chapter 7

>>Tracking the Macroeconomy

AFTER THE REVOLUTION

In December 1975 the government of Portugal—a provisional government in the process of establishing a democracy—feared that it was facing an economic crisis. Business owners, alarmed by the rise of leftist political parties, were issuing dire warnings about plunging production. Newspapers speculated that the economy had shrunk 10 or even 15% since the 1974 revolution that had overthrown the country's long-standing dictatorship.

In the face of this supposed economic collapse, some Portuguese were pronouncing democracy itself a failure. Others declared that capitalism was the culprit and demanded that the government seize control of the nation's factories to force them to produce more. But how bad was the situation, really?

To answer this question, Portugal's top monetary official invited his old friend Richard Eckaus, an economist at the Massachusetts Institute of Technology, and two other MIT economists to look at the country's national accounts, the set of data collected on the country's economic activity. The visiting experts had to engage in a lot of educated guesswork: Portugal's economic data collection had always been somewhat incomplete, and it had been further disrupted by political upheavals. For example, the country's statisticians normally tracked construction with data on the sales of structural steel and concrete. But in the somewhat chaotic situation of 1975, these indicators were moving in opposite directions because many builders were ignoring the construction regulations

Guy LeQuerrec/ Magnum


Walter Bibikow/ Index Stock

With accurate economic data, Portugal was able to make the transition from revolution in 1975 to a prosperous democracy today.

What you will learn in this chapter:

- How economists use aggregate measures to track the performance of the economy
- What **gross domestic product,** or **GDP,** is and the three ways of calculating it
- The difference between **real GDP** and **nominal GDP** and why real GDP is the appropriate measure of real economic activity
- The significance of the **unemployment rate** and how it moves over the business cycle
- What a **price index** is and how it is used to calculate the **inflation rate**

and using very little steel. (Travel tip: if you find yourself visiting Portugal, try to avoid being in a 1975-vintage building during an earthquake.)

Still, they went to work with the available data, and within a week they were able to make a rough estimate: aggregate output had declined only 3% from 1974 to 1975. The economy had suffered a serious setback, but its decline was much less drastic than the calamity being portrayed in the newspapers. (Later revisions pushed the decline up to 4.5%, but that was still much less than feared.) The Portuguese government certainly had work to do, but there was no need to abandon either democracy or a market economy. In fact, the economy soon began to recover. Over the past three decades, Portugal—though it has had its problems—has, on the whole, been a success story. A once-backward dictatorship is now a fairly prosperous, solidly democratic member of the European Union.

What's the lesson of this story? It is that economic measurement matters. If the government of Portugal had believed the scare stories some were telling at the time, it might have made major policy mistakes. Good macroeconomic policy depends on good measurement of what is happening in the economy as a whole.

In this chapter, we explain how macroeconomists measure key aspects of the economy—the level of income and aggregate output, the level of employment and unemployment, and the level and rate of change of prices.

The National Accounts

Almost all countries calculate a set of numbers known as the *national income and product accounts*. In fact, the accuracy of a country's accounts is a remarkably reliable indicator of its state of economic development—in general, the more reliable the accounts, the more economically advanced the country. When international economic agencies seek to help a less developed country, typically the first order of business is to send a team of experts to audit and improve the country's accounts.

The **national income and product accounts,** or **national accounts,** keep track of the flows of money between different sectors of the economy.

In the United States, these numbers are calculated by the Bureau of Economic Analysis, a division of the U.S. government's Commerce Department. The **national income and product accounts,** often referred to simply as the **national accounts,** keep track of the spending of consumers, sales of producers, business investment spending, government purchases, and a variety of other flows of money between different sectors of the economy. Let's see how they work.

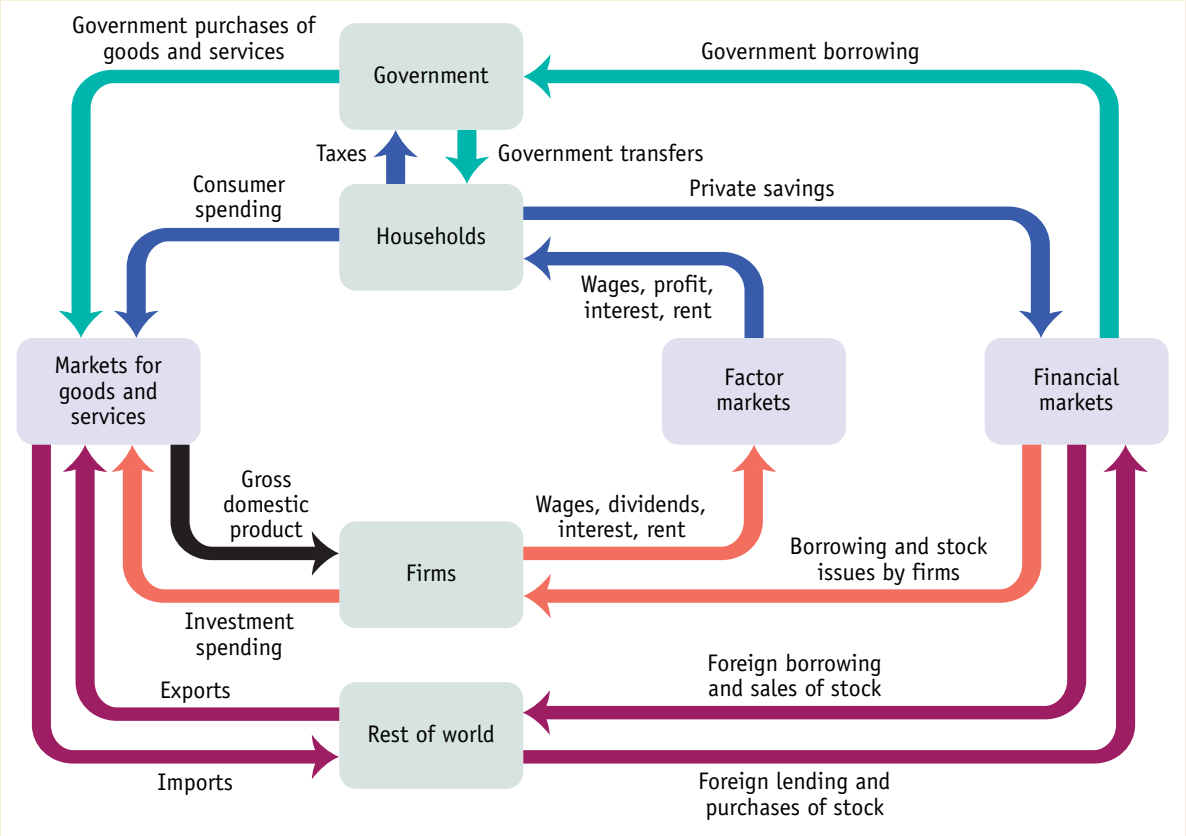
The Circular-Flow Diagram, Revisited and Expanded

To understand the principles behind the national accounts, it helps to look at Figure 7-1, a revised and expanded *circular-flow diagram* similar to the one we introduced in Chapter 2. Recall that in Figure 2-7 we showed the flows of money, goods and services, and factors of production through the economy. Here we restrict ourselves to flows of money but add extra elements that allow us to show the key concepts behind the national accounts. As in our original version of the circular-flow diagram, the underlying principle is that the flow of money into each market or sector is equal to the flow of money coming out of that market or sector.

Figure 2-7 showed a simplified world containing only two kinds of "inhabitants," households and firms. And it illustrated the circular flow of money between households and firms, which remains visible in Figure 7-1. In the markets for goods and services, households engage in **consumer spending,** buy goods and services from domestic firms and from firms in the rest of the world. Households also own factors of production—

Consumer spending is household spending on goods and services.

Figure 7-1 An Expanded Circular-Flow Diagram: The Flows of Money Through the Economy



A circular flow of funds connects the four sectors of the economy—households, firms, government, and the rest of the world—via three types of markets: the factor markets, the markets for goods and services, and the financial markets. Funds flow from firms to households in the form of wages, profit, interest, and rent through the factor markets. After paying taxes to the government and receiving government transfers, households allocate the remaining income—disposable income—to private savings and consumer spending. Via the financial markets, private savings and funds from the rest of the world are channeled into investment spending by firms, government borrowing, foreign borrowing and lending, and foreign transactions of stocks. In turn, funds flow from the government and households to firms to pay for purchases of goods and services. Finally, exports to the rest of the world generate a flow of funds into the economy and imports lead to a flow of funds out of the economy. If we add up consumer spending on goods and services, investment spending by firms, government purchases of goods and services, and exports, then subtract the value of imports, the total flow of funds represented by this calculation is total spending on final goods and services produced in the United States. Equivalently, it's the value of all the final goods and services produced in the United States—that is, the gross domestic product of the economy.

labor, land, physical capital and financial capital. They sell the use of these factors of production to firms, receiving wages, rent, profit, and interest payments in return. Firms buy and pay households for the use of those factors of production in the factor markets. Most households derive the bulk of their income from wages earned by selling labor. But households derive additional income from their indirect ownership of the physical capital used by firms, mainly in the form of **stocks,** shares in the ownership of a company, and **bonds,** borrowing by firms in the form of an IOU that pays interest. So the income households receive from the factor markets includes profit distributed to shareholders, and the interest payments on bonds held by households. Finally, households receive rent in return for allowing firms to use land or structures that they own. So households receive income in the form of wages, profit, interest, and rent via factor markets.

A **stock** is a share in the ownership of a company held by a shareholder.

A **bond** is borrowing in the form of an IOU that pays interest.

In our original, simplified circular-flow diagram, households spent all the income they receive via factor markets on goods and services. Figure 7-1, however, illustrates a more complicated and more realistic model. There we see two reasons why goods and services don't in fact absorb all of households' income. First, households don't get to keep all the income they receive via the factor markets. They must pay part of their income to the government in the form of taxes, such as income taxes and sales taxes. In addition, some households receive **government transfers**—payments by the government to individuals for which no good or service is provided in return, such as Social Security benefits and unemployment insurance payments. The total income households have left after paying taxes and receiving government transfers is **disposable income.**

Government transfers are payments by the government to individuals for which no good or service is provided in return.

Disposable income, equal to income plus government transfers minus taxes, is the total amount of household income available to spend on consumption and to save.

In addition, households normally don't spend all their disposable income on goods and services. Instead, part of their income is typically set aside as **private savings,** which goes into **financial markets** where individuals, banks, and other institutions buy and sell stocks and bonds as well as make loans. As Figure 7-1 shows, the financial markets also receive funds from the rest of the world and provide funds to the government, to firms, and to the rest of the world.

Private savings, equal to disposable income minus consumer spending, is disposable income that is not spent on consumption.

The banking, stock, and bond markets, which channel private savings and foreign lending into investment spending, government borrowing, and foreign borrowing are known as the **financial markets.**

Before going further, we can use the box representing households to illustrate an important general feature of the circular-flow diagram: the total sum of flows of money out of a given box is equal to the total sum of flows of money into that box. It's simply a matter of accounting: what goes in must come out. So, for example, the total flow of money out of households—the sum of taxes paid, consumer spending, and private savings—must equal the total flow of money into households—the sum of wages, profit, interest, rent, and government transfers.

Now let's look at the other types of inhabitants we've added to the circular-flow diagram, including the government and the rest of the world. The government returns part of the money it collects from taxes to households in the form of government transfers. However, it uses much of its tax revenue, plus additional funds borrowed in the financial markets through **government borrowing,** to buy goods and services. **Government purchases of goods and services,** the total purchases by federal, state, and local governments, include everything from the military spending on ammunition to your local public school's spending on chalk, erasers, and teacher salaries.

Government borrowing is the amount of funds borrowed by the government in the financial markets.

Government purchases of goods and services are government expenditures on goods and services.

