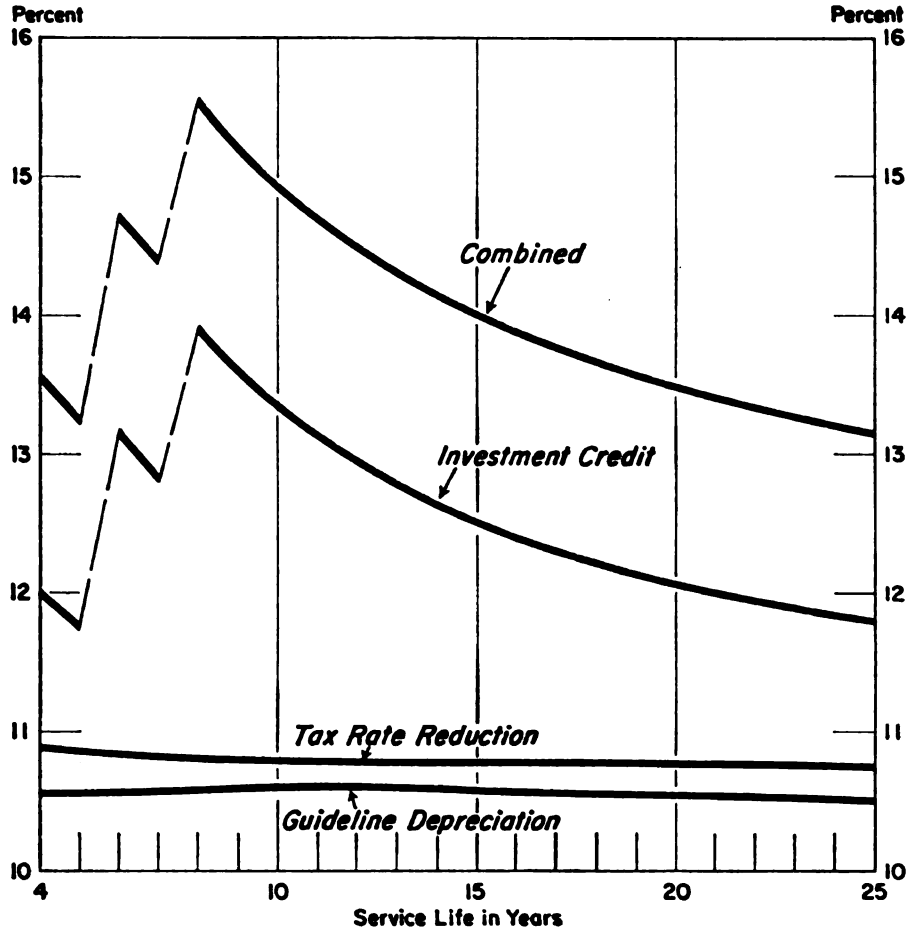


CHART 2

After-Tax Equity Returns Yielded (1) By the Investment Credit, (2) By Guideline Depreciation, (3) By the Tax Rate Reduction, and (4) By All Combined; When the Return With None of Them Is Exactly 10 Percent

(Mixed Capital: Two-Thirds Equity, One-Third Debt)



(1) For assets in the 10-15 year service-life range the combined results of the provisions will enhance the equity rates of return by an average of 35% and 45% for the all-equity and leveraged cases respectively.

(2) The benefits from the guidelines and the credit provisions are substantially higher for the leveraged cases than the all-equity cases.

(3) The investment credit benefit is substantially larger than the other provisions, but diminishes rather rapidly as assumed asset lives are extended beyond the 10-15 year range.

(4) The traditional cash recovery period is enhanced in the first year by 38% and 39% for the all-equity and leveraged cases respectively.

There are several other possible incentive approaches that can be used to enhance the equity rate of return to the same extent as has been outlined above. Terborgh derives the "equivalences" of the asset price reductions, the first-year depreciation writeoffs, and the tax rate reductions that would be necessary to raise the after-tax equity return to the level achieved by the combined operation of the three measures in Figure 3-1. The results for the 10-15 year asset category are summarized as follows.[13]

(1) First-year depreciation writeoffs of the asset cost would need to be 53% and 57% to enhance the returns for the all-equity and leveraged cases to the extent outlined in conclusion (1) above.

(2) Asset price reductions of 16% would be required to provide the same changes in the equity rates of return.

(3) Corporate tax rates as applied to the expected income from the new capital projects would have

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[13] Ibid., pp. 17-18.

to be reduced from 52% to 34% and 29% respectively to achieve the specified effects on the equity returns.

The discussion thus far in this chapter has included substantial evidence of the possible incentive values of the investment credit provisions, the corporate tax rate reduction, and the guideline depreciation system. The practices found in the field interviews are examined in the next sections, and are related to the reasons given to justify them. The corporate executives interviewed related many of the same reasons for practices followed in regard to all three of the incentive measures in discussing their influence on individual capital projects.

Before turning to the practices found in the field study, the interrelationship between the incentive provisions should be mentioned. The relative influence of the investment credit and guideline provisions on the mathematical acceptance criteria discussed depend heavily on the level of the corporate income tax rates. The higher the tax rates the greater are the incentives resulting from the credit and guideline provisions. This fact is not only important as statutory tax rates change over time, but also due to the varying effective tax rates being paid by firms when statutory rates are constant. This latter fact is examined further in Chapter V.

Investment Credit--Practice

Twenty-six of the companies visited in the study consider the investment credit provision explicitly in the formal analysis of alternative capital-expenditure proposals (Table 3-1). These companies were nearly evenly divided between those considering the credit as an immediate cash inflow or as an inflow in the first year or so that the asset is in use.

TABLE 3-1

APPROACHES TO CONSIDERING INVESTMENT CREDIT IN PROJECT EVALUATIONS

Approaches	Firms
Explicitly Included in Each Proposal:	26
Included at time zero	14
Included in first year of project's life	12
Explicitly Excluded from Each Proposal	18

Several reasons were mentioned in the firms that do not give consideration to the investment credit explicitly. One comment frequently offered as a reason for not considering the credit was that a firm cannot earn income by merely buying assets. This statement is generally true from an accounting income determination view, but it is not relevant for financial decision-making purposes. It is true that newly acquired fixed assets must be utilized in conjunction with other economic factors of production before utility can be added to a product and income recorded in good con-

science by accountants, but this statement certainly does not change the fact that an asset being evaluated can be made financially more desirable by the so-called incentive provisions being discussed.

Several firms indicated the investment credit can easily be repealed at any time by the Congress. It is thus felt that this uncertainty of the future of the provision should preclude its recognition explicitly in the evaluation process. It is certainly true that the whims of Congress are often unpredictable, but it is also a well-known fact that once a provision becomes entrenched in the tax law the pressure of vested interests often precludes its dislodgment with any substantial degree of dispatch. A good case can be made that eventually the current investment credit provision will be broadened rather than eliminated from the law.[14] This is the historical pattern of many of the tax provisions currently in existence.

The principal reason stated by the interviewees for the lack of attention given to the investment credit is that it is of relative insignificance. Even the firms explicitly

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[14]During the year that has elapsed since the field interviews were begun the likelihood that the investment credit provision will be repealed at least temporarily has increased substantially. This possibility has undoubtedly enhanced the uncertainty and relative instability of the credit in the minds of business executives, and is discussed in Chapter VI.

recognizing it in the evaluation process generally indicated that only marginal projects could possibly have been affected thus far by the credit. Since many other factors weigh so heavily in economic evaluations the investment credit is not felt to be large enough generally to influence individual projects. The examples in preceding sections have indicated that to the contrary, the investment credit can have a substantial influence on acceptance criteria, but have also shown that generalizations to refute reasons given for ignoring the credit may be somewhat perilous.

Several additional interrelated factors involving the lack of attention given to the investment credit provisions are listed below and discussed in the remaining pages of this section.

(1) The evaluation criteria utilized by a number of firms are relatively crude.

(2) The kinds of projects to which the credit is applicable often differs from those being evaluated by sophisticated criteria.

(3) Many projects are planned over a long period of time.

(4) Excess liquidity conditions have been experienced by many of the firms during the past several years.

(5) The basis of acquired assets was initially reduced by the amount of the credit for the purpose of calculating future tax depreciation allowances.

Acceptance Criteria

The firms in the study that prepare evaluations on a before-tax basis could not generally be expected to recognize

the impact of the credit on individual projects. A few of the firms were using pre-tax calculations because they were operating under tax loss conditions, but they were nonetheless quite concerned with the influence of the investment credit through the possible utilization of the credit carryback and carryover provisions.

A majority of the firms that were not explicitly recognizing the investment credit in proposal evaluations either do not use the time-adjusting criteria or utilize them only on major projects. The time-adjusting measures are much more sensitive to the recognition of the incentive value of the credit than the book profit methods which are used by many firms to derive rate of return and recovery period calculations. The rate of return measures that average the net income expected from projects would certainly blunt the recognition of the influence of the incentive value of the credit by spreading it over the economic life of the asset. This result would occur even if these firms explicitly included the credit in their computations, but did so in some way other than reducing the immediate investment outlay. The use of rate of return measures that average the investment in a capital project evaluation will also blunt the recognizable incentive value.

Several of the companies that are utilizing the traditional recovery period approach calculate it as the reciprocal of an average rate of return measure. Since this approach ignores the cash flow concept that is necessary for

a correct determination of recovery periods, all of the subtle difficulties inherent in the rate of return measures carry over, and thus will not be likely to result in a recognition of the true impact of the investment credit on alternative projects.

Nature of Projects

As was discussed in Chapter II, many of the firms utilizing the discounting acceptance criteria have just recently begun to do so for major projects as a way of educating personnel and testing the usefulness of these criteria. Since the investment credit provisions do not generally apply to real property, and a large portion of the cost of major projects is often for this kind of facilities, it is possible to see why these firms think the impact of the credit is immaterial. The only projects being evaluated by acceptance criteria which are likely to result in a proper recognition of the incentive value of the credit are not eligible to receive its benefits!

One of the principal reasons for the passage of the investment credit provisions was to encourage early replacement of existing machinery and equipment, and several executives said that this had occurred in some isolated instances. It is important to note that the approach taken in the illustrations in previous sections regarding the influence of the investment credit on the expected internal yield of a proposal is not necessarily valid in the case of replacement type

decisions. It is useful to indicate the improvement in the internal yields on independent projects that may be competing for funds allocated by firms for capital expenditures. However, if the decision is whether to acquire a machine to replace an existing one this year, or a year or two hence, the yield approach may be deceptive. The only advantage to acquiring the new machine this year that does not exist anyhow is the return that can be earned by reinvesting the funds provided by the investment credit and extra earnings during the coming year. This is a crucial distinction, and indicates again the importance of the care that must be taken in generalizing about the incentive value of tax provisions.[15]

Length of Planning Horizon

Another factor that appears to have influenced the lack of recognition of the incentive value of the investment credit is the long planning period required for some capital projects. This factor is especially important in the case of major projects involving real property which is not eligible for the credit. It was mentioned by several executives that the real impact of the investment credit has not yet had time to be felt because of the long start-up and planning period involved in many capital-expenditure projects. Although many of these projects may have in fact ultimately

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[15]This point raises a host of considerations regarding possible reinvestment rates for future periods. An example of some of the problematical subtleties involved is discussed in a later section of this chapter.

benefited from the credit, it was not available during their planning stages and thus was not influential in the accept-or-reject decisions.

Liquidity Conditions

It was implied in Chapter II that many of the firms in the study have been operating for the past few years under conditions that approach a capital rationing position only in the broadest of views. It was admitted in several firms that cash was available that was substantially in excess of currently planned needs. The interrelationship of such excess liquidity conditions with the crudity of some of the acceptance criteria in use was commented on in Chapter II.[16] It is quite possible that these same excess cash positions have resulted in the lack of recognition of the incentive value of the investment credit by these firms. This possibility is greatly enhanced when some of the reasons discussed above are also present in given firms. This line of reasoning was corroborated explicitly by several executives and implicitly by several others.

Asset Basis Reduction Provision

The initial investment credit provision effected in 1962 required a reduction in the tax basis of Section 38 property for purposes of determining future depreciation. The incentive influence of the credit was obviously not as

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[16]See pp. 19-20.

strong until the repeal of this provision in 1964.[17] The basis reduction provision, plus one or more of the preceding factors which have been discussed, definitely increased the probability that many firms would consider the investment credit too immaterial to influence particular projects. This fact is especially true in the case of public utility companies due to the smaller allowable credit and the requirement by some regulatory commissions that the firms pass on the benefits of the credit.

The preceding comments reveal the difficulties involved in generalizing about the recognition of the possible incentive influences of the investment credit provisions. The possibility of such recognition has been substantially lessened in some firms in which relatively crude evaluation criteria were utilized on certain types of projects requiring long planning periods, and especially in those firms where capital rationing was not an important factor.

Corporate Rate Reduction--Practice

Approximately two-thirds of the firms interviewed are currently utilizing a 48% tax rate in the evaluations of capital projects. Nearly all of these firms indicated the rate reduction has not resulted in the acceptance of specific projects that would not have been accepted otherwise. All

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[17]See the article "MAPI Study on Incentives," Journal of Taxation, Vol. XXIV (January, 1963), 2-5.

of the factors mentioned in the preceding section except the basis reduction provision are relevant to a discussion of the incentive value of the tax cut. This is particularly true of the length of the planning period required for many projects.

The fact that the rate reduction has been in two steps has probably influenced the degree of recognition of its incentive value. Furthermore, it was pointed out in the theory section that the rate reduction applies to all taxable income expected from both old assets and new ones being considered as replacements. Even though the internal yield on a new asset is substantially improved by this incentive provision, the relative position of the asset may not be changed because the yield on the old asset will also be enhanced.

Another factor which may account for some lack of cognizance of the incentive value of the corporate tax cut is there is little differential between the improvement of yields over a broad range of asset lives. The tax rate reduction differs from the investment credit in this respect. The problem of recognizing the incentive value of the tax cut in evaluating projects with varying economic lives again raises the issue of what earnings can be expected from the additional funds made available. This factor is discussed in a later section of this chapter.

The nine firms that were evaluating some or all of their proposals on a before-tax basis quite naturally

indicated that no incentive value was apparent from the rate reduction. All but one of these firms were either utilizing crude acceptance criteria, or operating under tax loss conditions, or both. Those firms operating under tax loss conditions could only be expected to recognize the influence of the rate reduction through the benefit of operating loss carryback and carryover provisions.

Depreciation Guideline System--Practice

Thirty-nine of the companies visited in the study are following the guideline procedures for some or all of their assets which are currently owned or are being acquired (Table 3-2). One-third of these firms stated the guidelines have not resulted in a substantial reduction in asset lives. Most of these thirteen firms adopted the guidelines primarily for administrative reasons. Several of the executives indicated that asset lives for tax purposes were already below the guidelines and that no advantage could be gained by their adoption.

TABLE 3-2

IMPORTANCE OF DEPRECIATION GUIDELINE PROVISIONS

Change in Depreciable Tax Lives of Assets	Firms
Substantial change--over 15%	20
Slight to moderate change--zero to 15%	6
No change	13
Total firms adopting guidelines	39

In twenty of the firms visited it was stated that the guidelines have had a substantial impact on the depreciation allowable for tax purposes. Two factors are of importance in this regard. About one-third of this group of companies indicated that the pooling arrangement which essentially allowed additional depreciation on assets that had been fully written off was an important incentive when the guidelines were initially adopted. This provision is no longer applicable and the benefits cannot be expected to recur.

The principal beneficial factor has been the reduction of asset lives for tax depreciation purposes. A substantial number of firms indicated that reductions have occurred for various groups of assets ranging from 15% to 50% of the previously allowed lives. Most of these firms are handling the earnings or cash flow patterns in the manner outlined in the theory section when economic and tax lives do not coincide.

Even though a large group of companies indicated that the benefits in the above paragraphs are being realized, very few of them related that any assets have as yet been acquired that would not have been purchased anyhow. As was true of the other incentive provisions, there have been some earlier replacements of old assets but this practice does not appear to be at all widespread.

Another factor that appears to have influenced the attitudes of firms toward the incentive value of the guide-

lines involves the imposition of the reserve ratio test. Firms are rightfully apprehensive that some of the initial benefits derived from the guidelines will be eliminated if the reserve ratio test is imposed. Although the test has been currently postponed, the typical caution of the American business executive will probably preclude any widespread explicit indication of incentive values from the guidelines until the test is eliminated or modified.

As was mentioned in the theory section, the guidelines are more difficult to generalize about and to criticize in practice than the other incentive measures. The guideline incentive values shown in Table 3-2 may be tempered or enhanced depending on the kind of investment project being evaluated and the circumstances of individual firms.

Supply of Funds from Tax Incentives--The Total Wealth Concept

Earlier sections of this chapter have included an examination of the enhancement of the economic worth of individual capital expenditure projects which may result from certain incentive provisions in the Internal Revenue Code. Substantial improvements in the yield and recovery period measures have been shown to result under a variety of circumstances. The studies by Terborgh and others were discussed, and it was noted that the after-tax equity yield may be a more useful measure of economic desirability and incentive value than the traditional internal yield. However, it was also noted that the funds supplied by the

incentive measures must be considered explicitly in evaluations of capital-expenditure alternatives.

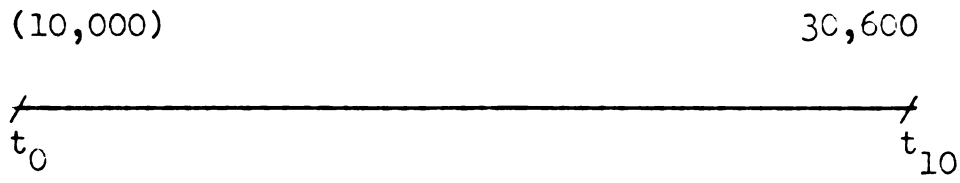
The economic desirability of receiving a larger amount of funds from either the investment credit or tax cut, and from accelerating depreciation write-offs through the guideline provisions, depends partially or entirely on the reinvestment possibilities that exist when such funds are obtained. This fact leads to the need for another reexamination of the mathematical acceptance criteria considered thus far in the evaluations of investment decisions.

In the final analysis, the change in a firm's economic position which may be expected to result from capital investments should determine the choice between alternatives. The change in the economic condition of a firm can be measured by deriving the total wealth that can be accumulated by the end of a project's life. The implementation of a total wealth concept requires explicit assumptions about the possible reinvestment rates for cash receipts and expected cost of capital rates for cash outlays over the life of a project. The following example presents the total wealth concept initially by ignoring incentive measures to illustrate the fundamental principle of reinvestment rates. The example is subsequently extended to indicate how alternative proposals may be influenced by the realization and reinvestment of the investment credit.

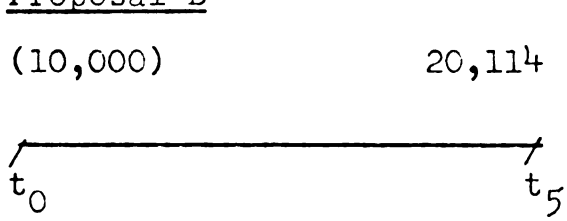
Illustration III-5

Assume a firm has $10,000 to invest in either of two capital-expenditure proposals. The estimated cash benefits from the proposals are shown on the time scales below. Proposal A will result in a net cash benefit at t_{10} of $30,600. Proposal B is expected to result in a net cash benefit at t_5 of $20,114. An 8% cost of capital rate is assumed initially.

Proposal A



Proposal B



The calculations in Appendix B show that the net present worth of Proposal A and Proposal B amount to $14,174 and $13,689 respectively. Proposal A is thus the more desirable alternative according to the net present worth criterion. If the internal yields are determined for these alternatives, Proposal A is deemed less desirable than Proposal B since the yields are 11.8% and 15% respectively.

The contradictory results from the two acceptance criteria arise from the fact that the proposals are not being considered over a common time period.[18] Ezra Solomon and others have suggested that measuring the wealth which can be expected to be accumulated by a firm at the end of a common time period is a correct approach for evaluations of capital-expenditure alternatives when such contradictory results occur.[19] Rather than compare individual capital proposals, alternative courses of action which may require several intermediate investments must be evaluated. The course of action, rather than the individual investment proposal, which results in the greatest total wealth at a common future reference point should be considered as the most economically desirable decision. The use of the total wealth approach requires explicit assumptions regarding future costs of capital and reinvestment rates.

If the assumption is made that the $20,114 receipt from Proposal B at t_5 can be reinvested at 9% until t_{10},

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[18]See Lorie and Savage, pp. 229-239.

[19]Ezra Solomon, "The Arithmetic of Capital Budgeting Decisions," Journal of Business, Vol. XXIX (April, 1956), 124-129. See also, J. T. S. Porterfield, Investment Decisions and Capital Costs (Englewood Cliffs: Prentice-Hall, Inc., 1965), pp. 24-41. The latter author compares the net present worth approach with a net terminal value measure that is similar to the total wealth concept. He also sets forth the rigorous assumptions that are necessary for NPW to always yield the same correct answers as the net terminal value measure.

the total wealth accumulated at that time would amount to $30,947. This reinvestment assumption makes the total wealth from the course of action including Proposal B higher and more desirable than the $30,600 expected from Proposal A. This decision coincides with the results obtained by correctly utilizing the net present worth measure, although the benefits from Proposal A must first be discounted back to t_5 at 9%, and then to t_0 at an 8% cost of capital.[20] The use of different cost of capital rates results in a net present worth of $13,535 for Proposal A, and thus causes its rejection because the comparable measure involving Proposal B has been calculated as $13,689.

