

Principles of Managerial Economics

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Preface

Principles of Managerial Economics is intended primarily for use in upper division and graduate coursework. The emphasis is on developing an understanding of the basic principles and concepts underlying the use of economic analysis in the process of making managerial decisions. Our main objective in developing the text itself was to write a book that is clearly written, easily understood, comprehensive in coverage, and theoretically sound in applications of theory to managerial decision making and practice.

Our experience is that undergraduate and graduate students come to courses in managerial economics with substantially different backgrounds in economics and certain types of quantitative methods. In addition, our experience is that graduate students with some background in economics and quantitative methods often require a review of their work in these areas of study because the work was not taken immediately preceding the course in managerial economics. For those reasons, *Principles of Managerial Economics* opens with three foundation chapters that are an introduction to or a review of the principles of supply and demand, optimization concepts and techniques, and regression analysis. We believe that the foundation material on quantitative methods is more than adequate for comprehending all remaining chapter material, including applications of basic mathematical and statistical methods and techniques that are covered in the following chapters. In almost all cases of quantitative usage, a narrative follows that explains or interprets such usage.

The heart of *Principles of Managerial Economics* lies in the body of material beginning with Chapter 5. Our plan is to develop comprehensive, although not encyclopedic, coverage of topics that are pertinent to the study of managerial economics. These topics include demand, forecasting, supply, pricing, profit, regulation, antitrust, and capital budgeting. Economic analysis is emphasized in each chapter, and applications to managerial decision making are also emphasized. As in the case of foundation chapters, each chapter is enriched with brief "boxed" articles, questions and problems intended to encourage discussion and practice with respect to analysis, methods, and techniques, as well as suggested reading with annotations for each item listed.

A number of people have influenced and contributed to the development of *Principles of Economics*. Among those who significantly influenced the underlying plan of development are John E. Filer, University of Mississippi; Ann R. Horowitz, University of Florida; and Dennis R. Murphy, Western Washington University. Those who read and reviewed part or all of the text material and whose thoughtful criticism greatly improved the final textbook are Robert M. Aududdell, Loyola

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We especially appreciated the encouragement and support of Linda Frascino, Acquisitions Editor for Economics and Finance, who worked actively with us to plan and develop this textbook. Her competence and integrity were unfailing from beginning to end. In addition, we appreciated Joan Foley, Production Editor, who worked as hard as we did in bringing the project to completion, and Gert Glassen, Supplemental Books Editor, who pushed us through completion of all three supplemental books that accompany our textbook.

The understanding and support of our wives, Mary Christine and Youngshin, were constant sustaining forces and sources of encouragement from the beginning to the end of the writing process. Our special gratitude to them cannot be expressed adequately and cannot be overstated.

J. Ronnie Davis Semoon Chang

Contents

	Preface	xi		Maximization and Minimization	67
				Profit Maximization: The Case	
1.	Introduction to Managerial			of One Product	70
	Economics	1		Profit Maximization: The Case	
				of Two Products	75
	Managerial Economics	3		Constrained Optimization	76
	Managerial Decision Making	5		Summary	84
	Uncertainty in Managerial Decision			Questions and Problems	86
	Making	6		Suggested Reading	88
	An Overview	6			
	Suggested Reading	7	4.	Elements of Regression	
				Analysis	89
2.	Principles of Supply and			Model Specification	90
	Demand	8		Estimation of an Inventory Model	93
	Scarcity and the Market System	9		Statistics of Reliability	99
	Market Demand	10		Multiple Regression	108
	Market Supply	21		Test of Assumptions	110
	Market Equilibrium	27		Presenting an Estimated Equation	113
	Price Ceilings and Price Floors	35		Summary	113
	Market Structures	41		Questions and Problems	113
	Summary	44		Suggested Reading	118
	Questions and Problems	45		Suggested Reading	110
	Suggested Reading	48	5	Demand Functions	119
	Suggested Reading	40	<i>J</i> .	Demana Functions	119
3	Optimization Concepts and			Demand Function	120
J.	Techniques	49		Estimating Demand Functions	124
	recunques	47		Estimating a Demand Function	
	A Review of Functions	50		for Airline Travel	129
	Slopes of Linear and Nonlinear			Common Practical Problems in	
	Functions	53		Estimating Demand Functions	132
	Rules of Differentiation: Functions			Graphing Estimated Demand	
	with One Independent Variable	57		Functions	133
	Differentiation: Functions with Two			Interpretation of Estimated	
	or More Independent Variables	63		Coefficients	136
	Derivatives and Partial Derivatives			The Houthakker and Taylor	
	of Higher Order	66		Empirical Estimates	138

