

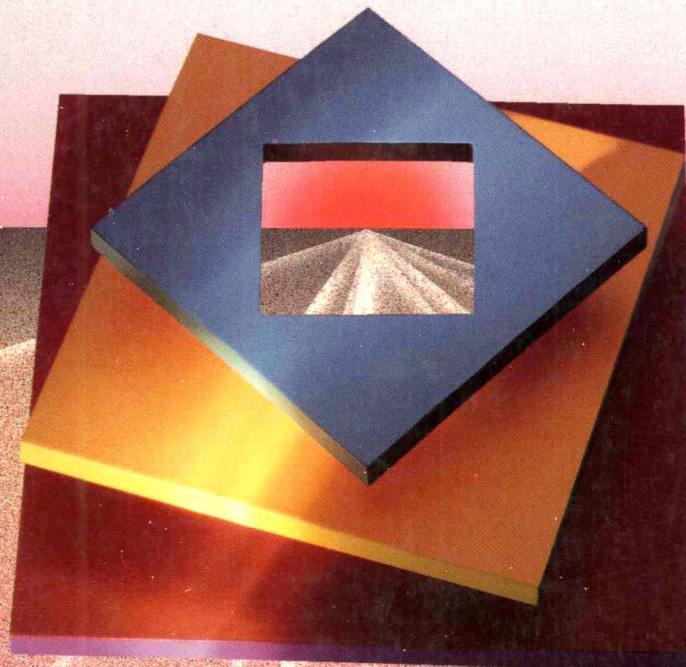
STUDY GUIDE

DAVID E. SPENCER

# MACROECONOMICS

SECOND EDITION

MICHAEL PARKIN





STUDY GUIDE

PARKIN

# MACROECONOMICS

SECOND EDITION

**DAVID E. SPENCER**

Brigham Young University



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# PREFACE: TO THE STUDENT

My objective in preparing this *Study Guide* to accompany *Macroeconomics, Second Edition*, by Michael Parkin is to help you master course material in order to do well on examinations. If that objective is realized, you will not only achieve a higher grade in the course but you will develop a deeper understanding of economics and the many economic issues that play such an important role in all our lives.

A study guide, however, is not a substitute for the text. Before you approach a chapter in the *Study Guide*, you should carefully read the corresponding chapter in the text. The major purpose of this *Study Guide*, then, is to *reinforce* and *deepen* your understanding of economics, not to initiate that understanding. I have tried to keep that purpose sharply in focus as I have prepared each chapter. Each chapter of the *Study Guide* contains two parts. The first part contains four sections intended to enhance your individual study effectiveness while the second part consists of several self-test sections followed by answers to all the self-test questions. Let's take a look at the basic content of each chapter by discussing each of these sections.

## CHAPTER CONTENTS

**Chapter in Perspective:** As students proceed from chapter to chapter through the text, they frequently get bogged down in the detail and lose sight of the broader picture. The purpose of this first section of each *Study Guide* chapter is to put each chapter of the text into perspective by indicating how it relates to preceding and following chapters and by highlighting some of the central issues that are examined.

**Learning Objectives:** This section simply repeats the learning objectives from the text. As you work through each chapter of the *Study Guide*, it would be a good idea to ask

yourself if you have achieved each of these objectives.

**Helpful Hints:** When you encounter difficulty in mastering concepts or techniques, you will not be alone. Many students find certain concepts difficult and often make the same kinds of mistakes. A major purpose of this section is to help students avoid these common errors. An additional purpose is to highlight or supplement the text's discussion of key concepts.

**Key Figures and Tables:** Each chapter of the text contains numerous figures and tables but not all are equally important. Some are designated as "key" figures or tables and identified in the textbook by a diamond-shaped icon. In this section each of these is discussed to help you focus your study on the most important diagrams.

**Self-Test:** Along with the Helpful Hints, this will be the most useful section of the *Study Guide*. The questions are designed to give you practice and to test the skills and techniques you must master to do well on exams. The Self-Test section contains five parts (listed below) and is followed by an Answer section.

