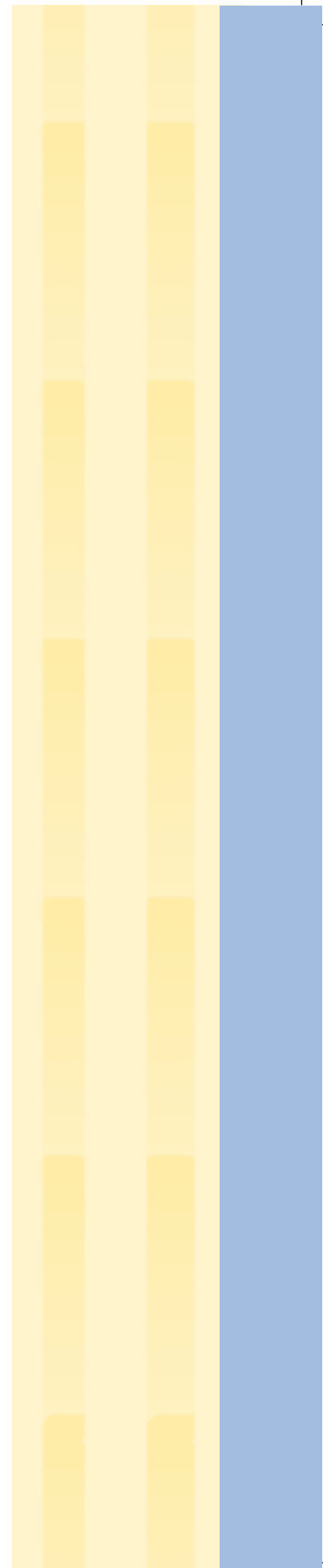


part I

Introduction



CHAPTER ONE

The Science of Macroeconomics

The whole of science is nothing more than the refinement of everyday thinking.

— Albert Einstein

1-1 What Macroeconomists Study

Why have some countries experienced rapid growth in incomes over the past century while others stay mired in poverty? Why do some countries have high rates of inflation while others maintain stable prices? Why do all countries experience recessions and depressions—recurrent periods of falling incomes and rising unemployment—and how can government policy reduce the frequency and severity of these episodes? Macroeconomics, the study of the economy as a whole, attempts to answer these and many related questions.

To appreciate the importance of macroeconomics, you need only read the newspaper or listen to the news. Every day you can see headlines such as INCOME GROWTH SLOWS, FED MOVES TO COMBAT INFLATION, or STOCKS FALL AMID RECESSION FEARS. Although these macroeconomic events may seem abstract, they touch all of our lives. Business executives forecasting the demand for their products must guess how fast consumers' incomes will grow. Senior citizens living on fixed incomes wonder how fast prices will rise. Recent college graduates looking for jobs hope that the economy will boom and that firms will be hiring.

Because the state of the economy affects everyone, macroeconomic issues play a central role in political debate. Voters are aware of how the economy is doing, and they know that government policy can affect the economy in powerful ways. As a result, the popularity of the incumbent president rises when the economy is doing well and falls when it is doing poorly.

Macroeconomic issues are also at the center of world politics. In recent years, Europe has moved toward a common currency, many Asian countries have experienced financial turmoil and capital flight, and the United States has financed large trade deficits by borrowing from abroad. When world leaders meet, these topics are often high on their agendas.



Although the job of making economic policy falls to world leaders, the job of explaining how the economy as a whole works falls to macroeconomists. Toward this end, macroeconomists collect data on incomes, prices, unemployment, and many other variables from different time periods and different countries. They then attempt to formulate general theories that help to explain these data. Like astronomers studying the evolution of stars or biologists studying the evolution of species, macroeconomists cannot conduct controlled experiments. Instead, they must make use of the data that history gives them. Macroeconomists observe that economies differ from one another and that they change over time. These observations provide both the motivation for developing macroeconomic theories and the data for testing them.

To be sure, macroeconomics is a young and imperfect science. The macroeconomist's ability to predict the future course of economic events is no better than the meteorologist's ability to predict next month's weather. But, as you will see, macroeconomists do know quite a lot about how the economy works. This knowledge is useful both for explaining economic events and for formulating economic policy.