	Summary	142	9.	Costs of Production	286
	Questions and Problems	143		E-villait and Invaligit Coats	287
	Suggested Reading	147		Explicit and Implicit Costs Short-Run Cost Functions	290
	8 8 25 15			Long-Run Cost Functions	300
6.	Demand Elasticities	148		Empirical Estimation of Cost	205
	Dries Electicity of Domand	150		Functions	305
	Price Elasticity of Demand	130		Learning Curves	310
	Price Elasticity and the Demand	157		Economic Order Quantity and	210
	Curve Price Elasticity and Total Revenue			Inventory Cost	318
	Cross Elasticity of Demand	164		Summary	323
	Income Elasticity of Demand	169		Questions and Problems	324
	•	172		Suggested Reading	327
	Advertising Elasticity of Demand	1/2		~	
	Empirical Estimates of Demand Elasticities	173	10.	Pricing Theory and	
		181		Market Structures	329
	Summary Questions and Problems	183		Profit Maximization	331
	Suggested Reading	187		Pricing in Perfectly Competitive	331
	Suggested Reading	107		Markets	336
				Pricing in Monopolistic Markets	347
7.	Forecasting Methods and			Pricing in Monopolistically	517
2 . 2	Techniques	188		Competitive Markets	358
	•			Pricing in Oligopolistic Markets	363
	Judgmental Techniques	190		Summary	369
	Time-Series Methods	194		Questions and Problems	371
	The Index of Leading Indicators	199		Suggested Reading	374
	Econometric Models	208		buggested Reading	571
	Corporate Forecasting	214	11	Duinium Obinatium Dunatium	
	Sales Forecasting	218	11.	Pricing Objectives, Practices,	27/
	Summary	221		and Analysis	376
	Questions and Problems	222		Pricing Objectives	377
	Suggested Reading	226		Cost-Plus Pricing	381
				Market Pricing, Penetration	
Q	Economics of Production	227		Pricing, and Price Skimming	385
0.	Leonomies of Production	441		Loss Leader, Predatory, and	
	Production Function	230		Limit Pricing	386
	Production with One Variable			Price Discrimination	387
	Input	232		Pricing Multiple Products	396
	Cobb-Douglas Production			Transfer Pricing	402
	Function	242		Summary	406
	Optimization in Production with			Questions and Problems	407
	Two (or More) Variable Inputs	249		Suggested Reading	412
	Linear Programming in Productio				
	Optimization	266	12	Basic Profit Analysis	413
	Summary	279			
	Questions and Problems	280		Profit Contribution	414
	Suggested Reading	285		Break-Even Analysis	417

	Degree of Operating Leverage	421	Cost of Capital	502
	Profit Norm Analysis	425	Evaluation of Proposed	
	Summary	428	Investments	509
	Questions and Problems	429	Summary	522
	Suggested Reading	432	Questions and Problems	524
			Suggested Reading	528
13.	Government Regulation of			
	Business and Antitrust		Appendix	529
	Policies	433	Student's t Distribution	530
	Government Regulation of		Five Percent Significance Points o	\mathbf{f}
	Business	435	d_L and d_U in Two-Tailed Tests	531
	Antitrust Laws and Policies	456	Present Value of \$1 Received at	
	Summary	479	Annual Interest i at the End of	
	Questions and Problems	480	Period n	532
	Suggested Reading	483	Present Value of a Stream of \$1	536
	8		Received at Annual Interest i	
14	Analysis and Planning of		for n Periods	536
17.	Capital Expenditures	485	Name Index	541
	Forecasting Cash Flows of a			
	Project	487	Subject Index	549