**Concept Review:** This section contains simple "recall" questions designed to check your knowledge of the basic terminology and fundamental concepts of each chapter. These questions should build your confidence. This part is not a test of deep understanding, or mastery of analytical skills.

**True or False:** These questions test your basic knowledge of chapter concepts as well as your ability to apply these concepts. These are the first questions to challenge your understanding to see if you can identify mistakes in statements using basic concepts.

**Multiple Choice:** These more difficult questions test your analytical ability by asking you to apply concepts to new situations, to manipulate information, and to solve numerical and graphical problems. Since most examinations will consist mainly—if not exclusively—of multiple choice questions, these questions will provide useful practice.

**Short Answer:** Each chapter contains several short answer questions that ask about basic concepts and can generally be answered in a few sentences or a paragraph. Avoid the tendency simply to read the questions and think you know the answer. Writing down brief responses or answering the questions out loud in a study group will prove to be very beneficial.

**Problems:** The best way to learn economics is to do problems. Thus each self-test concludes with a collection of several numerical or graphical problems. In most chapters, this section will be the most challenging part of the Self-Test. It is also likely to be the most helpful in deepening your understanding of the chapter material. The problems are designed to teach as much as to test. They are purposely arranged so as to lead you through the problem-solving analysis in a gradual and sequential fashion, from easier to more difficult parts.

**Answers:** The Self-Test is followed by a section that contains the answers to all Self-Test items. I recommend that you complete the entire Self-Test before looking at the answers. Then, when you find a difference between your answer and the correct answer, return to the text chapter to correct or extend your understanding.

## SOME FRIENDLY ADVICE

The best way to ensure a good grade in your economics course is to develop a thorough understanding of economics, and that will require effort. There is no effective method short of that. With that in mind, let me offer some advice on how to develop such an understanding and how this study guide can help.

1. *Read the chapter in the text first.* Make a commitment to yourself at the beginning of the course that you will read the relevant chapter *before* your instructor lectures on it. You may be amazed at how your instructor's ability to teach improves if you come to class prepared. In this initial reading, note the concepts and issues that seem more difficult but don't concentrate on these yet. Your purpose at this point is to get a general understanding of the concepts and issues.
2. *Read the first four sections of the study guide chapter.* Study both the Helpful Hints and Key Figures and Tables sections especially carefully. They are intended first to help you identify which ideas and concepts are relatively more important and then to help you extend and deepen your understanding of them. Hopefully, some of the difficulties you noted in your first reading of the textbook chapter will be overcome by this process.
3. *Keep a good set of lecture notes.* Good lecture notes are vital for focusing your study. Your instructor will only lecture on a subset of topics from the textbook and those topics should usually be given priority when studying for exams.
4. *Return to the text.* After your instructor's lecture, read the chapter again, but this time for mastery of the detail. Use a pencil and paper to make notes and to work through the analysis of the text, especially when graphs are involved. By the end of this experience

you should have a thorough understanding of the material and be ready to test yourself.

5. *Complete the Self-Test sections of the study guide.* To test your understanding and to identify areas of weakness, complete the Concept Review, True or False, Multiple Choice, Short Answer, and Problem sections of the Self-Test. I recommend using a pencil to write your answers in the *Study Guide*. This will allow you to erase your mistakes and have neat, completed pages from which to study. I also recommend writing the answers to the Multiple Choice questions on a separate sheet of paper so that these questions can be freshly reviewed later.

Avoid the mistake of thinking that because your test will only contain multiple choice questions, you will not benefit greatly from completing the Short Answer and Problem sections. Indeed, these may be the most instructive exercises.

As you respond to the Short Answer questions, you will learn more if you will take the time *actually to write* brief responses rather than simply saying to yourself: "I know the answer to that one." The act of physically writing answers will reveal weaknesses of which you are yet unaware. This is at least as true for working through the Problems section. The problems are generally sequential and intended to guide you step-by-step through some important aspect of economic analysis. In many cases, your deepest learning will take place as you work these problems.