Investment Credit Provisions and the Total Wealth Approach

The preceding analysis illustrated the principle of the reinvestment of earnings as they arise from capital projects, and the influence that such a procedure can have on the evaluation of alternatives. Consider next the same example with the added stipulation that the investment credit provisions are available. A full 7% credit is allowable on Proposal A. Only 1/3 of the 7% credit is available on B since the life of the asset is only five years, but since B's proceeds must be reinvested at t_5 another credit is assumed to be available at that time. The decision-maker

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[20]The 9% reinvestment rate is the opportunity cost of capital from the end of t_5 through t_{10} and is the proper rate to utilize in calculating the present worth of the alternatives. A different decision could result if a different reinvestment rate were assumed.

must now consider the rate at which the $700 credit on A and the two $233 credits on B can be reinvested.[21] Assuming the credits are considered as cash inflows at t_1 and t_6 respectively,[22] and the same 9% reinvestment rate is available, the total wealth of alternatives A and B at t_{10} accumulates to $32,120 and $31,782 respectively. The size and timing of the available investment credits and the assumed reinvestment rate have resulted in a change to A as the most economically desirable course of action.

The use of the total wealth approach suggests a further alteration in the mathematical acceptance criteria discussed thus far. Since it has been suggested that the equity rate of return is a desirable acceptance criterion for evaluating capital expenditures, consistency requires that financial leverage be considered explicitly in the implementation of the total wealth concept. This approach would require separation of the cash flows for various courses of action into debt and equity components. The total wealth expected to be accumulated should thus be in terms of the equity shareholder. However, not only must explicit assumptions be made regarding future changes in the

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[21]It is assumed that B's replacement will be available at t_5 for $10,000 and that the remaining $10,114 funds being reinvested are not eligible for the credit. It is also assumed that no credits result from the assets purchased by the $700 and $233 credits.

[22]This assumption is contrary to an earlier one on page 63, but is utilized here only for illustrative purposes.

capital structure of a company to implement this approach, but these changes and their varying costs over time must be related to individual projects or courses of action. Since the ease with which a measure can be implemented influences the extent of its use, it is doubtful that many firms will attempt such refinements until a number of less difficult problems of implementation are resolved.

The Total Wealth Approach and Recovery Periods

The comments in the preceding paragraph concerning the total wealth return to equity shareholders also apply to the recovery period acceptance criteria. Not only should the recovery period be calculated in terms of the common equity holder, but the reinvestment of intermediate proceeds should also be considered explicitly in calculating the break-even period for a project. Whereas the previous calculations regarding the progressive recovery periods exceeded the years necessary for a traditional payback due to the necessity of recovering the cost of capital, the total wealth or reinvestment approach could result in a shorter break-even period than the traditional measure. The results would depend on such factors as the length of asset lives, earnings patterns, costs of capital, and reinvestment rates. However, all of the difficulties mentioned in the previous section are inherent in the combined implementation of the total wealth and recovery period approaches. It is thus quite unlikely that firms will consider it as a useful tool of analysis for quite some time.

Supply of Funds from Tax Incentives--Practice

Whereas nearly all of the interviewees stated that additional funds have been provided by the incentive measures, hardly any of them recognize the effect on single projects and none of their firms use the total wealth criterion. The question was asked in these firms whether all projects acquired would have been financed anyhow. The reply was almost invariably positive. If these replies are correct, it can be concluded that the measures have hardly provided the firms visited any incentive at all. However, if the comments in the firms interviewed are representative it is highly improbable that all firms in this country could acquire additional external financing in lieu of the tax measures at the same time due to capital market constraints. These constraints would occur primarily due to limitations on the supply of funds available in the market for given time periods, and the rise in capital costs that would result from the increased demand for external funds. The importance of the latter factor would depend on both the absolute and relative changes in costs of capital, and the sensitivity of capital outlays to such changes. Meyer and Glauber recently set forth the following conclusions regarding these factors.[23]

(1) Investment demand is sensitive to high interest rates, and especially as the economy approaches

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[23]John R. Meyer and Robert R. Glauber, Investment Decisions, Economic Forecasting, and Public Policy (Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1964), pp. 240-257.

the upper turning point of a business cycle.

(2) Business management probably values internal funds more than external funds, which accordingly would result in a discontinuous supply function near the point where internal sources are exhausted by a firm's demand.

(3) During business downturns residual internal funds are a principal determinant of investment levels.

The experience of the period of 1962-65 at least partially corroborates the preceding conclusions. It is probable that from 1962 to late 1964 the incentive measures merely added to the existing liquidity of firms and thus shifted out the supply function without substantially increasing market interest rates. As firms began to seek more external funds in 1965 and early 1966, long-term interest rates rose sharply. The extent of the additional rise that might have occurred in absence of the incentive measures is open to conjecture, but is partially dependent on the next point.

Corporations have generally maintained relatively constant debt/equity and dividend payout ratios in recent years. The main source of external funds has been long-term debt, with a decline in new common stock issues being offset by greater generations of funds internally. If the funds supplied by the tax incentives had not been available, and if firms had concurrently attempted to maintain the same dividend payout and debt/equity ratios, and also to make the same capital expenditures, then funds would have to have come primarily from external common equity sources. The effects of this increased demand on the costs of equity

capital are again subject to conjecture.

At least two factors should be mentioned that could mitigate to some degree the influence of the incentive measures on the amount of capital expenditures by firms. Annual tax payments are being speeded up to a more complete current pay-as-you-go basis gradually through 1970. This factor definitely reduces the total availability of funds to business firms, and was mentioned by several executives as having a dampening influence on the incentive value of the tax provisions.

The second factor is concerned with the possible shifting of the burden of the income tax levied on corporations. The controversial Krzyzaniak-Musgrave study suggested the strong possibility of an immediate 100% shifting of the burden of tax increases by manufacturing firms during the short run.[24] If the results of this study were correct, and are continuing to occur, then it can be argued that some direct or indirect passing on of the benefits from tax incentive measures may be occurring. Indeed, the relative general price stability that was maintained in the United States from 1958 through 1964 may have been partially due to competitive pressures that resulted from some shifting or passing on of the benefits arising from incentive measures. However, additional

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[24]Marian Krzyzaniak and Richard A. Musgrave, The Shifting of the Corporation Income Tax (Baltimore: The Johns Hopkins Press, 1963), pp. 63-66.

findings in the above-mentioned study suggested "zero un-shifting" in the short run for tax decreases.[25] These findings imply some incentive influences may exist that can result in additional capital investment by corporations. To the extent that the replies in the firms interviewed in this study are not negated by the remarks about acquiring the funds anyhow, the current findings appear to at least partially corroborate the suggestions of the Musgrave study regarding the incentive influences of tax decreases.

Accelerated Depreciation--Theory

The following methods are available for depreciating tangible fixed assets for income tax purposes:

(1) the straight-line method,

(2) the declining-balance method, using a rate not exceeding twice the straight-line rate,

(3) the sum-of-years-digits method,

(4) other accelerated methods subject to certain limitations.[26]

The second and third methods were widely heralded at the time of their passage in 1954 as incentives for long-term business investment. The sum-of-years-digits method (SYD hereafter) is examined first in this section. The double-declining balance method (DDB) and some brief

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[25] Ibid., p. 58.

[26] 1965 Federal Tax Course (New York: Commerce Clearing House, Inc., 1964), pp. 1138-1144.

considerations involving asset salvage values are discussed last. The incentive values of both methods are examined first in terms of the traditional measures and subsequently by the total wealth concept.

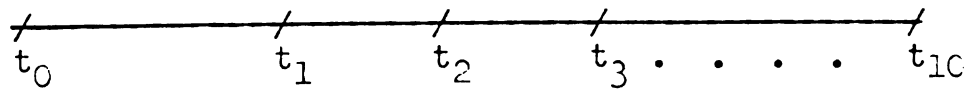
Sum-of-Years-Digits Method

The amount of depreciation allowable by the SYD method for the first year of the tax life of an asset can be determined by utilizing the formulas in Appendix A. These formulas show that the annual allowable depreciation charge based on the SYD method declines by a uniform amount each year. The following example will suffice for purposes of the current discussion.

Illustration III-6

Assume the cash flow pattern on the time scale below is expected to result from a $220,000 investment outlay. A 48% income tax rate is assumed and the SYD method of depreciation is used. No salvage value is expected at the end of the asset's 10-year life.

(220,000) 51,440 49,520 47,600 . . . 34,160



Based on the formulas in Appendix A, the first-year depreciation for the proposal shown above amounts to $40,000 and can be expected to decrease by 1/55 or $4,000 annually

through t_{10}. The cash benefits are thus expected to decrease by the amount of the annual tax increase of $1,920. The projected cash flow pattern shown on the time scale is an arithmetic gradient which declines annually by $1,920. Tables are available to determine the present worth of such a flow pattern.[27] The internal yield on the project is approximately 15.7%, and is based on such tables and the formulas in Appendix A.

If straight-line depreciation is assumed for the asset the annual net cash benefits after taxes amount to $42,800 and the internal yield is 13.8%. The 1.9% increase in yield resulting from the use of accelerated depreciation is slightly less than 14% for this asset.

The preceding results cannot be generalized since only the benefits related to a single asset were examined. The incentive value of accelerated depreciation, irrespective of the acceptance criteria utilized, depends on a number of factors. The principal factors are the levels of expected tax rates, the absolute size of cash benefits before taxes, the economic and tax lives of assets being evaluated, and estimated salvage values. The latter three factors are examined in a subsequent section on the best tax depreciation policy to be followed by business firms.

Since the absolute size of the tax savings depends on the level of tax rates this factor is an especially crucial

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[27]Tables are given for gradient present worth factors by Taylor on pp. 439-479.

determinant of the incentive value of accelerated depreciation. Nevertheless, it is the present worth of the absolute tax savings and their influence on a project's internal yield that is of great importance for decision-making purposes. If in the previous example the tax rate had been 30%, the internal yields would have been 18.7% and 19.6% using SL and SYD respectively. The relative increase in yields is only 5%, which differs to a substantial degree from the change under the 48% tax rate assumed initially. If a 70% tax rate is assumed the accelerated depreciation allowance results in a much greater present worth for the tax savings. Internal yields of 8.8% and 10.2% would have been derived for the two depreciation methods. The 1.4% change amounts to a 16% increase as compared with 14% and 5% increases assuming 48% and 30% income tax rates.

The comparison thus far of SL and SYD has ignored a crucial factor in the determination of the incentive value of accelerated depreciation. It was illustrated in the previous sections of this chapter that the reinvestment of funds received must be considered explicitly in evaluating the so-called incentive provisions of the Code. One crucial difference exists in the case of accelerated depreciation. The investment credit and tax cut measures result in changes in both the amount and timing of benefits received from a capital project. However, both the accelerated depreciation and guideline provisions influence only the timing of after-tax benefits. The total amount of taxes to be paid remains

unchanged over the life of the asset.[28] The relative importance of the depreciation provisions thus depends entirely on expected future cost of capital and reinvestment rates. The total wealth concept takes these rates into consideration and provides a measure of how much better off a firm is as a result of using the SYD or some other accelerated depreciation method.

Continuing with the $220,000 asset shown on the time scale on page 99, and assuming a reinvestment rate of 15%, the total wealth accumulated at t_{10} would amount to $869,011 and $913,765 based on the SL and SYD methods. The difference in total wealth at t_{10} amounts to $44,754. Even though the total expected cash benefits from projects may change, the differences between the total wealth accumulations at t_{10} will not change as long as the income tax and reinvestment rates are assumed to remain constant.[29] Given the asset cost and its expected life, the total wealth resulting from the reinvestment of funds from accelerated depreciation depends entirely on the level of tax rates and the reinvestment opportunities available.

Declining-Balance Depreciation

The annual maximum depreciation rate allowable under the declining-balance method is twice the straight-line rate.

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[28]These results depend on the tax rate remaining constant.

[29]For an elaboration of this view see Richard H. Bernhard, "On the Importance of Reinvestment Rates in Appraising Accelerated Depreciation Plans," Journal of Industrial Engineering, Vol. XIV (May-June, 1963), 135-137.

The rate is applied to the book value at the beginning of each year to derive the annual depreciation on an asset. The first-year depreciation charge for the $220,000 asset used in the previous illustration amounts to $44,000. This charge results in a book value at the beginning of t_2 of $176,000. The depreciation charge in t_2 is $35,200 ($176,000 x 20%). Based on the assumed tax rate of 48%, the $8,800 decline in depreciation will result in an increase in tax outlays in t_2 of $4,224. By applying a constant depreciation rate to a progressively smaller book value each year the net cash benefits from the asset will decrease by a geometric gradient equal to the annual increase in tax outlays. However, since the asset would never be completely written off under this procedure a firm is allowed to switch to the straight-line method at any time it may prove advantageous without requesting permission from the tax authorities.

The year in which the depreciation charge will be less by utilizing the declining-balance method rather than SL is the most advantageous time to switch methods. When no salvage value exists the switch point is usually one year after the mid-point in the life of the asset being evaluated. In the case of the 10-year life for the asset being discussed the switch point is at the end of year six.[30]

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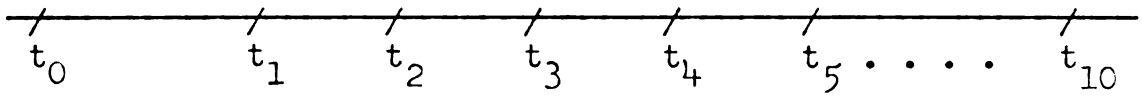
[30]See Taylor, pp. 306-309, for the proper derivation of the switch point when the salvage value is not zero and when service lives involve an odd number of years.

This particular switch point results in a cash flow pattern that is a decreasing geometric gradient for years one through five, and a constant amount of $39,161 for years six through ten.

(220,000) 53,360 49,136 45,757 44,053 40,891 . . . 39,161



The internal yield on the project based on the use of declining-balance depreciation is approximately 15.3%. Following the assumption in the previous example of a 15% reinvestment rate, the total wealth at t_{10} amounts to $907,931. These results raise the question of the best tax depreciation policy a firm should follow, and how such a policy can be ascertained.

The Best Tax Depreciation Policy

Bierman and Smidt have prepared tables to calculate the present worth of a dollar of declining-balance depreciation charges for given time periods and costs of capital for the case where salvage value is zero and the asset's economic and tax lives are equal.[31] These tables are quite useful for evaluating capital-expenditure alternatives and choosing between alternative depreciation methods. The present worth of the tax savings can be easily calculated by multiplying

[31]Harold Bierman and Seymour Smidt, The Capital Budgeting Decision (New York: The Macmillan Company, 1960), pp. 232-241.

the results obtained from the tables by the expected tax rate. Taylor illustrates the derivation of the present worth and uniform annual charge of depreciation allowances for cases involving positive salvage values, switch points, and tax lives deviating from economic lives.[32]

Davidson and Drake have set forth in a major article an analysis utilizing indifference curves to ascertain the best tax depreciation method for firms to utilize.[33] Their alternatives are narrowed to the SYD and DDB methods. The method that results in the greatest present worth of the tax savings from the asset write-off is supposed to be the best tax depreciation policy. The three principal variables in this kind of decision are asset service lives, cost of capital rates, and salvage values as a percent of cost. For example, the indifference curves presented by Davidson and Drake enable the decision-maker to determine at what cost of capital rate the firm should be indifferent between the two methods given the salvage value and service life of an asset.[34] If the expected cost of capital is greater than the rate at the indifference point

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[32]Taylor, pp. 306-311, 322-325.

[33]Sidney Davidson and David F. Drake, "Capital Budgeting and the Best Tax Depreciation Method," Journal of Business, Vol. XXXIV (October, 1961), 442-453. See also the article by the same authors entitled "The 'Best' Tax Depreciation Method--1964," Journal of Business, Vol. XXXVII (July, 1964), 258-260.

[34]Davidson and Drake, "Capital Budgeting and the Best Tax Depreciation Method," p. 449.

the declining-balance method is preferable, and vice-versa if the rate is below the indifference point. The principal findings of this approach are summarized below and need no elaboration here.

	Favors DDB	Favors SYD
Service lives	short	long
Cost of capital rates	high	low
Salvage as a percent of initial cost	high	low

The analysis presented by Davidson and Drake is certainly useful for choosing between alternative depreciation methods when the criterion is the present worth of the tax savings. However, as has been pointed out in previous discussions about other incentive measures, the reinvestment of the early years tax savings must be considered explicitly in evaluating the best depreciation method to utilize. Maximization of the total wealth which can be accumulated at the end of an asset's service life should be the overriding criterion in this type of decision. The total wealth that can be accumulated depends on the three factors mentioned above and the reinvestment rate expected for intermediate savings over the life of a project.[35]

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[35]See Bernhard, pp. 135-137.

In the illustration involving the $220,000 asset in the previous section, the SYD measure proved more advantageous than DDB since the total wealth accumulations at t_{10} were $913,765 and $907,931 respectively. These results were based on an assumed reinvestment rate of 15%. A different reinvestment rate could make DDB the preferable method. Although they were apparently not constructed for this purpose, the indifference curves shown by Davidson and Drake can be utilized to derive the reinvestment rate which will make one method preferable over the other.[36] All reinvestment rates exceeding 40% will result in a greater total wealth accumulation under the DDB method for the example outlined above.

The recognition by the firms in the study of the economic desirability of utilizing accelerated depreciation methods is examined in the next section.

Accelerated Depreciation --Practice

Eight of the firms interviewed are not utilizing accelerated depreciation methods to any degree for income tax purposes (Table 3-3). Of the remaining thirty-six firms, approximately 30% are following tax-allocation procedures and normalizing tax liabilities and depreciation charges for external reporting purposes. Several of these firms are

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[36]Davidson and Drake, "Capital Budgeting and the Best Tax Depreciation Method," p. 449-450.

TABLE 3-3

UTILIZATION OF ACCELERATED DEPRECIATION METHODS FOR FEDERAL INCOME TAX PURPOSES

Methods	Firms
Extensive Utilization:	36
Sum-of-years-digits method	22
Double-declining balance method	9
Both sum-of-years-digits and double-declining balance methods	5
Nominal or Zero Utilization	8

precluded for regulatory reasons from recording accelerated depreciation for accounting purposes. The executives interviewed in most of the other firms felt that the additional cost involved in normalizing the accounting income determination process is substantially offset by the ability to acquire and utilize the additional funds resulting from the tax savings from accelerated depreciation. However, only two of the firms seemed to recognize to any degree the incentive influence of accelerated depreciation on individual capital-expenditure projects that was demonstrated in previous sections.

In six out of the twenty-six firms following accelerated procedures for both tax and financial reporting purposes it was indicated by the interviewee that a slight incentive effect has been noticeable in the past several years. The incentive recognized was again from a supply of funds viewpoint rather than individual projects. It is felt

in several of these firms that much of the slight beneficial effects would be diluted by the additional record-keeping entailed in normalizing reported depreciation charges.

Most of the remaining firms gave one or more of the following as the principal reason(s) for utilizing accelerated depreciation for both financial reporting and Federal income tax purposes.

(1) High obsolescence results in very short and often unpredictable asset service lives.

(2) Large asset cost amortization is expected to coincide with low maintenance and repair outlays in the early years of an asset's economic life. This process is reversed in later years and the cost of using the asset will be relatively even over the period of use.

(3) It is considered desirable to report operating and financial results on a conservative basis. These desired results can be attained by larger write-offs in the early and productive years of an asset's life.

(4) The additional costs involved in maintaining separate records for tax and reporting purposes are not worth whatever benefits may result.

The high degree of obsolescence experienced by much of the plant and equipment owned by firms in highly competitive industries in the United States is well known. Officials of several of the firms included in the study have argued for accelerated depreciation measures before Congressional and other groups for a long period of years. Some relief was provided by the 1954 Code. Other firms have argued subsequently for additional relief, some of which has been provided by the guidelines, investment credit, and tax

rate reduction. However, in several of the firms interviewed it was indicated that the problem of obsolescence was not particularly severe. The accelerated depreciation methods should not be viewed as incentives for the firms in the first category, but rather as relief from a previously competitive disadvantage. The latter group is provided with an incentive continually to innovate and modernize long-term assets in use, and may actually be returned to its competitively advantageous position in relation to the former group of companies through tax incentive provisions.

Only one point can be noted in regard to the second reason listed above. A few executives indicated that experience since adoption of acceleration depreciation methods has not shown that maintenance and repair outlays will coincide with the widely held theoretical expectations. These firms have experienced either relatively constant or even slightly declining costs for maintenance and repairs. With the charges for accelerated depreciation declining rather rapidly, the total annual costs involved in long-term asset utilization has declined in these companies.

Several of the factors examined in the discussions of other tax measures earlier in this chapter also undoubtedly affect the degree of recognition of the incentive value of the accelerated depreciation methods. Probably the principal factors are the liquidity conditions experienced and the crudeness of some evaluation techniques utilized. The latter

factor is especially crucial since the value of the accelerated depreciation provisions depend entirely on the timing of the tax savings that are reinvestable by the firms. The use of the total wealth or other time-adjusting acceptance criteria would certainly enhance the likelihood of recognition of the incentive value of accelerated depreciation.

SYD vs. DDB Depreciation

Twenty-two firms use SYD almost exclusively for tax depreciation purposes, whereas nine firms utilize only the DDB method. Five firms use both methods extensively (Table 3-3).

The principal reason given for choosing the declining-balance method is its ease of application when the group method of depreciation is utilized. The grouping of assets under the guideline provisions may be expected to increase the use of DDB over SYD. In fact, several firms using the SYD and grouping procedures stated the difficulty in evaluating cash flows resulting from individual projects has precluded the adoption of time-adjusting acceptance criteria. The resultant continuation of these firms' usage of the average RR and RP measures which blunt the recognition of the possible incentive value completes the circularity of this reasoning process. Several executives stated that the main difficulty of the declining-balance method when it is used on an individual asset basis is the

determination of switch points to the straight-line method, and especially if salvage values are involved.