Contents

Chapter 1

Introduction to Managerial Economics

MANAGERIAL ECONOMICS
MANAGERIAL DECISION MAKING
UNCERTAINTY IN MANAGERIAL DECISION
MAKING
AN OVERVIEW
Suggested Reading

The *traditional* American business firm was an enterprise owned by an individual or a small number of individuals who operated a shop, mill, factory, bank, plantation, or other single operating unit. This type of firm normally handled only one economic activity, dealt in a single product line, and operated in only one geographic area. Generally, such firms were personally owned and managed enterprises. Some owners of these traditional enterprises hired salaried employees to administer or to help administer the operating unit. As the work within single operating units increased, these salaried managers even employed subordinates such as superintendents to supervise the work force. In this sense, therefore, some traditional enterprises employed managers whose activities were similar to those of lowest management in a modern business enterprise. As late as 1840, however, there were no middle managers who supervised the work of other managers and who in turn reported to senior executives who themselves were salaried managers. At that time, nearly all top managers were owners who were either partners or major stockholders in the enterprise that they managed.¹

By bringing several units under its control, the *modern* enterprise began to operate in different locations, engage in different types of economic activities, and handle different lines of goods and services. The activities of these units and transactions between these units became monitored and coordinated by salaried employees who were top and middle managers. The multiunit enterprise administered by a hierarchy of managers who monitored and coordinated the work of units under their control can be termed *modern*. Before 1840, such enterprises did not exist in the United States. By World War I, this type of firm had become dominant in many sectors of the American economy. "By the middle of the twentieth century," Alfred D. Chandler, Jr., points out, "these enterprises employed hundreds and even thousands of middle and top managers who supervised the work of dozens and often hundreds of operating units employing tens and often hundreds of thousands of workers." Even relatively small enterprises operating in local or regional markets had their top and middle managers. "Rarely in the history of the world," Chandler concluded, "has an institution grown to be so important and so pervasive in so short a period of time."

With the rise of the modern business enterprise and the ascendency of the manager, the need for management education also rose. American business education can be traced back to the early nineteenth century, but these private business colleges and trade schools were involved primarily in training clerks. The managerial and administrative aspects of business were largely ignored. By the 1800s, however, the need emerged for professional education in business administration and management. What are known today as business schools or colleges of business are typically dated from the establishment of the Wharton School of Finance and Economy, which was founded in 1881 at the University of Pennsylvania. Joseph Wharton's initial gift of \$100,000 was to be used to educate the young men of prominent families for careers

¹ Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, Mass.: Harvard University Press, 1977), p. 3. This introduction to the ascendency of management is indebted to Chandler's history of the modern business enterprise in the United States and the corresponding rise of "managerial capitalism." Chandler's book was awarded the Pulitzer Prize in history in 1978.

² Chandler, The Visible Hand: The Managerial Revolution in American Business, p. 3.

³ Chandler, The Visible Hand: The Managerial Revolution in American Business, p. 3.

in business. In 1912, the Wharton School was given autonomy and organized with its own dean and faculty. Before the end of the century, business schools were also established at the University of California and the University of Chicago, and these prototypes were quickly followed by business schools established at New York University, the University of Wisconsin, the University of Michigan, and the Amos Tuck School of Dartmouth College. The Harvard Business Graduate School was founded in 1908.⁴

