Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States). Together, these countries account for about 70% of the world's output. One strength of the OECD data is that, for many variables, the OECD tries to make the variables comparable across member countries (or tells you when they are not comparable). The OECD puts out three useful publications, all available on the OECD site:

- The first is the *OECD Economic Outlook*, published twice a year. In addition to describing current macroeconomic issues and evolutions, it includes a data appendix, with data for many macroeconomic variables. The data typically go back to the 1980s and are reported consistently, both across time and across countries.
- The second is the *OECD Employment Outlook*, published annually. It focuses more specifically on labor-market issues and numbers.
- Occasionally, the OECD puts together current and past data, and publishes a set of OECD Historical Statistics in which various years are grouped together.

The main strength of the publications of the **International Monetary Fund** (IMF for short, located in Washington, D.C.) is that they cover nearly all of the countries of the world. The IMF has 187 member countries and provides data on each of them (www.imf.org).

- A particularly useful IMF publication is the *World Economic Outlook* (WEO for short), which is published twice a year and which describes major economic events in the world and in specific member countries. Selected series associated with the Outlook are available in the WEO database, available on the IMF site (www.imf.org/external/data.htm). Most of the data shown in this chapter come from this database.
- Two other useful publications are the *Global Financial Stability Report* (GFSR for short), which focuses on financial developments, and the *Fiscal Monitor*, which focuses on fiscal developments. All three publications are available on the IMF Web site (www.imf.org/external/index.htm).

Historical Statistics

- For long-term historical statistics for the United States, the basic reference is *Historical Statistics of the United States, Colonial Times to 1970*, Parts 1 and 2, published by the U.S. Department of Commerce, Bureau of the Census (www.census.gov/prod/www/abs/statab.html).
- For long-term historical statistics for several countries, a precious data source is Angus Maddison's *Monitoring the World Economy*, 1820–1992, Development Centre Studies, OECD, Paris, 1995. This study gives data going back to 1820 for 56 countries. Two even longer and broader sources are *The World Economy: A Millenial Perspective*, Development Studies, OECD, 2001, and *The World Economy: Historical Statistics*, Development Studies, OECD 2004, both also by Angus Maddison.

Current Macroeconomic Issues

A number of Web sites offer information and commentaries about the macroeconomic issues of the day. In addition to *The Economist* Web site mentioned earlier, the site maintained by Nouriel Roubini (www.rgemonitor.com) offers an extensive set of links to articles and discussions on macroeconomic issues (by subscription).

Finally, if you still have not found what you were looking for, a site maintained by Bill Goffe at the State University of New York (SUNY) (www.rfe.org), lists not only many more data sources, but also sources for economic information in general, from working papers, to data, to jokes, to jobs in economics, and to blogs.

Key Terms

Organization for Economic Cooperation and Development (OECD), 17
International Monetary Fund (IMF), 18

2

A Tour of the Book

he words *output*, *unemployment*, and *inflation* appear daily in newspapers and on the evening news. So when we used these words in Chapter 1, you knew roughly what we were talking about. It is now time to define these words more precisely, and this is what we do in the first three sections of this chapter.

Section 2-1 looks at output.

Section 2-2 looks at the unemployment rate.

Section 2-3 looks at the inflation rate.

Section 2-4 introduces two important relations between these three variables: Okun's law and the Phillips curve.

Section 2-5 then introduces the three central concepts around which the book is organized:

- The *short run*: What happens to the economy from year to year
- The *medium run*: What happens to the economy over a decade or so
- The *long run*: What happens to the economy over a half century or longer

Building on these three concepts, Section 2-6 gives you the road map to the rest of the book.

2-1 Aggregate Output

Economists studying economic activity in the nineteenth century or during the Great Depression had no measure of aggregate activity (*aggregate* is the word macroeconomists use for *total*) on which to rely. They had to put together bits and pieces of information, such as the shipments of iron ore or sales at some department stores, to try to infer what was happening to the economy as a whole.

Two economists, Simon Kuznets, from Harvard University, and Richard Stone, from Cambridge University, were given the Nobel Prize for their contributions to the development of the national income and product accounts—a gigantic intellectual and empirical achievement.

It was not until the end of World War II that **national income and product accounts** (or national income accounts, for short) were put together. Measures of aggregate output have been published on a regular basis in the United States since October 1947. (You will find measures of aggregate output for earlier times, but these have been constructed retrospectively.)

Like any accounting system, the national income accounts first define concepts and then construct measures corresponding to these concepts. You need only to look at statistics from countries that have not yet developed such accounts to realize that precision and consistency in such accounts are crucial. Without precision and consistency, numbers that should add up do not; trying to understand what is going on feels like trying to balance someone else's checkbook. We shall not burden you with the details of national income accounting here. But because you will occasionally need to know the definition of a variable and how variables relate to each other, Appendix 1 at the end of the book gives you the basic accounting framework used in the United States (and, with minor variations, in most other countries) today. You will find it useful whenever you want to look at economic data on your own.

GDP: Production and Income

The measure of **aggregate output** in the national income accounts is called the **gross domestic product**, or **GDP**, for short. To understand how GDP is constructed, it is best to work with a simple example. Consider an economy composed of just two firms:

You may come across another term, **gross national product**, or **GNP**. There is a subtle difference between "domestic" and "national," and thus between GDP and GNP. We examine the distinction in Chapter 18 and in Appendix 1 at the end of the book. For now, ignore it.

- Firm 1 produces steel, employing workers and using machines to produce the steel. It sells the steel for $100 to Firm 2, which produces cars. Firm 1 pays its workers $80, leaving $20 in profit to the firm.
- Firm 2 buys the steel and uses it, together with workers and machines, to produce cars. Revenues from car sales are $200. Of the $200, $100 goes to pay for steel and $70 goes to workers in the firm, leaving $30 in profit to the firm.

In reality, not only workers and machines are required for steel production, but so are iron ore, electricity, and so on. We shall ignore these to keep the example simple.

We can summarize this information in a table:

Steel Company (Firm 1)		
Revenues from sales		$100
Expenses		$80
Wages	$80	
Profit		$20

Car Company (Firm 2)		
Revenues from sales		$200
Expenses		$170
Wages	$70	
Steel purchases	$100	
Profit		$30

How would you define aggregate output in this economy? As the sum of the values of all goods produced in the economy—the sum of $100 from the production of steel and $200 from the production of cars, so $300? Or as just the value of cars, which is equal to $200?

An intermediate good is a good used in the production of another good. Some goods can be both final goods and intermediate goods. Potatoes sold directly to consumers are final goods. Potatoes used to produce potato chips are intermediate goods. Can you think of other examples?

Some thought suggests that the right answer must be $200. Why? Because steel is an **intermediate good**: It is used in the production of cars. Once we count the production of cars, we do not want to count the production of the goods that went into the production of these cars.

This motivates the first definition of GDP:

1. GDP Is the Value of the Final Goods and Services Produced in the Economy during a Given Period.

The important word here is **final**. We want to count only the production of final goods, not intermediate goods. Using our example, we can make this point in another way. Suppose the two firms merged, so that the sale of steel took place inside the new firm and was no longer recorded. The accounts of the new firm would be given by the following table:

Steel and Car Company	
Revenues from sales	$200
Expenses (wages)	$150
Profit	$50

All we would see would be one firm selling cars for $200, paying workers $80 + $70 = $150, and making $20 + $30 = $50 in profits. The $200 measure would remain unchanged—as it should. We do not want our measure of aggregate output to depend on whether firms decide to merge or not.

This first definition gives us one way to construct GDP: by recording and adding up the production of all final goods—and this is indeed roughly the way actual GDP numbers are put together. But it also suggests a second way of thinking about and constructing GDP:

2. GDP Is the Sum of Value Added in the Economy during a Given Period.

The term **value added** means exactly what it suggests. The value added by a firm is defined as the value of its production minus the value of the intermediate goods used in production.

In our two-firms example, the steel company does not use intermediate goods. Its value added is simply equal to the value of the steel it produces, $100. The car company, however, uses steel as an intermediate good. Thus, the value added by the car company is equal to the value of the cars it produces minus the value of the steel it uses in production, $200 − $100 = $100. Total value added in the economy, or GDP, equals $100 + $100 = $200. (Note that aggregate value added would remain the same if the steel and car firms merged and became a single firm. In this case, we would not observe intermediate goods at all—as steel would be produced and then used to produce cars within the single firm—and the value added in the single firm would simply be equal to the value of cars, $200.)

This definition gives us a second way of thinking about GDP. Put together, the two definitions imply that the value of final goods and services—the first definition of GDP—can also be thought of as the sum of the value added by all the firms in the economy—the second definition of GDP.

So far, we have looked at GDP from the *production side*. The other way of looking at GDP is from the *income side*. Go back to our example and think about the revenues left to a firm after it has paid for its intermediate goods: Some of the revenues go to pay workers—this component is called *labor income*. The rest goes to the firm—that component is called *capital income* or *profit income*.