Once you have tested your understanding and identified areas where that understanding might be weak, you should review the relevant parts of the textbook chapter.

6. *Use your instructor and/or teaching assistants.* When you have questions about any concept, ask someone who can give you appropriate help. Depending on the arrangements at your university, your instructor or the teaching assistants assigned to your class are anxious to

respond to your questions and, indeed, expect you to ask them.

7. *Carefully prepare for each exam.* If you have followed the previous six suggestions, you are an unusually wise student and your preparation for exams will be much less frustrating than for many of your colleagues. In preparation for an exam, review your lecture notes as well as each chapter in the text paying special attention to the Review sections and to each Chapter Summary. For each chapter, take another look at the Helpful Hints and Key Figures and Tables sections of the *Study Guide*. Also, quickly review the sections of the Self-Test, *except* the Multiple Choice section. If you used paper and pencil as you previously worked through the Short Answer and Problems sections, your review will likely proceed more quickly. Then, as a final preparation, complete the Multiple Choice section of the study guide again. This time, however, be sure not only to know why the correct choice is correct, but also to see if you *know why each incorrect choice is incorrect*. If you can do this, you will be very well prepared.

If available, working old exams your instructor has given in previous years is an excellent additional preparation. In addition to providing useful practice, old exams give you a feel for the style of question your instructor may ask. Remember, though, that old exams are a useful study aid only if you use them to *understand* the reasoning behind each question. Do not try to memorize answers in the hope that your instructor will ask the same question again.

8. *Form a study group.* A very useful way to motivate your study and to learn economics is to discuss the things you are learning with other students. As you discuss concepts and issues *aloud*, your understanding will deepen and your areas of weakness will become apparent. When you answer a question in your head only, you often skip steps in the chain of reasoning without realizing it. When you are forced to explain your reasoning out loud,

gaps and mistakes quickly appear, and you (and your fellow group members) can readily correct your reasoning.

As you effectively use the textbook and study guide together, you will not only be well prepared for tests, but, more important in the long run, you will have developed analytical skills and powers of reasoning that will benefit you throughout your life.

## DO YOU HAVE ANY FRIENDLY ADVICE FOR ME?

I have attempted to make this *Study Guide* as clear and as useful as possible, and to avoid errors. No doubt, I have not been entirely successful. This study guide has been carefully checked for errors but, most likely some were not detected. If you discover errors or have other suggestions for improving the *Study Guide*, please let me know. Send your correspondence to

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## ACKNOWLEDGMENTS

One cannot teach bright and motivated economics students without learning much from them about how to do a better job. Thus, I am grateful to the many students I have had the privilege of knowing. I would also like to express appreciation to Barbara Rifkind, Marjorie Williams, Cindy Johnson, Kari Heen, Amy Willcutt, and Sarah Hallet Corey at Addison-Wesley Publishing Co. Above all, I am grateful to my wife, Jan, whose love and support, both direct and indirect, continue to be invaluable.

*Provo, Utah*

D.E.S.

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# 1 WHAT IS ECONOMICS?

## CHAPTER IN PERSPECTIVE

This first chapter introduces the *subject* of economics by briefly discussing what kinds of questions economics tries to answer and why these questions are interesting and important. The fundamental economic problem is scarcity. Because wants exceed the resources available to satisfy them, we cannot have everything we want and must make choices. This problem leads to economizing behavior — choosing the best or optimal use of the resources available. Economics, as a subject, is the study of how we use limited resources to try to satisfy unlimited wants.

This chapter also introduces the *method* of economics: how economists use economic theory and models to answer economic questions and to analyze and understand how people and economic systems cope with the fundamental problem of scarcity.