It is noteworthy that all but one of the firms utilizing both the SYD and DDB methods extensively for tax purposes also apply primarily time-adjusting acceptance criteria in project evaluations. The sensitivity of these criteria enable these firms to decide between the accelerated methods in a much more discriminating manner than is possible with averaging measures. Two firms use computers to ascertain the most economically desirable method, and if the choice is DDB the proper switch point to the straight-line method is derived. Six of the firms following declining-balance procedures exclusively also utilize the time-adjusting criteria on some or all projects. In five of these firms these criteria are the principal ones used for all projects.

The principal advantage of the SYD method is the avoidance of switch point calculations and the difficulties arising from salvage values inherent in the DDB approach. If zero salvage values are not assumed, the initial cost is simply reduced by the estimated amount before applying the annual SYD factor to calculate depreciation. Although it is often viewed as difficult to compute, the SYD factor results in cash flow patterns that are generally easier to analyze in present value calculations than are flows resulting from the use of DDB. It was noted on page 99 that arithmetic gradient tables can be used to simplify the analysis.

Rationale for Straight-Line Depreciation in Practice

Three of the firms using straight-line procedures for tax and book purposes have operated in tax loss positions for several years. These firms understandably wish to defer writing off costs until taxable income conditions exist. Two firms using SL procedures appeared to be on rather shaky ground based on their rationale for doing so. In both of these firms studies have apparently been made in the past and the decision was in both cases to continue with SL as the principal tax depreciation method. One of these firms utilizes a before-tax acceptance criterion for evaluating most capital projects. This fact could account partially for the lack of recognition of the importance of accelerated depreciation. It should also be mentioned that the interview at this firm revealed that a high degree of obsolescence occurs on the assets utilized and the competition in the particular industry is rather severe. These facts would certainly suggest that the use of accelerated depreciation may be not only desirable, but also correct from an income determination viewpoint.

Another firm using SL for tax purposes is not in an especially capital intensive industry, which may account for the lack of recognition of the possible influence of accelerated depreciation. Furthermore, it was acknowledged in the interview that in a previous study of the desirability of changing methods the estimated savings which

could result from accelerated depreciation may have been unduly low.

Summary

The theoretical discussion in this chapter has shown that the investment credit, depreciation guidelines, tax rate reduction, and accelerated depreciation provisions enacted by Congress during the 1954-1964 decade can definitely have substantial incentive effects on the capital budgeting programs of business firms. Two new mathematical acceptance criteria were set forth which can assist firms in recognizing the two types of incentive values that exist. The discounted equity rate of return was discussed in evaluating the incentive influence on individual capital-expenditure projects. The incentive resulting from a greater supply of funds was examined by the total wealth concept. This concept requires explicit assumptions about future reinvestment and cost of capital rates, and evaluations of alternative courses of action rather than individual proposals.

Very few firms have recognized the substantial incentive influences which can result on individual projects. It was acknowledged in several of the interviews that a small number of replacement decisions have been made earlier than could otherwise have been expected in the absence of the incentive measures. Although nearly all of the firms visited have in fact derived some benefits from the invest-

ment credit provisions, only about one-half of them consider it explicitly in evaluating capital projects. Approximately 90% of the firms are following the guideline procedures, but the benefits resulting from lower tax depreciable lives were found to vary substantially between firms, and even within firms between different asset classifications. Thirty-six of the firms interviewed are utilizing primarily accelerated depreciation methods for tax purposes, and the SYD approach is substantially favored over DDB. It was acknowledged in nearly all of the firms that the tax rate reduction and the other incentive measures have enhanced the supply of funds available for capital expenditures. However, it was also stated that the funds would have been acquired anyhow in absence of the provisions. This statement implies that little incentive influences have resulted from the tax provisions.

Some of the tax policy implications related to the findings about the tax incentive provisions are presented in Chapter VI.

CHAPTER IV

INITIAL INVESTMENT AND CASH FLOW PROJECTIONS

Two stages in the capital-expenditure decision-making process were mentioned in Chapter II, and it was noted that the typical chronological discussion of these two stages has been reversed in this study. The first stage concerns a determination of the initial investment required and the benefits expected from capital projects. The second stage involves an application of mathematical acceptance criteria to determine the economic worthiness of each project.

The reversal of the discussion of these two stages allowed a more penetrating examination of the various Federal income tax incentive provisions that were set forth in Chapter III. The influences of these provisions--notably the investment credit, the guideline system, the tax rate reduction, and accelerated depreciation--are at least partially dependent on some of the factors discussed in this chapter. For example, all four of the provisions influence projects in substantially different ways depending on whether the initial investment consists of outlays for working capital, plant and equipment, or for an economic factor the cost of which can be immediately written off. Salvage values of assets especially affect the guideline

and accelerated depreciation influences on investment decisions. The basic theoretical aspects of these and other factors that can influence the initial investment and cash flow projections for individual projects are set forth in the following pages.

Salvage Values and Terminal Tax Effects--Theory

Salvage value can substantially influence the economic desirability of capital-expenditure projects. Several income tax provisions relating to salvage values are considered in the following sections. The practices found in the field study are subsequently set forth and analyzed.

New Asset Salvage Value

Salvage value considerations are inextricably tied to depreciation procedures followed for tax purposes. It was stated on page 106 that high salvage values are favorable toward the declining-balance method rather than sum-of-years-digits depreciation procedures, given a firm's cost of capital rate and the tax life of the asset. By shifting forward a high salvage value through depreciation charges to earlier years the DDB method is favored in present worth terms relative to the SYD method. The basic principle involved is the comparison of the present worth of taxes saved through earlier depreciation allowances with the present worth of salvage values expected to arise several years in the future.

Internal Revenue Code Section 167 (f) allows a reduction in salvage value estimates for assets acquired after October 16, 1962.[1] The salvage value to be considered in determining annual charges for depreciation may be reduced by as much as 10% of the tax basis of the asset. For example, consider Illustration IV-1 below.

Illustration IV-1

Assume an asset costing $100,000 has an expected economic life of 20 years, but the guideline life for tax purposes is 10 years. Further assume a salvage value of $10,000 is anticipated at t_{20} and that a 12% cost of capital rate is expected to exist for the firm in question. The income tax rate is assumed to be 48%.

The present worth of the $10,000 salvage value amounts to $1,037 at t_0. If the straight-line method is used, the tax saving which would result annually from spreading the salvage if the asset is fully depreciated has a present worth of $2,712. The $1,675 difference in present worths of salvage value spread over the depreciation period versus a lump sum at t_{20} could certainly influence the yield and recovery period on this project relative to a project without salvage value. If SYD rather than straight-line is the tax depreciation method, the

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[1]For a discussion of Code Section 167 (f) see 1965 Federal Tax Course (New York: Commerce Clearing House, Inc., 1964), p. 1137.

present worth of the resultant tax savings would amount to $3,162. Even more striking is the influence on the total wealth that could be accumulated by t_{20} by depreciating the salvage value over years one through ten. If a 12% reinvestment rate is assumed, the total wealth from the reinvested tax savings would amount to $30,511, in contrast to the $10,000 available from the expected salvage. Calculations for Illustration IV-1 are shown in Appendix B.

The foregoing illustration indicated the adverse influence on the economic desirability of investment projects which can generally result from salvage values. The specific factors which can lead to salvage making a project less desirable are:

(1) high tax rates,
(2) high costs of capital,
(3) accelerated depreciation, and
(4) long-lived assets.

All of these factors need not be present to discriminate against projects with salvage value.[2] Indeed, the 48% tax rate and 12% cost of capital rates used above are similar to those used by many business firms. Neither are the other assumed relationships of the above mentioned factors unrealistic. It should not be assumed however that a single factor makes salvage values undesirable. Each case being evaluated should be examined to see to what extent such influences exist.

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[2]These factors are elaborated on by Bierman and Smidt; see pp. 115-117. Additional discussion of these factors in this thesis is presented in Chapter V.

Replaced Asset Values

A business firm has several alternatives as to what can be done with an old asset that is currently being considered for replacement. The principal alternatives are selling the old asset outright, trading it in on a new asset, utilizing it elsewhere within the firm, or discarding it entirely. These four alternatives are considered either implicitly or explicitly each time an asset is replaced. The influences of each of these alternatives on the mathematical acceptance criteria on the new asset should be carefully examined. The alternative that has the greatest favorable influence on the acceptance criteria should be the one that is chosen if the new asset is in fact acquired.

The income tax effects of the alternatives involving the old asset can vary substantially for different investment decisions. If the old asset is scrapped an abandonment loss may be allowed by the tax authorities. This possibility is examined in the next chapter in the section on effective tax rates. The influence of selling the old asset at a loss is also discussed in the next chapter. Some of the multitude of the possibilities involving sales at a gain are discussed in the next section of this chapter. If the old asset is sold for its book value, the amount received should be deducted from the necessary outlay for the new asset to derive the incremental investment to be utilized for evaluation purposes. This procedure can obviously enhance the

economic desirability of the new asset, but no tax effects are involved unless a gain or loss results from the sale.

If the old asset is traded in, the tax basis of the new one must be determined for future tax depreciation purposes. For example, the tax basis of the new asset may be derived by adding the tax basis of the traded asset to any recognized gain and the additional investment (i.e., cash and "boot"), and then subtracting any "boot" received on the transactions.[3] As a result of this procedure, no loss or gain (as in the preceding example) is recognized and tax effects may not result immediately when the new asset is acquired. The prevention of immediate outlays for taxable gains that would otherwise result if the old asset is sold can certainly enhance the new asset's economic worthiness.

The last possibility that needs to be discussed briefly involves retaining the asset that is freed subsequent to the new acquisition. The value in use of the old asset may influence the new acquisition favorably or unfavorably, or it may be neutral in its effect. The influence depends on the present worth of the benefits that can be expected to be generated by the old asset when utilized elsewhere in the firm. The present worth from keeping the asset must be compared with the present worth

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[3]See the discussion regarding Code Section 1031 in 1965 Federal Tax Course (New York: Commerce Clearing House, Inc., 1964), pp. 1425-1426.

effects from trading, scrapping, or selling it. The alternative resulting in the greatest enhancement of the present worth of the new asset is the most desirable use of the replaced asset. Of course, as has been true in previous discussions, the alternatives can also be compared in total future wealth terms.

Gains on Sales of Sections 1231, 1245, and 1250 Assets

Prior to 1962, an important advantage often involved in the disposition of assets was the ability to qualify gains or losses resulting from sales as long-term capital gains or losses. It was extremely desirable to depreciate substantially an asset by assuming little or no salvage value and then pay only a maximum tax rate of 25% of any gains involved when it was sold. Two advantages resulted from this procedure. First, depreciation allowances were deducted from ordinary income which was taxed at the normal statutory rate existing at that time (e.g., 52%), but subsequent gains would be subjected to a maximum tax of only 25%. Second, the tax savings resulting from the "ordinary" expense deduction for depreciation could be reinvested in the meantime. The timing advantage is still generally possible, but the capital gains saving is gradually being eliminated by Code Sections 1245, 1250, and Revenue Ruling 62-92. Comments on the next several pages will show some of the relationships between ordinary income and long-term capital gains that may still result from sales of certain

kinds of assets. Capital losses are discussed in Chapter V.[4]

Gains arising from the sale of depreciable personal property may be partially taxed as ordinary income under Code Section 1245. Ordinary gains on sales for taxable years beginning after December 31, 1962, are limited to the lowest of:

(1) a recomputed basis less the adjusted basis, or

(2) the receipts realized less the adjusted basis of the property.

The adjusted basis of an asset is generally its initial cost less allowable depreciation for tax purposes for the period held. The recomputed basis is equal to the adjusted basis plus the depreciation allowable for tax purposes for years beginning after December 31, 1961. Consider Illustration IV-2 below.

Illustration IV-2

Assume a machine costing $100,000 was acquired on January 1, 1960, and was expected to prove useful and be depreciated over 10 years. Assume further that the double declining-balance method has been used for tax purposes and that the asset is sold for $70,000 on December 31, 1965.

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[4] Ibid., pp. 1503-1539. These pages contain an indication of many of the complex interrelationships between Code Sections 1231, 1245, and 1250 and Revenue Ruling 62-92.

The asset's adjusted basis on December 31, 1965, is $26,214. The post-1961 depreciation amounts to $37,786, which results in a recomputed basis of $64,000. The total taxable gain is based on the receipts realized less the adjusted basis, or $43,786. However, since the recomputed basis less the adjusted basis is $37,786, and is lower than the total gain, this figure is the amount taxable as ordinary income. The remaining $6,000 gain is taxed as a Section 1231 gain. In essence, the post-1961 depreciation that was deducted from ordinary income during 1962 through 1965 has been recaptured and only the gain exceeding the recaptured sum is to be treated as a long-term capital gain taxable at the 25% rate. If the asset had been sold for $45,000, the entire $18,786 gain would be taxable as ordinary income since the recomputed basis less the adjusted basis is unchanged and is substantially larger than the total gain.

The influence of Section 1245 should be considered for both old assets held and new asset acquisitions being contemplated. Once again, it should be mentioned that one of the principal factors to be considered in an economic evaluation is the total future wealth which can result from reinvesting the tax savings from accelerated depreciation prior to the recapture effects at the time of sale. Although the door is being effectively closed on many capital gains, the important advantage which results from the time factor in the reinvestment process still exists.

Another important factor concerning the depreciation recapture provisions should be mentioned. As stated in the previous paragraph, the purpose of Code Section 1245 is to close effectively the loophole which enabled firms to convert ordinary income into long-term capital gains. However, this new provision discriminates in favor of retaining the old asset in a replacement type decision. In the previous example, if the asset costing $100,000 on January 1, 1960, was to be replaced by a new asset on January 1, 1966, the incremental investment for the new project would naturally be higher than previously by the difference between the old capital gains tax and the new tax on an ordinary income basis. Such a difference could certainly result in deferring the replacement of the old asset.

The Revenue Act of 1964 included a provision attempting to close the capital gains loophole that was discussed in the previous section which had been left open by Section 1245 for depreciable real property. While the purpose of Section 1250 was basically the same as Section 1245, the details differ substantially.

> Real property was not included in the recapture provision applicable to depreciable personal property because Congress recognized the problem where there is an appreciable rise in the value of real property attributable to a rise in the general price level over a long period of time. Section 1250 . . . takes this factor into account. It makes sure that the ordinary income treatment is applied only to what may truly be called excess depreciation deductions.[5]

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[5] Ibid., pp. 1520-1521.

Thus, Section 1245 applied to all depreciation after a given date, and not just "excess" depreciation. Any gain on a Section 1250 asset resulting from a post-1963 sale within the first year of acquisition is taxable as ordinary income to the extent of depreciation taken since 1963. Gains resulting from any sales after assets have been held more than 10 years are taxable entirely as Section 1231 gains. Gains resulting from sales in the second through the tenth years may be taxed partially as ordinary income and partially as Section 1231 gains. Ordinary income is calculated as a percent of the excess of post-1963 accelerated depreciation over straight-line depreciation for the same period of time involved and is based on the following rules.

(1) 100% of the above mentioned excess is considered ordinary income for sales between the 12th and 20th months following acquisition.

(2) Section 1231 gains treatment allowed is based on 1% per month for each month the asset is held beyond 20 months through the 10th year (or the 120th month).

Consider the following hypothetical situation involving a Section 1250 acquisition.

Illustration IV-3

Assume a building costing $1,000,000 was acquired on January 1, 1962, and was sold for $850,000 on December 31, 1965. If the expected life was 20 years and DDB depreciation procedures were used, the adjusted basis on December 31, 1965, should amount to $656,100.

The total gain on the sale of the asset is $193,900. Since it has been held for 48 months, the excess of declining-balance over straight-line depreciation is $143,900. The total gain is divided into ordinary income of $103,608 and a Section 1231 gain of $90,292. Thus, at least a portion of the accelerated depreciation which reduced the asset basis has been recaptured as ordinary income. If the asset had been sold for only $750,000 the gain of $93,900 would have been divided into a Section 1231 gain of $26,292 and ordinary income of $67,608. The total gain in the latter case is less than the $143,900 excess depreciation, but is partially treated as a capital gain because the holding period has exceeded the 20-month minimum by 28 months.

The preceding comments about the advantageous and discriminatory elements of the Section 1245 recapture provisions are relevant for Section 1250 assets and transactions. These elements should be considered carefully in analyzing the economic worthiness of capital projects.

Although Sections 1245 and 1250 have resulted in reducing the influence of Section 1231 gains on some investment transactions, the possibility of such treatment still exists for certain assets included under Code Section 1231. For example, it is still possible to have gains resulting from sales of land taxed at a maximum rate of 25%. The important influences of capital gains treatment on economic evaluations should be recognized irrespective of whether a

replacement type decision or an entirely new asset with expected future terminal value is being considered. The recovery periods, present worths, and total future amounts of wealth that may result can be substantially altered by capital gains factors.

Salvage Values and Terminal Tax Effects--Practice

The preceding pages have included discussions of many of the theoretical considerations of terminal tax influences. Table 4-1 indicates the number of firms that are considering such influences. The following sections include the primary reasons given by firms for not considering salvage value factors.

TABLE 4-1

SALVAGE AND TERMINAL FACTORS CONSIDERED IN PROPOSAL EVALUATIONS

Factors	Firms
Net Asset Salvage Value	33
Replaced Asset Values:	
Salvage	37
Undepreciated tax basis	13
Alternative use	32
Gains on Sales of Section 1231, 1245, and 1250 Assets	32

New Asset Salvage Value

Table 4-1 indicates that in three-fourths of the firms included in the study the estimated salvage values of new

projects are usually considered explicitly in the evaluation process. In the eleven firms where salvage values are not explicitly considered at least four primary reasons were apparent.

(1) Salvage values are not predictable with any degree of accuracy beyond more than a few years.

(2) The amounts involved are generally quite small or slightly negative.

(3) The use of group or composite depreciation procedures generally precludes the consideration of salvage values.

(4) Several of the firms evaluate projects on a before-tax basis.

The difficulty of estimating salvage values many years hence is certainly not a matter to be viewed lightly. Even slight degrees of accuracy and sophistication in this area require many years to cultivate. However, the fact that at least one firm in each of the industries surveyed can and does attempt to estimate salvage value where it may be important indicates that the task is not at all impossible. Most of the executives in these firms feel their efforts are generally well spent in ascertaining future salvage values, and that some attempts in this direction are imperative to evaluate projects properly.

The fact that salvage values are ignored in firms that are using pre-tax acceptance criteria causes still another "scrambling" element in the ranking of capital-expenditure projects. What the ultimate influences are cannot be readily determined. Furthermore, it should be

mentioned that even in those firms that give consideration to salvage values, but which are not using time-adjusting measures, it cannot be expected that salvage influences will be consistent over a period of time in the investment decision-making process. The averaging techniques utilized in both the rate of return and recovery period measures would scramble the resulting influences of salvage values in an unpredictable fashion.

Although taxable gains and losses are not generally relevant when composite or group depreciation methods are used, some cash receipts may be expected upon retirement of the asset and should be considered in the evaluation of such projects. Although the tax depreciation may not be distinguishable for individual assets under these methods, this fact should not prevent a firm from ascertaining what the fair market value of the asset may be in the future. To do otherwise could certainly change the accept-or-reject decision for some projects.

Replaced Asset Values

Most of the reasons discussed in the preceding section were also cited by the seven firms that do not consider the salvage value of a replaced asset in calculating the incremental investment in a new project. The only other reason mentioned to any extent was the desire to ascertain the total commitment to a new project. This factor is certainly important in considering the overall capital-expenditure program of a firm, but is erroneous when applied

to the decision-making process for specific assets. Many of the firms interviewed make calculations on both bases, i.e., on a gross investment and an incremental investment basis which includes a reduction for the replaced asset's salvage value. This kind of approach probably results in a more informed decision-maker and is quite desirable as long as the grossing procedure is not allowed to cloud the real issue--the incremental investment and benefits relating to specific projects.

New projects that do not involve replacements of existing assets are discriminated against by salvage values on replacement-type projects. No substantial efforts to explicitly consider such discriminations in the decision-making process were apparent from the field interviews. Several firms visited consider the accounting book value of the replaced asset in the evaluation process. This book value "block" as it is usually called, is not relevant to the decision to acquire a new asset except to the extent that book value coincides with the undepreciated tax basis. Furthermore, this "block" discriminates against the new asset when the book value exceeds the tax basis.

The terminal factor receiving the least amount of attention by the firms visited in the study is the undepreciated tax basis of assets exchanged for like-kind assets. The principal reason for ignoring this factor is its lack of size in absolute terms. Approximately 70% of the firms do not consider this factor. Most of the firms interviewed stated

that such exchanges do not occur frequently, and the tax basis is generally quite small when trade-ins are made. A few of the firms that consider salvage value on sales of replaced assets acknowledged the inconsistency in not treating exchange transactions accordingly.

As shown in Table 4-1, twelve of the firms visited do not consider the alternative use value of assets freed as a result of implementing a new project. The main reasons given were as follows.

(1) Assets are seldom used elsewhere in the firm, and when the situation does arise the amounts involved are quite nominal.

(2) The concept of opportunity costs or alternative use values is too difficult to be implemented by most employees.

(3) The subsequent use of the asset retained is unrelated to the new acquisition. This idea is based on the premise that two assets were needed anyhow by the firm.

The idea that opportunity costs are too difficult to implement in most decisions is arguable only to a certain degree. However, much the same point was made regarding the use of present worth techniques for evaluating projects prior to their actual implementation in most firms. In fact, one of the firms where this reason was mentioned has one of the most sophisticated capital-expenditure analysis programs examined in the study, and its employees reportedly had relatively little difficulty in starting to use present worth techniques.

