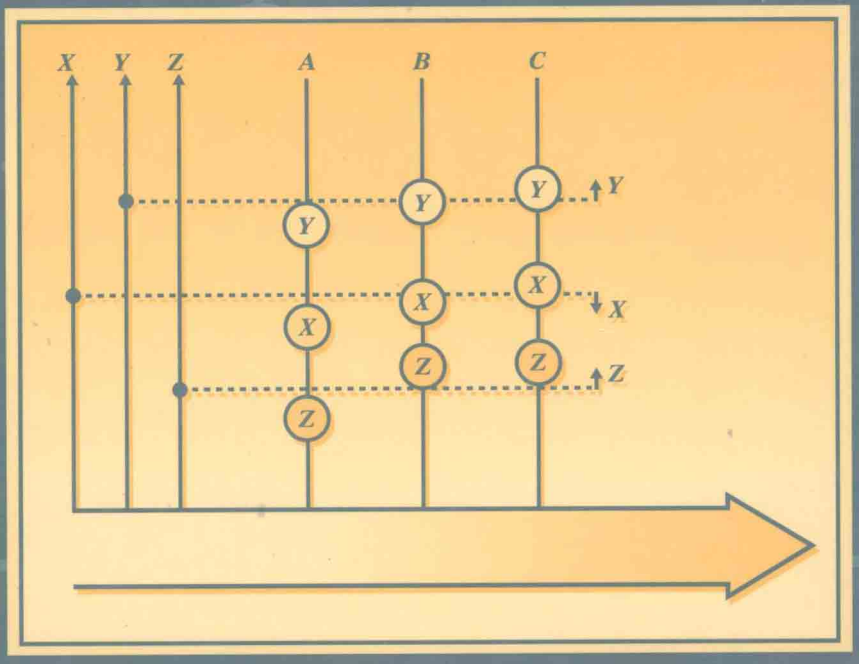
ECONOMIC DECISION ANALYSIS

THIRD EDITION



W. J. FABRYCKY • G. J. THUESEN • D. VERMA

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ECONOMIC DECISION ANALYSIS

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PREFACE

Matters of national and international economic concern, such as the deficit, taxation, inflation, and the balance of payments are subjects that often lead to considerable debate. However, when it comes to the economic analysis of specific internal operations within the business or industrial firm, the bases for disagreement seem to diminish. Much credit for this is due to the accumulated body of systematic knowledge about economic decision analysis developed by applied economists, management scientists, industrial engineers, operations researchers, and others.

The third edition of *Economic Decision Analysis*, like its predecessors, presents methods and analysis techniques for improving the economic outcome of managerial decisions in the face of other factors. The most important change over earlier editions is the explicit treatment of factors other than those easily reduced to economic terms. This is accomplished through a unique decision evaluation display that clearly incorporates multiple criteria. Another significant change is the partition of subject matter into topics essential to determining the economic difference between mutually exclusive alternatives and topics that place economic decision analysis solidly within the financial function of the firm.

This is an applied text intended for use by students in such college courses as business, industrial, or managerial economics; agricultural and forest economics; and engineering economics. It is also planned for use by business and industrial economists, management analysts, and technical staff personnel in business, industry, and government whose task is to assist with economic decision making. The observation that economic criteria are of primary importance in most decision situations provides ample justification for consideration of this subject matter by decision makers in professional practice, as well as decision makers in training.

Part I provides background material of a prerequisite nature. The four steps in formulating economic decisions precede a chapter devoted to basic economic concepts to lay a foundation for the quantitative material that follows. Because of the importance of estimating in decision analysis, an introductory chapter is devoted to the process of estimating economic elements followed later by methods for dealing with estimating errors.

Part II presents the fundamental methods for evaluating decision alternatives for both private and public enterprise. It includes the role of interest in economic equivalence and in the formulation of economic comparisons based on present worth, annual equivalent, rate of return, and payout criteria. Inflationary effects are treated in a separate chapter, as is the evaluation of asset replacement. The continuing emphasis on improving public decision making justifies the inclusion of a chapter on benefit-cost and cost-effectiveness analysis.