Every era has its own economic problems. In the 1970s, Presidents Richard Nixon, Gerald Ford, and Jimmy Carter all wrestled in vain with a rising rate of inflation. In the 1980s, inflation subsided, but Presidents Ronald Reagan and George Bush presided over large federal budget deficits. In the 1990s, with President Bill Clinton in the Oval Office, the budget deficit shrank and even turned into a budget surplus, but federal taxes as a share of national income reached a historic high. So it was no surprise that when President George W. Bush moved into the White House in 2001, he put a tax cut high on his agenda. The basic principles of macroeconomics do not change from decade to decade, but the macroeconomist must apply these principles with flexibility and creativity to meet changing circumstances.

CASE STUDY

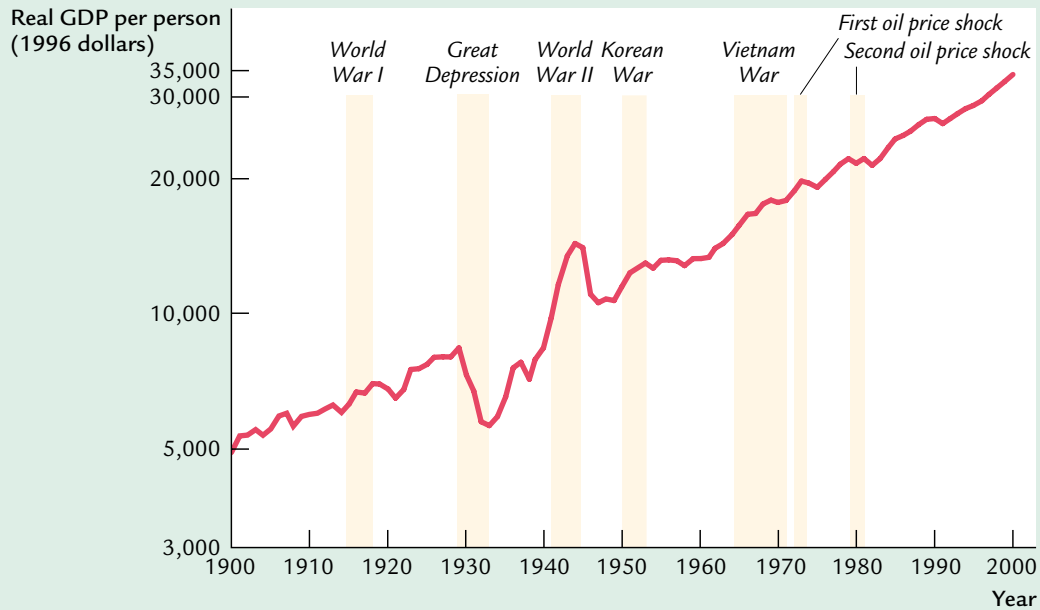
The Historical Performance of the U.S. Economy

Economists use many types of data to measure the performance of an economy. Three macroeconomic variables are especially important: real gross domestic product (GDP), the inflation rate, and the unemployment rate. **Real GDP** measures the total income of everyone in the economy (adjusted for the level of prices). The **inflation rate** measures how fast prices are rising. The **unemployment rate** measures the fraction of the labor force that is out of work. Macroeconomists study how these variables are determined, why they change over time, and how they interact with one another.

Figure 1-1 shows real GDP per person in the United States. Two aspects of this figure are noteworthy. First, real GDP grows over time. Real GDP per person is today about five times its level in 1900. This growth in average



figure 1-1



Real GDP per Person in the U.S. Economy

Real GDP measures the total income of everyone in the economy, and real GDP per person measures the income of the average person in the economy. This figure shows that real GDP per person tends to grow over time and that this normal growth is sometimes interrupted by periods of declining income, called recessions or depressions.