Goods and services sold to residents of other countries are **exports;** goods and services purchased by residents of other countries are **imports.**

The rest of the world participates in the U.S. economy in three ways. First, some of the goods and services produced in the United States are sold to residents of other countries. For example, more than half of America's annual wheat and cotton crops are sold abroad. Goods and services sold to other countries are known as **exports.** Export sales lead to a flow of funds from the rest of the world into the United States to pay for them. Second, some of the goods and services purchased by residents of the United States are produced abroad. For example, many consumer goods are made in China. Goods and services purchased from residents of other countries are known as **imports.** Import purchases lead to a flow of money out of the United States to pay for them. Third, foreigners can participate in U.S. financial markets by making transactions. Foreign lending—lending by foreigners to parties in the United States, and purchases by foreigners of shares of stock in American companies—generates a flow of funds into the United States from the rest of the world. Conversely, foreign borrowing—borrowing by foreigners from U.S. parties and sales to Americans of stock in foreign companies—leads to a flow of funds out of the United States to the rest of the world.

Finally, let's go back to the markets for goods and services. In Chapter 2 we focused only on purchases of goods and services by households. We now see that there are other types of spending on goods and services, including government purchases, imports, and exports. Notice that firms also buy goods and services in our expanded economy. For example, an automobile company that is building a new factory will buy investment goods, stamping presses, welding robots, and other machines from companies that specialize in producing these items. It will also accumulate an inventory of finished cars in preparation for shipping them to dealers. The national income accounts count this **investment spending**—spending on productive physical capital,

Investment spending is spending on productive physical capital, such as machinery and construction of structures, and on changes to inventories.

such as machinery and construction of structures, and on changes to *inventories*—as part of total spending on goods and services.

You might ask why changes to inventories are included in investment spending—finished cars aren't, after all, used to produce more cars. Additional inventories of finished goods are counted as investment spending because, like machinery, they contribute to greater future sales for a firm. So spending on additions to inventories is a form of investment spending by a firm. Conversely, a drawing-down of inventories is counted as a fall in investment spending because it leads to lower future sales. It's also important to understand that investment spending includes spending on construction of any structure, regardless of whether it is an assembly plant or a new house. Why include construction of homes? Because, like a plant, a new house produces a future stream of services—housing services for its occupants.

Suppose that we add up consumer spending on goods and services, investment spending, government purchases of goods and services, and the value of exports, then subtract the value of imports. That measure has a name: it's a country's *gross domestic product*. But before we can formally define gross domestic product, or GDP, we have to examine an important distinction between classes of goods and services: the difference between *final goods and services* versus *intermediate goods and services*.

Gross Domestic Product

A consumer's purchase a new car from a dealer is one example of a sale of **final goods and services:** goods and services sold to the final, or end, user. But an automobile manufacturer's purchase of steel from a steel foundry or glass from a glassmaker is an example of purchasing **intermediate goods and services:** goods and services that are inputs for production of final goods and services. In the case of intermediate goods and services, the purchaser—another firm—is *not* the final user.

Gross domestic product, or **GDP,** is the total value of all *final* goods and services produced in an economy during a given period, usually a year. In 2004 the GDP of the United States was $11,734 billion, or about $40,000 per person. So if you are an economist trying to construct a country's national accounts, *one way to calculate GDP is to calculate it directly: survey firms and find out the value of their production of final goods and services.* We'll explain in detail in the next section why intermediate goods, and some other types of goods as well, are not included in the calculation of GDP.

Final goods and services are goods and services sold to the final, or end, user.

Intermediate goods and services are goods and services—bought from one firm by another firm—that are inputs for production of final goods and services.

Gross domestic product, or **GDP,** is the total dollar value of all final goods and services produced in the economy during a given year.

But adding up the total value of final goods and services produced isn't the only way of calculating GDP. Since GDP is equal to the total value of final goods and services produced in the economy, it must also equal the flow of money received by firms from sales in the goods and services market. If you look again at the circular-flow diagram in Figure 7-1, you will see that the arrow going from markets for goods and services to firms is indeed labeled "gross domestic product." By our basic rule of accounting, which says that flows out of any box are equal to flows into the box, the flow of funds out of the markets for goods and services to firms is equal to the total flow of funds into the markets for goods and services from other sectors. And as you can see from Figure 7-1, the total flow of funds into the markets for goods and services is total spending on domestically produced final goods and services—the sum of consumer spending, investment spending, government purchases of goods and services, and exports minus imports. *So a second way of calculating GDP is to add up total spending on domestically produced final goods and services in the economy.*

"You wouldn't think there'd be much money in potatoes, chickens, and woodchopping, but it all adds up."

And there is yet another way of calculating GDP. The flow from firms to the factor markets is the factor income paid out by firms to households in the form of wages, profit, interest, and rent. Again, by accounting rules, the value of the flow of factor income from firms to households must be equal to the flow of money into firms from the markets for goods and services. And this last value, we know, is the total value of production in the economy—GDP. An intuitive explanation of why

GDP is equal to the total value of factor income paid by firms in the economy to households is the fact that the value of each sale in the economy must accrue to someone as income—either as wages, interest, payments, rent, or profit. *So a third way of calculating GDP is to sum the total factor income earned by households from firms in the economy.*

Calculating GDP

We've just explained that there are in fact three methods for calculating GDP. Government statisticians use all three methods. To explain how these three methods work, we will consider a hypothetical economy, shown in Figure 7-2. This economy consists of three firms—American Motors, Inc., which produces one car per year; American Steel, Inc., which produces the steel that goes into the car; and American Ore, Inc., which mines the iron ore that goes into the steel. This economy produces one car, worth $21,500. So GDP is $21,500. Let's look at how the three different methods of calculating GDP yield the same result.

Measuring GDP as the Value of Production of Final Goods and Services

The first method for calculating GDP is to add up the value of all the final goods and services produced in the economy—a calculation that excludes the value of intermediate goods and services (goods and services that are inputs in the production of final goods and services). Why are intermediate goods and services excluded? After all, don't they represent a very large and valuable portion of the economy?

To understand why only final goods and services are included in GDP, look at the simplified economy described in Figure 7-2. Should we measure the GDP of this economy by adding up the total sales of the iron ore producer, the steel producer, and the auto producer? If we did, we would in effect be counting the value of the steel twice—once when it is sold by the steel plant to the auto plant, and again when the steel auto body is sold to a consumer as a finished car. And we would be counting the value of the iron ore *three* times—once when it is mined and sold to the steel company, a second time when it is made into steel and sold to the auto producer, and a third time when the steel is made into a car and sold to the consumer. So counting the full value of each producer's sales would cause us to count the same items several times and artificially inflate the

Figure 7-2

Calculating GDP

In this hypothetical economy consisting of three firms, GDP can be calculated in three different ways: Measuring GDP as the value of production of final goods and services, by summing each firm's value added; measuring GDP as spending on domestically produced final goods and services, and measuring GDP as factor income earned from firms in the economy.

Total spending on domestically produced final goods and services = $21,500

	American Ore, Inc.	American Steel, Inc.	American Motors, Inc.	Total factor income
Value of sales	$4,200 (ore)	$9,000 (steel)	$21,500 (car)	
Intermediate goods	0	4,200 (iron ore)	9,000 (steel)	
Wages	2,000	3,700	10,000	$15,700
Interest payments	1,000	600	1,000	2,600
Rent	200	300	500	1,000
Profit	1,000	200	1,000	2,200
Total expenditure by firm	4,200	9,000	21,500	
Value added per firm = Value of sales – cost of intermediate goods	4,200	4,800	12,500	

Total payments to factors = $21,500

Sum of value added = $21,500

FOR INQUIRING MINDS

OUR IMPUTED LIVES

An old line says that when a person marries his or her housekeeper or chef, GDP falls. And it's true: when someone provides services for pay, those services are counted as a part of GDP. But the services family members provide to each other are not. Some economists have produced alternative measures that try to "impute" the value of household work—that is, assign an estimate of what the market value of that work would have been if it had been paid for. But the standard measure of GDP doesn't contain that imputation.

GDP estimates do, however, include an imputation for the value of "owner-occupied housing." That is, if you buy the home you were formerly renting, GDP does not go down. It's true that because you no longer pay rent to your landlord, the landlord no longer sells a service to you—namely, use of the house or apartment. But the statisticians make an estimate of what you would have paid if you rented whatever you live in, whether it's an apartment or a house. For the purposes of the statistics, it's as if you were renting your dwelling from yourself.

If you think about it, this makes a lot of sense. In a homeowning country like the United States, the pleasure we derive from our houses is an important part of the standard of living. So to be accurate, estimates of GDP must take into account the value of housing that is occupied by owners as well as the value of rental housing.

calculation of GDP. For example, in Figure 7-2, the total value of all sales, intermediate and final, is $34,700: $21,500 from the sale of the car, plus $9,000 from the sale of the steel, plus $4,200 from the sale of the iron ore. Yet we know that GDP is only $21,500.

The way we avoid double-counting is to count only each producer's **value added** in the calculation of GDP: the difference between the value of its sales and the value of the inputs it purchases from other businesses. In this case, the value added of the auto producer is the dollar value of the cars it manufactures *minus* the cost of the steel it buys, or $12,500. The value added of the steel producer is the dollar value of the steel it produces *minus* the cost of the ore it buys, or $4,800. Only the ore producer, which we have assumed doesn't buy any intermediate inputs, has value added equal to its total sales, $4,200. The sum of the three producers' value added is $21,500, equal to GDP.

The **value added** of a producer is the value of its sales minus the value of its purchases of inputs.

Measuring GDP as Spending on Domestically Produced Final Goods and Services Another way to calculate GDP is by adding up total spending on domestically produced final goods and services. That is, GDP can be measured by the flow of funds into firms. Like the method that estimates GDP as the value of production, this measurement must be carried out in a way that avoids double-counting. In terms of our steel and auto example, we don't want to count both consumer spending on a car (represented in Figure 7-2 by the sales price of the car) and the auto producer's spending on steel (represented in Figure 7-2 by the price of a car's worth of steel). If we counted both, we would be counting the steel embodied in the car twice. We solve this problem by counting only the value of sales to *final buyers*, such as consumers, firms that purchase investment goods, the government, or foreign buyers. In other words, in order to avoid double-counting of spending, we omit sales of inputs from one business to another when estimating GDP using spending data.

As we've already pointed out, however, the national accounts *do* include investment spending by firms as a part of final spending. That is, an auto company's purchase of steel to make a car isn't considered a part of final spending, but the company's purchase of new machinery for its factory *is* considered a part of final spending. What's the difference? Steel is an input that is used up in production; machinery, although it is used to make cars, will last for a number of years. Since purchases of capital goods, like machinery, that will last for a considerable time aren't closely tied to current production, the national accounts consider such purchases a form of final sales.

In later chapters, we will repeatedly make use of the proposition that GDP is equal to total spending on domestically produced goods and services by final buyers. We will also develop models of how each group of final buyers decides how much to spend. So it is useful at this point to look at a breakdown of the types of spending that make up GDP.

PITFALLS

GDP: WHAT'S IN AND WHAT'S OUT

It's easy to confuse what is included and what isn't included in GDP. So let's stop here for a moment and make sure the distinction is clear. Probably the biggest source of confusion is the difference between investment spending and spending on inputs. Investment spending—spending on investment goods, construction of structures (residential as well as commercial), and changes to inventories—is included in GDP. But spending on inputs is not. Why the difference? Recall from Chapter 2 that we made a distinction between resources that are *used up* and those that are *not used up* in production. An input, like steel, is used up in production. A metal-stamping machine, an investment good, is not; it will last for many years and will be used repeatedly to make many cars. Since spending on investment goods and construction of structures is not directly tied to current output, economists consider such spending to be spending on final goods. And spending on changes to inventories, considered a part of investment spending, is also included in GDP. Why? Because, like a machine, additional inventory is an investment in future sales. And when a good is released for sale from inventories, its value is subtracted from the value of inventories and so from GDP. Used goods are not included in GDP because, as with inputs, to include them would be to double-count: counting them once when sold as new and again when resold as used. Finally, financial assets such as stocks and bonds are not included in GDP because they don't represent either the production or the sale of final goods and services. Rather, a bond represents a promise to repay with interest, and a stock represents a proof of ownership.