## LEARNING OBJECTIVES

*After studying this chapter, you will be able to:*

- **State the kinds of questions that economics tries to answer**
- **Explain why all economic questions and economic activity arise from scarcity**
- **Explain why scarcity forces people to make choices**
- **Define opportunity cost**
- **Describe the function and the working parts of an economy**
- **Distinguish between positive and normative statements**
- **Explain what is meant by an economic theory and how economic theories are developed by building and testing economic models**



## HELPFUL HINTS

1. The definition of economics (the study of how people use limited resources to satisfy unlimited wants) leads us directly to three important economic concepts—choice, opportunity cost, and competition. Since wants exceed resources, we cannot have everything we want and therefore must make *choices* among alternatives. In making a choice we forgo alternatives that we might have chosen and the *opportunity cost* of any choice is the value of the best forgone alternative. The fact that wants exceed resources also means that wants and individuals must *compete* against each other for the scarce resources.

2. Another fundamental point of this chapter is that economics is a science. It is important to understand that, like other sciences, economics seeks to enlarge our understanding of the world by constructing, examining, and testing *economic models*. Such models are highly simplified representations of the real world. Rather than making models less useful, this simplicity actually enhances their usefulness. By selectively abstracting from the less relevant complexity of the real world, economic models allow us to focus more clearly on those factors that are most important for the question under investigation.

Models are frequently compared to maps, which are useful because they "abstract from" real world detail. A map does not indicate every feature of the landscape (e.g., trees, streetlamps, etc.) but rather offers a simplified view, which is carefully selected according to the purpose of the map.

3. The most important purpose for studying economics is not to learn *what* to think about economics but *how* to think about economics. The "what" — the facts and descriptions of the economy — can always be found in books. The principal value of a course in economics is the ability to think critically about economic problems and to understand how the econo-

my works. This comes through the mastery of economic theory and model-building.

## KEY FIGURE

**Figure 1.1 A Picture of the Economy**

This figure illustrates the flow of goods and services as well as flows of money in the economy. There are three decision-making sectors (households, firms, and governments) and two groups of markets (goods markets and factor markets). Households supply factors of production to firms through factor markets for which they receive payment of wages, interest, rent, and profits. Firms supply goods and services to households through goods markets for which they receive money payments. Governments collect taxes from both households and firms and supply goods and services to both in addition to other benefits (transfer payments) to households and subsidies to firms.

## SELF-TEST

### CONCEPT REVIEW

1. The fundamental and pervasive fact that gives rise to economic problems is \_\_\_\_\_. This simply means that human wants \_\_\_\_\_ the resources available to satisfy them. The inescapable consequence is that people must make \_\_\_\_\_.
2. When we choose an action, the value of the best forgone alternative is the \_\_\_\_\_ cost of that action.
3. The process of evaluating the costs and benefits of our choices in order to do the

best we can with limited resources is called \_\_\_\_\_.

4. An economy is a mechanism that determines \_\_\_\_\_ is produced, \_\_\_\_\_ it is produced, and \_\_\_\_\_ it is produced.
5. The three groups of decision makers in the economy are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
6. Factors of production are classified under three general headings. The physical and mental resources of human beings are called \_\_\_\_\_, natural resources are called \_\_\_\_\_, and manufactured goods used in production (e.g., machines and factories) are called \_\_\_\_\_.
7. While all economies must have some way of coordinating choices, there are two fundamental mechanisms. The \_\_\_\_\_ mechanism relies on the authority of some kind of central planning, while the \_\_\_\_\_ mechanism relies on the adjustment of \_\_\_\_\_ in economic markets. A(n) \_\_\_\_\_ economy has elements of both of these fundamental mechanisms.
8. An economy that is economically linked with other economies in the world is called \_\_\_\_\_.
9. Statements about what *is* are called

\_\_\_\_\_ statements, while those about what *ought* to be are called \_\_\_\_\_ statements.

10. The branch of economics that studies the choices of individual households and firms is called \_\_\_\_\_, while the branch which studies behavior of the economy as a whole is called \_\_\_\_\_.

