Seventh Edition

The Capital Budgeting Decision

Economic Analysis of Investment Projects

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Preface to the Seventh Edition

Recalls one former head of an office-equipment company controlled by Exxon: "Their MBA's came in and said, 'Give us your five-year plan.' Our long-range plan was where we'd have lunch tomorrow."

Laurie P. Cohen, The Wall Street Journal, *Monday, September 10, 1984*

This edition follows the direction of its predecessors. When the first edition was published in 1960, we were convinced that the net present value method was superior to other methods of making investment decisions. We still believe this. In the important area of uncertainty, however, our attitudes have undergone some changes that were first incorporated in the second edition. The greatest changes from the first edition will be found in the general method of incorporating uncertainty in the investment decision process and in the introduction of the strategic net present value concept.

We continue to advocate the net present value method. In practice, most projects are analyzed using an estimate of the expected cash flows. A risk adjustment is necessary. The risk adjustment should reflect all of the strategic aspects of the project. The most common procedure is to use a risk-adjusted discount rate. We attempt to point out the advantages and disadvantages of this approach. Even when using a risk-adjusted discount rate, it may not be appropriate to require all projects to earn a rate equal to the firm's average cost of capital. Some investments with internal rates of return greater than the firm's weighted average cost of capital may be acceptable. The average cost of capital is a useful concept in handling capital structure questions, but it is less useful in evaluating investment alternatives. However, it is simple to apply; thus, it is widely used in investment analysis.

Our preference is to use a default-free rate of interest to take the time value of money into consideration and to take risk into account separately, preferably by subtracting a dollar risk adjustment from the cash flows. This permits a more flexible approach. Some cash-flow components (such as tax shields) of an investment can be less uncertain than others (such as contribution margins).

Part I of the book has been extensively rewritten and rearranged. A new Chapter 2, "The Time Value of Money," has been inserted. Previously we relegated the basic elements of the time-value calculation to an appendix, but

now those who want the calculations explained more fully can use Chapter 2 for that purpose. The new Chapter 3 is a consolidation of the old Chapters 2 and 4, with some material contained in Chapter 4. We now explain the net present value method in one chapter with fewer distractions. Chapter 4 now introduces the internal rate of return as well as the widely used payback and return on investment. The material was previously contained in Chapters 2 and 3.

Chapter 5 considers mutually exclusive investments, which were previously covered in Chapter 3. Chapter 6 deals with the determination and uses of cash flows and the impact of income taxes. This material was previously covered in Chapters 6 and 7. All these changes were made at the suggestion of more than one reviewer, and having made the changes, we agree that it is a more logical sequence than the one contained in the sixth edition. It is useful to first explain time-value calculations, then the net present value method, compare net present value and other available capital budgeting methods, deal with the complexity of mutually exclusive investments, and then define and explain cash flows.

This edition differs from previous editions in the arrangement of material. All of the basic material is in Part I. Part II deals with various special aspects of capital budgeting, such as replacement decisions, leasing, and timing. Part III covers uncertainty. Some of the material on uncertainty is no more difficult than other parts of the book, but a few chapters in this section are more complex. The material has been designed so that a professor who wishes to deal with fundamentals of uncertainty early in the course can assign Part III immediately following Part I. Part IV contains cases. Suggestions for using the cases are contained in the solutions manual, which is available from the publisher to instructors who adopt the text. If students have used our *Financial Management for Decision Making* in a previous course, the instructor who does not want to review the basic elements of capital budgeting can begin with Part II of this text.

In this edition we introduce the term *strategic net present value* (*S-NPV*) to call attention to adjustments that need to be made to a basic present value calculation so that the net present value will more accurately reflect the value of the project. Some of these adjustments were not traditionally considered to be part of capital budgeting or were not given adequate emphasis.

The value of a project must take into consideration the flexibility that it provides management. One project may commit management to a definite course of action; another may provide flexibility by giving management the option of making decisions in the future when more information is available. Chapter 18 emphasizes the need to assign a value to this flexibility. We point out that option pricing theory (also known as contingent claims analysis) sometimes provides a method for valuing flexibility.[1] But even though any knowledgeable, careful manager already incorporates the basic concepts of S-NPV, it is very

[1] See S. P. Mason and R. C. Merton, "The Role of Contingent Claims Analysis in Corporate Finance," in *Recent Advances in Corporate Finance*, ed. E. I. Altman and M. G. Subrahmanyam, (Homewood: Irwin, 1985), pp. 7–54; and F. Black and M. Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, May 1973, pp. 637–659.

useful to acknowledge formally the necessity of considering all decision alternatives and of using option theory where appropriate and feasible.