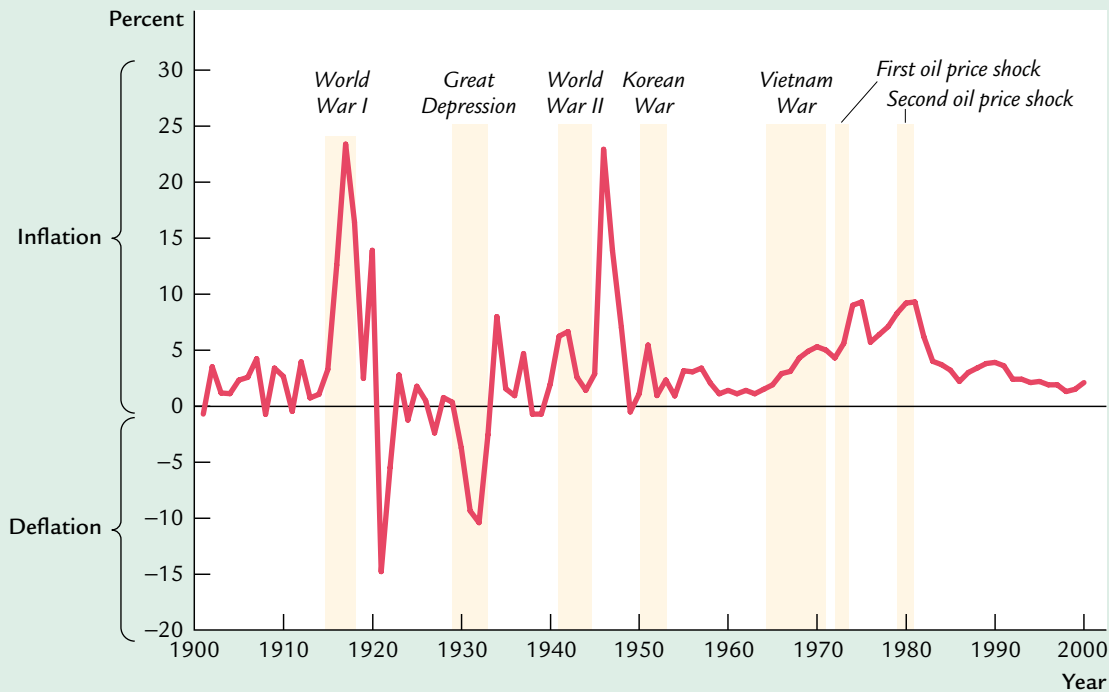
Note: Real GDP is plotted here on a logarithmic scale. On such a scale, equal distances on the vertical axis represent equal *percentage* changes. Thus, the distance between \$5,000 and \$10,000 (a 100 percent change) is the same as the distance between \$10,000 and \$20,000 (a 100 percent change).
Source: U.S. Bureau of the Census (*Historical Statistics of the United States: Colonial Times to 1970*) and U.S. Department of Commerce.

income allows us to enjoy a higher standard of living than our great-grandparents did. Second, although real GDP rises in most years, this growth is not steady. There are repeated periods during which real GDP falls, the most dramatic instance being the early 1930s. Such periods are called **recessions** if they are mild and **depressions** if they are more severe. Not surprisingly, periods of declining income are associated with substantial economic hardship.

Figure 1-2 shows the U.S. inflation rate. You can see that inflation varies substantially. In the first half of the twentieth century, the inflation rate averaged only slightly above zero. Periods of falling prices, called **deflation**, were almost as common as periods of rising prices. In the past half century, inflation has been the norm. The inflation problem became most severe during the late 1970s, when prices rose at a rate of almost 10 percent per year. In recent years,



figure 1-2



The Inflation Rate in the U.S. Economy

The inflation rate measures the percentage change in the average level of prices from the year before. When the inflation rate is above zero, prices are rising. When it is below zero, prices are falling. If the inflation rate declines but remains positive, prices are rising but at a slower rate.

Note: The inflation rate is measured here using the GDP deflator.

Source: U.S. Bureau of the Census (*Historical Statistics of the United States: Colonial Times to 1970*) and U.S. Department of Commerce.

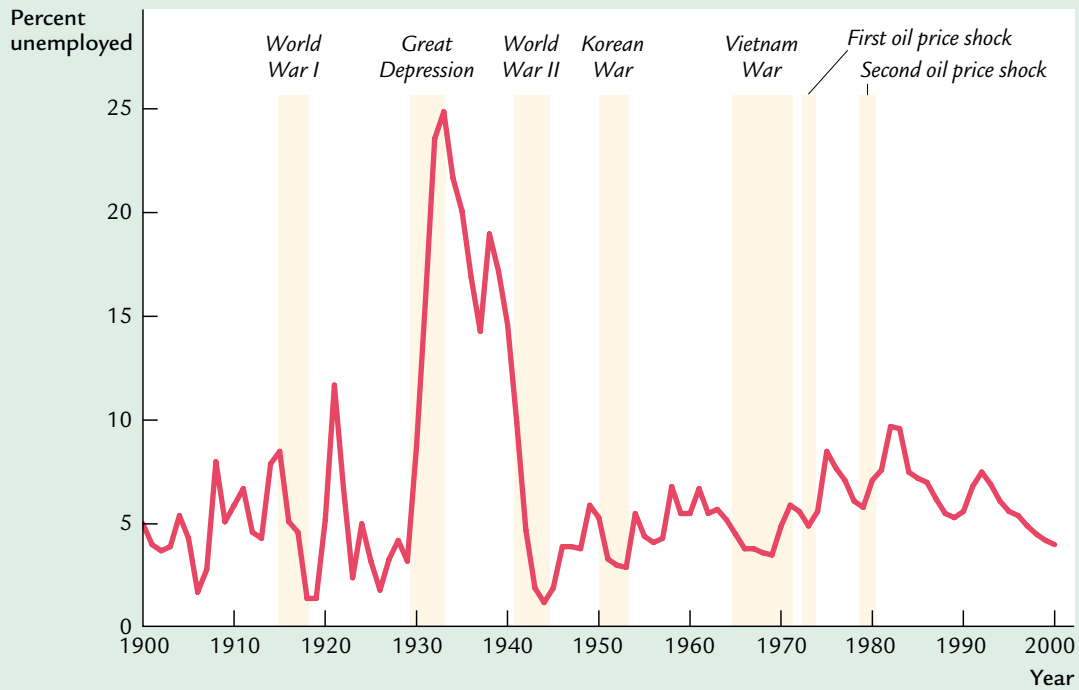
the inflation rate has been about 2 or 3 percent per year, indicating that prices have been fairly stable.