Whether an old asset that is released is either cause or effect is also a question of fact, and is not

subject to dispute in some firms. If the old asset becomes deficient or outmoded in its current usage, and results in a new asset being sought which subsequently releases the former for usage elsewhere, then the benefits and investment of the new asset should reflect this fact. If however, the firm is merely expanding and a new machine is acquired and the old one is moved to another line where its efficiency remains intact, then ignoring the alternative use value is correct. It should be apparent that a rather fine line exists for distinctions of this nature. It is not, however, a question of semantics as was contended in one firm.

Gains on Sales of Sections 1231, 1245, and 1250 Assets

The depreciation recapture procedures outlined in Revenue Ruling 62-92 and Code Sections 1245 and 1250 have not had a substantial impact on most of the firms visited in the study, although roughly three-fourths of them consider such procedures when they are relevant (Table 4-1). The reasons listed for ignoring salvage values in the preceding pages are once again relevant. Furthermore, the time period these provisions have been applicable does not seem to have been long enough for them to have had any substantial influence on the thinking and evaluation process of the executives in many firms. Most of the assets sold by the firms visited were acquired at least several years ago and a substantial portion of any gains had arisen from excess depreciation prior to December 31, 1961. This portion of

the total gain would be taxable under Section 1231 or as a long-term capital gain. It is quite probable that the ability of firms to reduce expected salvage value for acquisitions under Section 167 (f) will result in more gains from sales in the future, and impress upon business executives the importance of the need for considering gains in the evaluation process that will be subject to ordinary income rates rather than a 25% maximum.

One additional reason given for ignoring Section 1231 gains in the evaluation process should be mentioned. A few firms indicated that capital gains were approximately offset by capital losses each year and thus no attempt was made to consider either. While such reasoning may be logical from an annual tax determination viewpoint, it is not necessarily logical from an individual project evaluation viewpoint.

Working Capital and Income Tax Effects--Theory

The principles involved in the initial and terminal influences discussed in the salvage value sections are also applicable to working capital needs for investment projects.

Most important investment projects considered by business firms involve initial buildups in cash balances, receivables, and inventories during the early periods of a project's life. A gradual liquidation of so-called current or working assets is also usually normal as the productivity of the plant and equipment declines in later years. To the

extent that a given absolute level of current assets is required for a project, the funds so invested should be viewed as at least as fixed as the outlays for machines or buildings to which they are related. As long as funds are tied up in inventories, receivables, and cash balances, an adequate return is just as necessary for them as for plant and equipment outlays if the project is to be economically viable. If predictable changes in working capital needs occur over the life of a project, the further locking up or unlocking of cash should be explicitly considered for evaluation purposes.

One of the principal tax influences relates to inventories. Cash outlays are made in the early years of a project's life for wages, raw materials, and other productive factors. Some of these outlays are often lodged in inventories at the end of the accounting period and thus will not be deducted as expenses for taxation purposes. This procedure results in income tax outlays being higher in the early period than they would otherwise be if all cash expenditures were expensed. In subsequent accounting periods these items will be expensed as the inventory is liquidated. Taxes during the later periods will thus be lower.

Some disagreement still exists in the literature as to the best way to calculate the investment in working capital. Most authors suggest that the increased investment

for cash, receivables, and inventories should be reduced by the current trade accounts payable which could be expected to occur from the increased activity. The assumption is often made that the working capital ratio is unchanged in the process of estimating accounts payable. This method is supposed to show the use of cash involved in the permanent increase in net current assets.[6] Furthermore, changes in net working capital should be shown as cash flows over the project's life. This approach to estimating working capital needs and changes is relatively easy to implement. In addition, it is generally consistent with the usual approach taken in calculating a cut-off rate with which the project's rate of return will be compared. Non-interest bearing current liabilities are usually ignored in calculating cost of capital cut-off rates. By netting such liabilities against current asset needs, they are effectively "counted" in the evaluation process. Conceptually however, there seems to be little logical basis for this type of distinction between short-term sources and uses of funds and those that are generally construed as being longer term in nature.

A theoretically correct alternative for calculating the tax effects of working capital items is to project all cash flows in the future including leads and lags in receivables and payables. However, this procedure may often

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[6]See Bierman and Smidt, pp. 114-115, for an elaboration of this viewpoint.

be extremely difficult and time consuming to implement for individual projects. The differences in results between these two methods of estimating working capital may often be so small that expediency would dictate the former being preferable.

The examples in previous sections have indicated the present worth and total future wealth influences that can result from large early or terminal cash inflows or outflows. Thus, nothing can be gained by additional illustrations for working capital influences which are similar in principle. The primary point that needs to be recognized here is the discrimination against projects involving working capital needs when compared with projects that do not involve such outlays. The latter category may be favored over the former, since funds are not tied up for long periods of time or subsequently being released on a dollar for dollar basis without any return on the investment. The higher the cost of capital and reinvestment rates for such periods the greater the discrimination will be against projects involving outlays for working capital.

One factor should be mentioned in favor of projects involving working capital outlays. Since such expenditures will often be returned dollar for dollar the risk element inherent may not be as great as on a project involving fixed facilities all of which can become obsolete overnight.

Working Capital and Income Tax Effects--Practice

As shown in Table 4-2, only three firms visited do not consider working capital explicitly as an addition to the funds invested in plant and equipment for a project. All three of the firms use non-discounting acceptance measures, and two of them evaluate projects on a pre-tax basis only. The executives interviewed seemed to be aware of the inconsistency involved in treating working capital and plant outlays differently in their evaluation processes. A lack of relevancy appeared to be the principal reason for this procedure, but total working capital investment was not at all insignificant in two of these firms. Another important problem in these firms has been the inability to allocate the total amount of working capital to specific projects.

TABLE 4-2

WORKING CAPITAL FACTORS CONSIDERED IN PROPOSAL EVALUATIONS

Factors	Firms
Working Capital Considered as Capital Expenditure:	41
Gross current assets	18
Gross current assets minus current trade payables	18
Others	5
Working Capital Included in Recovery Period Derivation	32

Eighteen firms consider working capital on a gross basis without netting payables against current assets. The primary reason for this policy is the conservatism involved in showing the total commitments for a project. Several of these firms also utilized non-discounting acceptance measures, and the working capital items were not on a cash flow basis.

Approximately one-fourth of the firms interviewed ignore working capital in calculating the recovery period for projects. While this approach is consistent with the theory of traditional recovery period calculations it is erroneous for progressive recovery period purposes. A firm cannot break even until all funds committed to a project are returned with a minimum yield being earned. Furthermore, no logical basis necessarily exists for ignoring working capital outlays for one acceptance criterion and considering them for others.

Eighteen of the firms visited follow the practice of considering working capital on a net of trade payables basis. Several of the executives in these firms stated that to do otherwise would be inconsistent with their cost of capital cut-off rate calculations. In many of these firms working capital is considered only on rather large major projects. The primary reason cited for this practice was an inability to derive working capital flows for smaller projects even though they were often acknowledged as being relevant.

Five firms either netted cash and trade payables or ignored them entirely for evaluation purposes on the grounds

of their immateriality. This argument obviously cannot be refuted.

Capital Expenditure vs. Current Expense--Theory and Practice

Several options exist in Federal income tax regulations that allow firms a choice as to whether outlays will be expensed in the current year or capitalized and amortized over some future period. These options influence both the amount considered as initial investment and the future cash flow pattern for new projects. The following pages include a brief discussion of the theory and practices relating to some of these options.

Research and Development

The expenditures by business enterprises for research and development are often considered the wellspring of the long-term industrial growth in the United States. It can be argued that virtually all expenditures for so-called fixed plant and equipment stem ultimately from previous research endeavors. Code Section 174 provides firms with an option to either expense such outlays immediately or to capitalize and amortize them over some future period.[7] The critical problem from a capital budgeting viewpoint is the inability to relate specific benefits which can be expected

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[7]For a discussion of Code Section 174 see 1965 Federal Tax Course (New York: Commerce Clearing House, Inc., 1964), pp. 632-633.

to result, and the duration of these benefits, to specific dollars paid out for research. Only ten of the firms in the study evaluate any of their research proposals using essentially the same acceptance criteria that are utilized for other capital-expenditure proposals (Table 4-3). It is significant to note that while approximately two-thirds of the companies in the study budget some or all research and development outlays separately from both the capital and operating expense budgets, only eight capitalize any of these costs for book or tax purposes. Most of the firms visited indicated the general line of reasoning stated above in discussing why research and development costs are not subjected to the same evaluation process as other capital expenditures.

TABLE 4-3

FACTORS EVALUATED AS CAPITAL EXPENDITURES

Factors	Firms
Research and Development	10
Major Maintenance or Repairs	8
Major Acquisitions	20
Leased Facilities	38

Businessmen are often chided that the immediate write-off practices that were outlined above are ultra-conservative and do not properly reflect net income from a financial statement viewpoint. While this fact is hardly

open to question in many instances, the time value of money almost forces the business executive to follow these practices. If a given outlay can be made for either of two projects which would result in the same earnings before taxes and cost amortization, and if one of these projects involves research outlays while the other is a depreciable asset, the latter alternative may be decidedly disadvantaged. Since under current tax rates 48% of the research outlay will be recouped almost immediately, the present worth of this project would definitely be favored over a depreciable asset. However, it is probably more important that the dollar investment remaining unrecovered (and thus subject to risk of loss) is substantially less for the research project and that the funds can be reinvested almost immediately in other projects. The total future wealth that could thus accumulate from the depreciable project may be substantially less than from the research project. Accordingly, it is often more desirable to increase revenues through research and development outlays than through plant and equipment expenditures. A note of caution should be sounded regarding this last point, however. If the benefits expected from a project are low in early years and high in later years it may be desirable to have a cost to amortize against those that are expected in the more distant future. The crucial factor is once again what can be done with the tax outlays retained by immediately writing off research and development expenditures.

The absolute statutory tax rate is an important factor that influences the relative advantage of research and development over tangible fixed assets. The present worth of immediate tax savings resulting from research and development writeoffs was decreased relative to the present worth of tax savings from depreciation by the 4% tax rate reduction effected in 1964 and 1965. The tax cut thus discriminates against research and development outlays in general as compared with plant and equipment projects. This discriminatory element was not found to have importantly influenced decisions between the two kinds of outlays in the firms in the field study.

Major Maintenance or Repairs

Accounting theory holds that outlays made for repairs or maintenance which result in enhancement of the physical life or productive capabilities of existing assets should be considered a capital outlay and entered in the proper records accordingly. This treatment involves an estimation of the future service potential of the existing asset without the repairs, and what changes can be expected to result if the outlays are made. Another alternative in many cases is the disposition of the old facility and acquisition of a new one as discussed earlier in this chapter. In making such decisions, the extremely fine line between capital outlay and current expense often becomes blurred and indiscernible. The probable treatment by the tax authorities

for these kinds of expenditures is a crucial element in the decision between alternatives.

Table 4-3 shows that eight of the companies that were interviewed consider major repair or maintenance decisions as an integral part of their capital budgeting programs. This type of outlay is subjected to essentially the same analytical process that other capital expenditures go through. This factor is definitely a strong point in the capital budgeting programs of these firms, and is a very desirable approach regardless of the tax implications. The alternatives in this area of decision making are inextricably interrelated, and should be treated accordingly irrespective of the artificial separations sometimes attempted. Many of the firms visited seemed to agree with the idea that major maintenance decisions should be evaluated as indicated above, but have not generally made it a part of their normal capital budgeting routine. However, several companies have done so on large or unusual projects that occasionally arise.

Other writings have indicated many of the special problems involved in replacement vs. repair type decisions, and have related what attempts business firms have made to utilize appropriate techniques for solving them.[8]

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[8]Elly Vassilatou-Thanopoulos, Financial Analysis Techniques for Equipment Replacement Decisions, Research Monograph No. 1 (New York: National Association of Accountants, 1965). This study reviews some of the theoretical problems involved in equipment replacement decisions and practices followed by a group of medium-sized firms in evaluating proposals of this type.

Innumerable tax factors including investment credit allowances, accelerated amortization, capital gains or losses, undepreciated tax bases, salvage values, and obsolescence losses are all possible crucial items in the evaluation of replacement projects. The influences of these factors on investment projects in general has been demonstrated throughout this thesis and further arithmetic examples are not necessary at this point. In fact, many of the previous examples involved replacement decisions although no particular emphasis was indicated at the time. It should suffice to note that the explicit recognition of the integral nature of the outlays for major maintenance or repairs in their capital budgeting programs should be carefully considered by business firms. The treatment of the multitude of important income tax factors that are typically involved would immediately need to be reconciled in the evaluation process.

Major Acquisitions

The Federal income tax factors involved in the acquisition of existing business entities are sufficiently numerous and intricate that separate studies have been made in this area.[9] There were two principal points examined in the field study that are related to such acquisitions. First, an attempt was made to ascertain whether acquisitions

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[9]J. K. Butters, J. Lintner, and W. L. Cary, Effects of Taxation on Corporate Mergers (Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1951).

are evaluated as capital expenditures. Second, the question was posed as to what income tax factors have generally been involved in an influential way in the decision-making process for such acquisitions.

Table 4-3 shows that slightly less than half of the companies whose practices were examined in the study evaluate acquisitions of other firms as capital expenditures. Twelve of these firms have acquired a few small companies over the past several years, and stated that tax considerations had no influence at all on the acquisition. Of the eight companies indicating that taxes were a factor, none would indicate that they were of major or over-riding importance. Several stipulated that tax provisions would be more important from the viewpoint of the seller.[10] It was indicated in the rest of the firms that acquisitions have been immaterial in recent years.

The primary item specifically mentioned as having any bearing on major acquisitions involved the excess of the purchaser's cost over the book value of the assets as carried on the seller's books. If the excess is assignable to tangible assets, its subsequent amortization is generally acceptable to the tax authorities. If the assignment is to certain intangible assets, particularly goodwill, amortization for tax purposes is seldom possible. The financial influences of these tax consequences have been elaborated

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[10] Ibid., p. 27. These comments corroborate the findings of the earlier and exhaustive study of the above noted authors.

on at length in financial and accounting literature.[11] The only other factors mentioned by a few firms were operating loss carryovers that might be used by the purchaser, and the ability of the seller to engage in a tax-free exchange for the assets or stock given up. Both of these items can influence the bargaining position and subsequent final price if the transaction is effected.

Interest, Taxes, and Carrying Charges

Code Section 266 allows the taxpayer the option to capitalize certain outlays for interest, taxes, and carrying charges if they are in fact in the nature of capital expenditures.[12] The firms interviewed in the study seldom select the capitalization option. Only four firms capitalize such outlays on an occasional basis. The principal reasons given for not doing so were a general lack of relevancy, and the immediate tax savings from expensing such items.

Leasing and Income Taxes--Theory

Numerous articles have been written in recent years in which lease financing arrangements have been examined in

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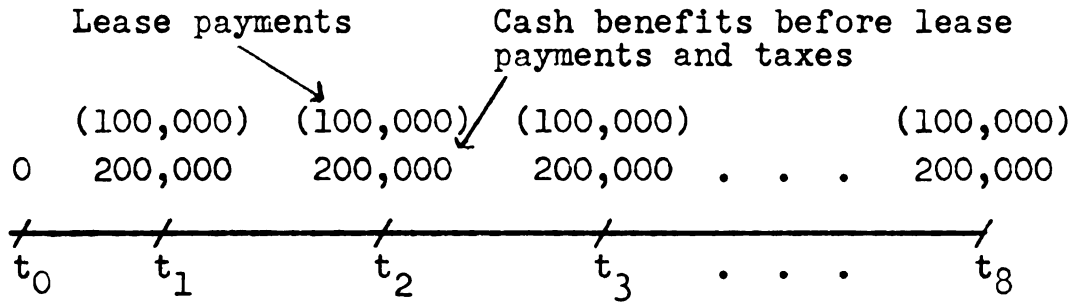
[11]Arthur R. Wyatt, A Critical Study of Accounting for Business Combinations, Accounting Research Study No. 5, (New York: American Institute of Certified Public Accountants, 1963).

[12]See the discussion of these factors in 1965 Federal Tax Course (New York: Commerce Clearing House, Inc., 1964), pp. 635-636.

a rather penetrating fashion.[13] It is now generally recognized that lease rental payments include at least two fundamental elements: charges for the use of the asset and charges for the use of the capital of the lessor. Much has been written concerning the proper method(s) for recognizing these two elements separately in the decision-making process, and of subsequently calculating a yield or rate of profitability on a leased project. Three approaches to leasing evaluations and the basic tax considerations involved are set forth in the following pages. Consider the example below.

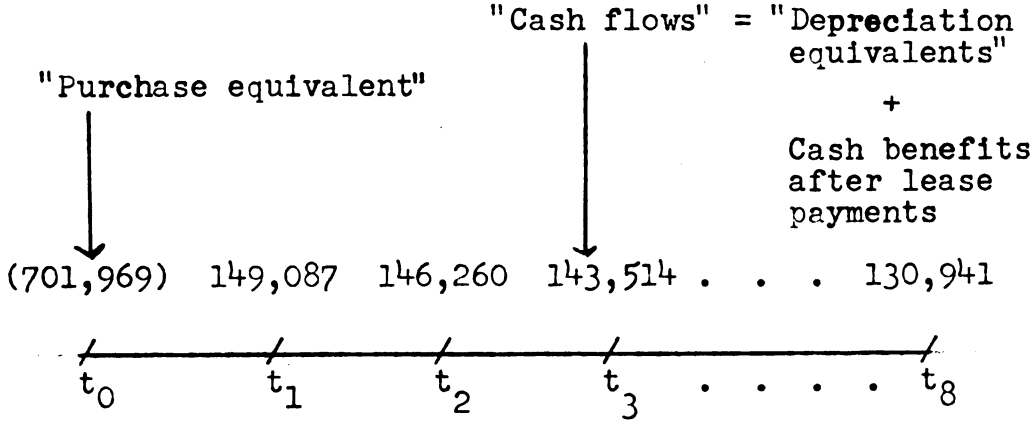
Illustration IV-4

Assume a project is being evaluated which would entail lease payments at the end of each of eight years that amount to $100,000. The project is expected to earn $200,000 annually before considering the lease payments and taxes. These facts are shown on the time scale below.



[13]For example, see D. R. Gant, "Illusion in Lease Financing," Harvard Business Review, XXXVII (March-April, 1959), 121-142; and also R. F. Vancil, "Lease or Borrow--New Method of Analysis," Harvard Business Review, XXXIX (September-October, 1961), 122-136.

The first step in one approach to analyzing leases is to calculate the total present worth of the series of lease payments. This procedure will allow a determination of the equivalent amount which would be needed to purchase the asset at time zero. Since leasing is in essence a form of borrowing, the discount rate should be a pure debt rate and is usually based on the firm's cost of long-term debt on an after-tax basis. The total present worth of the lease payments amounts to $701,969 when a 3% discount rate is used. This amount is called the "purchase equivalent" necessary to acquire the use of the asset. The next step involves calculation of hypothetical annual income tax outlays. This calculation can be derived by viewing the present worth of each of the yearly lease payments as "depreciation equivalents" which would prevent the outflow of taxes each year. Annual cash benefits after deducting lease payments and taxes at a 48% rate would amount to $52,000. When the "depreciation equivalents" are added back the annual "cash flows" which would result are as shown on the time scale below.



These cash flows are now comparable to the purchase equivalent just as any normal net cash benefits are comparable to the actual investment in a project when the internal yield is calculated. The discount rate which will equate the cash flow pattern shown on the preceding time scale with the purchase equivalent is slightly less than 12%. This rate is directly comparable with the pure equity yield on other investment projects. Calculations are shown in Appendix B for Illustration IV-4.

An alternative approach to evaluating lease projects is briefly outlined below. Assume the firm in the preceding example has an option to purchase the asset outright for $640,000 rather than leasing. From an opportunity cost viewpoint, the savings which would result from purchasing the asset would be the annual $100,000 lease payments. However, the firm would also gain annual depreciation allowances which would amount to $80,000 yearly on a straight-line basis. The incremental earnings or net cash benefits after taxes resulting from purchasing rather than leasing would thus amount to $90,400 annually. The rate which discounts the net cash benefits back to $640,000 is slightly over 2.7%, and is calculated in Appendix B. This rate can be viewed as the incremental yield or return from purchasing instead of leasing. Conversely, it can be said that the opportunity cost of leasing rather than purchasing is 2.7% after taxes. Since it was assumed earlier that the long-term debt financing rate is 3%, the leasing arrangement from

a cost basis is slightly more advantageous than borrowing and subsequently purchasing the asset outright.

Still another alternative to measure the attractiveness of leasing or buying is the total wealth concept. Assuming funds are available to purchase the asset in question, the alternative use of these funds until the lease payments are made annually is a very relevant factor. A decision to lease should then be made if the total funds can be utilized on various shorter-term investments in such a way that a greater total wealth can be accumulated than would occur if the asset is purchased. Tying up funds by an outright purchase often precludes the use of funds for a number of relatively smaller but more profitable projects. Of course, the assumption that short-term profitable projects will continually arise is crucial and may not be warranted.

Leasing previously offered several advantages from a tax standpoint. Three of these are discussed briefly below.

(1) Lease payments could be deducted on a more rapid basis than depreciation on purchased assets.

(2) Land was essentially depreciated in certain cases while it could not be so treated if it was bought outright.

(3) Both debt and equity financing costs were tax deductible.

Since the advent of accelerated depreciation measures in the 1954 Code the amortization of a purchased asset can be just as rapid as write-offs for lease payments, and is

often more rapid. These depreciation provisions have at least partially eliminated the first advantage mentioned above.