Of the $100 of value added by the steel manufacturer, $80 goes to workers (labor income) and the remaining $20 goes to the firm (capital income). Of the $100 of value added by the car manufacturer, $70 goes to labor income and $30 to capital income. For the economy as a whole, labor income is equal to $150 ($80 + $70), capital income is equal to $50 ($20 + $30). Value added is equal to the sum of labor income and capital income is equal to $200 ($150 + $50).

The labor share in the example is thus 75%. In advanced countries, the share of labor is indeed typically between 65 and 75%.

This motivates the third definition of GDP:

3. GDP Is the Sum of Incomes in the Economy during a Given Period.

To summarize: You can think about aggregate output— *GDP*—in three different but equivalent ways.

Two lessons to remember:

i. GDP is the measure of aggregate output, which we can look at from the production side (aggregate production), or the income side (aggregate income); and

ii. Aggregate production and aggregate income are always equal.

- From the *production side*: GDP equals the value of the final goods and services produced in the economy during a given period.
- Also from the *production side*: GDP is the sum of value added in the economy during a given period.
- From the *income side*: GDP is the sum of incomes in the economy during a given period.

Nominal and Real GDP

U.S. GDP was $14,660 billion in 2010, compared to $526 billion in 1960. Was U.S. output really 28 times higher in 2010 than in 1960? Obviously not: Much of the increase reflected an increase in prices rather than an increase in quantities produced. This leads to the distinction between nominal GDP and real GDP.

Warning! People often use *nominal* to denote small amounts. Economists use *nominal* for variables expressed in current prices. And they surely do not refer to small amounts: The numbers typically run in the billions or trillions of dollars.

Nominal GDP is the sum of the quantities of final goods produced times their current price. This definition makes clear that nominal GDP increases over time for two reasons:

- First, the production of most goods increases over time.
- Second, the prices of most goods also increase over time.

If our goal is to measure production and its change over time, we need to eliminate the effect of increasing prices on our measure of GDP. That's why **real GDP** is constructed as the sum of the quantities of final goods times *constant* (rather than *current*) prices.

If the economy produced only one final good, say, a particular car model, constructing real GDP would be easy: We would use the price of the car in a given year and then use it to multiply the quantity of cars produced in each year. An example will help here. Consider an economy that only produces cars—and to avoid issues we shall tackle later, assume the same model is produced every year. Suppose the number and the price of cars in three successive years are given by:

Nominal GDP, which is equal to the quantity of cars times their price, goes up from $200,000 in 2004 to $288,000 in 2005—a 44% increase—and from $288,000 in 2005 to $338,000 in 2006—a 16% increase.

Year	Quantity of Cars	Price of Cars	Nominal GDP	Real GDP (in 2005 dollars)
2004	10	$20,000	$200,000	$240,000
2005	12	$24,000	$288,000	$288,000
2006	13	$26,000	$338,000	$312,000

- To construct real GDP, we need to multiply the number of cars in each year by a *common* price. Suppose we use the price of a car in 2005 as the common price. This approach gives us in effect *real GDP in 2005 dollars.*
- Using this approach, real GDP in 2004 (in 2005 dollars) equals 10 cars × $24,000 per car = $240,000. Real GDP in 2005 (in 2005 dollars) equals 12 cars × $24,000 per car = $288,000, the same as nominal GDP in 2005. Real GDP in 2006 (in 2005 dollars) is equal to 13 × $24,000 = $312,000.

So real GDP goes up from $240,000 in 2004 to $288,000 in 2005—a 20% increase—and from $288,000 in 2005 to $312,000 in 2006—an 8% increase.

- How different would our results have been if we had decided to construct real GDP using the price of a car in, say, 2006 rather than 2005? Obviously, the level of real GDP in each year would be different (because the prices are not the same in 2006 as in 2005); but its rate of change from year to year would be the same as above.

To be sure, compute real GDP in 2006 dollars, and compute the rate of growth from 2004 to 2005, and from 2005 to 2006.

The problem in constructing real GDP in practice is that there is obviously more than one final good. Real GDP must be defined as a weighted average of the output of all final goods, and this brings us to what the weights should be.

The *relative prices* of the goods would appear to be the natural weights. If one good costs twice as much per unit as another, then that good should count for twice as much as the other in the construction of real output. But this raises the question: What if, as is typically the case, relative prices change over time? Should we choose the relative prices of a particular year as weights, or should we change the weights over time? More discussion of these issues, and of the way real GDP is constructed in the United States, is left to the appendix to this chapter. Here, what you should know is that the measure of real GDP in the U.S. national income accounts uses weights that reflect relative prices and which change over time. The measure is called **real GDP in chained (2005) dollars**. We use 2005 because, as in our example above, 2005 is the year when, by construction, real GDP is equal to nominal GDP. It is our best measure of the output of the U.S. economy, and its evolution shows how U.S. output has increased over time.

Figure 2-1 plots the evolution of both nominal GDP and real GDP since 1960. By construction, the two are equal in 2005. The figure shows that real GDP in 2010 was about 4.7 times its level of 1960—a considerable increase, but clearly much less than the 28-fold increase in nominal GDP over the same period. The difference between the two results comes from the increase in prices over the period.

Suppose real GDP was measured in 2000 dollars rather than 2005 dollars. Where would the nominal GDP and real GDP lines on the graph intersect?

The terms *nominal GDP* and *real GDP* each have many synonyms, and you are likely to encounter them in your readings:

- Nominal GDP is also called **dollar GDP** or **GDP in current dollars**.

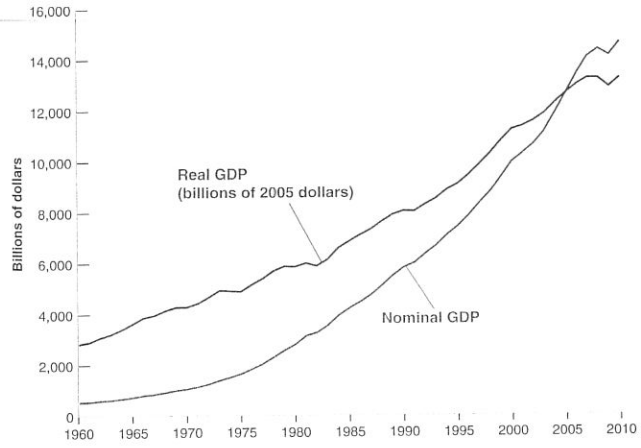


Figure 2-1

Nominal and real U.S. GDP, 1960–2010

From 1960 to 2010, nominal GDP increased by a factor of 28. Real GDP increased by a factor of about 5.

Source: Series GDPCA,GDPA: Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/

- Real GDP is also called **GDP in terms of goods**, **GDP in constant dollars**, **GDP adjusted for inflation**, or **GDP in (chained) 2005 dollars** or **GDP in 2005 dollars**—if the year in which real GDP is set equal to nominal GDP is 2005, as is the case in the United States at this time.

In the chapters that follow, unless we indicate otherwise,

- GDP will refer to *real GDP* and Y_t will denote *real GDP in year t*.
- Nominal GDP, and variables measured in current dollars, will be denoted by a dollar sign in front of them—for example, $\$Y_t$ for nominal GDP in year t.

GDP: Level versus Growth Rate

We have focused so far on the level of real GDP. This is an important number that gives the economic size of a country. A country with twice the GDP of another country is economically twice as big as the other country. Equally important is the level of **real GDP per person**, the ratio of real GDP to the population of the country. It gives us the average standard of living of the country.

Warning: One must be careful about how one does the comparison: Recall the discussion in Chapter 1 about the standard of living in China. This is discussed further in Chapter 10.

In assessing the performance of the economy from year to year, economists focus, however, on the rate of growth of real GDP, often called just **GDP growth**. Periods of positive GDP growth are called **expansions**. Periods of negative GDP growth are called **recessions**.

The evolution of GDP growth in the United States since 1960 is given in Figure 2-2. GDP growth in year t is constructed as $(Y_t - Y_{t-1})/Y_{t-1}$ and expressed as a percent. The figure shows how the U.S. economy has gone through a series of expansions, interrupted by short recessions. Again, you can see the effects of the crisis: zero growth in 2008, and a large negative growth rate in 2009.

The figure raises a small puzzle. According to the graph, growth was positive in 2001. But you may have heard people refer to the "recession of 2001." Why do they do so? Because they look at GDP growth quarter by quarter, rather than year by year. There

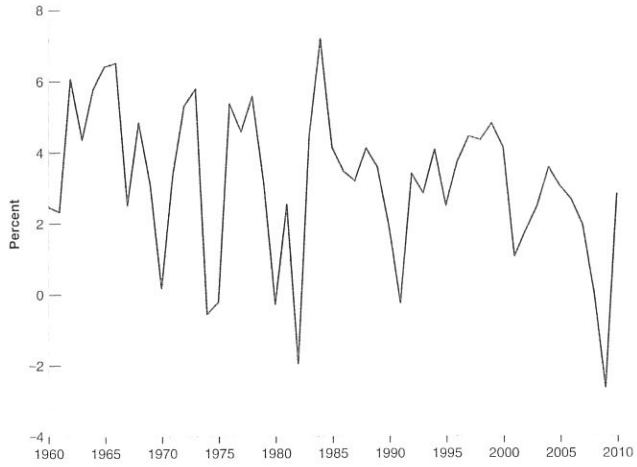
It is actually the subject of one of the boxes in Chapter 5.