Project evaluation must also take into account the competitive position of the firm undertaking the project. Forecasting future cash flows requires estimates of the future prices of inputs and outputs. The accuracy of such forecasts can be increased if the project analyst gives careful consideration to the nature of competition in the input and output markets and to the firm's position in that competitive picture. Frequently, firms develop a strategic plan designed to encourage expansion in favorable areas and discourage it in product lines that are considered to be unfavorable. The interrelations between strategic planning and project analysis need consideration.

The concept of strategic net present value is intended to emphasize the need to consider the value of flexibility and the value of competitive position, as well as the extent to which the firm can accurately forecast the cash flows from a project.

We present intuitive solutions to capital budgeting decisions in the early chapters. An understanding of this basic material will avoid certain types of errors in evaluating investments. Even though it will not give exact answers to all the types of complex problems that managers must solve, it will help improve decision making.

Professors who adopt the book are eligible to receive a disk containing Lotus 123 spreadsheets and a site license allowing them to distribute the material to their students. The disk includes problem assignments and suggests various ways in which the use of personal computers can be integrated with the teaching of capital budgeting. The spreadsheet assignments can be used to help the student develop skills in programming spreadsheets, or can be used by students with a minimal knowledge of Lotus to reduce the burden of calculations traditionally associated with studying capital budgeting. One spreadsheet is a sophisticated financial calculator, which includes the capability of producing present value profile graphs.

We wish to thank the many persons in government, academic, and business areas, as well as our colleagues Jerry Hass, Vithala Rao, and John McClain, who have raised questions and made suggestions that have advanced our thinking. In addition, we want to thank Rita Smidt for helping program the spreadsheets, and Philomena Curley and Barbara Guile for their cheerful assistance.

Extracts from
Preface to the First Edition

Businessmen and economists have been concerned with the problem of how financial resources available to a firm should be allocated to the many possible investment projects. Should a new plant be built? Equipment replaced? Bonds refunded? A new product introduced? These are all to some extent capital budgeting decisions to which there are theoretically sound solutions. The purpose of this book is to express the solution of the economist in the language of the business manager.

Decades ago, economists such as Böhm-Bawerk, Wicksell, and Irving Fisher laid the theoretical foundation for a sound economic approach to capital budgeting. In recent years the technical literature has contained articles (such as those by Dean, Solomon, Lorie, Savage, and Hirshleifer) that have significantly increased our understanding of what is required for sound capital budgeting decisions. However, these works have not been directed toward business managers and, until recently, the work of these men has had no perceptible influence on the way businessmen actually made capital investment decisions. Businessmen have tended to make capital budgeting decisions using their intuition, rules of thumb, or investment criteria with faulty theoretical foundations and thus have been likely to give incorrect answers in a large percentage of the decisions.

The purpose of this book is to present for an audience that may be completely unfamiliar with the technical literature on economic theory or capital budgeting a clear conception of how to evaluate investment proposals.

The authors are convinced that the "present-value" method is superior to other methods of evaluating the economic worth of investments that have been discussed in the business literature. They recognize that considerations other than that of economic worth are also important in making investment decisions. The early pages of the book show that "cash payback" and "return on investment" may give incorrect results. The "yield" or "investor's method" is shown to be inferior to the present-value method, especially where there are several alternative investments available. The explanation of the reasons for the inferiority of yield to present value is particularly timely, since popular business magazines have carried many articles praising the yield method without mentioning its important drawbacks.

The first four chapters present an over-all picture of the method of analysis advocated in this book that would be a suitable introduction for management at any level who need to be informed about the ideas involved in evaluating capital investments, but who are not directly involved in preparing investment evaluations. The remainder of the book elaborates on the basic description of the first four chapters and gives material that will assist a person in actually preparing the analysis of investments.

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APPENDIX TABLES

PART I

Capital Budgeting with Certainty

Sirs: The Indian who sold Manhattan for $24.00 was a sharp salesman. If he had put his $24 away at 6% compounded semiannually, it would now be $9.5 billion and could buy most of the now-improved land back.

S. Branch Walker, Stamford, CT. Life, August 31, 1959

In the first six chapters of this book we present a theoretically correct and easily applied approach to decisions involving benefits and outlays through time, that is, capital budgeting decisions. Essentially, the procedure consists of choosing a rate of discount that represents the time value of money and applying this rate of discount to future cash flows to compute their net present value. The sum of all the present values associated with an investment (including immediate outlays) is the net present value of the investment.

In these six chapters it is assumed that the case flows associated with an investment are known with certainty, that there are markets to borrow or lend funds at the rate of interest used in the time discounting, and that there are no constraints preventing the firm from using these markets. The objective of the discounting process is to take the time value of money into consideration, but it includes no adjustment for risk.

We advocate the use of the net present value method to evaluate investments both because of its simplicity and for its theoretical soundness. For many decisions, however, the internal rate of return method is equally effective.