#### TRUE OR FALSE

- \_\_\_ 1. Scarcity is a problem only for capitalist (market) economies.
- \_\_\_ 2. Economics is the study of how to use unlimited resources to satisfy limited wants.
- \_\_\_ 3. Scarcity can be eliminated through cooperation.
- \_\_\_ 4. The notion of opportunity cost is illustrated by the fact that because Fred studied for his economics exam last night he was unable to see a movie with his friends.
- \_\_\_ 5. Competition is a contest for command over scarce resources.
- \_\_\_ 6. The opportunity cost of any action is the cost of all forgone alternatives.
- \_\_\_ 7. To economists, capital is the money used by businesses to buy assets.
- \_\_\_ 8. The pair of scissors a barber uses to cut hair is an example of capital as a factor of production.

- \_\_\_ 9. In an economy in which economic activity is coordinated by a command mechanism, the decisions of *what*, *how*, and *for whom* are the result of price adjustment.
- \_\_\_ 10. A mixed economy is one in which there is both internal and international trade.
- \_\_\_ 11. The U.S. is a pure market economy.
- \_\_\_ 12. In economics, a closed economy is one in which there is very limited economic freedom.
- \_\_\_ 13. The U.S. is an open economy.
- \_\_\_ 14. Careful and systematic observation and measurement are basic components of any science.
- \_\_\_ 15. Economics is not a science since it deals with the study of willful human beings and not inanimate objects in nature.
- \_\_\_ 16. "An increase in the income tax rate will cause total tax revenue to fall." This is an example of a positive statement.
- \_\_\_ 17. Science is silent on positive questions.
- \_\_\_ 18. A positive statement is about what *is*, while a normative statement is about what *will be*.
- \_\_\_ 19. One of the key assumptions of an economic model is that people make choices which they expect to make them as well-off as possible.
- \_\_\_ 20. Economic models are of very limited value in helping us understand the real world because they abstract from the complexity of the real world.
- \_\_\_ 21. Models are complete descriptions of reality.
- \_\_\_ 22. Microeconomic is concerned with the economy as a whole.
- \_\_\_ 23. Macroeconomics includes the study of the causes of inflation.
- \_\_\_ 24. Testing an economic model requires comparing its predictions against real world events.
- \_\_\_ 25. When the predictions of a model conflict with the relevant facts, a theory must be discarded or modified.

#### MULTIPLE CHOICE

- 1. The fact that human wants cannot be fully satisfied with available resources is called the problem of
  - a. opportunity costs.
  - b. scarcity.
  - c. normative economics.
  - d. what to produce.
- 2. The problem of scarcity
  - a. exists only in economies which rely on the market mechanism.
  - b. exists only in economies which rely on the command mechanism.
  - c. exists in all economies.
  - d. means that at least some prices are too high.
- 3. When the government chooses to use resources to build a dam, those resources are no longer available to build a highway. This illustrates the concept of
  - a. microeconomics.
  - b. macroeconomics.
  - c. opportunity cost.
  - d. optimizing.

4. Sally has the chance to either attend an economics lecture or play tennis. If she chooses to attend the lecture, the value of playing tennis is
  - a. equal to the value of the lecture.
  - b. greater than the value of the lecture.
  - c. not comparable to the value of the lecture.
  - d. the opportunity cost of attending the lecture.
5. The opportunity cost of getting a \$10 haircut is
  - a. the customer's best alternative use of the \$10.
  - b. the customer's best alternative use of the time it takes to get a haircut.
  - c. the customer's best alternative use of both the \$10 and the time it takes to get a haircut.
  - d. the value of \$10 to the barber.
6. All decision makers in an economy
  - a. coordinate choices between groups.
  - b. supply factors of production.
  - c. make choices.
  - d. produce goods or services.
7. Which of the following is an example of capital as a factor of production?
  - a. Money held by General Motors
  - b. A General Motors bond
  - c. An automobile factory owned by General Motors
  - d. All of the above
8. All of the following are factors of production *except*
  - a. government.
  - b. natural resources.
  - c. land.
  - d. labor.
9. A closed economy is one that
  - a. has strict government control of production.
  - b. has no economic links with other economies
  - c. maintains strict control of its borders.
  - d. is characterized by a dominant agricultural sector.
10. The U.S. economy is best described as a
  - a. closed economy.
  - b. market economy.
  - c. command economy.
  - d. mixed economy.
11. A normative statement is one about
  - a. what is usually the case.
  - b. the assumptions of an economic model.
  - c. what ought to be.
  - d. what is.
12. "The rich face higher income tax rates than the poor" is an example of
  - a. a normative statement.
  - b. a positive statement.
  - c. a negative statement.
  - d. a theoretical statement.
13. An economic model is tested by
  - a. examining the realism of its assumptions.
  - b. comparing its predictions with the facts.
  - c. the Testing Committee of the American Economic Association.
  - d. the detail of its descriptions.
14. Which of the following is NOT a key assumption of an economic model?
  - a. People have preferences.
  - b. People economize.
  - c. People are constrained by a given technology and a fixed amount of resources.
  - d. People's choices are not coordinated.