Figure 2-2

Growth rate of U.S. GDP, 1960–2010

Since 1960, the U.S. economy has gone through a series of expansions, interrupted by short recessions. The most recent recession was the most severe recession in the period from 1960 to 2010.

Source: Calculated using series GDPCA in Figure 2-1



Real GDP, Technological Progress, and the Price of Computers

FOCUS

A tough problem in computing real GDP is how to deal with changes in quality of existing goods. One of the most difficult cases is computers. It would clearly be absurd to assume that a personal computer in 2010 is the same good as a personal computer produced in 1981 (the year in which the IBM PC was introduced): The same amount of money can clearly buy much more computing in 2010 than it could in 1981. But how much more? Does a 2010 computer provide 10 times, 100 times, or 1,000 times the computing services of a 1981 computer? How should we take into account the improvements in internal speed, the size of the random access memory (RAM) or of the hard disk, the fact that computers can access the Internet, and so on?

The approach used by economists to adjust for these improvements is to look at the market for computers and how it values computers with different characteristics in a given year. Example: Suppose the evidence from prices of different models on the market shows that people are willing to pay 10% more for a computer with a speed of 3 GHz (3,000 megahertz) rather than 2 GHz. (The first edition of this book, published in 1996, compared two computers, with speeds of 50 and 16 megaherz, respectively. This change is a good indication of technological progress. A further indication of technological progress is that, for the past few years, progress has not been made by increasing the speed of processors, but rather by using multicore processors. We shall leave this aspect aside here, but people in charge of national income accounts cannot; they have to take this change into account as well.) Suppose new computers this year have a speed of 3 GHz compared to a speed of 2 GHz for new computers last year. And suppose the dollar price of new computers this year is the same as the dollar price of new computers last year. Then economists in charge of computing the adjusted price of computers will conclude that new computers are in fact 10% cheaper than last year.

This approach, which treats goods as providing a collection of characteristics—for computers, speed, memory, and so on—each with an implicit price, is called **hedonic pricing** ("hedone" means "pleasure" in Greek). It is used by the Department of Commerce—which constructs real GDP—to estimate changes in the price of complex and fast changing goods, such as automobiles and computers. Using this approach, the Department of Commerce estimates that, for a given price, the quality of new computers has increased on average by 18% a year since 1981. Put another way, a typical personal computer in 2010 delivers $1.18^{29} = 121$ times the computing services a typical personal computer delivered in 1981.

Not only do computers deliver more services, they have become cheaper as well: Their dollar price has declined by about 10% a year since 1981. Putting this together with the information in the previous paragraph, this implies that their quality-adjusted price has fallen at an average rate of 18% + 10% = 28% per year. Put another way, a dollar spent on a computer today buys $1.28^{29} = 1{,}285$ times more computing services than a dollar spent on a computer in 1981.

is no official definition of what constitutes a recession, but the convention is to refer to a "recession" if the economy goes through at least two consecutive quarters of negative growth. Although GDP growth was positive for 2001 as a whole, it was negative during each of the first three quarters of 2001; thus 2001 qualifies as a (mild) recession.

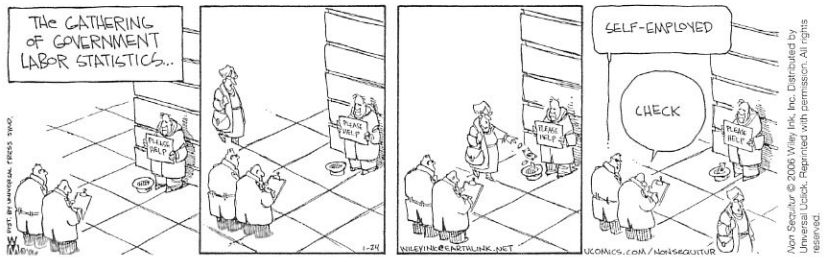
2-2 The Unemployment Rate

Because it is a measure of aggregate activity, GDP is obviously the most important macroeconomic variable. But two other variables, unemployment and inflation, tell us about other important aspects of how an economy is performing. This section focuses on the unemployment rate.

We start with two definitions: **Employment** is the number of people who have a job. **Unemployment** is the number of people who do not have a job but are looking for one. The **labor force** is the sum of employment and unemployment:

$$L = N + U$$

$$\text{labor force} = \text{employment} + \text{unemployment}$$



The **unemployment rate** is the ratio of the number of people who are unemployed to the number of people in the labor force:

$$u = \frac{U}{L}$$

$$\text{unemployment rate} = \text{unemployment}/\text{labor force}$$

Constructing the unemployment rate is less obvious than you might have thought. The cartoon above not withstanding, determining whether somebody is employed is straightforward. Determining whether somebody is unemployed is harder. Recall from the definition that, to be classified as unemployed, a person must meet two conditions: that he or she does not have a job, and he or she is looking for one; this second condition is harder to assess.

Until the 1940s in the United States, and until more recently in most other countries, the only available source of data on unemployment was the number of people registered at unemployment offices, and so only those workers who were registered in unemployment offices were counted as unemployed. This system led to a poor measure of unemployment. How many of those looking for jobs actually registered at the unemployment office varied both across countries and across time. Those who had no incentive to register—for example, those who had exhausted their unemployment benefits—were unlikely to take the time to come to the unemployment office, so they were not counted. Countries with less generous benefit systems were likely to have fewer unemployed registering, and therefore smaller measured unemployment rates.

Today, most rich countries rely on large surveys of households to compute the unemployment rate. In the United States, this survey is called the **Current Population Survey (CPS)**. It relies on interviews of 50,000 households every month. The survey classifies a person as employed if he or she has a job at the time of the interview; it classifies a person as unemployed if he or she does not have a job *and has been looking for a job in the last four weeks.* Most other countries use a similar definition of unemployment. In the United States, estimates based on the CPS show that, during 2010, an average of 139.0 million people were employed, and 14.8 million people were unemployed, so the unemployment rate was $14.8/(139.0 + 14.8) = 9.6\%$.

Note that only those *looking for a job* are counted as unemployed; those who do not have a job and are not looking for one are counted as **not in the labor force**. When unemployment is high, some of the unemployed give up looking for a job and therefore are no longer counted as unemployed. These people are known as **discouraged workers.** Take an extreme example: If all workers without a job gave up looking for one, the unemployment rate would equal zero. This would make the unemployment rate a very poor indicator of what is happening in the labor market. This example is too extreme; in practice, when the economy slows down, we typically observe both an increase in unemployment and an increase in the number of people who drop out of the labor force. Equivalently, a higher unemployment rate is typically associated with a lower **participation rate**, defined as the ratio of the labor force to the total population of working age.

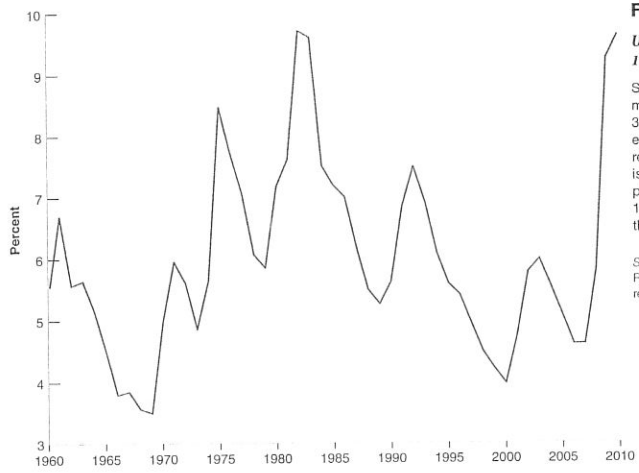


Figure 2-3

U.S. unemployment rate, 1960–2010

Since 1960, the U.S. unemployment rate has fluctuated between 3 and 10%, going down during expansions, and going up during recessions. The effect of the crisis is highly visible, with the unemployment rate reaching close to 10%, the highest such rate since the 1980s.

Source: Series UNRATE: Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/

Figure 2-3 shows the evolution of unemployment in the United States since 1970. Since 1960, the U.S. unemployment rate has fluctuated between 3 and 10%, going up during recessions and down during expansions. Again, you can see the effect of the crisis, with the unemployment rate reaching a peak at nearly 10% in 2010, the highest such rate since the 1980s.