The early demands of rapidly expanding industries and rising modern enterprises placed emphasis on entry-level skill development rather than on long-range administrative and management skills. Between World War I and World War II, business schools attempted to broaden the functional business perspective in production, marketing, and finance and to give added emphasis to managerial consideration. Analytical methods began to replace the descriptive techniques of previous periods. After World War II, the movement toward analysis continued. In part, the increasing emphasis on the development of basic problem solving and organizational skills recognized that, in the decades ahead, business would need a higher order of analytical ability as well as greater command over analytical techniques, greater capacity to deal with the external environment of business, and greater ability to cope with rapid change. In other words, by the 1980s, management education placed emphasis on the principles underlying the current and expected practice of business administration and management.⁵

The principles of economics and economic analysis are especially useful to managers at all levels of hierarchies found in modern business enterprises. In the business school curriculum of the 1980s, students take coursework in the *principles of economics* as part of their liberal education. In addition, undergraduate students who are preparing for careers in management usually take an upper-division course in *managerial economics*, which emphasizes the principles of economics that underlie managerial practice. The course is often called something other than managerial economics. At the graduate level of study, a course in managerial economics is now common in the curriculum of an MBA program. Courses in managerial economics at both undergraduate and graduate levels were developed in response to the need to introduce a higher order of applied economic analysis into programs of study leading to professional careers in management.

MANAGERIAL ECONOMICS

Managerial economics implies economic analysis used in the process of managerial decision making. In fact, managerial economics is often called business economics, although its principles and methods are also applicable to enterprises that are not organized as businesses as such. Managerial economics applies the principles and methods of economics to analyze problems faced by management of a business or other type of organization and to help find solutions that advance the best interests of such organizations. In this way, managerial economics is seen as being concerned

⁴ Paul S. Hugstat, *The Business School in the 1980s: Liberalism versus Vocationalism* (New York: Praeger, 1983), pp. 1–2.

⁵ Hugstat, The Business School in the 1980s: Liberalism versus Vocationalism, pp. 2 ff.

with objectives and choice among alternative means of furthering objectives. Managerial economics is directed at maximum achievement of organizational objectives.

The main body of economic theories, concepts, and methods applied in managerial economics is drawn from microeconomics. The prefix *micro* comes from the Greek *mikros*, meaning "small." **Microeconomics** is the branch of economics based on the economic behavior of relatively "small" units, such as an individual firm or household. Microeconomics deals with choices and decisions made by the most decentralized components of the whole economy. Microeconomic analysis is concerned with the factors that influence these choices and decisions made by individual consumers, workers, investors, owners, and managers as well as with the innumerable microeconomic choices and decisions that, in the aggregate, constitute the overall performance and accomplishment of the entire economy. Because of the importance of individual prices as a factor in microeconomic decisions, microeconomics is frequently called **price theory.**

An individual firm is not operated in a vacuum, however. A firm is operated in an environment that is not limited to market or industry conditions. Ultimately, a firm's operating environment is the economy, which both affects a firm's activities and is affected by the activities of all such firms. The overall economic environment, over which no individual firm has control, affects the price and availability of labor, materials, supplies, equipment, and other resources that firms use in production; the cost and availability of credit and other financing used in the operation and growth of a firm; and the firm's ability to sell its product(s) and thus generate its revenue from sales. The branch of economics that deals primarily with the analysis of the collective results of millions of individual economic decisions is macroeconomics. The prefix macro comes from the Greek makros, meaning "large." In general, macroeconomics deals primarily with the analysis of aggregates such as the national level of output and the absolute level of prices, whereas microeconomics deals with the analysis of the composition of output and the relative prices of various and different goods and services. Macroeconomics makes certain important contributions to managerial economics, but managerial economics draws more heavily from microeconomic theory, analysis, and methods.

Managerial economics also draws heavily on the decision sciences for techniques used in the analysis of alternative courses of action and in the evaluation of results obtained. Economic relationships can be expressed in mathematical form, which makes such relationships amenable to empirical testing or other modeling techniques. Optimization techniques are frequently used in the analysis of business problems. Optimization techniques constitute a process for determining the best possible solution to a given problem or the best alternative under consideration for a particular decision. The approach to optimality analysis is to determine the alternatives that are closest to meeting given objectives and thus to determine the decisions that are best or optimal. In this way, optimization techniques, particularly differential calculus and mathematical programming, are used to develop decision rules that can assist management in achieving a firm's established objectives.