When the lessee expenses the entire lease payment as it is incurred, land is effectively amortized if its cost is part of the total rental requirement. Thus, this advantage still exists to a substantial degree and may be important for certain kinds of lease arrangements.

Finally, to the extent that additional debt financing can result from lease arrangements without impairing equity costs, the ability to write off the total financial charges related to the lease is still advantageous.

One of the principal tax disadvantages in many lease arrangements is the inability of the lessee to gain the benefit of the investment credit which would otherwise be available on a purchased asset. However, the benefit is allowed to be directly passed on by some lessors when the transaction is in essence an instalment purchase. In addition, it may be indirectly passed on by other lessors through lower rental payments.

One of the tax disadvantages from the viewpoint of proponents of leasing used to be the favorable capital gains treatment allowed if assets were purchased and subsequently sold. As implied on page 122 much of this advantage is being gradually eliminated by the depreciation recapture provisions and lease arrangements will no longer be discriminated against by this factor.

Leasing and Income Taxes--Practice

Although outlays for leases are not usually included in the published figures for annual capital expenditures, lease projects are subjected to essentially the same evaluation procedures as other capital outlays in thirty-eight of the firms visited (Table 4-3). In many instances, the tools of analysis utilized for lease proposals are more sophisticated and rigorous than those that are applied to more frequently encountered purchase type proposals. In a few firms, discounting techniques that were first utilized for leasing proposals have subsequently spread to use for other types of decisions.

The amount of actual leasing entered into by the firms in the study varies substantially, but in over three-fourths of them it is not important in terms of other capital outlays. The most typical situation where leasing arrangements have been advantageous have been automobile fleets, computers and data processing machines, and other facilities where high degrees of obsolescence weigh heavily on the decision. Certain transportation companies also lease facilities to a great extent in relation to other outlays. Most of the executives interviewed stated they are often confronted with proposals to lease facilities, but usually reject them after careful scrutiny.

The principal tax advantage of leasing that was mentioned in the firms visited was the ability to amortize

the cost of using land as was discussed in the preceding section. Another reason offered in a few firms was that special leasing arrangements had been devised so that the effective after-tax financial costs were nearly zero. Finally, several executives stated that the provision allowing the investment credit to be passed on to the lessee had resulted in a second look at leasing arrangements for some projects.

Summary

This has been the first of two chapters considering a number of tax factors that can influence the incremental investment and cash benefits of new capital projects. The theoretical emphasis on most of the factors discussed in this chapter have involved either a terminal cash flow at the end of a project's life, or an initial outlay which could result in immediate or subsequent tax effects on the cash flow pattern.

The income tax influences are generally considered, although often incorrectly, by the majority of the firms for such factors as working capital flows, salvage values for both new and replaced assets, gains on assets sold, and the alternative use values of replaced assets. The principal reasons given by firms for ignoring these factors were a lack of relevancy and the inability to predict the amounts involved for specific proposals for more than a few years in the future.

Questions were asked in the field interviews in regard to what items other than plant and equipment are generally evaluated as capital expenditures. Research and development costs, major acquisitions, major maintenance or repairs, and interest and carrying charges are not evaluated as capital expenditures by a majority of the firms. The theoretical issues regarding the proper treatment and analysis of these items are slightly cloudy at best, and the practices of the firms seemed to corroborate the cloudiness.

Leased facilities are considered to be capital expenditures by nearly 90% of the firms even though the annual amounts involved seldom approach the size of other outlays such as research or major maintenance. The substantial amount of technical literature pertaining to analyses of leasing decisions appears to have had an important impact on most of the firms in the study. The principal advantages, taxation or otherwise, are quickly discerned and if they outweigh the advantages from purchased assets the lease proposal may be accepted. If not, the proposal is usually summarily rejected.

The next chapter includes an analysis of the effective tax rate used by firms, inflation and other kinds of risk, and other more general factors which influence the cash flows related to specific capital projects.

CHAPTER V

BROADER ISSUES: EFFECTIVE TAX RATES, RISK, AND INFLATION

This chapter concludes the examination begun in Chapter IV of tax factors that can influence the cash flow patterns of individual capital projects. However, the illustrations and theoretical discussions in Chapter IV and other earlier chapters were purposely simplified in many instances. Cash flow projections were usually assumed to remain at a constant level from year to year. Individual capital-expenditure projects were analyzed largely in isolation from the rest of the firm. Various elements of risk and uncertainty were ignored in most discussions. The extremely important topic of the influences of inflation on capital investment analysis was skirted entirely. Income tax rates were usually assumed to be equal to the existing 48% statutory levy. It is appropriate that the final major chapter of this study considers these broader topics, and their interrelationships with topics in earlier chapters and with each other. The practices found in the field study, and their respective rationales, are again set forth and briefly analyzed. Table 5-1 presents a summary of the findings of practices involving some of the tax provisions that influence the effective tax rate imposed on business

firms. Table 5-2 indicates the practices found regarding various treatments of risk in the investment decision-making process.

Effective Income Tax Rates

Some measure of profitability is the basis for nearly all newly proposed capital projects of U. S. business firms. The profitability measures may be implicit or explicit depending on the type of investment decisions involved. The absolute profitability on all projects is reduced by the imposition of Federal income taxes. The higher the effective tax rate the greater the reduction in the absolute incentive to invest in new projects. Furthermore, the tax is not neutral in its impact on the decision-making process, and the relative position of individual projects is often altered by the size of the tax rate. The risks involved in different kinds of projects can also be substantially altered by the size of the tax rate. Some of the factors that influence the size of the effective tax rate are examined in the following pages. The first section considers the influence of operating loss provisions.

Operating Loss Deductions

Firm operating losses result from ordinary operating income being lower for a tax year than allowable deductions for operating expenses. Deductions generally result either from outlays made during the current tax year or from the

amortization of the initial cost or other tax basis of long-term assets in use. Although most of the following discussion relates to the latter deduction, the principles apply equally as well to current year expense outlays by taxable entities.

The concept of a tax saving resulting from amortizing the cost of long-term assets was discussed in Chapter III, and can be extended to an examination of various kinds of tax losses discussed in this chapter. E. Cary Brown has presented much of what is pertinent for this discussion. Brown concerned himself with the lack of neutrality of a proportional business income tax on the incentive to invest in different types of capital projects. His discussions were placed in the context of the present worth of the tax saving resulting from depreciation allowances for the initial cost of assets. His principal conclusions are stated briefly below.[1]

(1) The effect on investment incentives of a proportional tax levied on business income can be neutralized (a) if the amount invested can be deducted from taxable income in the year it is made, and (b) if the Government will pay for any losses of the firm at the same rate as it taxes the firm's income. Neither adjustment taken alone is sufficient to neutralize the effects of the tax imposition.

(2) Depreciation of assets over a short period, such as three to five years, would come reasonably

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[1]E. Cary Brown, "Business-Income Taxation and Investment Incentives," Income, Employment and Public Policy, Essays in Honor of Alvin H. Hansen (New York: W. W. Norton & Co., Inc., 1948), Chapter IV.

close to neutralizing the adverse effect of the tax, provided the excess of depreciation or other costs over income in any year can be carried forward as an offset against future taxable income.

(3) If depreciation for tax purposes is spread over the economic life of an asset, the tax will adversely affect investment incentives, even though the Government reimburses business operating losses at the rate of tax. Under such a system of economic-life depreciation, incentives to invest are more adversely affected (a) the longer-lived the asset in which the investment is contemplated, (b) the higher the cost of investment funds to the individual firm, and (c) the greater the uncertainty of future income. These latter two effects are particularly severe on the new or small firm.

(4) Incentives for replacement proposals are less affected than incentives to make new investment. The existing firm would have its advantages furthered as against the new firm, because replacement outlays would be a larger proportion of total investment for the former than for the latter. For similar reasons, the static firm is favored over the growing one.

(5) The effects as indicated in points (2) and (4) are greater, the higher the rate of Federal income tax.

In regard to point (1) above, the present worth of the tax savings from depreciation allowances grows as it is shifted forward toward the time of asset acquisition. However, the relative pre-tax position of investment projects will not be restored unless the present worth of the depreciation tax savings offsets the decrease in income due to the imposition of the income tax. This neutralization can occur only if the asset is fully amortized in the year of acquisition. A first-year write-off is a necessary condition for complete neutralization, but it is not a sufficient condition.

If taxable receipts for a business entity are less than annual deductible expenses the Government would need to reimburse the firm for any such losses at the same rate as revenues are taxed to insure complete neutralization for all projects.

The influences of accelerated depreciation indicated in Brown's conclusions were discussed in Chapter III, and need no further consideration here except as they affect operating loss provisions. Section 172 of the Internal Revenue Code provides for the deduction from taxable income in other years of net operating losses resulting in the current year.[2] Net operating losses of corporations can be carried back and offset against gross income for the three previous tax years. Refunds of some or all of the taxes paid in those years are possible. If a corporation's operating loss deduction is not used up by the carryback provision, the remaining portion may be carried forward for as many as five years and deducted from gross income. If the deduction is not exhausted within the succeeding five years its benefit is lost to a corporation.

If provisions such as Code Section 172 were not available, the effective tax rate would be higher over a period of years for firms experiencing operating losses and fluctuating profits than for firms having a stable income

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[2]For a detailed discussion of Code Section 172, see 1965 Federal Tax Course (New York: Commerce Clearing House, Inc., 1964), pp. 1603-1616.

stream. Some discrimination does exist in favor of utility and other industries experiencing relatively steady demand for services, but only from the carryforward provision. The present worth of the future decrease in taxes resulting from the loss carryforward is naturally less than an immediate tax rebate that has been suggested by Brown.

Annual losses should also be examined in relation to specific capital-expenditure projects. The ability to pool income and deductible expenses that are related to all assets utilized by a business entity enables losses incurred on certain projects to be offset against profits from others. Taxes on income from profitable capital outlays can thus be reduced by early losses that may result from new projects as they are being brought on stream. In the evaluation process of new projects a hypothetical rebate should be added to the annual cash benefits for each year a loss is expected. This procedure can certainly enhance the economic desirability of some projects relative to others, and especially in situations where long start-up times or trial runs are necessary before a normal revenue pattern is generated.

As shown in Table 5-1, only eight of the firms visited in the field study have actually experienced tax operating losses in the past ten years. These firms have generally attempted to recognize the absence of an income tax liability in new project analyses since it could certainly influence

TABLE 5-1

EFFECTIVE TAX RATE FACTORS IN PROPOSAL EVALUATIONS

Factors	Firms
Operating Losses Experienced in Recent Years:	
Parent corporation	8
Subsidiaries or divisions	30
Individual Proposal Losses Properly Considered	28
Abandonment Losses Considered Important	3
Section 1231 and Capital Losses Considered Important	10
Statutory Tax Rate Utilized	29
State Income Taxes Considered Properly	24

the final accept-or-reject decisions. Three of these firms have utilized straight-line depreciation for tax purposes in attempting to minimize the current period's tax loss, and to defer the amounts to be deductible until revenues are generated in future periods. These firms have lost some tax deductions for allowable amounts of depreciation due to long periods of tax losses and the five-year carryforward limitation. It should also be stressed that these firms indicated that straight-line depreciation does not generally result in a large enough annual charge to calculate properly net profits or losses from an accounting viewpoint. Thus, not only are these firms being discriminated against by not being allowed an immediate rebate for operating losses, but their tax losses and published financial statements are both

being misstated by using the straight-line procedure rather than more accelerated methods of depreciation.

One other important element of discrimination involving the operating loss deduction allowed in the Code should be mentioned. It was stated in Chapter III that the annual allowable investment credit is generally restricted to $25,000 plus 25% of a firm's tax liability exceeding the $25,000 level. Credits in excess of this limitation may be carried back three years and forward five years with certain restrictions. Most of the comments in the preceding paragraphs regarding discrimination are again relevant, since a firm cannot receive the benefits from the credit provisions unless a tax liability exists. The credits may thus be lost forever due to a low and/or cyclical earnings pattern.[3] While it may be argued that an inefficient firm should not be promoted by the tax laws, this view is a value judgment and it can be just as effectively argued that incentive measures should not be discriminatory, and may be just what such firms need to help pull them out of their financial doldrums.

Slightly more than one-third of the companies interviewed do not properly recognize the influence on the total

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[3]A firm does not have to be operating at a tax loss to be discriminated against by the investment credit provisions in the Code. Firms that are expanding rapidly, but are not yet earning large profits must also frequently use the credit carry back and carry forward provisions since low tax liabilities are being coupled with relatively large investment credits.

tax liability that results from some projects generating losses while others generate profits (Table 5-1). Three principal arguments were given for this practice.

(1) The accounting system is not sufficiently refined to generate enough information about most individual projects to make such distinctions generally feasible.

(2) There is no rational basis for making any such distinctions between projects.

(3) Each project should be made to "stand on its own merits and not depend on tax gimmicks to justify its acceptance."

While the first reason may be a practical reality in some firms, the latter two are theoretically weak and should not be allowed to prevent a correct project evaluation where the desired information is generated by a firm's accounting system.

Abandonment and Retirement Losses on Business Property

If income taxes were not imposed on the profits of business firms the size of the undepreciated value of an old asset would have no influence on the decision to replace or discard it. Discussions in Chapter IV have shown how salvage values in general can influence investment decisions when the old asset is sold or traded in, but losses that may result from disposition were not elaborated on.

When the usefulness of an asset held by a business firm is suddenly terminated an abnormal retirement loss is allowable as a deduction. If the asset is physically abandoned the entire adjusted basis is deductible as a loss. If an asset is retired, but is not disposed of, a deductible

loss is recognized under Regulation 1.167 to the extent that its adjusted basis exceeds salvage or fair market value if the retirement:

(1) is abnormal,

(2) is normal and carried in a separate asset account, or

(3) is normal and carried in a multiple asset account and the tax depreciation is based on the life of the longest lived asset in the account.[4]

This regulation generally has the effect of an immediate tax saving that should be related to the new asset being considered for acquisition if it is the new asset which in fact results in the disposition of the old one. The overall effective tax rates of business firms are thus altered, and another scrambling element in the capital-expenditure decision-making process results. The pre-tax rankings of investment projects are altered by the imposition of the income tax and the deductibility of these losses. Replacements of undepreciated assets move up the ranking ladder relative to replacements of fully depreciated assets, and probably more importantly relative to new expansion projects where replacements are not involved. Existing and static firms that have large amounts of replacement proposals relative to new and rapidly expanding firms will have an advantage over the latter due to the imposition of Federal income taxes and these loss provisions.

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[4] Ibid., pp. 1146-1148. See the discussion of Regulation 1.167 (a) - 8.

Only three firms indicated abandonment or retirement losses are important with any degree of frequency. Two of these firms attempt to consider what influences abandonment would have on a new project's desirability if it occurred suddenly and prior to the end of its expected economic life. Approximately one-third of the firms visited do not consider the effects of the abandonment loss provision because it is seldom involved in replacement proposal evaluations. This reason is not surprising in view of the fact that nearly all of the firms in the study write off fixed assets using accelerated depreciation methods for tax purposes. The undepreciated tax basis is normally rather small unless a project has to be abandoned quite soon after acquisition. Irrespective of the lack of frequency of occurrence however, these loss provisions should not be ignored where they can substantially influence the ultimate investment decision.

One other reason firms probably do not consider Regulation 1.167 as being important relates to the acceptance criteria utilized for replacement decisions. As was mentioned in Chapter II, many small replacement projects are accepted after only a minimal (if any) effort is made to apply mathematical acceptance criteria. Since only the time-adjusting acceptance criteria can show the correct impact of these provisions, and replacement proposals are seldom evaluated with such criteria in some firms, it is not surprising that the sensitivity of investment decisions to

abandonment losses is often not recognized by business firms.

Section 1231 and Capital Losses

The influence of capital gains on investment decisions was discussed briefly in Chapter IV. Both capital gains and capital losses influence the effective tax rate a firm ultimately pays. If a replaced asset is sold for less than its undepreciated tax basis, the resulting loss may be a capital loss or treated as such if the transaction involves a Section 1231 asset. Capital losses are generally first offset against capital gains and thus prevent the tax outlays which would otherwise be necessary for the gains. If the capital losses exceed capital gains a five year carryforward is available for corporations.[5] However, most of the replacement decisions being made by firms usually involve Section 1231 assets which are merely treated as capital assets. Net 1231 gains are taxable at the maximum capital gains rate of 25%. If Section 1231 losses exceed Section 1231 gains, the net losses are deductible fully from operating income in the year incurred and are not carried forward. This treatment of Section 1231 losses results in discrimination against projects depending on when the asset is sold, and what gains are available to offset the loss. The tax saving that results from a deduction from normal operating income is obviously

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[5] Ibid., pp. 1534-1536.

worth more than a 25% capital gain tax saving.

Less than one-fourth of the firms visited have experienced a substantial number of losses on capital assets and Section 1231 assets in recent years. Losses were usually more than offset by gains in these firms. The majority of the firms visited consider the influences of Section 1231 and capital losses explicitly in evaluating replacement proposals in the relatively small number of cases in which the accept-or-reject decisions could be influenced.

Parent-Subsidiary Relationships

The Internal Revenue Code contains many provisions that influence the effective tax rates paid by a parent corporation and its subsidiaries. Only three such provisions were examined in the field study: consolidated tax returns, subsidiary operating losses, and foreign tax credits.

Consolidated Returns and Subsidiary Operating Losses. A group of affiliated corporations can file a consolidated tax return and be taxed as a single economic entity. Interfirm transactions must be eliminated to derive the single entity's net taxable income. Prior to the Revenue Act of 1964, a 2% penalty rate was added to the 22% surtax rate that was applied to consolidated net income. The penalty was offset to some degree by the allowance of an additional $25,000 tax exemption for each affiliate included

in the consolidated return. Both the 2% penalty and additional exemption provisions were eliminated by the Revenue Act of 1964. For most large firms, the advantage gained from the elimination of the former typically outweighs the latter's deletion from the Code.[6]

Approximately one-half of the firms visited in the study were filing a consolidated return. Nearly one-fourth of the firms interviewed indicated that for the first time a consolidated return had recently been filed or was currently being seriously considered. However, the primary points of emphasis in this phase of the interviews were the absolute levels of the tax rates used for evaluation purposes and whether the same rates were used in evaluating both parent and subsidiary investment projects.

Twenty-nine of the firms in the study that evaluate projects on an after-tax basis utilize the current Federal statutory rate (Table 5-1). Three firms use a 50% tax rate primarily for convenience in project calculations. Five firms use a rate that is considered to be an approximation of the effective tax rate actually incurred from parent and subsidiary operations. The effective tax rates obviously vary between these firms, and are estimated by considering

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[6] Ibid., see pp. 1918-1920, for a discussion of Code Sections 1501-1504. Ample evidence was given in Chapter III regarding the influence of a tax rate reduction on new investment. The penalty elimination and tax cuts combined amount to 6% for those firms that were previously filing consolidated returns.

many of the factors that are examined in this chapter.

When either the parent firm or any subsidiaries incur a loss from operations the tax saving concept is again relevant. For example, assume that one or more subsidiaries are expected to operate at a loss for a given future period. Since these losses can be offset against the operating profits of the parent corporation for Federal income tax purposes, the total tax paid will be less than the statutory rate multiplied times the parent's profits. It is therefore not logical to continue to deduct taxes in the cash flow estimates for projects being evaluated by or for subsidiaries. Analytically, the net cash flows projected for the subsidiary's projects should be increased by 48% of the expected losses because they prevent an outflow for taxes.[7] To do otherwise would result in discrimination in allocating capital to new and growing subsidiaries that often incur losses in the early years of operations. The present worth and recovery periods of investments in such subsidiaries are definitely enhanced by the ability to offset losses against other taxable income earned by the parent corporation.

Even if a consolidated return is not filed, the losses suffered on individual projects undertaken by subsidiaries should be recognized analytically in deciding between alter-

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[7]The same principle applies to firms organized with operating divisions or groups, but consolidated returns are not involved.

native uses of funds. The ability to carry such losses back or forward was discussed in the first section of this chapter, and should be explicitly recognized in the manner discussed at that time.

Thirty of the firms visited have subsidiaries that have operated at a loss in recent years (Table 5-1). Sixteen of these firms do not explicitly recognize in the evaluations prepared for subsidiary capital projects the fact that no taxes may be expected to result from subsidiary operations. Three primary reasons were given for including an outlay for taxes in evaluating projects for subsidiaries that have operated at a loss.

(1) Losses are not expected to persist for any appreciable period of time.

(2) Losses are not generally predictable with any degree of accuracy.

(3) Projects of the subsidiaries should be made "to stand on their own feet just as must parent capital projects."

The first two reasons are not generally arguable. However, if losses are predictable to any degree and are expected to persist beyond a year or two, nothing can be gained by ignoring reality and blindly applying a rate for a tax liability against subsidiary projects when none will in fact result. Nearly all of the firms that make no such distinction for varying tax rates have foreign subsidiaries that operate at a loss. Due to the variability of foreign tax rates, it seems even more imperative that these firms explicitly recognize the possibility of discriminating

against subsidiary projects that would otherwise be economically desirable.

Foreign Income. The complexities involving foreign income and taxes could easily fill several volumes of rather detailed discussions. Much has been said about certain loopholes in the Code that concern foreign income, and the attempts made by the Revenue Act of 1962 to close the loopholes. No attempt will be made in this study to survey all of the complexities involved in foreign income and the taxes related thereto.

A credit for foreign taxes paid is allowed as a direct reduction of the U. S. tax liability of domestic corporations that hold a certain portion of the outstanding stock of foreign firms.[8] The credit is allowed upon receipt of dividends from the foreign subsidiaries. A credit is also available for taxes paid by foreign "controlled" corporations even though the earnings have not been distributed to the U. S. parent corporation.[9] The primary points of investigation in the field study were whether the parent firms receive dividends from foreign subsidiaries,

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[8] Ibid., see pp. 2403-2412, especially regarding Code Section 901. Corporations also have the option to deduct the taxes paid from gross income.