At the start of economic reform in Eastern Europe in the early 1990s, unemployment increased dramatically. But equally dramatic was the fall in the participation rate. In Poland in 1990, 70% of the decrease in employment was reflected in early retirements—by people dropping out of the labor force rather than becoming unemployed.

Why Do Economists Care about Unemployment?

Economists care about unemployment for two reasons. First, they care about unemployment because of its direct effect on the welfare of the unemployed. Although unemployment benefits are more generous today than they were during the Great Depression, unemployment is still often associated with financial and psychological suffering. How much suffering depends on the nature of the unemployment. One image of unemployment is that of a stagnant pool, of people remaining unemployed for long periods of time. In normal times, in the United States, this image is not right: Every month, many people become unemployed, and many of the unemployed find jobs. When unemployment increases, however, as is the case now, the image becomes more accurate. Not only are more people unemployed, but also many of them are unemployed for a long time. For example, the mean duration of unemployment, which was 9 weeks on average during 2000–2007, increased to 33 weeks in 2010. In short, when the unemployment increases, not only does unemployment become both more widespread, but it also becomes more painful.

FOCUS

Did Spain Have a 24% Unemployment Rate in 1994?

In 1994, the official unemployment rate in Spain reached 24%. (It then decreased steadily, reaching a low of 8% in 2007, only to increase dramatically again since the beginning of the crisis. It now exceeds 20% and is still increasing. Thus, many of the issues in this Focus box are becoming relevant again.) This was roughly the same unemployment rate as in the United States in 1933, the worst year of the Great Depression. Yet Spain in 1994 looked nothing like the United States in 1933: There were few homeless, and most cities looked prosperous. Can we really believe that nearly one-fifth of the Spanish labor force was looking for work?

To answer this question, we must first examine how the Spanish unemployment number is put together. Like the CPS in the United States, unemployment is measured using a large survey of 60,000 households. People are classified as unemployed if they indicate that they are not working but are seeking work.

Can we be sure that people tell the truth? No. Although there is no obvious incentive to lie—answers to the survey are confidential and are not used to determine whether people are eligible for unemployment benefits—those who are working in the underground economy may prefer to play it safe and report that they are unemployed instead.

The size of the **underground economy**—the part of economic activity that is not measured in official statistics, either because the activity is illegal or because firms and workers would rather not report it and thus not pay taxes—is an old issue in Spain. And because of that, we actually know more about the underground economy in Spain than in many other countries: In 1985, the Spanish government tried to find out more and organized a detailed survey of 60,000 individuals. To try to elicit the truth from those interviewed, the questionnaire asked interviewees for an extremely precise account of the use of their time, making it more difficult to misreport. The answers were interesting. The underground economy in Spain—defined as the number of people working without declaring it to the social security administration—accounted for between 10 and 15% of employment. But it was composed mostly of people who already had a job and were taking a second or even a third job. The best estimate from the survey was that only about 15% of the unemployed were in fact working. This implied that the unemployment rate, which was officially 21% at the time, was in fact closer to 18%, still a very high number. In short, the Spanish underground economy was significant, but it just was not the case that most of the Spanish unemployed work in the underground economy.

How did the unemployed survive? Did they survive because unemployment benefits were unusually generous in Spain? No. Except for very generous unemployment benefits in two regions, Andalusia and Extremadura—which, not surprisingly, had even higher unemployment than the rest of the country—unemployment benefits were roughly in line with unemployment benefits in other OECD countries. Benefits were typically 70% of the wage for the first six months, and 60% thereafter. They were given for a period of 4 to 24 months, depending on how long people had worked before becoming unemployed. The 30% of the unemployed who had been unemployed for more than two years did not receive unemployment benefits.

So how did they survive? A key to the answer lies with the Spanish family structure. The unemployment rate was highest among the young: In 1994, it was close to 50% for those between 16 and 19, and around 40% for those between 20 and 24. The young typically stay at home until their late 20s, and have increasingly done so as unemployment increased. Looking at households rather than at individuals, the proportion of households where nobody was employed was less than 10% in 1994; the proportion of households that received neither wage income nor unemployment benefits was around 3%. In short, the family structure, and transfers from the rest of the family, were the factors that allowed many of the unemployed to survive.

It is probably because of statements like this that economics is known as the "dismal science."

Second, economists also care about the unemployment rate because it provides a signal that the economy may not be using some of its resources efficiently. Many workers who want to work do not find jobs; the economy is not utilizing its human resources efficiently. From this viewpoint, can very low unemployment also be a problem? The answer is yes. Like an engine running at too high a speed, an economy in which unemployment is very low may be overutilizing its resources and run into labor shortages. How low is "too low"? This is a difficult question, a question we will take up at more length later in the book. The question came up in 2000 in the United States. At the end of 2000, some economists worried that the unemployment rate, 4% at the time, was indeed too low. So, while they did not advocate triggering a recession, they favored lower (but positive) output growth for some time, so as to allow the unemployment rate to increase to a somewhat higher level. It turned out that they got more than they had asked for: a recession rather than a slowdown.

2-3 The Inflation Rate

Inflation is a sustained rise in the general level of prices—the **price level.** The **inflation rate** is the rate at which the price level increases. (Symmetrically, **deflation** is a sustained decline in the price level. It corresponds to a negative inflation rate).

Deflation is rare, but it happens. Japan has had deflation, off and on, since the late 1990s. The United States experienced deflation in the 1930s during the Great Depression.

The practical issue is how to define the price level so the inflation rate can be measured. Macroeconomists typically look at two measures of the price level, at two *price indexes*: the GDP deflator and the Consumer Price Index.

The GDP Deflator

We saw earlier how increases in nominal GDP can come either from an increase in real GDP, or from an increase in prices. Put another way, if we see nominal GDP increase faster than real GDP, the difference must come from an increase in prices.

This remark motivates the definition of the GDP deflator. The **GDP deflator** in year t, P_t, is defined as the ratio of nominal GDP to real GDP in year t:

$$P_t = \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} = \frac{\$Y_t}{Y_t}$$

Index numbers are often set equal to 100 (in the base year) rather than to 1. If you look at the Economic Report of the President (see Chapter 1) you will see that the GDP deflator, reported in Table B-3, is equal to 100 for 2005 (the base year), 103.2 in 2006, and so on.

Note that, in the year in which, by construction, real GDP is equal to nominal GDP (2005 at this point in the United States), this definition implies that the price level is equal to 1. This is worth emphasizing: The GDP deflator is called an **index number**. Its level is chosen arbitrarily—here it is equal to 1 in 2005—and has no economic interpretation. But its rate of change, $(P_t - P_{t-1})/P_{t-1}$ (which we shall denote by π_t in the rest of the book), has a clear economic interpretation: It gives the rate at which the general level of prices increases over time—the rate of inflation.

Compute the GDP deflator and the associated rate of inflation from 2004 to 2005 and from 2005 to 2006 in our car example in Section 2-1, when real GDP is constructed using the 2005 price of cars as the common price.

One advantage to defining the price level as the GDP deflator is that it implies a simple relation among *nominal GDP*, *real GDP*, and the *GDP deflator*. To see this, reorganize the previous equation to get:

$$\$Y_t = P_t Y_t$$

Nominal GDP is equal to the GDP deflator times real GDP. Or, putting it in terms of rates of change: The rate of growth of nominal GDP is equal to the rate of inflation plus the rate of growth of real GDP.

For a refresher, see Appendix 2, Proposition 7.

The Consumer Price Index

The GDP deflator gives the average price of output—the final goods *produced* in the economy. But consumers care about the average price of consumption—the goods they *consume*. The two prices need not be the same: The set of goods produced in the economy is not the same as the set of goods purchased by consumers, for two reasons:

- Some of the goods in GDP are sold not to consumers but to firms (machine tools, for example), to the government, or to foreigners.
- Some of the goods bought by consumers are not produced domestically but are imported from abroad.

To measure the average price of consumption, or, equivalently, the **cost of living**, macroeconomists look at another index, the **Consumer Price Index, or CPI.** The CPI has been in existence in the United States since 1917 and is published monthly (in contrast, numbers for GDP and the GDP deflator are only constructed and published quarterly).

Do not confuse the CPI with the PPI, or *producer price index*, which is an index of prices of domestically produced goods in manufacturing, mining, agriculture, fishing, forestry, and electric utility industries.

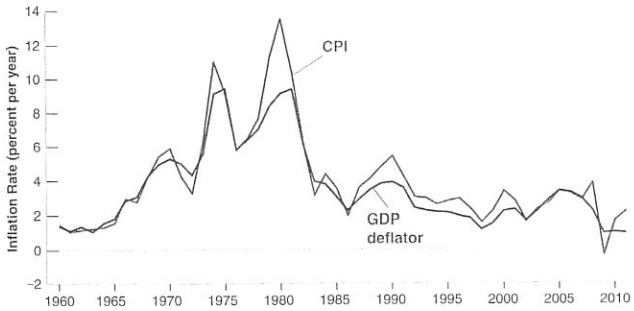
The CPI gives the cost in dollars of a specific list of goods and services over time. The list, which is based on a detailed study of consumer spending, attempts to

Figure 2-4

Inflation rate, using the CPI and the GDP deflator, 1960–2010

The inflation rates, computed using either the CPI or the GDP deflator, are largely similar.