Figure 1-3 shows the U.S. unemployment rate. Notice that there is always some unemployment in our economy. In addition, although there is no long-term trend, the amount of unemployment varies from year to year. Recessions and depressions are associated with unusually high unemployment. The highest rates of unemployment were reached during the Great Depression of the 1930s.

These three figures offer a glimpse at the history of the U.S. economy. In the chapters that follow, we first discuss how these variables are measured and then develop theories to explain how they behave.



figure 1-3



The Unemployment Rate in the U.S. Economy

The unemployment rate measures the percentage of people in the labor force who do not have jobs. This figure shows that the economy always has some unemployment and that the amount fluctuates from year to year.

Source: U.S. Bureau of the Census (*Historical Statistics of the United States: Colonial Times to 1970*) and U.S. Department of Commerce.

1-2 How Economists Think

Although economists often study politically charged issues, they try to address these issues with a scientist’s objectivity. Like any science, economics has its own set of tools—terminology, data, and a way of thinking—that can seem foreign and arcane to the layman. The best way to become familiar with these tools is to practice using them, and this book will afford you ample opportunity to do so. To make these tools less forbidding, however, let’s discuss a few of them here.

Theory as Model Building

Young children learn much about the world around them by playing with toy versions of real objects. For instance, they often put together models of cars, trains, or planes. These models are far from realistic, but the model-builder learns



a lot from them nonetheless. The model illustrates the essence of the real object it is designed to resemble.

Economists also use **models** to understand the world, but an economist's model is more likely to be made of symbols and equations than plastic and glue. Economists build their "toy economies" to help explain economic variables, such as GDP, inflation, and unemployment. Economic models illustrate, often in mathematical terms, the relationships among the variables. They are useful because they help us to dispense with irrelevant details and to focus on important connections.

Models have two kinds of variables: endogenous variables and exogenous variables. **Endogenous variables** are those variables that a model tries to explain. **Exogenous variables** are those variables that a model takes as given. The purpose of a model is to show how the exogenous variables affect the endogenous variables. In other words, as Figure 1-4 illustrates, exogenous variables come from outside the model and serve as the model's input, whereas endogenous variables are determined inside the model and are the model's output.

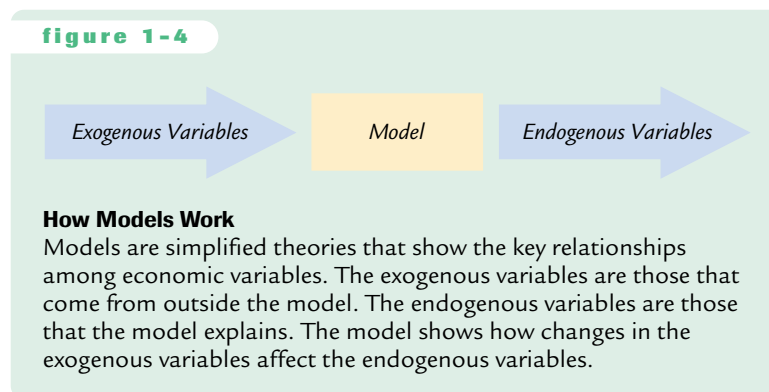
To make these ideas more concrete, let's review the most celebrated of all economic models—the model of supply and demand. Imagine that an economist were interested in figuring out what factors influence the price of pizza and the quantity of pizza sold. He or she would develop a model that described the behavior of pizza buyers, the behavior of pizza sellers, and their interaction in the market for pizza. For example, the economist supposes that the quantity of pizza demanded by consumers Q^d depends on the price of pizza P and on aggregate income Y . This relationship is expressed in the equation