15. When economists say that people are rational, it means they
  - a. do not make errors of judgment.
  - b. make the best decision from their perspective.
  - c. act on complete information.
  - d. will not later regret any decision made now.
16. The branch of economics that studies the decisions of individual households and firms is called
  - a. microeconomics.
  - b. macroeconomics.
  - c. positive economics.
  - d. normative economics.
17. All of the following are microeconomic issues EXCEPT
  - a. wages and earnings.
  - b. distribution of wealth.
  - c. production.
  - d. unemployment.
18. Which of the following would NOT be considered a macroeconomic topic?
  - a. The reasons for a decline in the price of orange juice
  - b. The cause of recessions
  - c. The effect of the government budget deficit on inflation
  - d. The determination of aggregate income
5. Sarah takes five courses each school term. She is considering taking economics as her fifth course this term. If she decides to do so, what is the opportunity cost of taking the economics course?
6. What are the three broad classifications of factors of production? Give two examples of each.
7. Why is the U.S. economy considered to be mixed?
8. Is the following statement normative or positive? *Why?* "All college students should take an economics course."
9. How are economic models tested?

#### PROBLEMS

1. It takes one hour to travel from Boston to New York by airplane and five hours by train. Further, suppose that air fare is \$100 and train fare is \$60. Which mode of transportation has the lower opportunity cost for the following people?
  - a) A person who can earn \$5 an hour
  - b) A person who can earn \$10 an hour
  - c) A person who can earn \$12 an hour
2. Suppose the government builds and staffs a hospital in order to provide "free" medical care.
  - a) What is the opportunity cost of the free medical care?
  - b) Is it free from the perspective of society as a whole?
3. Indicate whether each of the following statements is positive or normative. If it is normative (positive), rewrite it so that it becomes positive (normative).
  - a) "The government ought to reduce the size of the deficit in order to lower interest rates."

#### SHORT ANSWER

1. What is meant by scarcity?
2. Why does the existence of scarcity mean that we must make choices?
3. Why will cooperation not eliminate scarcity?
4. What is meant by opportunity cost? What is the opportunity cost of spending two hours studying for an economics exam?

- b) "Government imposition of a tax on tobacco products will reduce their consumption."
4. Suppose we examine a model of plant growth which predicts that, given the amount of water and sunlight, the application of fertilizer stimulates plant growth. How might you test the model?

## ANSWERS

### CONCEPT REVIEW

1. scarcity; exceed; choices
2. opportunity
3. optimizing
4. what; how; for whom
5. households; firms; governments
6. labor; land; capital
7. command; market; prices; mixed
8. open
9. positive; normative
10. microeconomics; macroeconomics

### TRUE OR FALSE

- |      |       |       |       |       |
|------|-------|-------|-------|-------|
| 1. F | 6. F  | 11. F | 16. T | 21. F |
| 2. T | 7. F  | 12. F | 17. F | 22. F |
| 3. F | 8. T  | 13. T | 18. T | 23. T |
| 4. T | 9. F  | 14. T | 19. F | 24. T |
| 5. T | 10. F | 15. F | 20. F | 25. T |