Source: Calculated using series GDPDEF, CPI-AUSCL Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/



represent the consumption basket of a typical urban consumer and is updated roughly only once every 10 years.

Each month, Bureau of Labor Statistics (BLS) employees visit stores to find out what has happened to the price of the goods on the list; prices are collected in 87 cities, from about 23,000 retail stores, car dealerships, gas stations, hospitals, and so on. These prices are then used to construct the Consumer Price Index.

Like the GDP deflator (the price level associated with aggregate output, GDP), the CPI is an index. It is set equal to 100 in the period chosen as the base period and so its level has no particular significance. The current base period is 1982 to 1984, so the average for the period 1982 to 1984 is equal to 100. In 2010, the CPI was 222.8; thus, it cost more than twice as much in dollars to purchase the same consumption basket than in 1982–1984.

Do not ask why such a strange base period was chosen. Nobody seems to remember.

You may wonder how the rate of inflation differs depending on whether the GDP deflator or the CPI is used to measure it. The answer is given in Figure 2-4, which plots the two inflation rates since 1960 for the United States. The figure yields two conclusions:

- The CPI and the GDP deflator move together most of the time. In most years, the two inflation rates differ by less than 1%.
- But there are clear exceptions. In 1979 and 1980, the increase in the CPI was significantly larger than the increase in the GDP deflator. The reason is not hard to find. Recall that the GDP deflator is the price of goods *produced* in the United States, whereas the CPI is the price of goods *consumed* in the United States. That means when the price of imported goods increases relative to the price of goods produced in the United States, the CPI increases faster than the GDP deflator. This is precisely what happened in 1979 and 1980. The price of oil doubled. And although the United States is a producer of oil, it produces much less than it consumes: It was and still is a major oil importer. The result was a large increase in the CPI compared to the GDP deflator.

You may wonder why the effect of the increases in the price of oil since 1999 is much less visible in the figure. The answer: The increases have taken place more slowly over time, and other factors have worked in the opposite direction.

In what follows, we shall typically assume that the two indexes move together so we do not need to distinguish between them. we shall simply talk about *the price level* and denote it by P_t, without indicating whether we have the CPI or the GDP deflator in mind.

Why Do Economists Care about Inflation?

If a higher inflation rate meant just a faster but proportional increase in all prices and wages—a case called *pure inflation*—inflation would be only a minor inconvenience, as relative prices would be unaffected.

Take, for example, the workers' *real wage*—the wage measured in terms of goods rather than in dollars. In an economy with 10% more inflation, prices would increase by 10% more a year. But wages would also increase by 10% more a year, so real wages would be unaffected by inflation. Inflation would not be entirely irrelevant; people would have to keep track of the increase in prices and wages when making decisions. But this would be a small burden, hardly justifying making control of the inflation rate one of the major goals of macroeconomic policy.

So why do economists care about inflation? Precisely because there is no such thing as pure inflation:

- During periods of inflation, not all prices and wages rise proportionately. Because they don't, inflation affects income distribution. For example, retirees in many countries receive payments that do not keep up with the price level, so they lose in relation to other groups when inflation is high. This is not the case in the United States, where Social Security benefits automatically rise with the CPI, protecting retirees from inflation. But during the very high inflation that took place in Russia in the 1990s, retirement pensions did not keep up with inflation, and many retirees were pushed to near starvation.
- Inflation leads to other distortions. Variations in relative prices also lead to more uncertainty, making it harder for firms to make decisions about the future, such as investment decisions. Some prices, which are fixed by law or by regulation, lag behind the others, leading to changes in relative prices. Taxation interacts with inflation to create more distortions. If tax brackets are not adjusted for inflation, for example, people move into higher and higher tax brackets as their nominal income increases, even if their real income remains the same.

This is known as *bracket creep*. In the United States, the tax brackets are adjusted automatically for inflation: If inflation is 5%, all tax brackets also go up by 5%—in other words, there is no bracket creep.

If inflation is so bad, does this imply that deflation (negative inflation) is good?

The answer is no. First, high deflation (a large negative rate of inflation) would create many of the same problems as high inflation, from distortions to increased uncertainty. Second, as we shall see later in the book, even a low rate of deflation limits the ability of monetary policy to affect output. So what is the "best" rate of inflation? Most macroeconomists believe that the best rate of inflation is a low and stable rate of inflation, somewhere between 1 and 4%. We shall look at the pros and cons of different rates of inflation later in the book.

Newspapers sometimes confuse deflation and recession. They may happen together but they are not the same. Deflation is a decrease in the price level. A recession is a decrease in real output.

2-4 Output, Unemployment, and the Inflation Rate: Okun's Law and the Phillips Curve

We have looked separately at the three main dimensions of aggregate economic activity: output growth, the unemployment rate, and the inflation rate. Clearly they are not independent, and much of this book will be spent looking at the relations among them in detail. But it is useful to have a first look now.

Okun's Law

Intuition suggests that if output growth is high, unemployment will decrease, and this is indeed true. This relation was first examined by American economist Arthur Okun and for this reason has become known as **Okun's law**. Figure 2-5 plots the change in the unemployment rate on the vertical axis against the rate of growth of output on the horizontal axis for the United States since 1960. It also draws the line that best fits the cloud of points in the figure. Looking at the figure and the line suggests two conclusions:

Arthur Okun was an adviser to President Kennedy in the 1960s. Okun's law is, of course, not a law, but an empirical regularity.

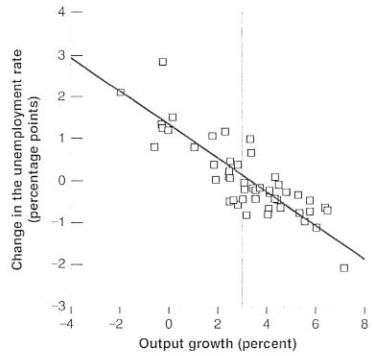
- The line is downward sloping and fits the cloud of points quite well. Put in economic terms: There is a tight relation between the two variables: Higher output

Figure 2-5

Changes in the unemployment rate versus output growth in the United States, 1960–2010

Output growth that is higher than usual is associated with a reduction in the unemployment rate; output growth that is lower than usual is associated with an increase in the unemployment rate.

Source: See Figures 2-2 and 2-3.



Such a graph, plotting one variable against another, is called a scatterplot. The line is called a regression line. For more on regressions, see Appendix 3.

growth leads to a decrease in unemployment. The slope of the line is −0.4. This implies that, on average, an increase in the growth rate of 1% decreases the unemployment rate by roughly −0.4%. This is why unemployment goes up in recessions and down in expansions. This relation has a simple but important implication: The key to decreasing unemployment is a high enough rate of growth.

- This vertical line crosses the horizontal axis at the point where output growth is roughly equal to 3%. In economic terms: It takes a growth rate of about 3% to keep unemployment constant. This is for two reasons. The first is that population, and thus the labor force, increases over time, so employment must grow over time just to keep the unemployment rate constant. The second is that output per worker is also increasing with time, which implies that output growth is higher than employment growth. Suppose, for example, that the labor force grows at 1% and that output per worker grows at 2%. Then output growth must be equal to 3% (1% + 2%) just to keep the unemployment rate constant.

The Phillips Curve

Okun's law implies that, with strong enough growth, one can decrease the unemployment rate to very low levels. But intuition suggests that, when unemployment becomes very low, the economy is likely to overheat, and that this will lead to upward pressure on inflation. And, to a large extent, this is true. This relation was first explored in 1958 by a New Zealand economist, A. W. Phillips, and has become known as the **Phillips curve**. Phillips plotted the rate of inflation against the unemployment rate. Since then, the Phillips curve has been redefined as a relation between the *change in the rate of inflation* and the unemployment rate. Figure 2-6 plots the change in the inflation rate (measured using the CPI) on the vertical axis against the unemployment rate on the horizontal axis, together with the line that fits the cloud of points best, for the United States since 1960. Looking at the figure again suggests two conclusions:

It should probably be known as the Phillips relation, but it is too late to change that.

- The line is downward sloping, although the fit is not as tight as it was for Okun's law: Higher unemployment leads, on average, to a decrease in inflation; lower unemployment leads to an increase in inflation. But this is only true on average. Sometimes, high unemployment is associated with an increase in inflation.