$$Q^d = D(P, Y),$$

where $D()$ represents the demand function. Similarly, the economist supposes that the quantity of pizza supplied by pizzerias Q^s depends on the price of pizza P and on the price of materials P_m , such as cheese, tomatoes, flour, and anchovies. This relationship is expressed as

$$Q^s = S(P, P_m),$$

figure 1-4



where $S()$ represents the supply function. Finally, the economist assumes that the price of pizza adjusts to bring the quantity supplied and quantity demanded into balance:

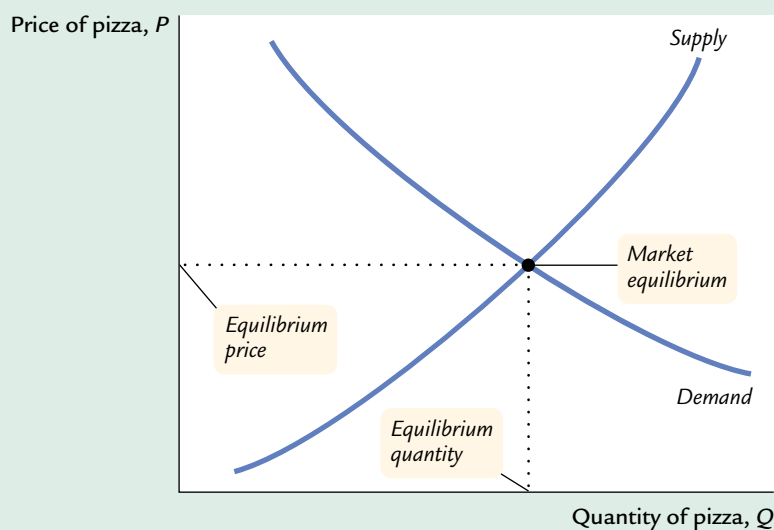
$$Q^s = Q^d.$$

These three equations compose a model of the market for pizza.

The economist illustrates the model with a supply-and-demand diagram, as in Figure 1-5. The demand curve shows the relationship between the quantity of pizza demanded and the price of pizza, while holding aggregate income constant. The demand curve slopes downward because a higher price of pizza encourages consumers to switch to other foods and buy less pizza. The supply curve shows the relationship between the quantity of pizza supplied and the price of pizza, while holding the price of materials constant. The supply curve slopes upward because a higher price of pizza makes selling pizza more profitable, which encourages pizzerias to produce more of it. The equilibrium for the market is the price and quantity at which the supply and demand curves intersect. At the equilibrium price, consumers choose to buy the amount of pizza that pizzerias choose to produce.

This model of the pizza market has two exogenous variables and two endogenous variables. The exogenous variables are aggregate income and the price of materials. The model does not attempt to explain them but takes them as given (perhaps to be explained by another model). The endogenous variables are the

figure 1-5



The Model of Supply and Demand

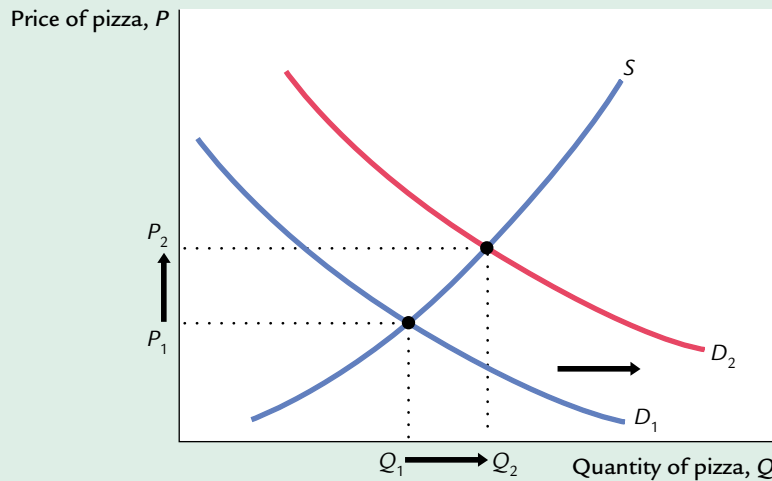
The most famous economic model is that of supply and demand for a good or service—in this case, pizza. The demand curve is a downward-sloping curve relating the price of pizza to the quantity of pizza that consumers demand. The supply curve is an upward-sloping curve relating the price of pizza to the quantity of pizza that pizzerias supply. The price of pizza adjusts until the quantity supplied equals the quantity demanded. The point where the two curves cross is the market equilibrium, which shows the equilibrium price of pizza and the equilibrium quantity of pizza.