[9] Ibid., see pp. 2417-2419, for a discussion of "controlled" corporations and Code Section 951-958.

and what tax rates are applied in the economic evaluations for subsidiary capital projects.

Approximately three-fourths of the firms interviewed have foreign subsidiaries from which dividends have been received in recent years. Most of these firms have also had foreign subsidiaries that have operated at a loss. As noted in the preceding section, many of these firms still apply a tax rate to the projects being evaluated for the loss subsidiaries. Several other firms apply what is felt will be the effective tax rate for the particular subsidiary and country involved. The total rate may be higher than the U. S. rate, and depends on the country in which the subsidiaries are located. Ten firms even attempt to recognize the influence that delays expected in repatriation of dividends will have on a subsidiary's cash flow estimates for particular projects. This approach is definitely correct and highly desirable where possible.

State Income Taxes

The last factor to be discussed that involves effective tax rates is the relevancy of state income taxes. Thirty-seven states currently have corporate income taxes with maximum rates ranging as high as 10%. The economic desirability of a project may thus be influenced substantially depending on the state or states in which it generates revenues. Without becoming embroiled in the complexities of a variety of state income tax laws, it can be generally

concluded that some addition should be made to the Federal income taxes imposed on capital projects that are also exposed to state income tax levies. Whether all of the details of individual state tax laws should be considered in evaluating projects is probably open to question on the grounds of expediency. The area of what income should in fact be taxed in given states is still a very open and disputed question. Some explicit consideration should nevertheless be given for state income tax levies when capital investment projects are being evaluated.

Twenty-eight firms earn income in states that have corporate income tax laws. Thirteen of these firms include the state income taxes in cash flow estimates as an additional expense entirely separate from Federal income taxes. This approach is certainly valid, and it highlights in the evaluation process the differences in taxes imposed in the various states. Four firms ignore state taxes based on the grounds of irrelevancy. Several other firms add the state income tax rate directly to the Federal rate. State income taxes were acknowledged as having important influences on certain projects in a few of the firms visited.

Risk and Income Taxes

Risk is such a multifarious concept that no attempt will be made in this thesis to examine it comprehensively. Nevertheless, no study of the influence of Federal income tax factors on capital expenditure decisions would be

complete without some consideration of the topic of risk. The remaining pages in this chapter include a brief look at certain sources of risk. The concept of time risk as it is related to different kinds of capital projects is examined. Several of the more useful methods that are used for analyzing and highlighting the influences of risk on the decision-making process are briefly discussed. The final section of the chapter considers a type of risk that influences all of the discussion in this thesis--the risk of inflation or rising costs and prices.

Sources of Risk

Merrett and Sykes have presented a discussion of the following sources of risk that are related to the capital investment decision-making process.[10]

Risk from undertaking insufficient numbers of similar projects.

This risk exists when business firms consider only a small number of projects of a similar nature, and arises even if completely accurate estimates of the probabilities associated with different project variables are possible. The risk still exists that the mean profit from a given type of project will not materialize due to the possible failure of the law of averages operating with so few similar investments.

Risk from misinterpretation of projected data.

This risk results from the human element of misinterpretation and faulty forecasting of interrelated factors that are involved in investment decisions.

Risk from bias in the data and its assessment.

Both the derivation and assessment of the raw data for capital projects are subject to the risk of bias

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[10]See Merrett and Sykes, Chapter 6. Much of the discussion in the rest of this chapter is a condensation of some of the material presented by these authors, but with a particular emphasis on income tax factors.

on the part of the individuals involved in the decision-making process. In addition, numerous biases result from the income tax laws. Some of these biases have been discussed throughout this thesis. It is important that the decision-maker knows that certain biases exist before he can be unbiased.

Risk from a changing economic environment.

The past data usually utilized to assist firms in projecting the future will not often remain unchanged. Changes involving varying market shares, prices, government tax policies, general economic conditions, etc., are all important but often are not controllable by individual firms. Incorrect decisions can result from a failure to consider the possible influences of such external changes on the decision-making process.

Risk of analytical errors.

Both the technical and financial analyses of capital projects are subject to error. Nearly all project analyses will have some errors of this type, and consequently the risk of a faulty decision being made is present. Much of the discussion in previous chapters was related to the possibility of erroneous financial analyses through the use of certain acceptance criteria. Furthermore, both the inclusion and exclusion of most of the tax factors discussed may result in faulty analyses. The possibility of exclusion was discussed thoroughly, but equally serious errors may also result if tax factors are included but are either improperly included or the results are erroneously interpreted.

The sources of risk discussed briefly above are not necessarily mutually exclusive in their impact on investment decisions. Furthermore, they are related in many instances to the element of time risk which is examined below. Frequently the longer the time period related to an investment project, the greater the risk of error from data bias, predictability of environmental changes, misinterpretation of projections, and analytical errors.

The Time Risk Factor

The element of time risk relates to the possibility of sudden and complete cessation of the cash benefits being generated by capital projects. The general importance of how soon a firm could expect to break even from a new investment has been discussed throughout this thesis. In addition to the traditional recovery period approach, a so-called progressive recovery period concept was outlined in Chapter II. A substantial portion of the discussion of the tax factors that have been examined in this study has been related to their influences on a project's recovery period. Indeed, the element of time risk is the major type of risk that most tax provisions have been intended to influence. Provisions such as accelerated amortization, the depreciation guidelines, the investment credit, and immediate write-offs of research and development costs have all been related mainly to a more rapid recovery of the investment in a new and possibly risky project.

A distinction between the time risk concept and other sources of risk is an important one in the evaluation process. Recovery period measures, and the influences on them of the above mentioned tax factors, are related entirely to the time risk element. These measures do not generally highlight sources of risk other than the time factor. Many of the firms visited either have not recognized, or often do not explicitly consider, this important

distinction. When the question was posed: "Do you consider risk explicitly in the decision-making process, and if so, how?", the answer in approximately half of the firms was, "through using a shorter recovery period requirement." The other firms in the study indicated the methods of analysis discussed in the next section were used to consider risk elements--both of a time nature and otherwise.

One further point should be made concerning the time risk factor and the break-even or recovery period. The rate of recovery is probably at least as important as the absolute magnitude of the time period involved. For example, it is important to know that an investment will be 80% recovered in three years when the total payback period is six years. Twenty-one of the firms using recovery period calculations also consider the rate of recovery explicitly in project evaluations.

Approaches to Probability Analysis

Nearly all of the firms visited in the study utilize some form of probability analysis in evaluating new projects. However, most firms consider probabilities only indirectly or implicitly. The individuals involved in the decision-making process usually include their estimates of the figures that have the greatest likelihood of occurrence. These estimates are obviously based on subjective judgment. One of the difficulties that is involved in this approach is

that the most likely value that is expected can have any probability as long as it is of a higher magnitude than the next most likely figure. Another problem is that the most probable values can vary widely between different types of projects, or even the same type of projects over differing periods of time. Different probabilities for many tax factors can substantially influence investment decisions. To illustrate, consider an asset that costs $10,000 and has an estimated useful life of five years. Further assume a salvage value estimate of $2,000 is included in the evaluation process, and that the expected probability of this amount is 0.5. If the next most likely estimate is that salvage value may be -$500, and the probability is 0.45, then a lack of explicit consideration of the latter possibility might easily result in an erroneous decision when the project is compared with others having different risks and probabilities.

Another approach to probability analysis that is commonly discussed, but is much less frequently used, involves the calculation of the mean or average expected monetary value (EMV) for each quantifiable variable. Consider the example below involving salvage values. The most probable salvage estimate is $5,000, and is denoted Event S_2. The expected probability for S_2 is 0.6. The other two salvage estimates are $10,000 and zero, and each has an expected probability of 0.2. The average expected monetary value equals the most likely estimate of $5,000 in this case,

Event	(1) Probability	(2) Amount	(1) x (2) (3) EMV
S_1	0.2	$10,000	$2,000
S_2	0.6	5,000	3,000
S_3	0.2	zero	zero
	1.0		5,000

but only because both the probabilities of the individual events and the expected amounts of salvage values were assumed to be symmetrical. If S_1 and S_3 had probabilities of 0.1 and 0.3 respectively, the expected monetary value would amount to $4,000. This difference in the "expected" salvage value could easily change the investment decision in this case.[11] Errors in this type of analysis may also arise from weighting the probabilities of each event according to their relative arithmetic size when the probability of the probabilities may be substantially dissimilar. If the 0.3 probability of event S_3 in the second case above had been "forced" due to a lack of knowledge about the estimate, it should obviously not be given the same weight as the probabilities of S_1 and S_2 if the latter are completely certain at 0.1 and 0.6 respectively.

Executives in three of the firms stated that an attempt to weight explicitly the probabilities of various

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[11]This discussion ignores differences in the marginal utility of money. The implicit assumption in the example above is that the marginal utility is constant irrespective of the dollar amounts involved.

events is made in analyzing some capital-expenditure proposals (Table 5-2). In several other firms it was mentioned that a rough average of the most likely estimates (e.g., two or three values) is used for many variables.

TABLE 5-2

APPROACHES TO CONSIDERING RISK IN PROPOSAL EVALUATIONS

Approaches	Firms
Probability of Expected Monetary Values	3
Sensitivity Analysis	34
Simulation by Models	4
Variable Cut-Off Requirements	30
Calculation of Specific Price-Level Changes	24
Calculation of General Price-Level Changes	3

Sensitivity Analysis

Approximately three-fourths of the firms interviewed utilize some form of sensitivity analysis in evaluating new proposals (Table 5-2). Sensitivity analysis involves changing the magnitude of certain crucial variables to ascertain what influences on the economic desirability of projects can be expected.

An illustration of sensitivity analysis is as follows. Assume that a 10% price reduction is being considered for a one-year period until a firm's product can gain a certain share of an existing market. Even though

the desired share of the market can be obtained, assume the price reduction will make the product line operate at a loss for the first year. As was noted in an earlier section of this chapter, the ability to offset the loss on one project against profits on others for Federal income tax purposes may make the proposal acceptable. To test the sensitivity of the proposal to price changes, an alternative assumption may be that a 25% price reduction should be considered. Although early losses would be greater, the larger price reduction may result in a gaining of the desired market share more rapidly. Both the size and time value of the losses resulting from the hypothesized price reductions can have an important influence on the proposal. All of the factors involving taxation which have been discussed in previous chapters can be analyzed, varied, and further analyzed. Such variables as salvage values, depreciable tax lives, immediate writeoffs or capitalizations, levels of expected tax rates, debt/equity ratios and levels of expected after-tax capital costs, and many others can be changed to determine how importantly different project's desirabilities depend on them.

One particularly crucial problem that arises in most sensitivity analyses is the inability of the decision-maker to vary more than one or a few variables at the same time. Frequently the interaction of variables cannot be easily ferreted out. This problem has been alleviated somewhat by a few firms through the use of model building and simulation techniques.

Simulating Risk

Mathematical model building and simulating risk have grown in importance in many areas of decision-making in recent years. Barish has defined risk as:[12]

> . . . the result of the variations in the values of a variable which are caused by the actions and interaction of many factors.

He has also stated that simulation means:[13]

> . . . the use of a model which takes account of those essentials of reality which are significant to the decision-making objective. A decision is reached by running various alternatives through the model and comparing results. The model does not have to look like reality, but it must give the results which reality will give with respect to the problems under study.

High-speed computers have been refined and developed in recent years to the point where simulating risk may be a very economical way to analyze certain types of capital projects. The interactions of a variety of assumptions that involve many different variables can be derived and evaluated through the use of computer simulations. For example, if subjective probability estimates and ranges of values can be supplied for each factor involved in a capital-expenditure proposal, a simulation of the resulting range of internal yields or other acceptance measures is possible. By considering the probabilities and interactions of the

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[12]Norman N. Barish, Economic Analysis for Engineering and Managerial Decision-Making (New York: McGraw-Hill Book Company, Inc., 1962), p. 393.

[13]Ibid., p. 380.

variables involved, computers will produce estimates of the probability of reaching a given internal yield, i.e., the probability of achieving a yield of 14% is 95% or higher.

Four of the firms interviewed have used computer simulation techniques to analyze a few very large and important investment projects. However, none of these firms were any more concerned with tax factors than any other crucial variables. Although the multitude of possible values and probabilities for the tax factors discussed in previous chapters could undoubtedly be handled through computer simulations, the size of such an undertaking is beyond the scope of this study.[14]

Cut-Off Requirements

Another approach utilized for handling risk in the decision-making process is to vary the size of the cut-off requirements for acceptance of projects involving different types and levels of risk. After the internal yields, recovery periods, or other criteria are calculated most firms still must allocate capital between projects. The question raised in the interviewing process was whether cut-off or target requirements were used, and if so, whether they were

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[14]For illustrations of simulation applications to capital budgeting in general, see Leon W. Woodfield, "An Experiment in Application of The Monte Carlo Method for Simulating Capital Budgeting Decisions under Uncertainty" (unpublished D.B.A. thesis, Department of Accounting and Financial Administration, Michigan State University, 1965).

calculated on an after-tax basis.

Several firms had an absolute minimum cut-off rate of return, and nearly half of the firms had minimum recovery periods. Executives in thirty firms indicated their cut-off requirements would vary to some extent, and would depend on the risk and nature of the projects involved (Table 5-2). Accordingly, a proposal for the replacement of a machine which will have little salvage value and for which the expected cost savings are quite predictable, would need to result in a much lower after-tax yield than a plant to be built for the production of a new and untested product. Executives in a total of thirty-eight firms indicated that target or cut-off requirements are used in the decision-making process.

Ample evidence has been presented in this thesis to show that if cut-off yardsticks are to be compared with the acceptance criteria utilized they both must be on an after-tax basis.[15] All of the firms that calculate their acceptance criteria on after-tax basis are consistent in their comparisons with cut-off criteria.

The Risk of Inflation

The discussion thus far in this thesis has ignored the possibility of anticipated inflation and its influences

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[15]For further elaboration regarding the need to use an after-tax cost of capital rate in proposal evaluations see, A. A. Robichek and J. G. McDonald, "The Cost of Capital Concept: Potential Use and Misuse," Financial Executive, XXIV (June, 1965), 20-49.

on the investment decision-making process. Inflation is a special kind of risk--the risk of rising prices and costs in both the economy in general and in individual firms.

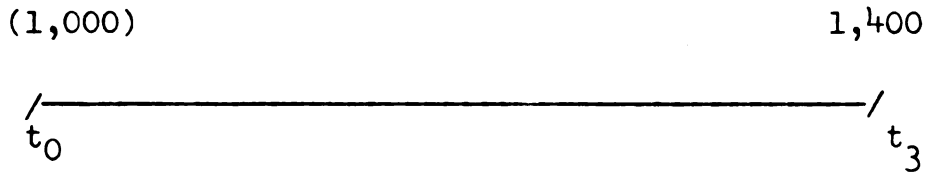
At least two kinds of adjustments may be necessary to properly calculate the yield on investment projects if inflation is expected to occur. First, if specific price or cost changes are expected, they should be explicitly reflected in the actual cash flow projections for individual projects. Twenty-four of the firms visited explicitly recognize specific price level changes in project evaluations. The primary reasons given by firms for not following this practice were that price changes are unpredictable, and are generally immaterial anyhow. However, several of the latter firms have in fact experienced price depressions for some of their products in recent years. Some of these firms have also experienced increasing wage and other costs. When these two factors are combined with even slight increases in the general price level, the real yields on projects may be altered substantially. Some explicit efforts should certainly be made to recognize the interaction of these factors in new project evaluations.

A second important adjustment in project evaluations is necessary for the rate of general inflation that is anticipated so that the future dollar receipts may be equated in real present worth terms with the initial investment. From an analytical standpoint, the adjustment need not be nearly as difficult as is often thought. The adjustment for

both the time value of money and anticipated general inflation can be made at the same time by merely discounting the expected receipts by the factor yielded by $\frac{R}{(1 + k)^t(1 + i)^t}$ when (k) represents the cost of capital or discount rate in the absence of inflation, (i) is the rate of general inflation expected, and (R) the dollar receipts anticipated in year (t).

Illustration V-1

Assume an investment of $1,000 at t_0 is expected to result in a cash inflow of $1,400 at t_3 as shown on the time scale below. Further assume that the cost of capital in the absence of inflation is 7%, and the rate of anticipated general inflation is 3%.



The discount rate based on the preceding assumptions is exactly 10.21%. By using the present worth factor for 10% however, the real present worth of the expected benefit is approximated as $1,052. Calculations are shown in Appendix B.

If annual receipts rise more slowly than the general price level, the real yield on the total capital invested will be less than the yield in the absence of inflation. If receipts are fully responsive to the general rate of inflation, the yield on total capital will remain unchanged.

However, these conclusions are based on several rather rigid and unrealistic assumptions. They apply only in the absence of income taxes, and when the project involves a non-depreciable asset that is financed entirely by equity funds. As has been shown in previous chapters, if a firm utilizes debt capital to partially finance investment projects, this fact should be recognized explicitly in the evaluation process. Recognition is particularly important when income taxes are imposed and inflation exists. George Terborgh has succinctly analyzed some of the influences of anticipated inflation on capital investment decisions. Two of his conclusions are stated below.[16] The rationale for the conclusions of Terborgh are briefly explored in the rest of this section.

(1) For a depreciable investment which is financed entirely by equity funds, inflation will reduce the real after-tax yield even if pre-tax receipts are fully responsive to the expected rate of general inflation.

(2) For a depreciable asset financed by both long-term debt and equity, inflation will reduce the yield on total capital even though pre-tax receipts are fully responsive to inflation. The effect on the yield on equity capital depends on a number of factors such as the debt/equity ratio, the cost of debt, the rate of inflation, the tax depreciation procedures and asset service lives, salvage values, and the level of the statutory tax rate.

In regard to the first conclusion stated above, the main factor influencing the yield on equity capital is the

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[16]George Terborgh, Effect of Anticipated Inflation on Investment Analysis (Washington, D.C.: Machinery and Allied Products Institute, 1960), pp. 8-14.

amount and pattern of depreciation of the cost of the asset. Since the monetary amounts of depreciation are restricted to total historical cost, the tax deductions for this factor do not move in response to general inflation as is often the case for wages, materials, and other costs. The real effective tax rate is therefore higher than it would be if depreciation were calculated on a price-level adjusted basis. The equity yield could remain constant in real terms under these assumptions if the pre-tax revenues were more than responsive to the general level of inflation. Alternatively, if the after-tax revenues can be increased by certain tax provisions the erosion of the equity yield can be prevented. The incentive provisions discussed in Chapter III--the investment credit, the tax rate reductions, the guideline system, and accelerated depreciation--can all enhance or at least prevent a deterioration of the real equity yield on capital projects.

The results on project yields become substantially more scrambled when long-term debt funds are included in the analysis. When pre-tax revenues move in harmony with the general price level, the real return to total capital will decline as stated above in the all-equity case as a result of the fixed depreciation write-off. However, it is generally recognized that when inflation occurs the use of debt can enhance the return to equity capital. This is especially true due to the tax deductible nature of interest payments for the use of debt funds. Before complete

restoration can occur, the favorable influence of the use of fixed cost funds on the equity yield must offset the unfavorable influence of historical cost depreciation. Terborgh has concluded that restoration will not generally occur, even with fully responsive receipts, unless the percentage of debt utilized equals the statutory tax rate levied on income.[17] Under the current 48% corporate tax rate in the United States, a debt/equity ratio of nearly 1:1 would be required before the equity shareholders could break-even in terms of pre-inflation conditions.

Two other factors involving tax influences that should be mentioned in a discussion of the impact of inflation on new proposals are asset salvage values and inventory valuations. Previous discussions have shown what influences salvage values and various related tax gain or loss provisions can have on investment decisions. To the extent that the size of an asset's salvage value does not respond to the general level of inflation, further mitigating effects can be expected on its real equity yield.

When a portion of the initial investment in a project is for inventories, the equity yield under the mixed capital assumption may be enhanced by inflation. Enhancement will generally occur only when the proportion of debt financing is relatively high, pre-tax receipts are fully responsive, and the Last-in First-out method of

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[17] Ibid., p. 13.

inventory valuation is utilized. The use of First-in First-out procedures normally results in a higher effective rate in a period of general inflation, and the additional burden generally falls on the equity shareholder.[18]

Three of the firms visited make explicit efforts to adjust cash flow estimates for general inflation for projects being considered for some foreign subsidiaries. These subsidiaries operate in countries that have experienced rather high rates of general inflation in recent years. Nearly all of the other firms in the study normally apply higher recovery period or internal yield requirements, or attempt other indirect means, to consider the influence of inflation on capital investment decisions. None of the executives interviewed stated that their firms attempt to consider explicitly general inflation influences on new investment projects related to operations in the United States.

Summary

This chapter has included a brief examination of certain factors that influence effective tax rates, various types and approaches to analyzing risk, and the impact of inflation on capital-expenditure decisions. These broader issues cut across the entire decision-making process for new

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[18] *Ibid.*, pp. 8-10.

project proposals. Some of the subtle influences on specific proposal evaluations are either not recognized or are frequently ignored by many of the business firms in the study.

The executives in many of the firms interviewed stated that the loss provisions discussed in the preceding pages are not usually explicitly considered in the evaluation of individual proposals. The principal reasons given in these firms were a general lack of relevancy due to the size of the losses incurred annually and a basic disagreement with the assertion that such distinctions should be made in regards to specific capital-expenditure proposals.