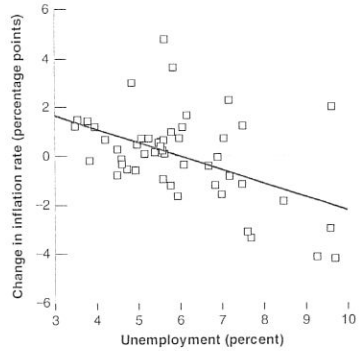


Figure 2-6

Changes in the inflation rate versus the unemployment rate in the United States, 1960–2010

A low unemployment rate leads to an increase in the inflation rate, a high unemployment rate to a decrease in the inflation rate.

Source: See Figures 2-3 and 2-4.

- The line crosses the horizontal axis at the point where the unemployment rate is roughly equal to 6%. In economic terms: When unemployment has been below 6%, inflation has typically increased, suggesting that the economy was overheating, operating above its potential. When unemployment has been above 6%, inflation has typically decreased, suggesting that the economy was operating below potential. But, again here, the relation is not tight enough that the unemployment rate at which the economy overheats can be pinned down very precisely. This explains why some economists believe that we should try to maintain a lower unemployment rate, say 4 or 5%, and others believe that it may be dangerous, leading to overheating and increasing inflation.

Clearly, a successful economy is an economy that combines high output growth, low unemployment, and low inflation. Can all these objectives be achieved simultaneously? Is low unemployment compatible with low and stable inflation? Do policy makers have the tools to sustain growth, to achieve low unemployment while maintaining low inflation? These are the questions we shall take up as we go through the book. The next two sections give you the road map.

2-5 The Short Run, the Medium Run, the Long Run

What determines the level of aggregate output in an economy?

- Reading newspapers suggests a first answer: Movements in output come from movements in the demand for goods. You probably have read news stories that begin like this: "Production and sales of automobiles were higher last month due to a surge in consumer confidence, which drove consumers to showrooms in record numbers." Stories like these highlight the role demand plays in determining aggregate output; they point to factors that affect demand, ranging from consumer confidence to interest rates.
- But, surely, no amount of Indian consumers rushing to Indian showrooms can increase India's output to the level of output in the United States. This suggests a second answer: What matters when it comes to aggregate output is the supply side—how much the economy can produce. How much can be produced depends on how advanced the technology of the country is, how much capital it is using, and the size and the skills of its labor force. These factors—not consumer confidence—are the fundamental determinants of a country's level of output.

- The previous argument can be taken one step further: Neither technology, nor capital, nor skills are given. The technological sophistication of a country depends on its ability to innovate and introduce new technologies. The size of its capital stock depends on how much people save. The skills of workers depend on the quality of the country's education system. Other factors are also important: If firms are to operate efficiently, for example, they need a clear system of laws under which to operate and an honest government to enforce those laws. This suggests a third answer: The true determinants of output are factors like a country's education system, its saving rate, and the quality of its government. If we want to understand what determines the level of output, we must look at these factors.

You might be wondering at this point, which of the three answers is right? The fact is that all three are right. But each applies over a different time frame:

- In the **short run**, say, a few years, the first answer is the right one. Year-to-year movements in output are primarily driven by movements in demand. Changes in demand, perhaps due to changes in consumer confidence or other factors, can lead to a decrease in output (a recession) or an increase in output (an expansion).
- In the **medium run**, say, a decade, the second answer is the right one. Over the medium run, the economy tends to return to the level of output determined by supply factors: the capital stock, the level of technology, and the size of the labor force. And, over a decade or so, these factors move sufficiently slowly that we can take them as given.
- In the **long run**, say, a few decades or more, the third answer is the right one. To understand why China has been able to achieve such a high growth rate since 1980, we must understand why both the capital stock and the level of technology in China are increasing so fast. To do so, we must look at factors like the education system, the saving rate, and the role of the government.

This way of thinking about the determinants of output underlies macroeconomics, and it underlies the organization of this book.

2-6 A Tour of the Book

The book is organized in three parts: A core; two extensions; and, finally, a comprehensive look at the role of macroeconomic policy. This organization is shown in Figure 2-7. We now describe it in more detail.

The Core

The core is composed of three parts—the short run, the medium run, and the long run.

- Chapters 3 to 5 look at how output is determined in the short run. To focus on the role of demand, we assume that firms are willing to supply any quantity at a given price. In other words, we ignore supply constraints. Chapter 3 looks at the goods market. Chapter 4 focuses on financial markets. Chapter 5 puts the goods and financial markets together. The resulting framework is known as the *IS–LM* model. Developed in the late 1930s, the *IS–LM* model still provides a simple way of thinking about the determination of output in the short run, and it remains a basic building block of macroeconomics. It also allows for a first pass at studying the effects of fiscal policy and monetary policy on output.

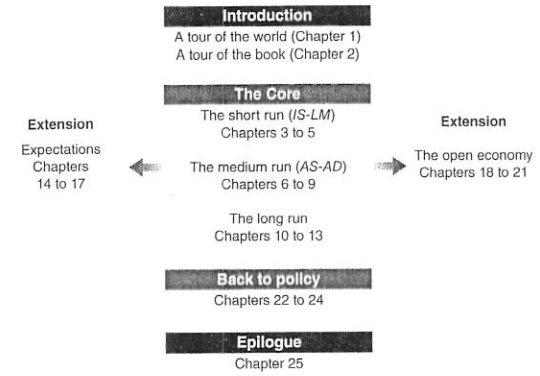


Figure 2-7

The organization of the book

- Chapters 6 to 9 develop the supply side and look at how output is determined in the medium run. Chapter 6 introduces the labor market. Chapter 7 puts together goods, financial, and labor markets and shows you how to think about the determination of output both in the short run and in the medium run. The resulting framework is called the aggregate supply-aggregate demand *AS–AD* model and, together with the *IS–LM*, is another workhorse of macroeconomics. Chapter 8 focuses on the relation between unemployment, inflation, and money growth. By then, you will have all the elements we need to take a first detailed look at the crisis. The crisis is unusual in a number of ways. The initial shock is a major shock to the financial system. Both monetary and fiscal policies are facing sharp constraints. As a result, the crisis is much deeper than a standard recession, and the recovery is proving to be very slow. This is the subject of Chapter 9.
- Chapters 10 to 13 focus on the long run. Chapter 10 introduces the relevant facts by looking at the growth of output both across countries and over long periods of time. Chapters 11 and 12 discuss how both capital accumulation and technological progress determine growth. Chapter 13 looks at the interaction among technological progress, wages, and unemployment.

Extensions

The core chapters give you a way of thinking about how output (and unemployment, and inflation) is determined over the short, medium, and long run. However, they leave out several elements, which are explored in two extensions:

- Expectations play an essential role in macroeconomics. Nearly all the economic decisions people and firms make—whether or not to buy a car, whether to buy bonds or to buy stocks, whether or not to build a new plant—depend on their expectations about future income, future profits, future interest rates, and so on. Fiscal and monetary policy affect economic activity not only through their direct effects, but also through their effects on people's and firms' expectations. While we touch on these issues in the core, Chapters 14 to 17 offer a more detailed treatment and draw the implications for fiscal and monetary policy.

- The core chapters treat the economy as *closed*, ignoring its interactions with the rest of the world. But the fact is, economies are increasingly *open*, trading goods and services and financial assets with one another. As a result, countries are becoming more and more interdependent. The nature of this interdependence and the implications for fiscal and monetary policy are the topics of Chapters 18 to 21.

Back to Policy

Monetary policy and fiscal policy are discussed in nearly every chapter of this book. But once the core and the extensions have been covered, it is useful to go back and put things together in order to assess the role of policy.

- Chapter 22 focuses on general issues of policy, whether macroeconomists really know enough about how the economy works to use policy as a stabilization tool at all, and whether policy makers can be trusted to do what is right.
- Chapters 23 and 24 return to the role of fiscal and monetary policy.

Epilogue

Macroeconomics is not a fixed body of knowledge. It evolves over time. The final chapter, Chapter 25, looks at the history of macroeconomics and how macroeconomists have come to believe what they believe today. From the outside, macroeconomics sometimes looks like a field divided among schools—"Keynesians," "monetarists," "new classicals," "supply-siders," and so on—hurling arguments at each other. The actual process of research is more orderly and more productive than this image suggests. We identify what we see as the main differences among macroeconomists, the set of propositions that define the core of macroeconomics today, and the challenges posed to macroeconomists by the crisis.