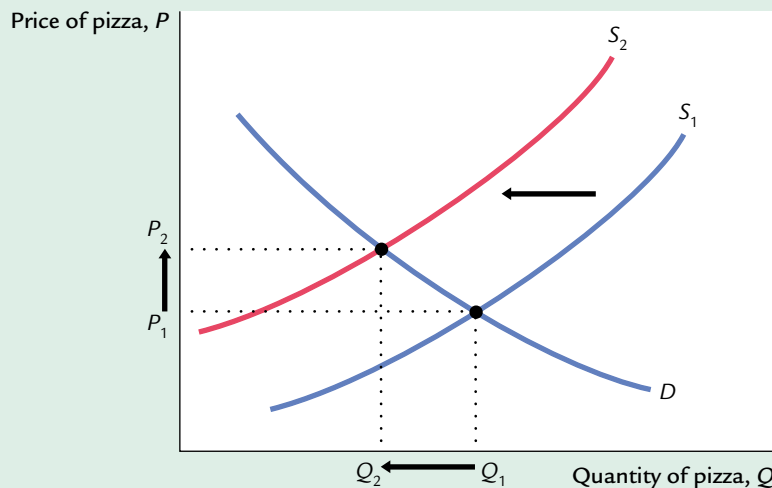
price of pizza and the quantity of pizza exchanged. These are the variables that the model attempts to explain.

The model can be used to show how a change in one of the exogenous variables affects both endogenous variables. For example, if aggregate income increases, then the demand for pizza increases, as in panel (a) of Figure 1-6. The model shows that both the equilibrium price and the equilibrium quantity of pizza rise. Similarly, if the price of materials increases, then the supply of pizza decreases, as in panel (b) of Figure 1-6. The model shows that in this case the equilibrium price of pizza rises and the equilibrium quantity of pizza falls. Thus, the model shows how changes in aggregate income or in the price of materials affect price and quantity in the market for pizza.

figure 1-6



(b) A Shift in Supply



Changes in Equilibrium

In panel (a), a rise in aggregate income causes the demand for pizza to increase: at any given price, consumers now want to buy more pizza. This is represented by a rightward shift in the demand curve from D_1 to D_2 . The market moves to the new intersection of supply and demand. The equilibrium price rises from P_1 to P_2 , and the equilibrium quantity of pizza rises from Q_1 to Q_2 . In panel (b), a rise in the price of materials decreases the supply of pizza: at any given price, pizzerias find that the sale of pizza is less profitable and therefore choose to produce less pizza. This is represented by a leftward shift in the supply curve from S_1 to S_2 . The market moves to the new intersection of supply and demand. The equilibrium price rises from P_1 to P_2 , and the equilibrium quantity falls from Q_1 to Q_2 .



Like all models, this model of the pizza market makes simplifying assumptions. The model does not take into account, for example, that every pizzeria is in a different location. For each customer, one pizzeria is more convenient than the others, and thus pizzerias have some ability to set their own prices. Although the model assumes that there is a single price for pizza, in fact there could be a different price at every pizzeria.

How should we react to the model's lack of realism? Should we discard the simple model of pizza supply and pizza demand? Should we attempt to build a more complex model that allows for diverse pizza prices? The answers to these questions depend on our purpose. If our goal is to explain how the price of cheese affects the average price of pizza and the amount of pizza sold, then the diversity of pizza prices is probably not important. The simple model of the pizza market does a good job of addressing that issue. Yet if our goal is to explain why towns with three pizzerias have lower pizza prices than towns with one pizzeria, the simple model is less useful.

FYI Using Functions to Express Relationships Among Variables

All economic models express relationships among economic variables. Often, these relationships are expressed as functions. A *function* is a mathematical concept that shows how one variable depends on a set of other variables. For example, in the model of the pizza market, we said that the quantity of pizza demanded depends on the price of pizza and on aggregate income. To express this, we use functional notation to write

$$Q^d = D(P, Y).$$

This equation says that the quantity of pizza demanded Q^d is a function of the price of pizza P and aggregate income Y . In functional notation, the variable preceding the parentheses denotes the function. In this case, $D()$ is the function expressing how the variables in parentheses determine the quantity of pizza demanded.