### MULTIPLE CHOICE

- |      |      |       |       |       |
|------|------|-------|-------|-------|
| 1. b | 5. c | 9. b  | 13. b | 17. d |
| 2. c | 6. c | 10. d | 14. d | 18. a |
| 3. c | 7. c | 11. c | 15. b |       |
| 4. d | 8. a | 12. b | 16. a |       |

### SHORT ANSWER

1. Scarcity is the universal condition that human wants always exceed the resources available to satisfy them.
2. The fact that goods and services are scarce means that individuals cannot have all of everything they want. It is therefore necessary to choose among alternatives.
3. Scarcity is a problem of essentially infinite wants and limited resources. While cooperation is one way to organize our activity as we confront the problem of scarcity, it cannot eliminate it and therefore cannot eliminate economic problems.
4. Opportunity cost is the best forgone alternative (opportunity). The opportunity cost of spending two hours studying for an economics exam is the best alternative activity you would have chosen. This, obviously, will be different for different individuals. It might be attending the opera, watching TV, or sleeping.
5. The opportunity cost of choosing the economics course is the course Sarah would have chosen otherwise. If her *next* best choice is a sociology course, then that would be the opportunity cost.
6. *Labor*: the effort and skill of a carpenter, the ability of an actor.  
*Land*: trees, water.  
*Capital*: a tractor, a factory building.
7. The U. S. economy is a mixed economy because it relies on both the market and command mechanisms. Most coordination is carried out through the market mechanism, but there are many economic decisions which are either made by or regulated by the government.

8. The given statement, however wise, is normative because it is about what ought to (should) be rather than what is.
9. Economic models are tested by comparing the model's predictions with the facts of the real world. If the predictions of the model are in conflict with those facts, the model is rejected, otherwise we do not reject the model.

#### PROBLEMS

1. The point here is to recognize that the opportunity cost of travel includes the best alternative value of travel time as well as the train or air fare.
  - a) Thus, if the opportunity cost of the time spent traveling is the \$5 an hour that could have been earned (but wasn't), the opportunity cost of train travel (in dollars) is the \$60 train fare plus the \$25 (\$5 an hour times five hours) in forgone income for a total of \$85. In this case the opportunity cost of air travel is the \$100 air fare plus \$5 in forgone income, for a total of \$105. Therefore, for a person whose best alternative use of time is to earn \$5 an hour, the opportunity cost of traveling by train is less than the opportunity cost of traveling by air.
  - b) For a person who can earn \$10 an hour, the opportunity cost of train travel will be \$110 (\$60 fare plus \$50 in forgone earnings) and the opportunity cost of air travel is \$110 (\$100 fare plus \$10 in foregone earnings). In this case the opportunity costs are the same.
  - c) For a person who could have earned \$12 an hour the opportunity cost of train travel (\$120) exceeds the opportunity cost of air travel (\$112).
2. a) Even though medical care may be offered without charge ("free"), there are still opportunity costs. The opportunity cost of providing such health care is the best alternative use of the resources used in the construction of the hospital and the best alternative use of the resources (including human resources) used in the operation of the hospital.
  - b) These resources are no longer available for other activities and therefore represent a cost to society.
3. a) The given statement is normative. The following is positive:

"If the government reduces the size of the deficit, interest rates will fall."

  - b) The given statement is positive. The following is normative:

"The government ought to impose a tax on tobacco products."
4. The prediction of the model can be tested by conducting the following experiment and carefully observing the outcome. Select a number of plots of ground of the same size which have similar characteristics and will be subject to the same amount of water and sunlight. Plant equal quantities of seeds in all the plots. In some of the plots apply no fertilizer and in some of the plots apply (perhaps varying amounts of) fertilizer. When the plants have grown, measure the growth of the plants and compare the growth measures of the fertilized plots and the unfertilized plots. If plant growth is *not* greater in fertilized plots, we discard the theory (model).