In addition to optimization techniques, statistical techniques are used in the analysis of business problems. **Statistical techniques** are used to estimate relationships among the variables in a business problem. **Econometrics** uses economic measurements and statistical techniques to develop and test economic models that are constructed to

express and explain factors involved in economic relationships. An **econometric model** attempts to provide information pertinent to a managerial decision. The primary statistical technique used in econometric models is **regression analysis**, which is capable of handling multiple, simultaneous movements and interactions of several variables.

MANAGERIAL DECISION MAKING

Decision making is an integral part of managing an enterprise. On any given day, a manager might be faced with any number of problems requiring decisions. Students of managerial economics, therefore, should have a fundamental understanding of the decision process and a basic appreciation for the decision process as well. In a sense, managerial economics is a study of the economic context of decision making. Managerial economics deals particularly with economic decisions with respect to the demand for a firm's product(s), the costs of producing a firm's product(s), the pricing of a firm's product(s), the profits made from the production and sale of a firm's product(s), and the capital investments budgeted by a firm. Even though the decision process consists of several phases, however, managerial economics is directed mainly at determining consequences that result from alternative actions.

For the most complex and far-reaching problems and even for some simple problems, the decision process can be disaggregated into several phases. The process begins with *establishing objectives* if objectives have not already been established. Since decisions ultimately are made in the context of these objectives, the objectives themselves should be expressed in operational statements so that it can be determined whether a given decision advances or comes closer to the objectives than others. The second phase is *defining the problem* that makes a decision necessary. After all, the decision process is meant to find solutions for problems. The third phase is *identifying variables* and factors that are related to the problem. Variables that have potential impact on the problem and its solution must be considered, and hypotheses should be developed to explain relationships among these variables and their relationships to the problem. The fourth phase is *identifying alternative courses of action*. These alternatives represent possible decisions.

The fifth phase is evaluating the alternative courses of action. The collection and analysis of data in the process of evaluating alternatives are the central core of managerial economics. Some data are available within a firm, mainly in records kept in the accounting, production, marketing, finance, and personnel departments. Other data are available only externally from government, industry, or other sources. In any event, pertinent data and information are used with appropriate models to evaluate results expected from each possible decision. Appropriate methods of analysis and representative models are critical to business decision making. The evaluation of alternatives with proper analysis and models must be related to established objectives. The best alternative course of action is the one that achieves the goals determined by the established objectives or that comes closest to achievement of these goals.

The final phase of the decision process is *implementing the decision*. Once the alternative courses of action have been evaluated, a decision is made and the appropriate course of action is implemented. The progress of the implemented solution in advancing the established objectives must also be evaluated and monitored, however.

Although a decision is made to implement a course of action that is expected to attain a particular goal, changes may be appropriate from time to time in response to changes in conditions or in a firm's operating environment.

UNCERTAINTY IN MANAGERIAL DECISION MAKING

Business decisions usually consist of choices between alternative courses of action. Most of these decisions are made in an environment over which management has limited or even no control. **States of nature** is the general term that is used to designate such conditions. Decision making depends on the decision maker's knowledge of possible states of nature and how each alternative course of action might turn out under each possible state of nature. The decision maker's knowledge may be classified as either a state of certainty or a state of uncertainty. Each of these states of knowledge implies use of different techniques in decision making.

Decision making under certainty includes most problems related to theories of choice that arise in economics and other behavioral sciences. Certainty underlies classical applications of calculus, algebra, linear programming, and optimization models used in maximization and minimization problems. These techniques are used to find the highest value of some function such as profits or the lowest value of some function such as costs. The outcome of long-range decisions such as investment may be highly uncertain, however. Under conditions of uncertainty, expected values of each alternative can be incorporated into the decision-making process. **Expected values** are a form of weighted average in which the value of each possible outcome is multiplied by the probability of that outcome actually occurring and then summed for each alternative. Measures of risk based on expected values and other techniques are used in decision making under conditions of uncertainty. Decision making under uncertainty is particularly appropriate for evaluation of capital investment alternatives.