Part III consolidates financial, accounting, depreciation, and income tax considerations as they pertain to economic analysis. These topics are intended to help economic decision analysis become an integral part of the financial function and general decision making within the firm.

Part IV treats estimates, risk, and uncertainty and includes such topics as allowance for variance in estimates, sensitivity analysis, probability concepts in decision making, simulation methods, and several approaches to decision making under uncertainty. The availability and applicability of modern tools for dealing with risk and uncertainty is the primary motivation for including these topics.

Part V is devoted entirely to economic decision models. Beginning with a chapter on models and economic modeling, it progresses to break-even decision models of both the linear and nonlinear type. Economic optimization models are then presented for a variety of common situations requiring solutions for minimum or maximum values of economic decision variables.

Only a basic background in mathematics, equivalent to one course in college algebra, is needed for a successful study of this book. Knowledge of calculus would be helpful, but it is not essential for a conceptual understanding. Our objective is to give students and practitioners alike access to the methods and techniques of economic decision analysis not heretofore presented in a manner suitable for broad application.

Special credit should be given to all the students who have assisted us in refining our thinking about this subject matter and its manner of presentation. Without their helpful reactions, we would be unsure about its usefulness. We also want to thank Mrs. LaVonda Matherly for her excellent help with the tedious editorial and word processing tasks.

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CONTENTS

PART 1

Introduction

CHAPTER 1

FORMULATING ECONOMIC DECISIONS

Both individuals and enterprises pursue objectives in the face of limited resources. Accordingly, it is desirable to obtain the greatest output for a given input, that is, to operate at high efficiency. The search should not be for a fair or good opportunity for the use of limited resources, but for the best opportunity. The subject of this book is concerned with decision making for the efficient use of limited resources to satisfy human wants.

A good overview of economic decision analysis can be obtained by considering four essential steps in formulating economic decisions. These are the creative step, definition, conversion, and decision steps. Taken together, these steps constitute a systematic plan for the efficient use of limited resources that will aid in arriving at economically sound decisions.

1.1 CREATIVE STEP

When known opportunities fail to offer sufficient promise for the profitable use of limited resources, more promising opportunities are sought. People with vision are those who accept the premise that better opportunities exist than are known to them. Accompanied by initiative, this view leads to exploration, investigation, research, and similar activities aimed at finding better opportunities. In such activities, steps are taken into the unknown to find new opportunities and then to determine their value compared with known opportunities. These steps are creative in nature and are part of the challenging task of discovering new opportunities with the potential to satisfy human needs and wants.

Economic Opening. Opportunities are not made; they are discovered. The person who concludes that there is no better way makes a self-fulfilling prophecy. When the belief is held that there is no better way, a search for one will not be undertaken, and a better way will not be discovered.

The *creative step* in economic decision analysis consists essentially of finding an opening through a barrier of economic and physical limitations. When aluminum was discovered, uses had to be found that would enable it to be marketed, and means had to be found whereby its physical characteristics could be improved and its production cost reduced. The legality of collecting fees for regulating parking, as contrasted to making a charge for the use of parking space, was the factor on which exploitation of the parking meter depended.

Economic limitations are continually changing with the needs and wants of people. Physical limitations are continually being pushed back by the advance of science and technology. Consequently, new openings that reveal new opportunities are continually developing. For each successful venture, an opening through the barrier of economic and physical limitations has been found and exploited.

New Combinations of Facts. Any situation embraces groups of facts, some known and some unknown. The ingredients for new opportunities for profit must be fashioned from the facts as they exist.

Many successful ideas are simply new combinations of commonly known facts. The highly successful device called a skateboard is the result of combining two simple ideas. The wheels from skates and a small version of the board used in surfing were combined to make it possible for people to experience aspects of both skating and surfing. The exploiters of the resulting new combination are reported to have profited handsomely.

Some successful ideas are dependent on the discovery of new facts. New facts may become known through research or by accident. *Research* is effort consciously directed to the discovery of new facts. In *basic research*, facts are sought without regard for their specific usefulness, on the premise that knowledge will in some way contribute to human progress. *Applied research* is effort consciously directed to the discovery of new facts needed to solve a specific problem.