Here is a summary of what's included and not included in GDP.

Included

- Domestically produced final goods and services, including capital goods, new construction of structures, and changes to inventories

Not Included

- Intermediate goods and services
- Inputs
- Used goods
- Financial assets like stocks and bonds
- Foreign-produced goods and services

Look again at the markets for goods and services in Figure 7-1, and you will see that one component of sales by firms is consumer spending. Let's denote consumer spending with the symbol *C*. Figure 7-1 also shows three other components of sales: sales of investment spending goods to other businesses, which we will denote by *I;* government purchases of goods and services, which we will denote by *G;* and sales to foreigners—that is, exports—which we will denote by *X*.

But not all of this final spending goes toward domestically produced goods and services: spending on imports, which we will denote by *IM*, "leaks" across national borders. Putting this all together gives us the following equation that breaks GDP down by the four sources of spending:

$$\textbf{(7-1)} \quad \text{GDP} = C + I + G + X - IM$$

We'll be seeing a lot of Equation 7-1 in later chapters.

Measuring GDP as Factor Income Earned from Firms in the Economy A final way to calculate GDP is to add up all the income earned by factors of production from firms in the economy—the wages earned by labor; the interest earned by those who lend their savings to firms and the government; the rent earned by those who lease their land or structures to firms; and the profit earned by the shareholders, the owners of the firms' capital. This is a valid measure because the money firms earn by selling goods and services must go somewhere; whatever isn't paid as wages, interest, or rent is profit. And part of profit is paid out to shareholders as *dividends*.

Figure 7-2 shows how this calculation works for our simplified economy. The shaded column at far right shows the total wages, interest, and rent paid by all these firms as well as their total profit. Summing up all of these yields total factor income of $21,500—again, equal to GDP.

We won't emphasize factor income as much as the other two methods of calculating GDP. It's important to keep in mind, however, that all the money spent on domestically produced goods and services generates factor income to households—that is, there really is a circular flow.

The Components of GDP Now that we know how GDP is calculated in principle, let's see what it looks like in practice.

Figure 7-3 shows the first two methods of calculating GDP side by side. The height of each bar above the horizontal axis represents the GDP of the U.S. economy in 2004: $11,734 billion. Each bar is divided to show the breakdown of that total in terms of where the value was added and how the money was spent.

FOR INQUIRING MINDS

GROSS WHAT?

Occasionally you may see references not to gross domestic product but to gross *national* product, or GNP. Is this just another name for the same thing? Not quite.

If you look at Figure 7-1 carefully, you may realize that there's a possibility that is missing from the figure. According to the figure, all factor income goes to domestic households. But what happens when profits are paid to foreigners who own stock in General Motors or Microsoft? And where do the profits earned by American companies operating overseas fit in?

The answer is that they go into GNP but not GDP. GNP is defined as the total factor income earned by residents of a country. It *excludes* factor income earned by foreigners, like profits paid to Japanese investors who own American stocks and payments to Mexican farm workers temporarily in the United States. But it *includes* factor income earned abroad by Americans, like the profits of IBM's European operations that accrue to IBM's American shareholders and the wages of American consultants who work temporarily in Asia.

In the early days of national income accounting, economists usually used GNP rather than GDP as a measure of the economy's size—although the measures were generally very close to each other. They switched to GDP mainly because it's considered a better indicator of short-run movements in production and because data on international flows of factor income are considered somewhat unreliable.

In practice, it doesn't make much difference which measure is used for large economies like that of the United States, where the flows of net factor income to other countries are small. In 2004, America's GNP was about 0.4% larger than its GDP, mainly because of the overseas profit of U.S. companies. For smaller countries, however, GDP and GNP can diverge significantly. For example, much of Ireland's industry is owned by American corporations, whose profit must be deducted from Ireland's GNP. In addition, Ireland has become a host to many temporary workers from poorer regions of Europe, whose wages must also be deducted from Ireland's GNP. As a result, in 2004 Ireland's GNP was only 84% of its GDP.

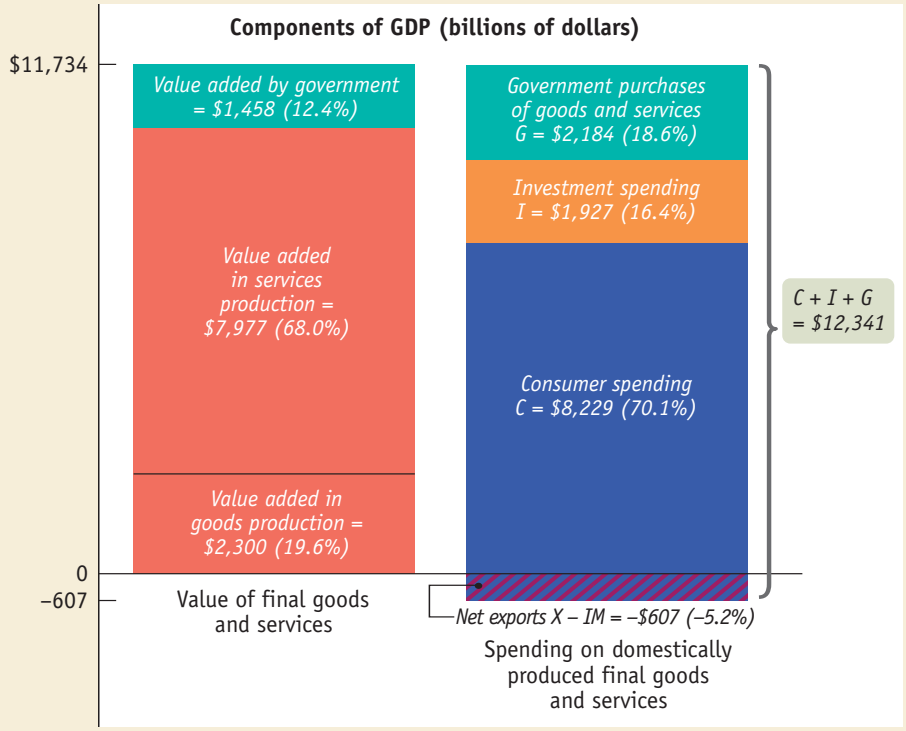
In the left bar in Figure 7-3, we see the breakdown of GDP by value added according to sector, the first method of calculating GDP. Of the $11,734 billion, $2,300 billion—less than 20%—consisted of the value added by producers of physical goods. Another $7,977 billion, or 68%, consisted of value added by private producers of services. The rest consisted of value added by government, in the form of military,

Figure 7-3

U.S. GDP in 2004: Two Methods of Calculating GDP

The two bars show two equivalent ways of calculating GDP. The height of each bar above the horizontal axis represents $11,734 billion, U.S. GDP in 2004. The left bar shows the breakdown of GDP according to the value added of each sector of the economy. From it we see that less than 20% of GDP in 2004 came from the value added in the production of goods. The rest came from the value added in the production of services. The right bar shows the breakdown of GDP according to the four types of spending: C, I, G, and X – IM. The right bar has a total length of $11,734 billion + $607 billion = $12,341 billion. The $607 billion, shown as the area extending below the horizontal axis, is the amount of total spending absorbed by net imports (negative net exports) in 2004.

Source: Bureau of Economic Analysis.



education, and other government services. As commentators often emphasize, the United States is now largely a service economy.

The right bar in Figure 7-3 corresponds to the second method of calculating GDP, showing the breakdown by tile four types of spending. The total length of the right bar is longer than the total length of the left bar, a difference of $607 billion (which, as you can see, extends below the horizontal axis). That's because the total length of the right bar represents total spending in the economy, spending on both domestically produced and foreign produced final goods and services. Within the bar, consumer spending (C), which is 70.1% of GDP, dominates the picture. But some of that spending was absorbed by foreign produced goods and services. In 2004, **net exports,** the difference between the value of exports and the value of imports (X – IM in Equation 7-1) was negative—the United States was a net importer of foreign goods and services. The 2004 value of X – IM was –$607 billion, or –5.2% of GDP. Thus a portion of the right bar extends below the horizontal axis by $607 billion to represent the amount of total spending that was absorbed by net imports and therefore did not lead to higher U.S. GDP. Investment spending (I) constituted 16.4% of GDP, while government purchases of goods and services (G) constituted 18.6% of GDP.

Net exports are the difference between the value of exports and the value of imports.

What GDP Tells Us

Now we've seen the various ways that gross domestic product is calculated. But what does the measurement of GDP tell us?

The most important use of GDP is as a measure of the size of the economy, providing us a scale against which to measure the economic performance of others years, or compare the economic performance of other countries. For example, suppose you want to compare the economies of different nations. A natural approach is to compare their GDPs. In 2004, as we've seen, U.S. GDP was $11,734 billion; Japan's GDP was $4,665 billion; and the combined GDP of the 25 countries that make up the European Union was $12,758 billion. This comparison tells us that Japan, although it has the world's second-largest national economy, carries considerably less economic weight than does the United States. When taken in aggregate, Europe is America's equal.

Still, one must be careful when using GDP numbers, especially when making comparisons over time. That's because part of the increase in the value of GDP over time represents increases in the *prices* of goods and services rather than an increase in output. For example, U.S. GDP was $5,803 billion in 1990 and had roughly doubled to $11,734 billion by 2004. But the U.S. economy didn't actually double in size over that period. To measure actual changes in aggregate output, we need a modified version of GDP that is adjusted for price change, known as *real GDP*. We'll see next how real GDP is calculated.

economics in action

Creating the National Accounts

The national accounts, like modern macroeconomics, owe their creation to the Great Depression. As the economy plunged into depression, government officials found their ability to respond crippled not only by the lack of adequate economic theories but also by the lack of adequate information. All they had were scattered statistics: railroad freight car loadings, stock prices, and incomplete indexes of industrial production. They could only guess at what was happening to the economy as a whole.

In response to this perceived lack of information, the Department of Commerce commissioned Simon Kuznets, a young Russian-born economist, to develop a set of national income accounts. (Kuznets later won the Nobel Prize in economics for his work.) The first version of these accounts was presented to Congress in 1937 and in a research report titled *National Income, 1929–35*.

There was, at first, some skepticism about the usefulness of such accounts. In 1936 the British economist John Maynard Keynes published *The General Theory of Employment,*

Interest, and Money, the book that created modern macroeconomic theory. Keynes argued against trying to use the concepts of aggregate output or the aggregate price level: "To say that net output to-day is greater, but the price-level lower, than ten years ago or one year ago, is a proposition of a similar character to the statement that Queen Victoria was a better queen but not a happier woman than Queen Elizabeth—a proposition not without meaning and not without interest, but unsuitable as material for the differential calculus." But macroeconomists soon found that the concepts of aggregate output and the aggregate price level, tied to actual measurements of these quantities, were powerful aids to understanding economic developments.

Kuznets's initial estimates fell short of the full modern set of accounts because they focused on income, not production. The push to fill out the national accounts came during World War II, when policy makers were in even more need of comprehensive measures of the economy's performance. The federal government began issuing estimates of gross domestic product and gross national product in 1942.