Certain kinds of risk are considered in approximately three-fourths of the firms through utilizing sensitivity analysis for critical parameters. Variable cut-off requirements are used in two-thirds of the firms to consider risk in the decision-making process. Specific price and cost changes are considered in slightly over one-half of the firms, but general inflation is seldom considered explicitly in evaluating individual proposals.

The conclusions of this study and certain tax policy implications are set forth in the next chapter.

CHAPTER VI

CONCLUSIONS AND TAX POLICY CONSIDERATIONS

A recent study by Richard E. Slitor includes estimations of the tax savings that are expected to result from some of the tax incentive provisions that were discussed in Chapter III.[1] Slitor estimates that the total savings during 1966 for the corporate sector will amount to over $6. billion from the tax rate reduction, the investment credit provision, and the guideline system. The rate reduction is expected to provide at least half of the $6. billion estimated savings, and the remainder is divided relatively evenly between the guideline system and the investment credit provision. This total tax savings certainly cannot be viewed as inconsequential when it is compared with the $61.6 billion projection for capital outlays during 1966 that was revealed in the recent McGraw-Hill survey.[2] Additional indirect investment incentives

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[1]Richard E. Slitor, "The Corporate Tax Cut: What Business Did with the 'Windfall,'" Challenge, XIV (March-April, 1966), 26-28, 38, 40.

[2]The most recent survey is summarized in the article, "Full Steam for Spending," Business Week, No. 1911 (April 16, 1966), pp. 37-39.

can be expected during the coming year from the multiplier effects of the tax savings, and more importantly, from the multiplier effects caused by the individual income tax rate reductions in the consumer sector. The conclusions in the next section must be examined with these and other factors as a frame of reference.

General Conclusions

The following general conclusions were derived primarily from the field interviews that formed the basis for the research for this thesis.

(1) The vast majority of the executives in the firms that were visited stated that only nominal incentive effects have occurred in terms of the economic desirability of specific capital projects.

(2) The general supply of funds effects from the investment credit, the guideline system, and the corporate tax rate reduction were generally described as moderate in most of the firms visited in the study. These moderate funds effects at least partially corroborate the unshifting results for tax rate reductions discussed in the Musgrave study that was mentioned in Chapter III.

(3) The actions of the firms in the study, and the corporate sector of the economy in

> general, that have been reflected in the tremendous surge in plant and equipment outlays in the past few years contradict the first two findings stated above. The size and rates of increase for such outlays imply that the actual stimulus from the incentive measures has been somewhat stronger than was acknowledged in the field interviews. This possibility suggests even greater corroboration of the Musgrave thesis than was noted in the preceding conclusion.

The following reasons appear to have had important influences on the first two conclusions of this study. First, despite some widely heralded improvements in the "business investment climate," substantial uncertainties seemed to exist in the minds of many of the interviewees as to future congressional or administrative tax policy changes. These uncertainties may play an important role in the lack of recognition of the incentive effects that can result from certain tax provisions.

Second, although a distinct shift toward the use of the more sensitive time-adjusting acceptance criteria for project evaluations was found in many of the firms visited, the crudity of the measures in other firms has precluded an explicit recognition of incentive effects. This factor has been reinforced by the selectivity and restrictiveness of some of the provisions, most notably the investment credit.

Third, the greater speed up in tax payments for large corporations has had a definite dampening influence on the recognition of the incentive effects in some of the firms visited in the field study.

Fourth, many of the firms were in a strong or excess liquidity position when the tax incentive measures began to take effect. This fact seemed to dampen somewhat the enthusiasm of the financial executives during the discussions about the incentive measures.

Fifth, some of the firms in the study were just beginning to be forced into greater reliance on external funds at the time of the interviews. The restrictive influences of the greater inelasticity of the supply of funds that have been suggested by Meyer and Glauber could not have been expected to change the viewpoint of firms toward the incentive measures until this increased emphasis on external financing began occurring.

Finally, the selectivity and gradualness of the tax measures has undoubtedly contributed to the lack of explicit recognition of their possible incentive effects.

Tax Policy Considerations

The business investment climate has changed in several ways during the year that has elapsed since the field interviews for this study were started. Interest rates for long-term debt have risen sharply since early in the second

quarter of 1965. The monetary authorities have taken several steps of a restrictive nature during this period, and the liquidity positions of many corporations have tightened somewhat. Graduated withholding of individual income taxes which became effective May 1, 1966, is expected to have at least a slightly dampening effect on business investment outlays. The substantially increased possibility of more rapid general inflation in the U. S. economy due to the Vietnam military conflict and other factors has been widely discussed by economic prognosticators. Although the latest McGraw-Hill survey has shown that the capital outlay intentions of most business firms still point sharply upward, they appear to have been moderately scaled down more recently.[3] This scaling down seems to have been partially because of the Administration's "moral persuasion" policy, and also has resulted from order backlogs, price increases, and supply shortages in the capital equipment and construction areas. Comments by public officials about the possibilities of tax increases and a moratorium on the investment credit have undoubtedly heightened the degree of uncertainty in the business community as to the ultimate overall profitability that can be expected from new fixed investment. The preceding comments suggest the possibility that the funds provided by the tax incentive measures, which are generally considered

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[3] Ibid., pp. 37-38.

to be internal in nature, may currently be valued more highly than they were at the time of the field study. This possibility and the other findings of this study suggest the following conclusions regarding possible tax policy changes for the immediate future and in the long run.

First, the investment credit provision should not be discontinued unless the likelihood of general inflation increases substantially in the next several months. To discontinue the credit even temporarily could cut substantially into projected levels for investment outlays when plant capacities are already being heavily strained. A moratorium would probably undermine still further the business community's uncertainty in regard to "that tax gimmick." This increased uncertainty could definitely dampen future incentive influences even if the credit is subsequently restored. Such a result would be an inefficient allocation of national resources.

Second, as the possibility of inflation fades and the general economy moves toward an economic downturn, the following policies should be considered by the Administration to more firmly entrench the investment credit as an incentive measure in the U. S. business community.

(1) The 25% restriction on the annual allowable investment credit and the related carryforward provision should be eliminated.

(2) The provision should be broadened to include assets other than those defined under Code

Section 38 to eliminate discrimination against certain kinds of capital projects.

(3) The absolute size of the credit should be increased.

These recommendations probably could not be implemented all at the same time because of Federal budgetary constraints, but they would overcome most of the uncertainty and criticism surrounding the investment credit provision that was found in the field study if implemented gradually over a period of time.

Third, substantial modification or elimination of the reserve-ratio test should be considered after the probability of general inflation has subsided. This action would remove the primary reservation of the business executives in the study toward the true incentive nature of the guideline system. Again, the expectational effects as to when and how the reserve-ratio test might be implemented have probably caused much of the lack of enthusiasm found in many firms for the guidelines as an important incentive.

Fourth, the corporate tax rate should not be increased even temporarily if such a policy can be avoided. A substantial amount of inertia and skepticism surrounded the expectations regarding the likelihood of the recent rate reduction and of its ultimate incentive influences. To restore the rates to the levels that had long been considered oppressive, and from which relief had been given up in many quarters, could quickly result in greater

uncertainties and lackadaisical attitudes of business executives toward incentive considerations in the investment decision-making process.

Finally, the operating loss carryforward provision should be made unlimited to prevent discrimination against certain firms and the distortion that may result on their published financial statements that was mentioned in Chapter V. Such a policy change would at least be a step in the direction of immediate tax rebates for operating losses that have been suggested in economic literature for quite some time.

In summary, the speeding-up process for corporate tax payments and graduated withholding for individuals should be given a chance to affect investment outlays, and the lagged effects of higher interest rates and other restrictive monetary policies should be given the opportunity to become operative before further policy changes are attempted. Restrictive fiscal policy changes should be considered with great caution lest the attempts of the past five years to cultivate a favorable investment climate be destroyed in a few short months because of temporary inflationary tendencies in the economy. Hasty action would undoubtedly give the business community additional reason for ignoring "those tax gimmicks."

APPENDIX A

MATHEMATICAL FRAMEWORK

The following symbols provide the basis for the mathematical framework utilized in this study.

- k represents the effective interest rate determined by discrete end-of-year compounding or discounting. This rate may represent the cost of capital of a firm or the internal yield on a project depending on the context in which it is used.
- t represents the time period or number of years involved in proposal evaluations.
- P designates a present sum of money. This sum usually represents the cost of an asset at the beginning of the initial period.
- R represents a single receipt or a series of receipts for (t) years.
- W designates a future sum or amount of wealth resulting from one or more receipts compounded to the end of some year (t) at interest rate (k).

The equations for the basic mathematical framework for this study are presented on the next several pages. These equations are based on the symbols listed above and are stated frequently in both mnemonic and algebraic form.

As the illustrations in Appendix B indicate, the mnemonic factors named in the following captions describe the process that takes place in making the actual calculations.[1] The alternative equations given and denoted (a) can be found in the literature of financial mathematics.

Single-Payment Compound-Amount Factor

$$(1)\quad W = P(SPCA\text{-}k\%\text{-}t) = P(1 + k)^t \qquad (1\text{-}a)$$

Equation (1-a) is frequently described as "the amount of one" in the literature of financial mathematics.

Single-Payment Present-Worth Factor

$$(2)\quad P = W(SPPW\text{-}k\%\text{-}t) = W\left(\frac{1}{(1 + k)^t}\right) \qquad (2\text{-}a)$$

Equation (2-a) is described as "the present value of one" in financial mathematics literature.

Sinking-Fund Deposit Factor

$$(3)\quad R = W(SFD\text{-}k\%\text{-}t) = W\left(\frac{1}{(1 + k)^t - 1}\right) \qquad (3\text{-}a)$$

Equation (3-a) is often referred to as "the uniform series that amounts to one" in the literature of financial mathematics.

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[1]For elaboration about the derivations and proofs of the equations presented for the basic framework in this thesis, see Norman N. Barish, Economic Analysis for Engineering and Managerial Decision-Making (New York: McGraw-Hill Book Company, Inc., 1962), pp. 49-60; and George A. Taylor, Managerial and Engineering Economy (Princeton, New Jersey: D. Van Nostrand Company, Inc., 1964), pp. 23-30.

Capital Recovery Factor

$$(4)\quad R = P(CR\text{-}k\%\text{-}t) = P\left(\frac{k(1+k)^t}{(1+k)^t - 1}\right) \qquad (4\text{-a})$$

Equation (4-a) is often referred to as "the uniform series that one will purchase" in the literature of financial mathematics. Alternative formulations that are used later in Appendix B are given in Equations (5) and (5-a).[2]

$$(5)\quad R = P(SFD\text{-}k\%\text{-}t) + Pk = P\left(\frac{k}{(1+k)^t - 1}\right) + Pk \qquad (5\text{-a})$$

Uniform-Series Compound-Amount Factor

$$(6)\quad W = R(USCA\text{-}k\%\text{-}t) = R\left(\frac{(1+k)^t - 1}{k}\right) \qquad (6\text{-a})$$

Equation (6-a) is frequently called "the compound amount of one per period" in financial mathematics literature.

Uniform-Series Present-Worth Factor

$$(7)\quad P = R(USPW\text{-}k\%\text{-}t) = R\left(\frac{(1+k)^t - 1}{k(1+k)^t}\right) \qquad (7\text{-a})$$

Equation (7-a) is often mentioned in financial literature as "the present value of an annuity of one."

The first seven equations in this appendix are expanded and modified in the following pages to provide the complete mathematical framework that is utilized in this thesis.

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[2]For a derivation of this alternative formulation, see Eugene L. Grant and W. Grant Ireson, Principles of Engineering Economy, 4th ed. (New York: The Ronald Press Company, 1964), p. 45.

Net Present Worth Measure

Equation (7) is restated below for the purpose of calculating the net present worth of an investment proposal that is expected to generate an even flow of net cash benefits after an initial outlay is made at time zero. In Equation (8) the cost of a proposal is denoted by (P), the expected net cash benefits by (R), and the discount rate by (k) for a given time period (t).

(8) NPW = R(USPW-k%-t) - P

Traditional Recovery Period Measure

Equation (9) indicates how the traditional recovery period can be measured when the annual net cash benefits (R) are expected to be uniform, and only the initial investment (P) is required to be recouped.

$$(9)\quad RP = \frac{P}{R}$$

Tax Saving Concept

The following symbols are utilized in many of the remaining equations in this appendix to show the influences of certain income tax considerations.

G represents gross cash benefits expected annually from capital projects.

O designates the expected annual amounts for cash disbursements for operating expenses related to (G).

Y represents taxable income expected to be earned each year.

r designates the tax rate charged annually against (Y).

D indicates the annual depreciation allowable for tax purposes.

T represents income taxes payable each year.

R designates net cash benefits expected for a year or series of years.

Equation (10) defines taxable income (Y) assuming depreciation is not a factor in the asset generating revenues.

$$(10) \quad Y = G - O$$

Federal income taxes (T) are determined annually by applying the tax rate (r) to taxable income as shown in Equation (11).

$$(11) \quad T = r(Y)$$

or

$$T = r(G - O)$$

Net cash benefits after taxes (R) can then be derived as shown in Equation (12).

$$(12) \quad R = G - O - T$$

or

$$R = G - O - tG + tO$$

or

$$R = (1 - t)(G - O)$$

However, when depreciation is taken into account in some of the examples in Appendix B, net cash benefits after taxes must be restated as follows in Equation (13).

$$(13)\quad R = (1 - t)(G - O) + t(D)$$

Sum-of-Years-Digits Depreciation

Equation (14) shows how to determine the amount of depreciation allowable by the SYD method for the first year of the tax life of an asset where (t) represents the tax life, (P) the initial investment cost, and (L) the expected salvage value.

$$(14)\quad D_1 = \left(\frac{2t}{t(t + 1)}\right)(P - L)$$

The annual allowable depreciation charge based on the SYD method declines by a uniform amount each year. This decline is determined by the following formula. The annual

$$(15)\quad d = \left(\frac{2}{t(t + 1)}\right)(P - L)$$

decline of (d) begins in year two with D_1 as calculated in Equation (14) serving as the initial base.

The present worth of the cash flow pattern that will result from the declining arithmetic gradient discussed in the preceding paragraph can be derived through the use of Equation (16). The annual gradient decrease in cash benefits is represented by (g) and the first year cash flow is symbolized by (Q) as follows.

$$(16)\quad NPW = Q(USPW\text{-}k\%\text{-}t) - g(GPW\text{-}k\%\text{-}t) - P$$

Declining-Balance Depreciation

The depreciation rate for any year (t) that is allowable under the declining-balance method is twice the straight-line rate or 2/n where (n) is the tax life of an asset. The rate 2/n is applied to the book value at the beginning of the year (t) in question. Equations (17) and (18) show these relationships where (D_t) is the amount of depreciation for a given year, (B) represents the book value of the asset, and (P) is the initial cost.

$$(17)\quad D_t = B_{t-1}(2/n)$$

$$(18)\quad B_t = P(1 - 2/n)^t$$

General Inflation Discount Factor

To consider the general rate of inflation in the discounting process the factor yielded by $\frac{1}{(1 + k)^t(1 + 1)^t}$ can be multiplied times any expected receipts (R). In the formulation (i) represents the expected rate of inflation for years (t) and (k) designates the cost of capital or discount rate in the absence of inflation. This approach to discounting for inflation is illustrated in the body of the thesis and the calculations are shown in Appendix B.

APPENDIX B

MATHEMATICAL CALCULATIONS

This appendix includes the most important basic calculations that are involved in the illustrations in the body of the thesis. Each illustration is restated and is keyed to the numbers utilized in the thesis. The equations in Appendix A are utilized to derive most of the calculations for the illustrations.

Illustration II-1

Assume a project requires an initial investment of $20,000 at time zero, that annual net cash benefits of $2,981 are expected for ten years, and that the cost of capital is estimated as 7%.

Net Present Worth

Equation (8) is utilized below to derive the net present worth (NPW) of the project.

(8) NPW = R(USPW-k%-t) - P

NPW = $2,981(USPW-7%-10) - $20,000

NPW = $2,981(7.0236) - $20,000

NPW = $20,937 - $20,000

NPW = $937.

Internal Yield

The internal yield is derived below for the project and is denoted by (k). The yield is approximated by linear interpolation as 8.04%, but the exact yield based on Equation (8) is 8%.

NPW = \$2,981(USPW-9%-10) - \$20,000

NPW = \$2,981(6.418) - \$20,000

NPW = \$19,131 - \$20,000

NPW = -\$869.

The NPW based on a 9% discount rate is negative, or -\$869. The yield is approximated by interpolating as follows.

$$k = 7\% + \left(\frac{\$20,937 - \$20,000}{\$20,937 - \$19,131}\right)(9\% - 7\%)$$

k = 7% + .52(2%)

k = 8.04% approximately

Uniform Annual Charge

The capital recovery variant of the UAC for Illustration II-1 is derived below and is based on Equation (4).

(4) R = P(CR-k%-t)

R = \$20,000(CR-7%-10)

R = \$20,000(.14238)

R = \$2,848.

Equation (5) was presented in Appendix A as an alternative formulation of Equation (4). The sinking fund variant of

the UAC approach can be calculated through the use of Equation (5).

(5) $R = P(SFD\text{-}k\%\text{-}t) + Pk$

$R = \$20,000(SFD\text{-}7\%\text{-}10) + \$20,000(.07)$

$R = \$20,000(.07238) + \$1,400$

$R = \$1,448 + \$1,400$

$R = \$2,848.$

Illustration II-2

Figure 2-1 in the body of the thesis presents data for two proposals currently being considered by a firm. Proposal G requires a current investment outlay of $220,000 and has an expected life of ten years. Net cash benefits after taxes amount to $10,000 in t_1 and are expected to increase each year by $10,000. Proposal H requires an outlay of $220,000 and has the same expected economic life as Proposal G. Benefits predicted for t_1 amount to $73,000, but are expected to decline each year by $8,000. Both assets have zero salvage estimates. A 50% income tax rate is anticipated for the ten-year period. Operating loss provisions are not assumed to be available for these proposals.

The internal yields on Proposals G and H are approximately 15% and 16.8% respectively as shown on the following page.

Proposal G

Equation (2) can be utilized to determine the internal yield on a proposal that has uneven flows such as Proposal G. By applying the 15% factor to each year's net cash benefits that have been shown in Figure 2-1, a total present worth of $219,983 results. Interpolation results in an internal yield of slightly less than 15%.

Proposal H

Equation (2) can also be utilized to derive the internal yield for the uneven cash benefits pattern that is expected for Proposal H.

By utilizing a discount rate of 15%, a total present worth for Proposal H of $230,535 results. By applying the single-payment present-worth factors for a 17% discount rate, a total wealth of $218,550 is found. By interpolating linearly between these two amounts as shown below, an internal yield of approximately 16.8% results.

$$k = 15\% + \left(\frac{\$230,535 - \$220,000}{\$230,535 - \$218,550}\right)(17\% - 15\%)$$

$$k = 15\% + \left(\frac{\$10,535}{\$11,985}\right)(2\%)$$

$$k = 15\% + (.879)(2\%)$$

$$k = 15\% + 1.758\%$$

$$k = 16.758\%$$

Illustration II-3

Assume the initial outlay expected for a new asset is $50,000 at time zero. Annual net cash benefits of $12,000 are expected for six years. A 10% cost of capital is assumed.

Traditional Recovery Period

By utilizing Equation (9) the traditional recovery period is shown to be 4.17 years.

$$(9)\quad RP = \frac{P}{R}$$

$$RP = \frac{\$50,000}{\$12,000}$$

$$RP = 4.17 \text{ years}$$

Progressive Recovery Period

The determination of a recovery period including a cost of capital charge (referred to as a progressive recovery period in the thesis) is facilitated by the use of Equation (4) which is restated below.

$$(4)\quad R = P(CR\text{-}k\%\text{-}t)$$

However, the number of years (t) is the unknown in this case rather than (R). The desired value of (t) can be found by calculating the capital recovery factor to multiply times the asset cost (P) to yield the known receipts (R). This calculation is shown on the following page.

$$\$12,000 = \$50,000(CR-10\%-t)$$

$$CR = \frac{\$12,000}{\$50,000}$$

$$CR = 0.24000$$

In the 10% table prepared by Taylor, this value of CR falls between five and six years.[1] Linear interpolation yields the following results.

$$t = 5 \text{ years} + \left(\frac{0.26380 - 0.24000}{0.26380 - 0.22961}\right) \quad (1 \text{ year})$$

$$t = 5 \text{ years} + .7 \text{ years}$$

$$t = 5.7 \text{ years}$$

Internal Yield

By interpolating between the present worths for 10% and 12%, a yield of approximately 11.5% is derived for Illustration II-3.

$$k = 10\% + \left(\frac{\$52,264 - \$50,000}{\$52,264 - \$49,337}\right) (12\% - 10\%)$$

$$k = 10\% + (.773)(2\%)$$

$$k = 11.546\%$$

All of the calculations on the following pages will follow a format similar to the one used above. However, some of the intermediate steps are eliminated gradually for the sake of brevity.

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[1] Taylor, p. 450. All of the factors used in the calculations in this appendix are based on the tables prepared by this author. See pp. 439-461.

Illustration III-2

Assume the net cash benefits for a proposal that requires an initial investment of $10,000 are estimated to amount to $2,013 for a period of eight years. The internal yield (k) is exactly 12% as shown below, since the factor for this rate equates the expected benefits with the $10,000 initial outlay and results in an NPW of zero.