If we knew more about the pizza market, we could give a numerical formula for the quantity of pizza demanded. We might be able to write

$$Q^d = 60 - 10P + 2Y.$$

In this case, the demand function is

$$D(P, Y) = 60 - 10P + 2Y.$$

For any price of pizza and aggregate income, this function gives the corresponding quantity of pizza demanded. For example, if aggregate income is \$10 and the price of pizza is \$2, then the quantity of pizza demanded is 60 pies; if the price of pizza rises to \$3, the quantity of pizza demanded falls to 50 pies.

Functional notation allows us to express a relationship among variables even when the precise numerical relationship is unknown. For example, we might know that the quantity of pizza demanded falls when the price rises from \$2 to \$3, but we might not know by how much it falls. In this case, functional notation is useful: as long as we know that a relationship among the variables exists, we can remind ourselves of that relationship using functional notation.



The art in economics is in judging when an assumption is clarifying and when it is misleading. Any model constructed to be completely realistic would be too complicated for anyone to understand. Simplification is a necessary part of building a useful model. Yet models lead to incorrect conclusions if they assume away features of the economy that are crucial to the issue at hand. Economic modeling therefore requires care and common sense.

A Multitude of Models

Macroeconomists study many facets of the economy. For example, they examine the role of saving in economic growth, the impact of labor unions on unemployment, the effect of inflation on interest rates, and the influence of trade policy on the trade balance and exchange rates. Macroeconomics is as diverse as the economy.

Although economists use models to address all these issues, no single model can answer all questions. Just as carpenters use different tools for different tasks, economists use different models to explain different economic phenomena. Students of macroeconomics, therefore, must keep in mind that there is no single “correct” model useful for all purposes. Instead, there are many models, each of which is useful for shedding light on a different facet of the economy. The field of macroeconomics is like a Swiss army knife—a set of complementary but distinct tools that can be applied in different ways in different circumstances.

This book therefore presents many different models that address different questions and that make different assumptions. Remember that a model is only as good as its assumptions and that an assumption that is useful for some purposes may be misleading for others. When using a model to address a question, the economist must keep in mind the underlying assumptions and judge whether these are reasonable for the matter at hand.

Prices: Flexible Versus Sticky

Throughout this book, one group of assumptions will prove especially important—those concerning the speed with which wages and prices adjust. Economists normally presume that the price of a good or a service moves quickly to bring quantity supplied and quantity demanded into balance. In other words, they assume that a market goes to the equilibrium of supply and demand. This assumption is called **market clearing** and is central to the model of the pizza market discussed earlier. For answering most questions, economists use market-clearing models.

Yet the assumption of *continuous* market clearing is not entirely realistic. For markets to clear continuously, prices must adjust instantly to changes in supply and demand. In fact, however, many wages and prices adjust slowly. Labor contracts often set wages for up to three years. Many firms leave their product prices the same for long periods of time—for example, magazine publishers typically



change their newsstand prices only every three or four years. Although market-clearing models assume that all wages and prices are **flexible**, in the real world some wages and prices are **sticky**.

The apparent stickiness of prices does not make market-clearing models useless. After all, prices are not stuck forever; eventually, they do adjust to changes in supply and demand. Market-clearing models might not describe the economy at every instant, but they do describe the equilibrium toward which the economy gravitates. Therefore, most macroeconomists believe that price flexibility is a good assumption for studying long-run issues, such as the growth in real GDP that we observe from decade to decade.

For studying short-run issues, such as year-to-year fluctuations in real GDP and unemployment, the assumption of price flexibility is less plausible. Over short periods, many prices are fixed at predetermined levels. Therefore, most macroeconomists believe that price stickiness is a better assumption for studying the behavior of the economy in the short run.

Microeconomic Thinking and Macroeconomic Models

Microeconomics is the study of how households and firms make decisions and how these decisionmakers interact in the marketplace. A central principle of microeconomics is that households and firms *optimize*—they do the best they can for themselves given their objectives and the constraints they face. In microeconomic models, households choose their purchases to maximize their level of satisfaction, which economists call *utility*, and firms make production decisions to maximize their profits.