In January 2000, in its publication *Survey of Current Business,* the Department of Commerce ran an article titled "GDP: One of the Great Inventions of the 20th Century." This may seem a bit over the top, but national income accounting, invented in the United States, has since become a tool of economic analysis and policy making around the world. ■

>>QUICK REVIEW

- A country's *national accounts* track flows of money among economic sectors.
- Households receive factor income in the form of wages, profit from ownership of *stocks,* interest paid on *bonds,* and rent. They also recieve *government transfers.*
- Households allocate *disposable income* between *consumer spending* and *private savings,* funds that flow into the *financial markets* and finance *investment spending* and any *government borrowing.*
- *Imports* lead to a flow of funds out of the country. *Exports* lead to a flow of funds into the country.
- *Gross domestic product,* or *GDP,* can be calculated in three different ways: add up the value of production of final goods and services by adding up *value added* of all firms; add up all spending on domestically produced *final goods and services;* or add up all factor income paid by firms. *Intermediate goods and services* are not included in the calculation of GDP.

>>CHECK YOUR UNDERSTANDING 7-1

1. Explain why the three methods of calculating GDP produce the same estimate of GDP.
2. What are the various sectors to which firms make sales? What are the various ways in which households are linked with other sectors of the economy?
3. Consider Figure 7-2 and suppose you mistakenly believed that total value added was $30,500, the sum of the sales price of a car and a car's worth of steel. What items would you be counting twice?

Solutions appear at back of book.

Real GDP and Aggregate Output

Although the commonly cited GDP number is an interesting and useful statistic, it is not a useful measure for tracking changes in aggregate output over time. For example, GDP can rise either because the economy is producing more or simply because the prices of the goods and services it produces have increased. Likewise, GDP can fall either because the economy is producing less or because prices have fallen. In order to separate these possibilities, we must calculate how much the economy has changed in *real* terms over any given period. That is, we need to calculate how much of the change in GDP is due to a change in aggregate output separate from a change in prices. The measure that is used for this purpose is known as real GDP. Let's look first at how real GDP is calculated, then at what it means.

Calculating Real GDP

To understand how real GDP is calculated, imagine an economy in which only two goods, apples and oranges, are produced and in which both goods are sold only to final consumers. The outputs and prices of the two fruits for two consecutive years are shown in Table 7-1.

The first thing we can say about these data is that the value of sales increased from year 1 to year 2. In the first year, the total value of sales was (2,000 billion × $0.25) + (1,000 billion × $0.50) = $1,000 billion; in the second it was (2,200 billion × $0.30) + (1,200 billion × $0.70) = $1,500 billion, which is 50% larger. But it is also clear from the table that this increase in the dollar value of GDP overstates the real growth in the economy. Although the quantities of both apples and oranges increased, the prices of both apples and oranges also rose. So part of the 50% increase in the dollar value of GDP simply reflects higher prices, not higher production of output.

TABLE 7-1

Calculating GDP and Real GDP in a Simple Economy

	Year 1	Year 2
Quantity of apples (billions)	2,000	2,200
Price of apple	$0.25	$0.30
Quantity of oranges (billions)	1,000	1,200
Price of orange	$0.50	$0.70
GDP (billions of dollars)	$1,000	$1,500
Real GDP (billions of year 1 dollars)	$1,000	$1,150

To estimate the true increase in aggregate output produced, we have to ask the following question: How much would GDP have gone up if prices had *not* changed? To answer this question, we need to find the value of output in year 2 expressed in year 1 prices. In year 1 the price of apples was $0.25 each and the price of oranges $0.50 each. So year 2 output *at year 1 prices* is (2,200 billion × $0.25) + (1,200 billion × $0.50) = $1,150 billion. And output in year 1 at year 1 prices was $1,000 billion. So in this example GDP measured in year 1 prices rose 15%—from $1,000 billion to $1,150 billion.

Real GDP is the value of all final goods and services produced in the economy during the year, calculated using the prices of a selected base year.

Nominal GDP is the value of all final goods and services produced in the economy during the year, calculated using the prices current in the year in which the output is produced.

Now we can define **real GDP:** it is the total value of final goods and services produced in the economy during a year, calculated as if prices had stayed constant at the level of some given base year. A real GDP number always comes with information about what the base year is. A GDP number that has not been adjusted for changes in prices is calculated using the prices in the year in which the output is produced. Economists call this measure **nominal GDP,** GDP at current prices. If we had used nominal GDP to measure the true change in output from year 1 to year 2 in our apples and oranges example, we would have overstated the true growth in output: we would have claimed it to be 50%, when in fact it was only 15%. By comparing output in the two years using a common set of prices—the year 1 prices in this example—we are able to focus solely on changes in the quantity of output by eliminating the influence of changes in prices.

Table 7-2 shows a real-life version of our apples and oranges example. The second column shows nominal GDP in 1996, 2000, and 2004. The third column shows real GDP for each year in 2000 dollars. For 2000 the two numbers are the same. But real GDP in 1996 expressed in 2000 dollars was higher than nominal GDP in 1996, reflecting the fact that prices were in general higher in 2000 than in 1996. Real GDP in 2004 expressed in 2000 dollars, however, was less than nominal GDP in 2004 because prices in 2000 were lower than in 2004.

TABLE 7-2

Nominal versus Real GDP in 1996, 2000, and 2004

	Nominal GDP (billions of current dollars)	Real GDP (billions of 2000 dollars)
1996	$7,817	$8,329
2000	9,817	9,817
2004	11,734	10,842

Source: U.S. Commerce Department.

A Technical Detail: "Chained" Dollars

Until the 1990s, the real GDP estimates published by the Bureau of Economic Analysis were calculated in exactly the way we calculated real GDP in Table 7-1: the Bureau picked a base year and calculated each year's real GDP in the base year's prices.

But the U.S. national accounts now report real GDP in "billions of chained 2000 dollars." What does "chained" mean?

You might have noticed that there is an alternative way to calculate real GDP using the data in Table 7-1. Why not measure it using the prices of year 2 rather than year 1 as the base-year prices? This procedure seems equally valid. According to that calculation, real GDP in year 1 at year 2 prices is (2,000 billion × \$0.30) + (1,000 billion × \$0.70) = \$1,300 billion; real GDP in year 2 in year 2 prices is \$1,500 billion, the same as nominal GDP in year 2. So using year 2 prices as the base year, the growth in real GDP is equal to (\$1,500 billion − \$1,300 billion)/\$1,300 billion = 0.154, or 15.4%. This is slightly higher than the figure we got from the previous calculation, in which year 1 prices were the base-year prices. In that calculation, we found that real GDP increased by 15%. Neither answer, 15.4% versus 15%, is more "correct" than the other.

Because 15.4% and 15% are pretty close to each other, it doesn't matter much which base year you choose in Table 7-1. But this isn't always true when calculating authentic GDP numbers. In fact, economists estimating the growth in U.S. real GDP during the 1980s and 1990s found that the results differed significantly depending on which year they used as a base. The main reason was the rapid pace of technological progress in computers, which led both to rapid growth in computer output and to falling prices of computers relative to those of other goods and services. When economists used an early base year, a year when computers were still expensive, their calculations produced a higher rate of real GDP growth than if they used a later base year, a year when computers were cheap. Because there was such a huge increase in output of computers, the two calculations produced very different estimates for real GDP.

As a result, the government economists who put together the U.S. national income accounts have adopted a method known as "chain-linking," which splits the difference between using early base years and late base years. We won't go into the details of that procedure; for the purposes of this book, we can think of calculating real GDP in the prices of a single base year.

What Real GDP Doesn't Measure

GDP is a measure of a country's aggregate output. Other things equal, a country with a larger population will have higher GDP simply because there are more people working. So if we want to compare GDP across countries but want to eliminate the effect of differences in population size, we use the measure **GDP per capita**—GDP divided by the size of the population, equivalent to the average GDP per person. Correspondingly, real GDP per capita is the average real GDP per person.

GDP per capita is GDP divided by the size of the population; it is equivalent to the average GDP per person.

Although real GDP per capita can be a useful measure in some circumstances, it has well-known limitations as a measure of a country's living standards. Every once in a while economists are accused of believing that growth in real GDP per capita is the only thing that matters—of thinking that increasing real GDP per capita is a goal in itself. In fact, economists rarely make that mistake; the idea that economists care only about real GDP per capita is a sort of urban legend. Let's take a moment to be clear about why a country's real GDP per capita is not a sufficient measure of human welfare in that country and why growth in real GDP per capita is not an appropriate policy goal in itself.

One way to think about this issue is to say that an increase in real GDP means an expansion in the economy's production possibility frontier. Because the economy has increased its productive capacity, there are more things that society can achieve. But whether society actually makes good use of that increased potential to improve living standards is another matter. To put it in a slightly different way, your income may be higher this year than last year, but whether you use that higher income to actually improve your quality of life is your choice.

The United Nations produces an annual document, the *Human Development Report,* that tries to rank countries by measures other than real GDP per capita. These measures include data on infant mortality, life expectancy, and literacy. It compiles these measures into the Human Development Index, which is an effort to determine how well societies are doing, aside from how much they produce. The index suggests that real GDP per capita is one of many important determinants of human welfare—but by no means the only one. Countries with high real GDP per capita—like the United States, European nations, and Japan—also score very well on just about every other indicator of human welfare. But there are some relatively poor countries—like Costa Rica—that have remarkably high literacy and life expectancy along with low infant mortality. And there are some relatively rich countries—especially countries with valuable natural resources—that score quite low on these criteria.

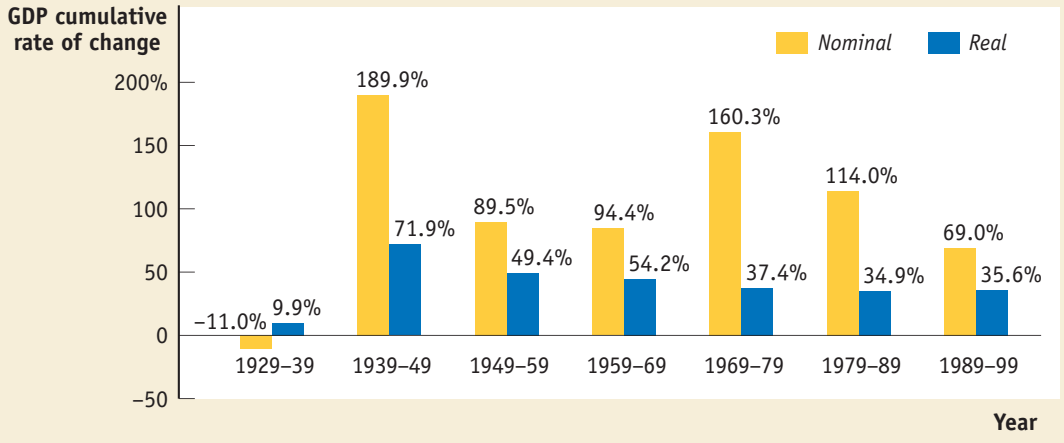
So let's say it again: real GDP per capita is a measure of an economy's average aggregate output per person—and so of what it *can* do. It is not a sufficient goal in itself because it doesn't address how a country uses that output to affect living standards. A country with a high GDP can afford to be healthy, to be well-educated, and in general to have a good quality of life. But there is not a one-to-one match between GDP and the quality of life.

economics in action

Good Decades, Bad Decades

How important is the distinction between nominal GDP and real GDP? If you are trying to interpret U.S. economic history, the answer is that it is very important indeed. Figure 7-4 tells the tale.

Figure 7-4 **The Difference Between Nominal GDP and Real GDP over Time in the United States**



To illustrate the difference between nominal GDP and real GDP, this figure shows the percent change in both measures over successive decades within the United States. (Real GDP was calculated using chained 2000 dollars.) The years 1929–1939 show the effect of deflation on the difference between nominal and real GDP: U.S. nominal GDP in 1939 was 11% lower than in 1929, but U.S. aggregate output as measured by real GDP was nearly 10% higher. The remaining years show the effect of inflation on the difference between the two measures: relatively high growth of U.S. nominal GDP in the years 1969–1979 and 1979–1989 contrast with relatively low growth of U.S. real GDP during those same periods. Those years experienced high levels of inflation and a simultaneous slowdown in real GDP growth.