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# 2 MAKING AND USING GRAPHS

## CHAPTER IN PERSPECTIVE

As a science, economics is characterized by systematic observation and measurement as well as the development of economic theory. In both of these components of economic science the use of graphs plays an important role.

Economic theory describes relationships among economic variables and graphs offer a very convenient way to represent such relationships. Indeed, the use of graphs allows us to economize in the sense that we are able to obtain much information with little effort. Graphs give a "picture" of the behavior of measured economic variables. Representing data graphically can be extremely useful for quickly conveying information about general characteristics of economic behavior.

As we will see in the next few chapters, graphical analysis of economic relationships is especially helpful when we are interested in discovering the theoretical consequences of a change in economic circumstances. Given the pervasive use of graphs in economics, this chapter reviews all the concepts and techniques you will need to construct and use graphs in this course.

## LEARNING OBJECTIVES

*After studying this chapter, you will be able to:*

- **Make and interpret a time-series graph and a scatter diagram**
- **Distinguish among linear and nonlinear relationships and relationships that have a maximum and a minimum**
- **Define and calculate the slope of a line**
- **Graph relationships among more than two variables**



## HELPFUL HINTS

1. The chapters of the text discuss numerous relationships among economic variables. Almost invariably these relationships will be represented and analyzed graphically. Thus an early, complete understanding of graphs will greatly facilitate mastery of the economic analysis of later chapters. Avoid the common mistake of assuming that a superficial understanding of graphs will be sufficient.
2. If your experience with graphical analysis is limited, this chapter will be crucial to your ability to readily understand later economic analysis. You will likely find significant rewards in occasionally returning to this chapter for review. If you are experienced in the construction and use of graphs, the chapter may be "old hat." Even in this case, the chapter should be skimmed and the Self-Test in this *Study Guide* completed. The main point is that you should be thoroughly familiar with the basic concepts and techniques of this chapter.
3. Slope is a *linear* concept since it is a property of a straight line. For this reason, the slope is constant along a straight line but is different at different points on a curved (nonlinear) line. When we are interested in the slope of a curved line, we actually calculate the slope of a straight line. The text presents two ways of choosing such a straight line and thus two alternative ways of calculating the slope of a curved line: (1) slope across an arc, and (2) slope at a point. The first of these calculates the slope of the *straight line* formed by the arc between two points on the curved line. The second calculates the slope of the *straight line* that just touches (is tangent to) the curve at a point.
4. Pay particular attention to graphing relationships among more than two variables.

## KEY FIGURES

### Figure 2.8 Positive Relationships

Variables that move up and down together are positively related. Three different positive relationships are illustrated in this figure. In each case, as the variable measured on the horizontal axis increases, the variable measured on the vertical axis also increases. Part (a) illustrates a positive linear relationship while parts (b) and (c) illustrate positive relationships that are not linear.

### Figure 2.9 Negative Relationships

This figure is a companion to Fig. 2.8 and illustrates negative relationships. Variables that move in opposite directions are negatively related. Three different negative relationships are illustrated in this figure. In each case, as the variable measured on the horizontal axis increases, the variable measured on the vertical axis decreases. Part (a) illustrates a negative linear relationship, while parts (b) and (c) illustrate negative relationships that are not linear.

### Figure 2.10 Maximum and Minimum Points

The relationship in part (a) reaches a maximum. As the variable measured on the horizontal axis increases, the value of the variable measured on the vertical axis increases, reaches a maximum at point *a* and then decreases. Similarly, the relationship in part (b) reaches a minimum at point *b*.

### Figure 2.11 Variables with No Relationship

If there is no relationship between two variables, changes in one will have no effect on the other. The two parts of this figure illustrate how we can represent such a lack of relationship. Part (a) illustrates the fact that changes in the variable measured on the horizontal axis leave the variable measured on the vertical axis unchanged. Part (b) illustrates that changes in the variable measured on the vertical axis leave the variable measured on the horizontal axis unchanged.