Summary

- We can think of GDP, the measure of aggregate output, in three equivalent ways: (1) GDP is the value of the final goods and services produced in the economy during a given period; (2) GDP is the sum of value added in the economy during a given period; and (3) GDP is the sum of incomes in the economy during a given period.
- Nominal GDP is the sum of the quantities of final goods produced times their current prices. This implies that changes in nominal GDP reflect both changes in quantities and changes in prices. Real GDP is a measure of output. Changes in real GDP reflect changes in quantities only.
- A person is classified as unemployed if he or she does not have a job and is looking for one. The unemployment rate is the ratio of the number of people unemployed to the number of people in the labor force. The labor force is the sum of those employed and those unemployed.
- Economists care about unemployment because of the human cost it represents. They also look at unemployment because it sends a signal about how efficiently the economy is using its resources. High unemployment indicates that the country is not utilizing its resources efficiently.
- Inflation is a rise in the general level of prices—the price level. The inflation rate is the rate at which the price level increases. Macroeconomists look at two measures of the price level. The first is the GDP deflator, which is the average price of the goods produced in the economy. The second is the Consumer Price Index (CPI), which is the average price of goods consumed in the economy.
- Inflation leads to changes in income distribution, to distortions, and to increased uncertainty.
- There are two important relations among output, unemployment, and inflation. The first, called Okun's law, is a relation between output growth and the change in unemployment: High output growth typically leads to a decrease in the unemployment rate. The second, called the Phillips curve, is a relation between unemployment and inflation: A low unemployment rate typically leads to an increase in the inflation rate.
- Macroeconomists distinguish between the short run (a few years), the medium run (a decade), and the long run (a few decades or more). They think of output as being determined by demand in the short run. They think of output as being determined by the level of technology, the capital stock, and the labor force in the medium run. Finally, they think of output as being determined by factors like education, research, saving, and the quality of government in the long run.

Key Terms

national income and product accounts, 20
aggregate output, 20
gross domestic product, GDP, 20
gross national product, GNP, 20
intermediate good, 20
final good, 21
value added, 21
nominal GDP, 22
real GDP, 22
real GDP in chained (2005) dollars, 23
dollar GDP, GDP in current dollars, 23
GDP in terms of goods, GDP in constant dollars, GDP adjusted for inflation, GDP in 2005 dollars, 24
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Questions and Problems

QUICK CHECK
All Quick Check questions and problems are available on MyEconLab.

1. Using the information in this chapter, label each of the following statements true, false, or uncertain. Explain briefly.

a. U.S. GDP was 28 times higher in 2010 than it was in 1960.
b. When the unemployment rate is high, the participation rate is also likely to be high.
c. The rate of unemployment tends to fall during expansions and rise during recessions.
d. If the Japanese CPI is currently at 108 and the U.S. CPI is at 104, then the Japanese rate of inflation is higher than the U.S. rate of inflation.
e. The rate of inflation computed using the CPI is a better index of inflation than the rate of inflation computed using the GDP deflator.
f. Okun's law shows that when output growth is lower than normal, the unemployment rate tends to rise.
g. Periods of negative GDP growth are called recessions.
h. When the economy is functioning normally, the unemployment rate is zero.
i. The Phillips curve is a relation between the level of inflation and the level of unemployment.

2. Suppose you are measuring annual U.S. GDP by adding up the final value of all goods and services produced in the economy. Determine the effect on GDP of each of the following transactions.

a. A seafood restaurant buys $100 worth of fish from a fisherman.
b. A family spends $100 on a fish dinner at a seafood restaurant.
c. Delta Air Lines buys a new jet from Boeing for $200 million.
d. The Greek national airline buys a new jet from Boeing for $200 million.
e. Delta Air Lines sells one of its jets to Denzel Washington for $100 million.

3. During a given year, the following activities occur:

i. A silver mining company pays its workers $200,000 to mine 75 pounds of silver. The silver is then sold to a jewelry manufacturer for $300,000.
ii. The jewelry manufacturer pays its workers $250,000 to make silver necklaces, which the manufacturer sells directly to consumers for $1,000,000.

a. Using the production-of-final-goods approach, what is GDP in this economy?
b. What is the value added at each stage of production? Using the value-added approach, what is GDP?
c. What are the total wages and profits earned? Using the income approach, what is GDP?

4. An economy produces three goods: cars, computers, and oranges. Quantities and prices per unit for years 2005 and 2006 are as follows:

	2005		2006	
	Quantity	Price	Quantity	Price
Cars	10	$2000	12	$3000
Computers	4	$1000	6	$500
Oranges	1000	$1	1000	$1

a. What is nominal GDP in 2005 and in 2006? By what percentage does nominal GDP change from 2005 to 2006?
b. Using the prices for 2005 as the set of common prices, what is real GDP in 2005 and in 2006? By what percentage does real GDP change from 2005 to 2006?

c. Using the prices for 2006 as the set of common prices, what is real GDP in 2005 and in 2006? By what percentage does real GDP change from 2005 to 2006?
d. Why are the two output growth rates constructed in (b) and (c) different? Which one is correct? Explain your answer.

5. Consider the economy described in Problem 4.
a. Use the prices for 2005 as the set of common prices to compute real GDP in 2005 and in 2006. Compute the GDP deflator for 2005 and for 2006 and compute the rate of inflation from 2005 to 2006.
b. Use the prices for 2006 as the set of common prices to compute real GDP in 2005 and in 2006. Compute the GDP deflator for 2005 and for 2006 and compute the rate of inflation from 2005 to 2006.
c. Why are the two rates of inflation different? Which one is correct? Explain your answer.

6. Consider the economy described in Problem 4.
a. Construct real GDP for years 2005 and 2006 by using the average price of each good over the two years.
b. By what percentage does real GDP change from 2005 to 2006?
c. What is the GDP deflator in 2005 and 2006? Using the GDP deflator, what is the rate of inflation from 2005 to 2006?
d. Is this an attractive solution to the problems pointed out in Problems 4 and 5 (i.e., two different growth rates and two different inflation rates, depending on which set of prices is used)? (The answer is yes and is the basis for the construction of chained-type deflators. See the appendix to this chapter for more discussion.)

7. Using macroeconomic relations:
a. Okun's law stated that when output growth is higher than usual, the unemployment rate tends to fall. Explain why usual output growth is positive.
b. In which year, a year where output growth is 2% or a year where output growth is -2%, will the unemployment rate rise more?
c. The Phillips curve is a relation between the change in the inflation rate and the level of the unemployment rate. Using the Phillips curve, is the unemployment rate zero when the rate of inflation is neither rising nor falling.
d. The Phillips curve is often portrayed a line with a negative slope. In the text, the slope is -0.4. In your opinion, is this a "better" economy if the line has a large slope, say -0.8, or a smaller slope, say -0.2?

DIG DEEPER

All Dig Deeper questions and problems are available on MyEconLab.

8. Hedonic pricing

As the first Focus box in this chapter explains, it is difficult to measure the true increase in prices of goods whose characteristics change over time. For such goods, part of any price increase can be attributed to an increase in quality. Hedonic pricing offers a method to compute the quality-adjusted increase in prices.

a. Consider the case of a routine medical checkup. Name some reasons you might want to use hedonic pricing to measure the change in the price of this service.

Now consider the case of a medical checkup for a pregnant woman. Suppose that a new ultrasound method is introduced. In the first year that this method is available, half of doctors offer the new method, and half offer the old method. A checkup using the new method costs 10% more than a checkup using the old method.

b. In percentage terms, how much of a quality increase does the new method represent over the old method? (*Hint:* Consider the fact that some women *choose* to see a doctor offering the new method when they could have chosen to see a doctor offering the old method.)

Now, in addition, suppose that in the first year the new ultrasound method is available, the price of checkups using the new method is 15% higher than the price of checkups in the previous year (when everyone used the old method).

c. How much of the higher price for checkups using the new method (as compared to checkups in the previous year) reflects a true price increase of checkups and how much represents a quality increase? In other words, how much higher is the quality-adjusted price of checkups using the new method as compared to the price of checkups in the previous year?

In many cases, the kind of information we used in parts (b) and (c) is not available. For example, suppose that in the year the new ultrasound method is introduced, all doctors adopt the new method, so the old method is no longer used. In addition, continue to assume that the price of checkups in the year the new method is introduced is 15% higher than the price of checkups in the previous year (when everyone used the old method). Thus, we observe a 15% price increase in checkups, but we realize that the quality of checkups has increased.

d. Under these assumptions, what information required to compute the quality-adjusted price increase of checkups is lacking? Even without this information, can we say anything about the quality-adjusted price increase of checkups? Is it more than 15%? less than 15%? Explain.

9. Measured and true GDP

Suppose that instead of cooking dinner for an hour, you decide to work an extra hour, earning an additional $12. You then purchase some (takeout) Chinese food, which costs you $10.

a. By how much does measured GDP increase?
b. Do you think the increase in measured GDP accurately reflects the effect on output of your decision to work? Explain.

EXPLORE FURTHER

10. Comparing the recessions of 2009 and 2001:

One very easy source for data is the Federal Reserve Bank of St. Louis FRED database. The series that measures real GDP is GDPC1, real GDP in each quarter of the year expressed at a seasonally adjusted annual rate (denoted SAAR). The monthly series for the unemployment rate is UNRATE. You can download these series in a variety of ways from this database.

a. Look at the data on quarterly real GDP growth from 1999 through 2001 and then from 2007 through 2009. Which recession has larger negative values for GDP growth, the recession centered on 2000 or the recession centered on 2008?
b. The unemployment rate is series UNRATE. Is the unemployment rate higher in the 2001 recession or the 2009 recession?
c. The National Bureau of Economic Research (NBER), which dates recessions, identified a recession beginning in March 2001 and ending in November 2001. The equivalent dates for the next, longer recession were December 2007 ending June 2009. In other words, according to the NBER, the economy began a recovery in November 2001 and in June 2009. Given your answers to parts (a) and (b), do you think the labor market recovered as quickly as GDP? Explain.