Source: Bureau of Economic Analysis.

Figure 7-4 shows the cumulative percent change in both U.S. nominal GDP and U.S. real GDP over successive decades since national income accounting began. That is, we show percent changes from 1929 to 1939, 1939 to 1949, and so on. In each pair, the bar on the left shows the percent change in U.S. nominal GDP over the time period, and the bar on the right shows the percent change in U.S. real GDP over the same period. (Real GDP was calculated using chained 2000 dollars.)

What we see right away is the effect of deflation during the 1930s: nominal GDP and real GDP actually moved in opposite directions during the Great Depression. Due to a falling price level, U.S. nominal GDP in 1939 was 11% lower than in 1929, but U.S. aggregate output as measured by real GDP was nearly 10% higher. After that, both nominal and real GDP rose every decade, but at different rates due to the influence of a changing price level. For example, U.S. nominal GDP grew much faster than U.S. real GDP for the years 1969–1979 and 1979–1989. The explanation is that those years saw high levels of inflation. ■

>>QUICK REVIEW

- To determine the actual growth in aggregate output, we calculate *real GDP* using prices from some given base year. In contrast, *nominal GDP* refers to the value of aggregate output calculated with current prices.
- Real *GDP per capita* is a measure of the average aggregate output per person. But it is not a sufficient measure of human welfare, nor is it an appropriate goal in itself, because it does not reflect important aspects of living standards within an economy.

>>CHECK YOUR UNDERSTANDING 7-2

1. Assume there are only two goods in the economy, french fries and onion rings. In 2004, 1,000,000 servings of french fries were sold at $0.40 each and 800,000 servings of onion rings at $0.60 each. From 2004 to 2005, the price of french fries rose by 25% and the servings sold fell by 10%; the price of onion rings fell by 15% and the servings sold rose by 5%.
   a. Calculate the nominal GDP in 2004 and 2005. Calculate real GDP in 2005 using 2004 as the base year.
   b. Why would an assessment of growth using nominal GDP be misguided?
2. From 1990 to 2000, the price of electronic equipment fell dramatically and the price of housing rose dramatically. What are the implications of this in deciding whether to use 1990 or 2000 as the base year in calculating 2005 real GDP?

Solutions appear at back of book.

The Unemployment Rate

In addition to measures of GDP, a number of other measures help us track the performance of the economy. As we learned in Chapter 6, one extremely important statistic for economic policy is the unemployment rate because unemployment leads to lost output and lower social welfare. Cases of very high unemployment, such as in a depression, often lead to political unrest. What exactly does the unemployment rate tell us about the economy?

Understanding the Unemployment Rate

Every month, the U.S. Census Bureau carries out the Current Population Survey, which involves interviewing a random sample of 60,000 American families. People are asked whether they are currently employed. If they are not employed, they are asked whether they have been looking for a job during the past four weeks. As you may recall from Chapter 6, the labor force is equal to the total of those who are either working or have recently been seeking employment; it does not include discouraged workers, those who have given up actively looking for a job. Those who are actively looking for work but have not, or at least not yet, found a job are classified as unemployed. The unemployment rate, which we showed how to calculate in Chapter 6, is the percent of the labor force that is unemployed.

What does the unemployment rate tell us? It indicates how easy or difficult it is to find a job given the current state of the economy. When the unemployment rate is low, nearly everyone who wants a job can find one. When the unemployment rate is high, jobs are hard to find. As an illustration, recall the story that we told at the beginning of Chapter 6: in the spring of 2000, when the U.S. unemployment rate was only about 4%, potential employers were anxiously wooing potential employees.

Two years later, when the unemployment rate had risen to 6%, new graduates found their job search much more difficult.

Although the unemployment rate is a good indicator of current conditions in the job market, it should not be taken literally as a measure of the percentage of people who want to work but can't find jobs. In some ways the unemployment rate exaggerates the difficulty people have in finding work. In other ways, the opposite is true: low measured unemployment can conceal deep frustration felt by discouraged workers.

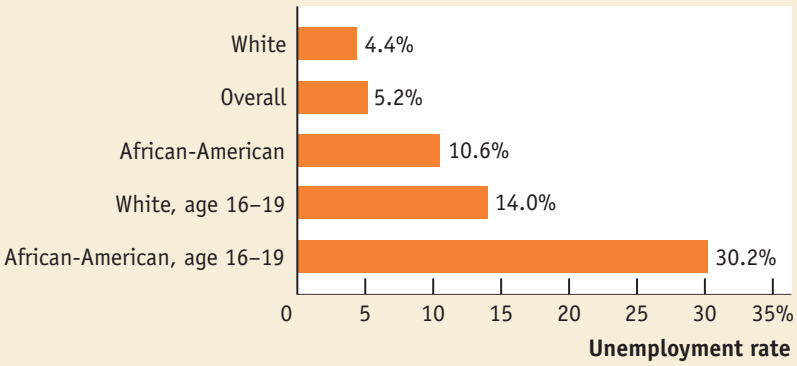
Let's start with the argument that the measured unemployment rate is an overstatement of the percentage of people who want to work but can't find jobs. It's normal for someone searching for work to take at least a few weeks to find a suitable job. Yet a worker who is quite confident of getting a job, but has not yet accepted a position, is counted as unemployed. This means that even in boom times, when jobs are very easy to find, the unemployment rate does not fall to zero. As we've seen, the spring of 2000 was a very good time to be looking for a job, yet the unemployment rate was still 4%. We'll discuss in Chapter 15 why measured unemployment persists even when jobs are plentiful.

Meanwhile, an individual who has given up looking for a job for the time being—say, a laid-off steelworker in a deeply depressed steel town—isn't counted as unemployed because he or she has not been searching for work during the previous four weeks. Because it does not count discouraged workers, the measured unemployment rate may understate the percentage of people who want to work but are unable to find jobs.

Finally, it's important to realize that the unemployment rate varies greatly among demographic groups. Figure 7-5 shows unemployment rates for different groups in January 2005, when the overall unemployment rate of 5.2% was low by historical standards. As you can see, in January 2005 the unemployment rate for African-American workers was more than twice the national average, the unemployment rate for white teenagers was almost three times the national average, and the unemployment rate for African-American teenagers, at more than 30%, was almost six times the national average. So even at a time when the overall unemployment rate was relatively low, jobs were hard to find for some groups. We'll examine the causes of persistent unemployment in Chapter 15.

So you should interpret the unemployment rate as an indicator of labor market conditions, not as a literal measure of the percentage of people unable to find jobs. Still, the

Figure 7-5 **Unemployment Rates for Different Groups in January 2005**



The overall unemployment rate in January 2005 was 5.2%. But underlying this average were wide variations in unemployment rates for different demographic groups: African-Americans had a much higher unemployment rate than whites, and young workers had much higher unemployment rates than older workers.

Source: Bureau of Labor Statistics.

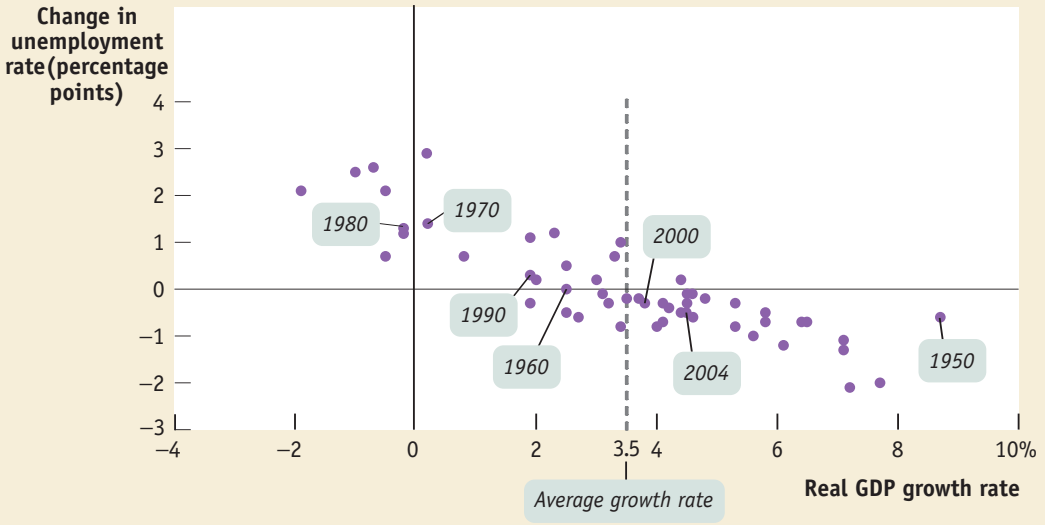
ups and downs of the unemployment rate have a significant impact on people's lives. What causes these fluctuations? We already saw, in Chapter 6, that the unemployment rate rises and falls with the business cycle. Now we can be more specific: there is a close relationship between the unemployment rate and the growth rate of real GDP.

Growth and Unemployment

Figure 7-6 is a scatter diagram showing observations of the growth rate of real GDP and changes in the unemployment rate over time in the United States. Each dot represents one year over the period 1949–2004. The horizontal axis measures the annual rate of growth in real GDP—the percent by which each year's real GDP changed compared to the previous year's real GDP. The vertical axis measures the *change* in the unemployment rate over the previous year in percentage points. For example, the average unemployment rate fell from 4.2% in 1999 to 4.0% in 2000; this is shown as a value of –0.2 along the vertical axis for the year 2000. Over the same period, real GDP grew by 3.7%; this is the value shown along the horizontal axis for the year 2000.

From the downward trend of the scatter points in Figure 7-6, it's clear that, in general, there is a negative relationship between growth in the economy and the rate of unemployment. Years of high growth in real GDP were years in which the unemployment rate fell, and years of low or negative growth in real GDP were years in which the unemployment rate rose. The average growth rate of real GDP over the period from 1949 to 2004 was 3.5%, and for reference we've included a dashed vertical line

Figure 7-6 **The Relationship between Real GDP and Unemployment, 1949–2004**



The horizontal axis measures the annual growth rate of real GDP, the vertical axis measures the *change* in the unemployment rate over the previous year, and each dot represents one year over the period 1949–2004. The data show that there is typically a negative relationship between growth in the economy and the change in the rate of unemployment. The vertical dashed line is drawn at a value of 3.5%, the average growth rate of real GDP from 1949 to 2004. Points lying to the right of the vertical dashed line indicate that years of above-average growth were typically years of a falling unemployment rate. Points lying to the left show that years of below-average growth were typically years of a rising unemployment rate. The downward trend of the scatter points shows that there is, in general, a negative relationship between the real GDP growth rate and the change in the unemployment rate.

Source: Bureau of Economic Analysis; Bureau of Labor Statistics.

indicating that value. You can see from examining the points lying to the right of the dashed vertical line that, with few exceptions, years when the economy grew faster than average were also years of a falling unemployment rate. For those years, the value on the vertical axis is negative. Points lying to the left of the vertical line show that years when the economy grew more slowly than average were typically years with a rising unemployment rate. This relationship helps us understand why recessions, periods when real GDP falls, are so painful. As illustrated by the points to the left of the vertical axis line in Figure 7-6, falling real GDP is always associated with a rising rate of unemployment, causing a great deal of hardship to families.

Our next and final subject in this chapter will be *price indexes,* which are measures of the aggregate price level.

economics in action

Jobless Recoveries

During recessions real GDP falls and the unemployment rate always rises. During expansions real GDP rises. Does the unemployment rate automatically fall?