Internal Yield Without Credit

(8) $NPW = R(USPW\text{-}k\%\text{-}t) - P$

$NPW = \$2,013(USPW\text{-}12\%\text{-}8) - \$10,000$

$NPW = \$2,013(4.9676) - \$10,000$

$NPW = \$10,000 - \$10,000 = 0$

thus

$k = 12\%$

Internal Yield With Credit

An internal yield of 14.2% is approximated below, and is based on the assumption of a 7% investment credit that is considered as a cash inflow at time zero. This assumption reduces the net initial investment to $9,300. The yield is derived by interpolating between the present worth of the cash benefits based on 12% and 15% discount rates, or $10,000 and $9,033 respectively. All subsequent yields will be approximated in a similar manner without additional elaboration.

$$k = 12\% + \left(\frac{\$10,000 - \$9,300}{\$10,000 - \$9,033}\right)(15\% - 12\%)$$

$k = 12\% + (.724)(3\%)$

$k = 12\% + 2.172\%$

$k = 14.172\%$

Recovery Periods Without Investment Credit

The traditional and progressive recovery periods are approximately 5.0 years and 7.5 years respectively without the investment credit. These periods are based on Equations (9) and (4) respectively as shown below.

(9) $RP = \frac{P}{R} = \frac{\$10,000}{\$\ 2,013} = 4.967$ years

(4) $R = P(CR\text{-}k\%\text{-}t)$ or \$2,013 $= \$20,000(CR\text{-}10\%\text{-}t)$

$CR = \frac{\$\ 2,013}{\$10,000} = 0.20130$

thus

$t = 7 \text{ years} + (\frac{0.20541 - 0.20130}{0.20541 - 0.18744})(1 \text{ year})$

$t = 7 \text{ years} + .52 \text{ years}$

$t = 7.52 \text{ years}$

Recovery Periods With Investment Credit

Following the same procedures as outlined above, the traditional and progressive recovery periods are roughly 4.6 years and 6.5 years respectively.

(9) $RP = \frac{P}{R} = \frac{\$9,300}{\$2,013} = 4.62$ years

(4) $R = P(CR\text{-}k\%\text{-}t)$ or \$2,013 $= \$9,300(CR - 10\%\text{-}t)$

$CR = \frac{\$2,013}{\$9,300} = 0.21645$

$t = 6 \text{ years} + (\frac{0.22961 - 0.21645}{0.22961 - 0.20541})(1 \text{ year})$

$t = 6 \text{ years} + .54 \text{ years}$

$t = 6.54 \text{ years}$

Illustration III-3

Assume the pre-tax cash flows for a project are expected to amount to $4,193. If these cash flows are reduced by a 52% income tax rate, the net cash benefits amount to $2,013. Assuming the same initial outlay of $10,000 and economic life of eight years as in the preceding illustration, the internal yield equals 12%. If the pre-tax flows are reduced by a 48% income tax rate, the after tax net cash benefits will amount to $2,180.

Internal Yield With Tax Reduction

An internal yield of 14.4% results from interpolating between the present worth figures below for 12% and 15% rates respectively.

$$k = 12\% + \left(\frac{\$10,829 - \$10,000}{\$10,829 - \$\ 9,782}\right)(15\% - 12\%)$$

$$k = 12\% + (.792)(3\%) = 12\% + 2.376\%$$

$$k = 14.376\%$$

Recovery Periods With Tax Reduction

The traditional and progressive recovery periods are 4.6 years and 6.5 years respectively, and the latter is based on a 10% cost of capital rate.

$$(9)\ RP = \frac{P}{R} = \frac{\$10,000}{\$\ 2,180} = 4.59 \text{ years}$$

$$(4)\ R = P(CR\text{-}k\%\text{-}t) \quad \text{or} \quad \$2,180 = \$10,000(CR\text{-}10\%\text{-}t)$$

$$CR = \frac{\$\ 2,180}{\$10,000} = 0.2180$$

$$t = 6 \text{ years} + \left(\frac{0.22961 - 0.21800}{0.22961 - 0.20541}\right)(1 \text{ year})$$

$$t = 6 \text{ years} + .48 \text{ years} = 6.48 \text{ years}$$

Illustration III-4

Assume that in 1961 a firm was considering the acquisition of an asset costing $14,300 that was expected to provide estimated annual cash benefits of $1,820. Assume further the income tax rate was 52%. A zero salvage value estimate was expected, and straight-line depreciation was to be used for tax purposes.

Internal Yield Without Guideline Depreciation

An internal yield of 8.1% results from the following interpolation between the present worth figures for an 8% and 9% discount rate respectively.

$$k = 8\% + \left(\frac{\$14,385 - \$14,300}{\$14,385 - \$13,616}\right)(9\% - 8\%)$$

$$k = 8\% + (.11)(1\%) = 8\% + .11\%$$

$$k = 8.11\%$$

Recovery Periods Without Guideline Depreciation

The recovery periods are 7.9 years and 11.8 years for the traditional and progressive measures respectively. The progressive measure is based on a cost of capital of 7%.

(9) $RP = \frac{P}{R} = \frac{\$14,300}{\$\ 1,820} = 7.9$ years

(4) $R = P(CR-k\%-t)$ or $\$1,820 = \$14,300(CR-7\%-t)$

$$CR = \frac{\$\ 1,820}{\$14,300} = 0.12722$$

$$t = 11 \text{ years} + \left(\frac{0.13336 - 0.12722}{0.13336 - 0.12590}\right)(1 \text{ year})$$

$$t = 11 \text{ years} + .823 \text{ years} = 11.823 \text{ years}$$

Internal Yield With Guideline Depreciation

An internal yield of 8.5% results on the project if it is assumed that the guideline procedures have just been made applicable and the tax life for the class to which the asset belongs has been shortened to eleven years. Cash benefits amount to $1,924 for the period t_1 through t_{11}, and $1,248 for t_{12} and t_{13}. The interpolation below is based on present worths for 8% and 9% respectively.

$$k = 8\% + \left(\frac{\$14,689 - \$14,300}{\$14,689 - \$13,944}\right)(9\% - 8\%)$$

$$k = 8\% + (.52)(1\%) = 8\% + .52\%$$

$$k = 8.52\%$$

Internal Yield With All Incentives

If the assumptions are made that the asset is eligible for the 7% investment credit and that the tax rate has been reduced to 48%, an internal yield of approximately 10.4% results as shown below. Cash benefits amount to $1,976 for the period t_1 through t_{11} and $1,352 for t_{12} and t_{13}. The $1,001 investment credit is assumed to be a cash inflow at time zero and thus reduces the outflow at that time to $13,299.

$$k = 10\% + \left(\frac{\$13,656 - \$13,299}{\$13,656 - \$12,025}\right)(12\% - 10\%)$$

$$k = 10\% + (.22)(2\%) = 10\% + .22\%$$

$$k = 10.44\%$$

Recovery Periods With All Incentives

The recovery periods are 6.7 years and 9.4 years for the traditional and progressive measures respectively. The latter approach is based on a cost of capital of 7%.

$$(9) \quad RP = \frac{P}{R} = \frac{\$13,299}{\$\ 1,976} = 6.73 \text{ years}$$

$$(4) \quad R = P(CR\text{-}k\%\text{-}t) \quad \text{or} \quad \$1,976 = \$13,299(CR\text{-}7\%\text{-}t)$$

$$CR = \frac{\$\ 1,976}{\$13,299} = 0.14858$$

$$t = 9 \text{ years} + \left(\frac{0.15349 - 0.14858}{0.15349 - 0.14238}\right)(1 \text{ year})$$

$$t = 9 \text{ years} + .44 \text{ years} = 9.44 \text{ years}$$

Illustration III-5

Assume a firm has $10,000 to invest in either of two capital-expenditure proposals. Proposal A will result in a net cash benefit at t_{10} of $30,600. Proposal B is expected to result in a net cash benefit at t_5 of $20,114. An 8% cost of capital rate is assumed initially.

Present Worth Without Investment Credit

By utilizing Equation (2) in Appendix A, the present worths of Proposal A and Proposal B are approximated below as $14,174 and $13,689 respectively.

Proposal A

(2) $P = W(SPPW\text{-}k\%\text{-}t) = \$30,600(.46319) = \$14,174.$

Proposal B

(2) $P = W(SPPW\text{-}k\%\text{-}t) = \$20,114(.68058) = \$13,689.$

Internal Yield Without Investment Credit

The internal yield is approximated below by interpolating between 10% and 12% for Proposal A, and amounts to 11.8%. The yield on Proposal B is exactly 15%.

Proposal A

$$k = 10\% + \left(\frac{\$11,798 - \$10,000}{\$11,798 - \$\ 9,852}\right)(12\% - 10\%)$$

$$k = 10\% + .924(2\%)$$

$$k = 11.848\%$$

Total Wealth Without Investment Credit

If the assumption is made that the $20,114 receipt expected from Proposal B at t_5 can be reinvested at 9% until t_{10}, the total wealth accumulated at that time would amount to $30,947. The amount is derived below by using Equation (1) and letting the $20,114 invested at t_5 represent (P) to accumulate to (W) in five years.

Proposal B

(1) $W = P(SPCA\text{-}k\%\text{-}t)$

$W = \$20,114(SPCA\text{-}9\%\text{-}5)$

$W = \$20,114(1.5386)$

$W = \$30,947.$

The total wealth expected from Proposal A is the cash receipt of $30,600 at the end of year ten.

Present Worth Using Two Discount Rates

The use of two cost of capital or discount rates is necessary for Proposal A to be comparable with Proposal B

at t_0. A present worth of $19,888 is derived for Proposal A at t_5 by discounting the $30,600 receipt at the assumed reinvestment rate of 9%. A present worth based on an 8% discount rate from t_5 back to t_0 amounts to $13,535.

Proposal A

(2) P = W(SPPW-k%-t) = $30,600(SPPW-9%-5)

thus

P = $30,600(64993) = $19,888

and

P = $19,888(SPPW-8%-5) = $19,888(.68058)

P = $13,535.

Total Wealth With Investment Credit

If a full 7% investment credit is considered to be available for Proposal A, the total wealth that can be accumulated at t_{10} amounts to $32,120. This amount is based on a $700 credit assumed to be reinvested at t_1 at a 9% rate. Two credits of $233 are considered to be related to Proposal B and if reinvested at t_1 and t_6 at 9% result in a total wealth of $31,782 as shown below.

Proposal A

(1) W = P(SPCA-k%-t) = $700(SPCA-9%-9) = $700(2.1719)

W = $1520.

The $32,120 total wealth estimate is derived by adding the amount that the investment will accumulate by t_{10}, or $1,520, to the $30,600 expected cash receipt at that time.

Proposal B

(1) W = P(SPCA-k%-t) = $?33(SPCA-9%-9) = $?33(?.1719)

W = $506.

and

(1) W = P(SPCA-k%-t) = $233(SPCA-9%-4) = $233(1.4116)

W = $329.

After adding the wealth accumulated from the two credits to the $30,947 calculated previously, the total wealth that can be expected from Proposal B at t_{10} is $31,782.

Illustration III-6

Assume an asset costing $220,000 is expected to generate net cash benefits before taxes and depreciation of $62,000 for a ten-year period. No salvage value is expected at t_{10} and a 48% income tax rate is estimated for the period. The net cash benefits that will be generated after taxes for the SYD, DDB, and straight-line depreciation methods are shown below.

	Net Cash Benefits After-Tax		
YEAR	SL	SYD	DDB
1	$42,800.	$51,440.	$53,360.
2	42,800.	49,520.	49,136.
3	42,800.	47,600.	45.757.
4	42,800.	45,680.	44,053.
5	42,800.	43,760.	40,891.
6	42,800.	41,840.	39,161.
7	42,800.	39,920.	39,161.
8	42,800.	38,000.	39,161.
9	42,800.	36,080.	39,161.
10	42,800.	34,160.	39,159.
Totals	$428,000	$428,000	$428,000

The internal yield on the asset if straight-line depreciation is utilized is approximately 13.8% and is derived below.

$$k = 12\% + \left(\frac{\$241,829 - \$220,000}{\$241,829 - \$205,813}\right)(15\% - 12\%)$$

$$k = 12\% + .606(3\%)$$

$$k = 13.82\%$$

If depreciation is calculated on the SYD basis, the first year writeoff will amount to $40,000 and is derived below through Equation (14). This amount declines each year by $4,000 which in turn results in an annual increase in taxes of $1,920 based in the 48% rate.

$$(14)\quad D_1 = \left(\frac{2t}{t(t+1)}\right)(P - L)$$

$$D_1 = \left(\frac{2 \times 10}{10 \times 11}\right)(\$220,000 - 0)$$

$$D_1 = 10/55 \times \$220,000$$

$$D_1 = \$40,000$$

The annual $4,000 decline in depreciation is calculated from Equation (15).

$$(15)\quad d = \left(\frac{2}{t(t+1)}\right)(P - L)$$

$$d = \left(\frac{2}{110}\right)(\$220,000 - 0)$$

$$d = 1/55 \times \$220,000$$

$$d = \$4,000.$$

Internal Yield

The internal yield on the asset is roughly 15.7% based on the SYD method of depreciation. The NPW is derived on the next page based on a 15% discount rate. Interpolation

between the present worths for 15% and 17% results in the yield mentioned.

(16) NPW = Q(USPW-k%-t) - g(GPW-k%-t) - P

NPW = \$51,440(USPW-15%-10) - \$1,920(GPW-15%-10) - \$220,000

NPW = \$51,440(5.0188) - \$1,920(16.979) - \$220,000

NPW = \$258,167 - \$32,600 - \$220,000

NPW = \$258,167 - \$252,600

NPW = \$5,567.

$$k = 15\% + \left(\frac{\$225,567 - \$220,000}{\$225,567 - \$209,519}\right)(17\% - 15\%)$$

k = 15% + .37(2%)

k = 15.7%

Total Wealth Measure

By utilizing Equation (6) and assuming a 15% annual reinvestment rate, the total wealth that can be accumulated by t_{10} if straight-line depreciation is used amounts to \$869,011.

(6) W = R(USCA-k%-t)

W = \$42,800(USCA-15%-10) = \$42,800(20.304)

W = \$869,011

An accumulation of wealth amounting to \$913,765 is possible if SYD depreciation is utilized. Each of the irregular cash flows resulting from this procedure can be compounded to t_{10} at 15% by using Equation (1).

Depreciation allowable for the first year of the asset's life under the declining-balance method amounts to $44,000. Based on Equation (17) the amount is 2/10 of the book value at t_0 of $220,000. The depreciation charge decreases, and consequently the tax outlays increase, by a geometric gradient through t_5. Since the tax authorities allow a switch to the straight-line method at the time it proves advantageous, the depreciation for the last five years amounts to $14,418 annually. The cash benefits pattern shown earlier for the DDB method result in an internal yield of approximately 15.3% as shown below.

$$k = 15\% + \left(\frac{\$224,941 - \$220,000}{\$224,941 - \$209,169}\right)(16\% - 15\%)$$

$$k = 15\% + .3(1\%)$$

$$k = 15.3\%$$

Reinvestment of the tax savings resulting from DDB depreciation for the asset being considered would accumulate to approximately $907,931 at t_{10}. Once again, the compound amount factor derived from Equation (1) for each year would need to be applied to the uneven cash flows to determine the total wealth for the asset.

Illustration IV-1

Assume an asset costing $100,000 has an expected economic life of 20 years, but the guideline life for tax purposes is 10 years. Further assume a salvage value of $10,000 is anticipated at t_{20} and that a 12% cost of capital

rate is expected to exist for the firm in question. The income tax rate is assumed to be 48%.

Equation (2) indicates the present worth of the $10,000 salvage value amounts to $1,037 at t_0.

(2) P = W(SPPW-k%-t)

P = $10,000(SPPW-12%-20) = $10,000(.10367)

P = $1,037.

If straight-line depreciation is used, the annual tax saving that would occur if the salvage value could be depreciated under Code Section 167 (f) amounts to $480, or ($10,000/10)(.48). The present worth of this stream of tax savings amounts to $2,712 as shown below utilizing Equation (7).

(7) P = R(USPW-k%-t)

P = $480(USPW-12%-10) = $480(5.6502)

P = $2,712.

If SYD is the depreciation method used, the first year depreciation resulting from the $10,000 salvage value is $1,818. Based on Equation (14) the amount is derived by multiplying 2/21 times $10,000. The annual decline in depreciation can be derived by using Equation (15) and amounts to $182. The present worth of the tax savings resulting from the arithmetic gradient approach shown in Equation (16) is $3,162. If a 12% reinvestment rate is assumed, the total wealth that would accumulate at t_{20} based on Equation (1) being applied to each of the decreasing amounts of depreciation

shown below will equal $30,511. This amount is in contrast to the $10,000 available from the expected salvage.

YEAR	SYD DEPR.
1	$1,818.
2	1,636.
3	1,454.
4	1,272.
5	1,090.
6	908.
7	726.
8	544.
9	362.
10	190.
Salvage Depreciated	$10,000.

Illustration IV-2

Assume a machine costing $100,000 was acquired on January 1, 1960, and was expected to prove useful and be depreciated over 10 years. Assume further that the double declining-balance method has been used to depreciate the asset for tax purposes and that it is sold for $70,000 on December 31, 1965.

Based on Equations (17) and (18) the total amount of depreciation through 1965 is $73,786, and the post-1961 depreciation amounts to $37,786. The asset's adjusted basis is $26,214, or $100,000 minus $73,786. The recomputed basis is $64,000 as shown below. The total gain on the sale amounts

$26,214.	Adjusted basis
37,686.	Post-1961 depreciation
$64,000.	Recomputed basis

to $43,786 ($70,000 - $26,214) and is divided between an

ordinary gain of $37,786 and a Section 1231 gain of $6,000 as calculated below.

$64,000.	Recomputed basis
26,214.	Adjusted basis
$37,786.	Ordinary gain

$43,786.	Total gain
37,786.	Ordinary gain
$ 6,000.	Section 1231 gain

If the asset is sold for $45,000, the entire gain of $18,786 ($45,000 - $26,214) is taxable as ordinary income.

Illustration IV-3

Assume a building costing $1,000,000 was acquired on January 1, 1962, and was sold for $850,000 on December 31, 1965. If the expected life was 20 years and DDB depreciation procedures were used, the adjusted basis on the date of sale should amount to $656,100 ($1,000,000 - $343,900). The accumulated depreciation is based on Equations (17) and (18).

The total gain on the asset is $850,000 minus $656,100 or $193,900. Since the asset has been held 28 months beyond the 20-month provision under Code Section 1250, the total gain should be divided as follows.

$103,608.	Ordinary income (100% - 28% x $143,900)
90,292.	Section 1231 gain (remainder)
$193,900.	Total gain

The $143,900 represents the excess of DDB over straight-line depreciation ($343,900 - $200,000). If the

asset had been sold for $750,000, the total gain of $93,900 would have been divided as shown below.

$67,608.	Ordinary income (100% - 28% x $93,900)
26,292.	Section 1231 gain (remainder)
$93,900.	Total gain

Illustration IV-4

Assume a project is being evaluated which would require lease payments at the end of each of eight years that amount to $100,000. The project is expected to earn $200,000 annually before considering the lease payments and income taxes. The present worth of the lease payments at a 3% discount rate amount to $701,969 based on Equation (7). This amount is termed the "purchase equivalent" for the asset services involved. By considering each year's outlay for the lease as a "depreciation equivalent" a cash flow pattern can be hypothesized. These depreciation equivalents are shown on the next page in present worth terms, and when added together they equal the purchase equivalent. Annual earnings after lease payments and taxes amount to $52,000 ($200,000 - $100,000 - $48,000) if a tax rate of 48% is assumed.

By adding the $52,000 annual earnings figure to each of the depreciation equivalents the hypothetical cash flow pattern can be derived. This hypothesized flow pattern is directly comparable with the purchase equivalent, and will result in an internal yield of slightly less than 12% based on Equation (2) being applied to each cash flow.

(1)	(2)	(3)	(4)	(5)	(6)
Year	Rentals	PW of Depr. Equiv. @ 3%	Gross Earnings	After-Tax Earnings (4) - (2) x (52%)	Cash Flows (3) + (5)
1	$100,000	$ 97,087	$ 200,000	$ 52,000	$ 149,087
2	100,000	94,260	200,000	52,000	146,260
3	100,000	91,514	200,000	52,000	143,514
4	100,000	88,849	200,000	52,000	140,849
5	100,000	86,261	200,000	52,000	138,261
6	100,000	83,748	200,000	52,000	135,748
7	100,000	81,309	200,000	52,000	133,309
8	100,000	78,941	200,000	52,000	130,941
	$800,000	$701,969	$1,600,000	$416,000	$1,117,969

If the firm has the alternative of purchasing the asset for $640,000 the annual depreciation allowances would be $80,000. Thus, a net "savings" of $20,000 annually ($100,000 - $80,000) would occur if the asset is purchased. Based on a 48% income tax rate the savings would amount to $10,400, and when added to the allowable depreciation a net cash benefit would result each year amounting to $90,400. The rate that equates this annual cash benefit pattern with the $640,000 outlay is approximately 2.7% as shown below.

$$k = 2\% + \left(\frac{\$662,225 - \$640,000}{\$662,225 - \$634,582}\right)(3\% - 2\%)$$

$$k = 2\% + .7(1\%)$$

$$k = 2.7\%$$

This rate can be viewed as the incremental yield from buying rather than leasing the asset.

Illustration V-1

Assume an investment of $1,000 at t_0 is expected to result in a cash inflow at t_3 of $1,400. Further assume that the cost of capital in the absence of inflation is 7%, and the rate of anticipated general inflation is 3%. The actual rate to discount the $1,400 cash inflow is 10.21%, or (1.07)(1.03) - 1.000, and is based on the formulation in Appendix A. However, since tables are not usually prepared for fractions of a percent the discount factor for 10% is used as follows.

$$P = \$1,400(.75131)$$

$$P = \$1,052.$$

The $1,052 amount is the present worth of $1,400 expected at t_3 and is discounted for a 3% annual inflation rate and by 7% for the time value of money.

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