For more on NBER recession dating, visit www.nber.org. This site provides a history of recession dates and some discussion of their methodology.

Further Readings

- If you want to learn more about the definition and the construction of the many economic indicators that are regularly reported on the news—from the help-wanted index to the retail sales index—two easy-to-read references are:
  The *Guide to Economic Indicators*, by Norman Frumkin, 3rd edition, M.E. Sharpe, 4th edition, New York, 2005.
  The Economist Guide to Economic Indicators, by the staff of *The Economist*, 6th edition, Bloomberg, New York, 2007.
- In 1995, the U.S. Senate set up a commission to study the construction of the CPI and make recommendations about potential changes. The commission concluded that the rate of inflation computed using the CPI was on average about 1% too high. If this conclusion is correct, this implies in particular that real wages (nominal wages divided by the CPI) have grown 1% more per year than is currently being reported. For more on the conclusions of the commission and some of the exchanges that followed, read *Consumer Prices, the Consumer Price Index, and the Cost of Living*, by Michael Boskin et al., *Journal of Economic Perspectives*, 1998, 12(1): pp. 3–26.
- For a short history of the construction of the National Income Accounts, read *GDP: One of the Great Inventions of the 20th Century*, Survey of Current Business, January 2000, 1–9. (www.bea.gov/bea/articles/beawide/2000/0100od.pdf)
- For a discussion of some of the problems involved in measuring activity, read "What We Don't Know Could Hurt Us; Some Reflections on the Measurement of Economic Activity," by Katherine Abraham, *Journal of Economic Perspectives*, 2005, 19(3): pp. 3–18.
- To see why it is hard to measure the price level and output correctly, read "Viagra and the Wealth of Nations" by Paul Krugman, 1998 (www.pkarchive.org/theory/viagra.html). (Paul Krugman is an economist at Princeton University and a columnist at the New York Times. His columns are opinionated, insightful, and fun to read.)

APPENDIX: The Construction of Real GDP, and Chain-Type Indexes

The example we used in the chapter had only one final good—cars—so constructing real GDP was easy. But how do we construct real GDP when there is more than one final good? This appendix gives the answer.

To understand how real GDP in an economy with many final goods is constructed, all you need to do is look at an economy where there are just two final goods. What works for two goods works just as well for millions of goods.

Suppose that an economy produces two final goods, say wine and potatoes:

- In year 0, it produces 10 pounds of potatoes at a price of $1 a pound, and 5 bottles of wine at a price of $2 a bottle.
- In year 1, it produces 15 pounds of potatoes at a price of $1 a pound, and 5 bottles of wine at a price of $3 a bottle.
- Nominal GDP in year 0 is therefore equal to $20. Nominal GDP in year 1 is equal to $30.

This information is summarized in the following table.

Nominal GDP in Year 0 and in Year 1.

	Year 0		
	Quantity	$ Price	$ Value
Potatoes (pounds)	10	1	10
Wine (bottles),	5	5	10
Nominal GDP			20
	Year 1		
	Quantity	$ Price	$ Value
Potatoes (pounds)	15	1	15
Wine (bottles)	5	3	15
Nominal GDP			30

The rate of growth of nominal GDP from year 0 to year 1 is equal to $(\$30 - \$20)/\$20 = 50\%$. But what is the rate of growth of real GDP?

Answering this question requires constructing real GDP for each of the two years. The basic idea behind constructing real GDP is to evaluate the quantities in each year using the *same set of prices.*

Suppose we choose, for example, the prices in year 0. Year 0 is then called the **base year**. In this case, the computation is as follows:

- Real GDP in year 0 is the sum of the quantity in year 0 times the price in year 0 for both goods: $(10 \times \$1) + (5 \times \$2) = \$20$.
- Real GDP in year 1 is the sum of the quantity in year 1 times the price in year 0 for both goods: $(15 \times \$1) + (5 \times \$2) = \$25$.
- The rate of growth of real GDP from year 0 to year 1 is then $(\$25 - \$20)/\$20$, or 25%.

This answer raises however an obvious issue: Instead of using year 0 as the base year, we could have used year 1, or any other year. If, for example, we had used year 1 as the base year, then:

- Real GDP in year 0 would be equal to $(10 \times \$1 + 5 \times \$3) = \$25$.
- Real GDP in year 1 would be equal to $(15 \times \$1 + 5 \times \$3) = \$30$.
- The rate of growth of real GDP from year 0 to year 1 would be equal to \$5/\$25, or 20%.

The answer using year 1 as the base year would therefore be different from the answer using year 0 as the base year. So if the choice of the base year affects the constructed percentage rate of change in output, which base year should one choose?

Until the mid-1990s in the United States—and still in most countries today—the practice was to choose a base year and change it infrequently, say, every five years or so. For example, in the United States, 1987 was the base year used from December 1991 to December 1995. That is, measures of real GDP published, for example, in 1994 for both 1994 and for all earlier years were constructed using 1987 prices. In December 1995, national income accounts shifted to 1992 as a base year; measures of real GDP for all earlier years were recalculated using 1992 prices.

This practice was logically unappealing. Every time the base year was changed and a new set of prices was used, all past real GDP numbers—and all past real GDP growth rates—were recomputed: Economic history was, in effect, rewritten every five years! Starting in December 1995, the U.S. Bureau of Economic Analysis (BEA)—the government office that produces the GDP numbers—shifted to a new method that does not suffer from this problem.

The method requires four steps:

- Constructing the rate of change of real GDP from year t to year $t + 1$ in two different ways. First using the prices from year t as the set of common prices; second, using the prices from year $t + 1$ as the set of common prices. For example, the rate of change of GDP from 2006 to 2007 is computed by:
  (1) Constructing real GDP for 2006 and real GDP for 2007 using 2006 prices as the set of common prices, and computing a first measure of the rate of growth of GDP from 2006 to 2007.
  (2) Constructing real GDP for 2006 and real GDP for 2007 using 2007 prices as the set of common prices, and computing a second measure of the rate of growth of GDP from 2006 to 2007.
- Constructing the rate of change of real GDP as the average of these two rates of change.
- Constructing an index for the level of real GDP by *linking*—or *chaining*—the constructed rates of change for each year. The index is set equal to 1 in some arbitrary year. At the time this book is written, the arbitrary year is 2005. Given that the constructed rate of change from 2005 to 2006 by the BEA is 2.6%, the index for 2006 equals $(1 + 2.6\%) = 1.026$. The index for 2006 is then obtained by multiplying the index for 2005 by the rate of change from 2005 to 2006, and so on. (You will find the value of this index—multiplied by 100—in the second column of Table B3 in the Economic Report of the President. Check that it is 100 in 2005 and 102.6 in 2006, and so on.)
- Multiplying this index by nominal GDP in 2005 to derive *real GDP in chained (2005) dollars*. As the index is 1 in 2005, this implies that real GDP in 2005 equals nominal GDP in 2005.

  Chained refers to the chaining of rates of change described above. *(2005)* refers to the year where, by construction, real GDP is equal to nominal GDP. (You will find the value of real GDP in chained (2005) dollars in the first column of Table B2 of the Economic Report of the President.)

  This index is more complicated to construct than the indexes used before 1995. (To make sure you understand the steps, construct real GDP in chained (year 0) dollars for year 1 in our example.) But it is clearly better conceptually: The prices used to evaluate real GDP in two adjacent years are the right prices, namely the average prices for those two years. And, because the rate of change from one year to the next is constructed using the prices in those two years rather than the set of prices in an arbitrary base year, history will not be rewritten every five years—as it used to be when, under the previous method for constructing real GDP, the base year was changed every five years.

(For more details, go to www.bea.doc.gov/bea/ARTICLES/NATIONAL/NIPA/1995/0795od.pdf)

Key Term

base year, 40

The Short Run

In the short run, demand determines output. Many factors affect demand, from consumer confidence to fiscal and monetary policy.

THE CORE

Chapter 3

Chapter 3 looks at equilibrium in the goods market and the determination of output. It focuses on the interaction among demand, production, and income. It shows how fiscal policy affects output.

Chapter 4

Chapter 4 looks at equilibrium in financial markets and the determination of the interest rate. It shows how monetary policy affects the interest rate.

Chapter 5

Chapter 5 looks at the goods market and financial markets together. It shows what determines output and the interest rate in the short run. It looks at the role of fiscal and monetary policy. The model developed in Chapter 5 is called the *IS–LM* model and is one of the workhorses of macroeconomics.