Not necessarily. Look again at Figure 7-6. The data suggest that unemployment falls when growth is *above average* (the points lying to the right of the dashed vertical line), where the average growth rate of real GDP has been about 3.5% per year. If the economy grows at a positive rate, but below 3.5% per year, can the unemployment rate rise even as the economy grows? Put another way, can the unemployment rate rise when the economy grows at a below-average rate?

Yes, it can. The combination of slow but positive growth in real GDP with a rising unemployment rate is sometimes called a jobless recovery. It's not a usual occurrence. Normally, once an expansion gets going, growth picks up to a level that reduces unemployment. But jobless recoveries have happened. In fact, one occurred during the most recent economic expansion: the recession of 2001 officially ended in November of that year, but the unemployment rate continued to rise until the summer of 2003. ■

>>QUICK REVIEW

- The unemployment rate is an indicator of the state of the labor market, not a literal measure of the percentage of frustrated workers who can't find jobs. It can overstate the true level of unemployment because it is normal for workers to spend some time searching for a job even when jobs are plentiful. However, it can also understate the true level of unemployment because it does not include discouraged workers.
- There is a strong negative relationship between growth in real GDP and changes in the unemployment rate. When growth is above average, the unemployment rate falls; when growth is below average, the unemployment rate rises.

>>CHECK YOUR UNDERSTANDING 7-3

1. Suppose the advent of employment websites enables job-seekers to find a suitable job more quickly. What effect will this have on the unemployment rate over time? Also suppose that these websites encourage job-seekers who had given up their search to begin looking again. What effect will this have on the unemployment rate?
2. Which of the following are consistent with the observed relationship between growth in real GDP and changes in the unemployment rate? Which are not?
   a. A rise in the unemployment rate accompanies a fall in real GDP.
   b. A business recovery is associated with a greater percentage of the labor force being employed.
   c. Negative real GDP growth is associated with a fall in the unemployment rate.

Solutions appear at back of book.

Price Indexes and the Aggregate Price Level

As we noted in Chapter 6, both inflation and deflation can pose problems for the economy. For that reason, we must have a way of measuring changes in the economy's overall price level over time. The aggregate price level, a single number, is supposed to be a measure of the overall price level. But a huge variety of goods and services are produced and consumed within the economy. How can we summarize the prices of all these goods and services with a single number? The answer lies in the concept of a *price index*—a concept best introduced with an example.

Market Baskets and Price Indexes

Suppose that a frost in Florida destroys most of the citrus harvest. As a result, the price of oranges rises from $0.20 each to $0.40 each, the price of grapefruit rises from $0.60 to $1.00, and the price of lemons rises from $0.25 to $0.45. How much has the price of citrus fruit increased?

One way to answer that question is to state three numbers, the changes in prices for oranges, grapefruit, and lemons. But this a very cumbersome method. Rather than having to recite three numbers every time someone asks what has happened to the prices of citrus fruit, we would prefer to have some kind of overall measure of the *average* price increase.

Economists measure average price changes for consumer goods and services by asking how much more or less a typical consumer would have to spend to buy his or her previous *consumption bundle*—the typical basket of goods and services purchased before the price changes. Suppose that before the frost a typical consumer bought 200 oranges, 50 grapefruit, and 100 lemons over the course of a year. The average individual might change that pattern of consumption after the price changes caused by the frost. But we can still ask how much it would cost if he or she were to buy the same mix of fruit. A hypothetical consumption bundle, used to measure changes in the overall price level, is known as a **market basket.**

A **market basket** is a hypothetical set of consumer purchasesof goods and services.

Table 7-3 shows the pre-frost and post-frost cost of the market basket. Before the frost, it cost $95. After the frost, the same bundle of goods cost $175. Since $175/$95 = 1.842, the post-frost basket costs 1.842 times the cost of the pre-frost basket, an increase in cost of 84.2%. So in this case we would say that the average price of citrus fruit increased 84.2% since the base year as a result of the frost.

TABLE 7-3

Calculating the Cost of a Market Basket

	Pre-frost	Post-frost
Price of orange	$0.20	$0.40
Price of grapefruit	$0.60	$1.00
Price of lemon	$0.25	$0.45
Cost of market basket (200 oranges, 50 grapefruit, 100 lemons)	(200 × $0.20) + (50 × $0.60) + (100 × $0.25) = $95.00	(200 × $0.40) + (50 × $1.00) + (100 × $0.45) = $175.00

Economists use the same method to measure changes in the overall price level: they track changes in the cost of buying a given market basket. In addition, economists perform another simplification in order to avoid having to keep track of the information that the market basket cost, for example, $95 in such-and-such a year. They *normalize* the measure of the aggregate price level so that it is equal to 100 in some given base year. A normalized measure of the overall price level is known as a **price index,** and it is always cited along with the year for which the aggregate price level is being measured and the base year. A price index can be calculated using the following formula:

A **price index** measures the cost of purchasing a given market basket in a given year, where that cost is normalized so that it is equal to 100 in the selected base year.

$$\textbf{(7-2)}\quad \text{Price index in a given year} = \frac{(\text{Cost of market basket in a given year})}{(\text{Cost of market basket in base year})} \times 100$$

For example, our citrus fruit market basket cost $95 before the frost; so we would define the price index for citrus fruit as (current cost of market basket/$95) × 100. This yields an index of 100 for the period before the frost and 184.2 for the period afterward. You should note that applying Equation 7-2 to calculate the price index for the

base year always results in a price index equal to 100. That is, the price index in the base year is equal to: (cost of market basket in base year/cost of market basket in base year) × 100 = 100.

The price index makes it clear that the average price of citrus has risen 84.2% as a consequence of the frost. Because of its simplicity and intuitive appeal, this method is used to calculate a variety of price indexes to track the average price change among different groups of goods and services. For example, the *consumer price index* is the most widely used measure of the aggregate price level, the overall price level of final goods and services across the economy. Price indexes are also the basis for measuring inflation. The **inflation rate** is the annual percent change in a price index. The inflation rate from year 1 to year 2 is calculated using the following formula:

The **inflation rate** is the percentage change per year in a price index—typically the consumer price index.

$$\textbf{(7-3)}\quad \text{Inflation rate} = \frac{(\text{Price index in year 2} - \text{Price index in year 1})}{(\text{Price index in year 1})} \times 100$$

Typically, a news report that cites "the inflation rate" is referring to the annual percent change in the consumer price index.

The Consumer Price Index

The most widely used measure of prices in the United States is the **consumer price index** (often referred to simply as the **CPI**), which is intended to show how the cost of all purchases by a typical urban family has changed over time. It is calculated by surveying market prices for a market basket that is intended to represent the consumption of a typical family of four living in a typical American city. The base period for the index is currently 1982–1984; that is, the index is calculated so that the average of consumer prices in 1982–1984 is 100.

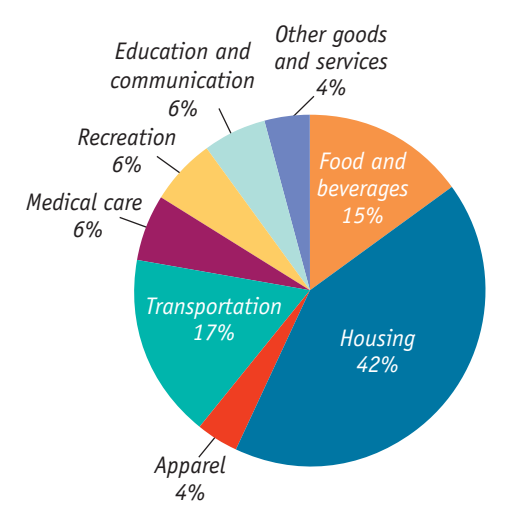
The **consumer price index,** or **CPI,** measures the cost of the market basket of a typical urban American family.

The market basket used to calculate the CPI is far more complex than the three-fruit market basket we described above. In fact, to calculate the CPI, the Department of Labor sends its employees out to survey supermarkets, gas stations, hardware stores, and so on—some 21,000 retail outlets in 85 cities. Every month it tabulates about 90,000 prices, on everything from Romaine lettuce to video rentals. Figure 7-7 shows the makeup of the market basket underlying the current consumer price index by broad categories. The largest component, housing, includes all the costs of owning or renting a residence, including heating and electricity.

Figure 7-8 shows how the CPI has changed over the past 90 years. Since 1940 the CPI has risen steadily, although its annual percent increases in recent years have been much smaller than those of the 1970s and early 1980s. A log scale is used so that equal percent changes in the CPI appear the same.

The United States is not the only country that calculates a consumer price index. In fact, nearly every country has one. As you might expect, the market baskets that make up these indexes differ quite a lot from country to country. In poor countries, where people must spend a high proportion of their income just to feed themselves, food makes up a large share of the price index. Among high-income countries, differences in consumption patterns lead to differences in the price indexes: the Japanese price index puts a larger weight on raw fish and a smaller weight on beef than ours does, and the French price index puts a larger weight on wine.

Figure 7-7 **The Makeup of the Consumer Price Index in 2004**



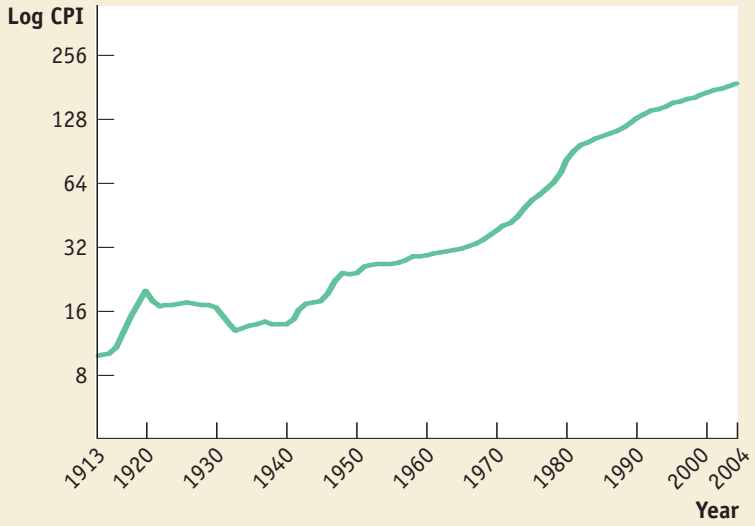
Housing—all the costs of owning or renting a residence—is the largest component of the market basket underlying the 2004 CPI, followed by transportation and food.
Source: Bureau of Labor Statistics.

Figure 7-8

The CPI, 1913–2004

Since 1940 the CPI has risen steadily. But the annual percent increases in recent years have been much smaller than those of the 1970s and early 1980s. (The vertical axis is measured in log scale so that equal percent changes in the CPI appear the same.)

Source: Bureau of Labor Statistics.



Other Price Measures

There are two other price measures that are also widely used to track economy-wide price changes. One is the **producer price index** (or PPI, which used to be known as the *wholesale price index*). As its name suggests, the producer price index measures the cost of a typical basket of goods and services—containing raw commodities such as steel, electricity, coal, and so on—purchased by producers. Because commodity producers are relatively quick to raise prices when they perceive a change in overall demand for their goods, the PPI often responds to inflationary or deflationary pressures more quickly than the CPI. As a result, the PPI is often regarded as an "early warning signal" of changes in the inflation rate.

The **producer price index** measures changes in the prices of goods purchased by producers.

The other widely used price measure is the *GDP deflator;* it isn't exactly a price index, although it serves the same purpose. Recall how we distinguished between nominal GDP (GDP in current prices), and real GDP (GDP calculated using the prices of a base year). The **GDP deflator** for a given year is equal to 100 times the ratio of nominal GDP for that year to real GDP for that year expressed in prices of a selected base year. Since real GDP is currently expressed in 2000 dollars, the GDP deflator for 2000 is equal to 100. If nominal GDP doubles but real GDP does not change, the GDP deflator indicates that the aggregate price level doubled.