Because economy-wide events arise from the interaction of many households and many firms, macroeconomics and microeconomics are inextricably linked. When we study the economy as a whole, we must consider the decisions of individual economic actors. For example, to understand what determines total consumer spending, we must think about a family deciding how much to spend today and how much to save for the future. To understand what determines total investment spending, we must think about a firm deciding whether to build a new factory. Because aggregate variables are the sum of the variables describing many individual decisions, macroeconomic theory rests on a microeconomic foundation.

Although microeconomic decisions always underlie economic models, in many models the optimizing behavior of households and firms is implicit rather than explicit. The model of the pizza market we discussed earlier is an example. Households' decisions about how much pizza to buy underlie the demand for pizza, and pizzerias' decisions about how much pizza to produce underlie the supply of pizza. Presumably, households make their decisions to maximize utility, and pizzerias make their decisions to maximize profit. Yet the model did not focus on these microeconomic decisions; it left them in the background. Similarly, in much of macroeconomics, the optimizing behavior of households and firms is left implicit.



1-3 How This Book Proceeds

This book has six parts. This chapter and the next make up Part One, the Introduction. Chapter 2 discusses how economists measure economic variables, such as aggregate income, the inflation rate, and the unemployment rate.

Part Two, “Classical Theory: The Economy in the Long Run,” presents the classical model of how the economy works. The key assumption of the classical model is that prices are flexible. That is, with rare exceptions, the classical model assumes market clearing. Because the assumption of price flexibility describes the economy only in the long run, classical theory is best suited for analyzing a time horizon of at least several years.

Part Three, “Growth Theory: The Economy in the Very Long Run,” builds on the classical model. It maintains the assumption of market clearing but adds a new emphasis on growth in the capital stock, the labor force, and technological knowledge. Growth theory is designed to explain how the economy evolves over a period of several decades.

Part Four, “Business Cycle Theory: The Economy in the Short Run,” examines the behavior of the economy when prices are sticky. The non-market-clearing model developed here is designed to analyze short-run issues, such as the reasons for economic fluctuations and the influence of government policy on those fluctuations. It is best suited to analyzing the changes in the economy we observe from month to month or from year to year.

Part Five, “Macroeconomic Policy Debates,” builds on the previous analysis to consider what role the government should take in the economy. It considers how, if at all, the government should respond to short-run fluctuations in real GDP and unemployment. It also examines the various views on the effects of government debt.

Part Six, “More on the Microeconomics Behind Macroeconomics,” presents some of the microeconomic models that are useful for analyzing macroeconomic issues. For example, it examines the household’s decisions regarding how much to consume and how much money to hold and the firm’s decision regarding how much to invest. These individual decisions together form the larger macroeconomic picture. The goal of studying these microeconomic decisions in detail is to refine our understanding of the aggregate economy.

Summary

1. Macroeconomics is the study of the economy as a whole—including growth in incomes, changes in prices, and the rate of unemployment. Macroeconomists attempt both to explain economic events and to devise policies to improve economic performance.
2. To understand the economy, economists use models—theories that simplify reality in order to reveal how exogenous variables influence endogenous variables. The art in the science of economics is in judging whether a model

captures the important economic relationships for the matter at hand. Because no single model can answer all questions, macroeconomists use different models to look at different issues.

3. A key feature of a macroeconomic model is whether it assumes that prices are flexible or sticky. According to most macroeconomists, models with flexible prices describe the economy in the long run, whereas models with sticky prices offer a better description of the economy in the short run.
4. Microeconomics is the study of how firms and individuals make decisions and how these decisionmakers interact. Because macroeconomic events arise from many microeconomic interactions, macroeconomists use many of the tools of microeconomics.

KEY CONCEPTS

Macroeconomics	Depression	Exogenous variables
Real GDP	Deflation	Market clearing
Inflation rate	Models	Flexible and sticky prices
Unemployment rate	Endogenous variables	Microeconomics
Recession		

QUESTIONS FOR REVIEW

1. Explain the difference between macroeconomics and microeconomics. How are these two fields related?
2. Why do economists build models?
3. What is a market-clearing model? When is the assumption of market clearing appropriate?

PROBLEMS AND APPLICATIONS

1. What macroeconomic issues have been in the news lately?
2. What do you think are the defining characteristics of a science? Does the study of the economy have these characteristics? Do you think macroeconomics should be called a science? Why or why not?
3. Use the model of supply and demand to explain how a fall in the price of frozen yogurt would affect the price of ice cream and the quantity of ice cream sold. In your explanation, identify the exogenous and endogenous variables.
4. How often does the price you pay for a haircut change? What does your answer imply about the usefulness of market-clearing models for analyzing the market for haircuts?