AN OVERVIEW

The approach to managerial economics that follows is basically conceptual. The emphasis is on the principles that underlie managerial economics. Although these concepts and principles are developed within the context of managerial applications,

⁶ In economic theory and literature, a distinction is often made between risk and uncertainty. Where a distinction is made, risk refers to situations in which the probabilities of future events are known objectively from prior experience over many trials. Uncertainty refers to situations where the probabilities are not known but can only be estimated. These latter situations are the case in practically all business decisions. For purposes of this discussion and in the remainder of this textbook, the two terms are used interchangeably. For the classic statement of the distinction between risk and uncertainty, see Frank H. Knight, *Risk*, *Uncertainty and Profit* (New York: Houghton Mifflin, 1921).

⁷ Optimization is merely introduced at this point in the textbook. For a systematic treatment of optimization concepts and techniques, see Chapter 3. These concepts and techniques are applied throughout the textbook. Basically, under conditions of certainty, the decision process involves the optimization (finding a maximum or minimum value) of some known objective, given certain known constraints.

8 The analysis and evaluation of alternatives under conditions of uncertainty are merely introduced at this point in the textbook. For a systematic treatment of decision making under uncertainty, see Chapter 14. Chapter 14 covers analysis and planning of capital expenditures. managerial economics is, in the final analysis, economics. The approach can be restated, therefore, as the economics applied in managerial practice.

The next three chapters are intended as foundation material. Chapter 2 is an introduction or review of the principles of supply and demand. Chapter 3 covers basic optimization concepts and techniques that are used from time to time in the remaining chapters. This chapter contains a review of essential mathematical concepts, including differential calculus. Chapter 4 covers basic regression analysis. This chapter is an introduction or review of the uses and interpretation of simple and multiple regression analysis.

The following part contains three chapters that deal with demand and forecasting. Chapter 5 introduces the concept of demand and demand functions. Estimation of demand functions is emphasized. Chapter 6 introduces demand elasticities. The managerial significance of demand elasticities is emphasized. Numerous empirical studies of demand elasticities are discussed. Chapter 7 covers forecasting methods and techniques.

The next part contains two chapters that deal with supply. Chapter 8 introduces the economics of production. Production concepts are covered. Optimization techniques, including linear programming, are covered. Chapter 9 introduces the costs of production. Cost concepts are covered, and empirical estimation of cost functions is emphasized.

The following part contains three chapters that deal with pricing and profit. Chapter 10 introduces pricing theory and market structures. The importance of market structure, which is a firm's market environment, is stressed. Economic models of pricing under various market structures are presented. Chapter 11 covers pricing objectives and practices. Chapter 12 introduces basic profit analysis.

The last part contains two chapters that deal with topics involved in the long-range planning horizon of a firm. Chapter 13 covers government regulation of business and antitrust policies. Chapter 14 introduces the analysis and planning of capital expenditures. Decision making under conditions of uncertainty is emphasized since the outcome of capital investments is unknown in almost all cases.

SUGGESTED READING

Baumol, William J., "What Can Economic Theory Contribute to Managerial Economics?" American Economic Review, 51 (May 1961), 142–146. A brief statement that a managerial economist can contribute economic analysis to a management group by virtue of knowledge of model building and the corresponding rich body of tools and techniques for dealing with the problems of a firm

Chandler, Alfred D., Jr., *The Visible Hand: The Managerial Revolution in American Business.* Cambridge, Mass.: Harvard University Press, 1977. A Pulitzer Prize—winning history of the rise of modern business enterprise and the ascendency of the manager.

Dean, Joel, Managerial Economics. Englewood Cliffs, N.J.: Prentice-Hall, 1951. A pioneering work that promoted managerial economics as a new branch of economic study.