The **GDP deflator** for a given year is 100 times the ratio of nominal GDP to real GDP in that year.

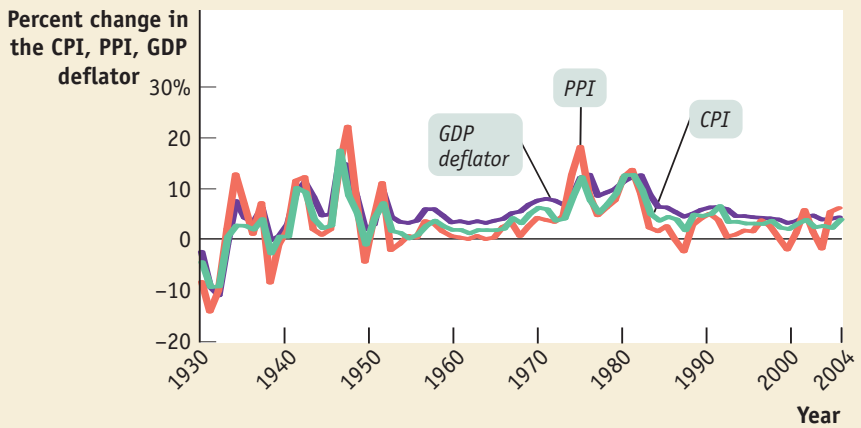
Perhaps the most important point about the different inflation rates generated by these three measures of prices is that they usually move closely together (although the

Figure 7-9

The CPI, the PPI, and the GDP Deflator

As the figure shows, these three different measures of inflation usually move closely together. Each reveals a drastic acceleration in the inflation rate during the 1940s and the 1970s and a return to relative price stability in the 1990s.

Source: Bureau of Economic Analysis; Bureau of Labor Statistics.



FOR INQUIRING MINDS

IS THE CPI BIASED?

The U.S. government takes considerable care in measuring consumer prices. Nonetheless, many—but not all—economists believe that the consumer price index systematically overstates the actual rate of inflation. Because many government payments are tied to the CPI, this is an important fact if true.

What do we mean by saying that the CPI overstates inflation? Imagine comparing two families: one in 1983, with an after-tax income of $20,000, and another in 2004, with an after-tax income of $40,000. According to the CPI, prices in 2004 were about twice as high as in 1983, so those two families should have about the same standard of living. Many economists argue, however, that the 2004 family would have a higher standard of living for two reasons.

One reason is the fact that the CPI measures the cost of buying a given market basket, when in fact consumers typically alter the mix of goods and services they buy away from products that have become relatively more expensive and toward products that have become relatively cheaper. For example, suppose that the price of hamburgers were to double suddenly. Americans currently eat a lot of burgers, but in the face of such a price rise many of them would switch to other foods—and a price index based on a market basket with a lot of hamburgers in it would overstate the true rise in the cost of living.

Actual changes in prices and in the mix of goods and services Americans consume are usually less dramatic than our hypothetical example. But the changing mix of consumption probably leads to some overstatement of inflation by the CPI.

The second reason arises from innovation. In 1983 many goods we now take for granted, especially those using information technology, didn't exist: there was no Internet and there were no iPods. By widening the range of consumer choice, innovation makes a given amount of money worth more. That is, innovation is like a fall in consumer prices.

For both these reasons, many economists believe that the CPI somewhat overstates inflation when we think of inflation as measuring the actual change in the cost of living of a typical urban American family. But there is no consensus on how large the bias is, and for the time being the official CPI remains the basis for most estimates of inflation.

producer price index tends to fluctuate more than either of the other two measures). Figure 7-9 shows the annual percent changes in the three indexes since 1930. By all three measures, the U.S. economy experienced deflation during the early years of the Great Depression, wartime inflation, accelerating inflation during the 1970s, and a return to relative price stability in the 1990s.

economics in action

Indexing to the CPI

Although GDP is a very important number for shaping economic policy, official statistics on GDP don't have a direct effect on people's lives. The CPI, by contrast, has a direct and immediate impact on millions of Americans. The reason is that many payments are tied or "indexed" to the CPI—the amount paid rises or falls when the CPI rises or falls.

Donald A. Higgs Photography

A small change in the CPI has large consequences for those dependent on Social Security payments.

The practice of indexing payments to consumer prices goes back to the dawn of the United States as a nation. In 1780 the Massachusetts state legislature recognized that the pay of its soldiers fighting the British needed to be increased because of inflation that occurred during the Revolutionary War. The legislature adopted a formula that made a soldier's pay proportional to the cost of a market basket, consisting of 5 bushels of corn, $68\frac{4}{7}$ pounds of beef, 10 pounds of sheep's wool, and 16 pounds of sole leather.

Today, more than 35 million older and disabled Americans receive checks from Social Security, a national retirement program that accounts for almost a quarter of current total federal spending—more than the defense budget. The amount of an individual's check is determined by a formula that reflects his or her previous payments into the system as well as other factors. In addition, all Social Security payments are adjusted each year to offset any increase in consumer prices over the previous year. The CPI is used to calculate the official estimate of the inflation rate used to adjust these payments yearly. So every percentage point added to the official estimate of the rate of inflation adds 1% to the checks received by tens of millions of individuals.

Other government payments are also indexed to the CPI. In addition, income tax brackets, the bands of income levels that determine a taxpayer's income tax rate, are also indexed to the CPI. (An individual in a higher income bracket pays a higher income tax rate in a progressive tax system like ours.) Indexing also extends to the private sector, where many private contracts, including some wage settlements, contain cost-of-living allowances (called COLAs) that adjust payments in proportion to changes in the CPI.

Because the CPI plays such an important and direct role in people's lives, it's a politically sensitive number. The Bureau of Labor Statistics, which calculates the CPI, takes great care in collecting and interpreting price and consumption data. They use a complex method in which households are surveyed to determine what they buy and where they shop and a carefully selected sample of stores are surveyed to get representative prices.

As explained in For Inquiring Minds on p. 180, however, there is still considerable controversy about whether the CPI accurately measures inflation. ■

>>QUICK REVIEW

- Changes in the aggregate price level are measured by the cost of buying a particular *market basket* during different years. A *price index* for a given year is the cost of the market basket in that year normalized so that the price index equals 100 in a selected base year.
- The *inflation rate* is calculated as the percent change in a *price index*. The most commonly used price index is the *consumer price index*, or *CPI*, which tracks the cost of a basket of consumer goods and services. The *producer price index* does the same for goods and services used as inputs by firms. The *GDP deflator* measures the aggregate price level as the ratio of nominal to real GDP times 100. These three measures normally behave quite similarly.

>>CHECK YOUR UNDERSTANDING 7-4

1. Consider Table 7-3 but suppose that the market basket is composed of 100 oranges, 50 grapefruit, and 200 lemons. How does this change the pre-frost and post-frost price indexes? Explain. Generalize your explanation to how the construction of the market basket affects the price index.
2. Using what you have learned from Question 1, explain the effect of each of the following events on how well a CPI based on a market basket determined 10 years ago functions in measuring the change in prices today.
   a. A typical family owns more cars than it would have a decade ago. Over that time, the average price of a car has increased more than the average prices of other goods.
   b. Virtually no households had broadband Internet access a decade ago. Now, many households have it, and the price has regularly fallen each year.
3. The consumer price index in the United States (base period 1982–1984) was 184.0 in 2003 and 188.9 in 2004. Calculate the inflation rate from 2003 to 2004.

Solutions appear at back of book.

• A LOOK AHEAD •

We have now seen how economists put actual numbers to key macroeconomic variables such as aggregate output, the unemployment rate, and the aggregate price level. Now we can turn to the actual study of macroeconomics—analyzing how the values of those key macroeconomic variables are determined in the real world.

As we will learn, our analysis will depend on whether we are considering the long-run behavior of the economy or the short-run ups and downs of the business cycle. In the next few chapters we will set the short run to one side and focus on the long run. Our next topic will be the determinants of aggregate output in the long run—that is, the story behind *long-run growth*.

SUMMARY

1. Economists keep track of the flows of money between sectors with the **national income and product accounts,** or **national accounts.** Households earn income via the factor markets from wages, interest on **bonds,** profit accruing to owners of **stocks,** and rent on land. In addition, they receive **government transfers** from the government. **Disposable income,** total household income minus taxes plus government transfers, is allocated to **consumer spending** (C) and **private savings.** Via the **financial markets,** private savings and foreign lending are channeled to **investment spending** (I), government borrowing, and foreign borrowing. **Government purchases of goods and services** (G) are paid for by tax revenues and any **government borrowing. Exports** (X) generate an inflow of funds into the country from the rest of the world, but **imports** (IM) lead to an outflow of funds to the rest of the world. Foreigners can also buy stocks and bonds in the U.S. financial markets.
2. **Gross domestic product,** or **GDP,** measures the value of all **final goods and services** produced in the economy. It does not include the value of **intermediate goods and services.** It can be calculated in three ways: add up the **value added** by all producers; add up all spending on domestically produced final goods and services, leading to the equation $GDP = C + I + G + X - IM$; or add up all the income paid by domestic firms to factors of production. These three methods are equivalent because in the economy as a whole, total income paid by domestic firms to factors of production must equal total spending on domestically produced final goods and services. ($X - IM$), exports minus imports, is often called **net exports.**
3. **Real GDP** is the value of the final goods and services produced calculated using the prices of a selected base year. Except in the base year, real GDP is not the same as **nominal GDP,** aggregate output calculated using current prices. Analysis of the growth rate of aggregate output must use real GDP because doing so eliminates any change in the value of aggregate output due solely to price changes. Real **GDP per capita** is a measure of average aggregate output per person, but is not in itself an appropriate policy goal.
4. The unemployment rate is an indicator of the state of the labor market, but it should not be taken literally as a measure of the percentage of people who want to work but can't find jobs. It may overstate the true level of unemployment because a person typically spends time unemployed while searching for a job. It may also understate the true level of unemployment because it does not include discouraged workers.
5. There is a strong negative relationship between growth in real GDP and changes in the unemployment rate: when growth is above average, the unemployment rate falls; when it is below average, the unemployment rate rises.
6. To measure the aggregate price level, economists calculate the cost of purchasing a **market basket.** A **price index** is the ratio of the current cost of that market basket to the cost in a selected base year, multiplied by 100.
7. The **inflation rate** is the yearly percent change in a price index, typically based on the **consumer price index,** or **CPI,** the most common measure of the aggregate price level. A similar index for goods and services purchased by firms is the **producer price index.** Finally, economists also use the **GDP deflator,** which measures the price level by calculating the ratio of nominal to real GDP times 100.