Harris, Robert G., "The Values of Economic Theory in Management Education," *American Economic Review*, 74 (May 1984), 122–126. An interesting and critical discussion of the role of economics in management education and the values of economic theory.

Teece, David J., and Sidney G. Winter, "The Limits of Neoclassical Theory in Management Education," *American Economic Review*, 74 (May 1984), 116–121. An interesting and critical discussion of management problems and economic analysis.

Chapter 2

Principles of Supply and Demand

SCARCITY AND THE MARKET SYSTEM MARKET DEMAND

Law of Demand

An Empirical Example: Demand for Wheat Substitution and Income Effects Exceptions to the Empirical Law of Demand An Increase (or Decrease) in Market Demand

Quantity Demanded and Demand Changes in the Demand for Wheat

MARKET SUPPLY

Law of Supply

An Empirical Example: Supply of Wheat An Increase (or Decrease) in Market Supply

Quantity Supplied and Supply Changes in the Supply of Wheat

MARKET EQUILIBRIUM

A Graphical Analysis of Market Equilibrium for Wheat

An Algebraic Analysis of Market Equilibrium for Wheat

The Effect of Demand and Supply Shifts on Market Equilibrium Increase in Demand (Constant Supply) Decrease in Demand (Constant Supply)
Increase in Supply (Constant Demand)
Decrease in Supply (Constant Demand)
Simultaneous Increases in Demand and
Supply

Simultaneous Decreases in Demand and Supply

Simultaneous Increase in Demand and Decrease in Supply

Simultaneous Decrease in Demand and Increase in Supply

PRICE CEILINGS AND PRICE FLOORS

Price Ceilings Price Floors

MARKET STRUCTURES

Monopoly
Oligopoly
Monopolistic Competition
Perfect Competition

SUMMARY

Questions and Problems Suggested Reading We often refer to physics as a natural science. By this, we mean that physics is a science that deals with a certain aspect of nature. The aspect of nature that physicists study is matter and motion. Some physicists, for example, are committed to the study of atomic structure and contribute to theories and experimentation that deal with subatomic particles. These physicists have identified four forces in nature: gravity, electromagnetism, and the "strong" and "weak" nuclear forces. They suspect that a "unification theory" will be discovered to show that each of these four forces is simply a different way of looking at one basic underlying force. If the theory is articulated and is not falsified by experimentation, the meaning would be that there is a single physical force in nature that drives the whole universe. All of this comes from a science that deals with a limited but central aspect of nature: matter and motion.

SCARCITY AND THE MARKET SYSTEM

Economics also deals with a limited but central aspect of nature: **scarcity**. Of itself, nature is niggardly relative to human needs and wants. Without the application of human labor and tools, nature rarely provides even the necessities of life in the form and quantity required. Societies do not have the means to achieve all economic objectives simultaneously and fully. The central fact of economics is scarcity of the means of production relative to the goods and services for which people express a need or desire.

If a society of people does not have the means to produce all that it needs or wants, **choice** is necessary. It must be understood that choosing to build more schools and day care centers means choosing to produce less of other things such as microcomputers and automobiles. The necessity of choice implies **cost**. The cost of using raw materials, skilled and unskilled labor, plant and equipment, and energy to produce microcomputers is forgoing the opportunity to use those resources to produce something else, say, food processors, baseball bats, or submarines. For this reason, the cost implied by choice is often called **opportunity cost**.

Because of scarcity, every society has a mechanism for making certain basic choices. Societies must decide *what* goods and services are produced, *how much* of each kind of good and service to produce, *how* to produce these goods and services, and *who* receives the goods and services produced.

In a market system, choices and decisions are made at a decentralized level without any central authority to impose order. Yet, there is observed economic order. Decisions are made by individual producers and consumers who are led by their own motivations to strive toward achievement of their own objectives. The force that motivates behavior in the household or consuming sector is the desire to satisfy wants. The business or producing sector is motivated by the desire to realize profits from