KEY TERMS

National income and product accounts (national accounts), p. 160
Consumer spending, p. 160
Stock, p. 161
Bond, p. 161
Government transfers, p. 162
Disposable income, p. 162
Private savings, p. 162
Financial markets, p. 162
Government borrowing, p. 162
Government purchases of goods and services, p. 162
Exports, p. 162
Imports, p. 162
Investment spending, p. 162
Final goods and services, p. 163
Intermediate goods and services, p. 163
Gross domestic product (GDP), p. 163
Value added, p. 165
Net exports, p. 168
Real GDP, p. 170
Nominal GDP, p. 170
GDP per capita, p. 171
Market basket, p. 177
Price index, p. 177
Inflation rate, p. 178
Consumer price index (CPI), p. 178
Producer price index, p. 179
GDP deflator, p. 179

PROBLEMS

1. At right is a simplified circular-flow diagram for the economy of Micronia.

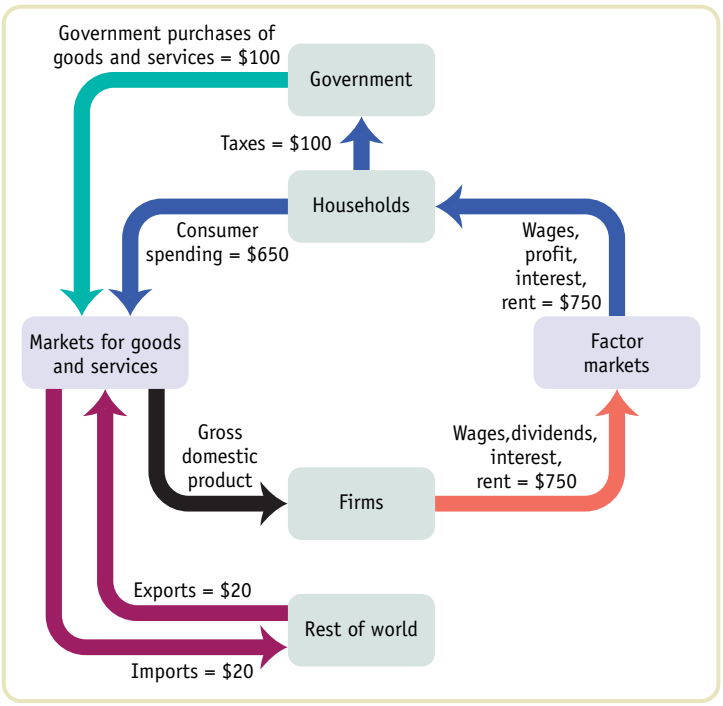
a. What is GDP in Micronia?

b. What are net exports?

c. What is disposable income?

d. Does the total flow of money out of households—the sum of taxes paid, consumer spending, and private savings—equal the total flow of money into households?

e. How does the government of Micronia finance its purchases of goods and services?



2. A more complex circular-flow diagram for the economy of Macronia is shown at right.

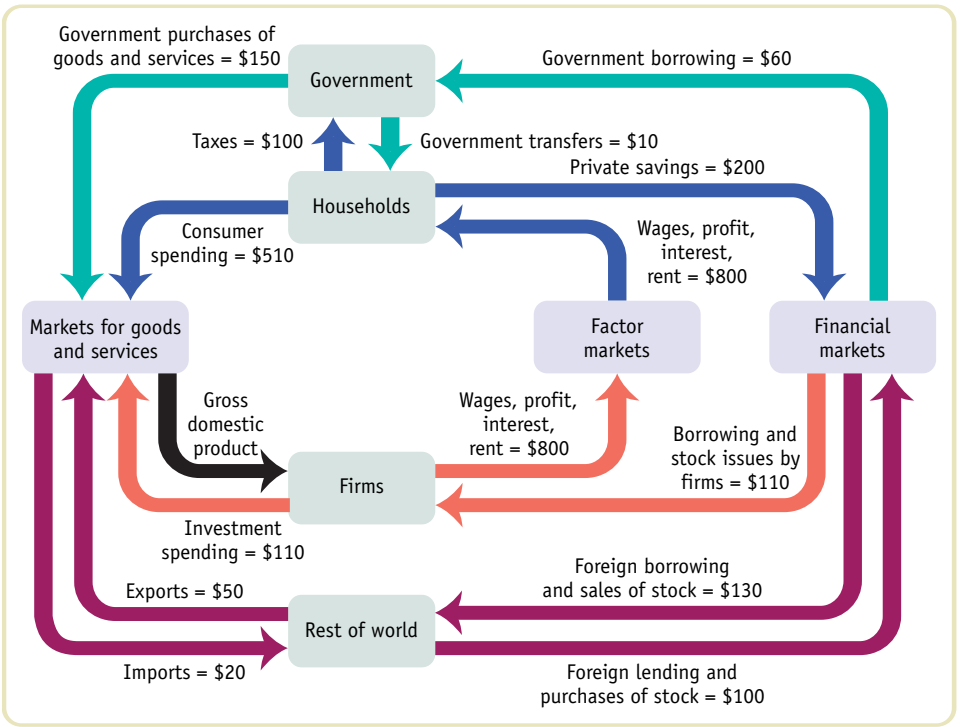
a. What is GDP in Macronia?

b. What are net exports?

c. What is disposable income?

d. Does the total flow of money out of households—the sum of taxes paid, consumer spending, and private savings—equal the total flow of money into households?

e. How does the government finance its spending?



3. The small economy of Pizzania produces three goods (bread, cheese, and pizza), each produced by a separate company. The bread and cheese companies produce all the inputs they need to make bread and cheese, respectively; the pizza company uses the bread and cheese from the other companies to make its pizzas. All three companies employ labor to help produce their goods, and the difference between the value of goods sold and the sum of labor and input costs is the firm's profit. This table summarizes the activities of the three companies when all the bread and cheese produced are sold to the pizza company as inputs in the production of pizzas.

	Bread company	Cheese company	Pizza company
Cost of inputs	$0	$0	$50 Bread 35 Cheese
Wages	15	20	75
Value of output	50	35	200

   a. Calculate GDP as the value added in production.
   b. Calculate GDP as spending on final goods and services.
   c. Calculate GDP as factor income.

4. In the economy of Pizzania (from Problem 3), bread and cheese produced are sold both to the pizza company for inputs in the production of pizzas and to consumers as final goods. The accompanying table summarizes the activities of the three companies.

	Bread company	Cheese company	Pizza company
Cost of inputs	$0	$0	$50 Bread 35 Cheese
Wages	25	30	75
Value of output	100	60	200

   a. Calculate GDP as the value added in production.
   b. Calculate GDP as spending on final goods and services.
   c. Calculate GDP as factor income.

5. Which of the following transactions will be included in GDP for the United States?
   a. Coca-Cola builds a new bottling plant in the United States.
   b. Delta sells one of its existing airplanes to Korean Air.
   c. Ms. Moneybags buys an existing share of Disney stock.
   d. A California winery produces a bottle of Chardonnay and sells it to a customer in Montreal, Canada.
   e. An American buys a bottle of French perfume.
   f. A book publisher produces too many copies of a new book; the books don't sell this year, so the publisher adds the surplus books to inventories.

6. The economy of Britannica produces three goods: computers, DVDs, and pizza. The accompanying table shows the prices and output of the three goods for the years 2002, 2003, and 2004.

	Computers		DVDs		Pizza	
Year	Price	Quantity	Price	Quantity	Price	Quantity
2002	$900	10	$10	100	$15	2
2003	1,000	10.5	12	105	16	2
2004	1,050	12	14	110	17	3

   a. What is the percent change in production of each of the goods from 2002 to 2003 and from 2003 to 2004?
   b. What is the percent change in prices of each of the goods from 2002 to 2003 and from 2003 to 2004?
   c. Calculate nominal GDP in Britannica for each of the three years. What is the percent change in nominal GDP from 2002 to 2003 and from 2003 to 2004?
   d. Calculate real GDP in Britannica using 2002 prices for each of the three years. What is the percent change in real GDP from 2002 to 2003 and from 2003 to 2004?

7. The accompanying table shows data on nominal GDP (in billions of dollars), real GDP (in billions of dollars) using 2000 as the base year, and population (in thousands) of the U.S. in 1960, 1970, 1980, 1990, 2000, and 2004, years in which the price level consistently rose.

Year	Nominal GDP (billions of dollars)	Real GDP (billions of 2000 dollars)	Population (thousands)
1960	$526.4	$2,501.8	180,671
1970	1,038.5	3,771.9	205,052
1980	2,789.5	5,161.7	227,726
1990	5,803.1	7,112.5	250,132
2000	9,817.0	9,817.0	282,388
2004	11,734.0	10,841.9	293,907

   a. Why is real GDP greater than nominal GDP for all years before 2000 and lower for 2004? Does nominal GDP have to equal real GDP in 2000?
   b. Calculate the percent change in real GDP from 1960 to 1970, 1970 to 1980, 1980 to 1990, and 1990 to 2000. Which period had the highest growth rate?
   c. Calculate real GDP per capita for each of the years in the table.
   d. Calculate the percent change in real GDP per capita from 1960 to 1970, 1970 to 1980, 1980 to 1990, and 1990 to 2000. Which period had the highest growth rate?
   e. How do the percent change in real GDP and the percent change in real GDP per capita compare? Which is larger? Do we expect them to have this relationship?

8. This table shows the Human Development Index (HDI) and real GDP per capita in U.S. dollars for six nations in 2002.

	HDI	Real GDP per capita
Brazil	0.775	$7,770
Canada	0.943	29,480
Japan	0.938	26,940
Mexico	0.802	8,970
Saudi Arabia	0.768	12,650
United States	0.939	35,750

Rank the nations according to HDI and according to real GDP per capita. Why do the two vary?

9. In general, how does the unemployment rate vary with changes in real GDP? Explain why after several quarters of a severe recession, we might observe a decrease in the official unemployment rate. Could we see an increase in the official unemployment rate after several quarters of a strong expansion?

10. Each month, usually on the first Friday of the month, the Bureau of Labor Statistics releases the Employment Situation Summary for the previous month. Go to www.bls.gov and find the latest report. (On the Bureau of Labor Statistics home page, click on "National unemployment rate" and then choose "Employment Situation Summary.") How does the unemployment rate compare to the rate one year earlier? What percentage of unemployed workers are long-term unemployed workers?

11. Eastland College is concerned about the rising cost of textbooks that students must purchase. To better identify the increase in the cost of textbooks, the dean asks you, the Economics Department's star student, to create an index of textbook prices. The average student purchases three English, two math, and four economics textbooks; the prices of these books are given in the accompanying table.

a. Create the market index for these books for all years with a base year of 2002.

	2002	2003	2004
English textbook	$50	$55	$57
Math textbook	70	72	74
Economics textbook	80	90	100

b. What is the percent change in the price of an English textbook from 2002 to 2004?

c. What is the percent change in the price of a math textbook from 2002 to 2004?

d. What is the percent change in the price of an economics textbook from 2002 to 2004?

e. What is the percent change in the market index from 2002 to 2004?

12. The consumer price index, or CPI, measures the cost of living for the average consumer by multiplying the price for each category of expenditure (housing, food, and so on) by the importance of that expenditure in the average consumer's market basket and summing over all categories. However, using data from the consumer price index, we can see that changes in the cost of living for different consumers can vary a great deal. Let's compare the cost of living for a hypothetical retired person and a hypothetical college student. Let's assume that the market basket of a retired person is allocated in the following way: 10% on housing, 15% on food, 5% on transportation, 60% on medical care, 0% on education, and 10% on recreation. The college student's market basket is allocated as follows: 5% on housing, 15% on food, 20% on transportation, 0% on medical care, 40% on education, and 20% on recreation. The accompanying table shows the December 2004 CPI for each of the relevant categories.

	CPI—December 2004
Housing	190.7
Food	188.9
Transportation	164.8
Medical care	314.9
Education	112.6
Recreation	108.5

Calculate the overall CPI for the retired person and the college student by multiplying the CPI for each of the categories by the relative importance of that category to the individual and then summing each of the categories. The CPI for all items in December 2004 was 190.3. How do your calculations for a CPI for the retired person and the college student compare to the overall CPI?

13. Each month the Bureau of Labor Statistics releases the Consumer Price Index Summary for the previous month. Go to www.bls.gov and find the latest report. (On the Bureau of Labor Statistics home page, click on "CPI" under "Latest Numbers" and then choose "Consumer Price Index Summary.") What was the CPI for the previous month? How did it change from the previous month? How does the CPI compare to the same month one year ago?

14. The accompanying table contains two price indexes for the years 2002, 2003, and 2004: the GDP deflator and the CPI. For each price index, calculate the inflation rate from 2002 to 2003 and from 2003 to 2004.

Year	GDP deflator	CPI
2002	104.1	179.9
2003	106.0	184.0
2004	108.3	188.9