Chapter 7

Measuring the Wealth of Nations

LEARNING OBJECTIVES

LO 7.1 Justify the importance of using the market value of final goods and services to calculate GDP, and explain why each component of GDP is important.

LO 7.2 Explain the equivalence of the expenditure and income approaches to valuing an economy.

LO 7.3 Explain the three approaches that are used to calculate GDP, and list the categories of spending that are included in the expenditure approach.

LO 7.4 Explain the difference between real and nominal GDP, and calculate the GDP deflator.

LO 7.5 Calculate and explain the meanings of GDP per capita and the real GDP annual growth rate.

LO 7.6 Discuss some limitations to GDP, including its measurement of home production, the underground economy, environmental degradation, and well-being.

IT'S MORE THAN COUNTING PEANUTS

If we made a list of the economic changes that are most dramatically reshaping the world, the rapid growth of China's economy would likely top it. In 1978, when China's leaders moved to open up its economic system, it was the world's 15th-largest economy. The size of China's economy doubled. Then it doubled, and doubled, and doubled again. By 2011, China's economy clocked in at about $6 trillion, passing Japan's to become the second largest economy in the world. Rapid economic growth can create jobs, reduce poverty, and improve standards of living. In China, the fraction of the population living below the international poverty line ($1.25 per person per day) fell from over 80 percent in 1978 to under 20 percent today.

Economic growth has increased living standards all over the world in recent decades, although typically in less dramatic fashion than in China. The health of the national economy has a powerful effect on everyday life in any country. When the economy is doing well, jobs are plentiful and most people can live well and securely. When the economy does poorly, jobs are scarce, businesses close down, and people struggle. It's no wonder

that politicians spend a lot of energy debating the best plan to expand the economy. Over the next few chapters, we'll discuss many of the ideas and terms used in those debates.

But, first, we need to answer a basic question: How do we measure the "size" of the economy? If we can answer that, we can compare China's economy to economies of other nations, and we can determine whether an economy is growing, or not, over time. What does it really *mean* to say that China has a $6 trillion economy?

The answers to these questions require some careful accounting. As a start, think about just one of the many transactions that take place in the U.S. economy. Say you bought a jar of peanut butter when you went to the grocery store. Although you may not have thought beyond your next peanut butter and jelly sandwich, your purchase contributed to the size of the economy.

Consider some of the things that happened before that jar of peanut butter made it into your shopping cart: A farmer grew the peanuts, perhaps on a small farm in Georgia. The farmer sold his peanuts to a wholesaler in Atlanta. The wholesaler then sold the peanuts to a peanut butter factory in Ohio, which combined the peanuts with other ingredients to produce a jar of peanut butter. The factory then sold that jar to a grocery store chain, which delivered it to your neighborhood store.

Many people were employed to produce that peanut butter: farmers, accountants, truck drivers, custodians, and cashiers at the grocery store. Many firms earned profits from the jar of peanut butter, too: the peanut farm, the wholesaler, the factory, the shipping company, and your local store. Clearly, the activities that went into making and buying the jar of peanut butter added value to the economy. Can we measure how much?

The peanuts passed through many stages: from seed, to harvested nut, to peanut butter, to a jar on the grocery store shelf. At each stage, the peanuts were sold as an output of one firm and purchased as an input by another firm. Should we add up all of these sales individually to calculate the value the jar of peanut butter added to the economy? No—if we did that, we'd be over-counting the value of the peanuts. All of the sales were just steps toward one end product: your peanut butter. How then *do* we calculate the total value of your jar of peanut butter to the economy?

This is the problem that economists faced in the 1920s and 1930s when they first attempted to calculate the value of the U.S. economy. How can you add up all economic activity to arrive at an overall value for the economy, *without* double-counting items that are resold more than once before they reach the consumer?

The solution is a system called *national income accounting*, created by Nobel Prize winners Simon Kuznets and Richard Stone. In this chapter, we'll see how to use this system to calculate the value of a national economy. We'll see why it's so useful to measure a country's total output, and also why the most commonly used measure has some limitations. In later chapters, we'll put these ideas to work to explain economic growth, unemployment, and economic booms and slow-downs.

Valuing an Economy

Economics has traditionally been divided into two broad fields, microeconomics and macroeconomics. *Microeconomics* is the study of how individuals and firms manage resources. In microeconomics,

we zero in on a single person's budget, or one firm's cost of production, or the price of a particular good. **Macroeconomics**, on the other hand, is the study of the economy on a broad scale, focusing on issues such as economic growth, unemployment, and inflation. In macroeconomics, we talk about consumption, production, and prices in the *aggregate*, on a national level, and we look at the effects of those aggregate forces on the whole economy.

macroeconomics the study of the economy on a broad scale, focusing on issues such as economic growth, unemployment, and inflation

Compared to microeconomics, the concepts may often seem distant from decisions we make and challenges we face, but macroeconomic issues can have profound impacts on our daily lives. Everyone tends to do better when there is steady economic growth, stable prices, and low unemployment. On the flip side, long periods of stagnation, inflation, and high unemployment can do great damage to families and communities.

At the start of the chapter, we introduced one of the most important macroeconomic issues of our time: the incredible growth of the Chinese economy. But, how do we know how big is the Chinese economy is? How do we know that it is larger than Japan's but smaller than the United States'? What does it mean to say that the size of China's economy doubled? To talk about these critical issues, we need a tool for measuring the "size" or "value" of a national economy. Based on the kind of questions it lets us answer, you can see why this metric is one of the most important and commonly used data points in macroeconomics. It gives us a sense of the well-being of the average person in a country. It also allows us to gauge the direction an economy is headed, by looking at changes over time.

We'll see later in the chapter that we have to think carefully about what we mean by the "size" or "value" of an economy, because there are various ways to measure it. Just as you might measure the economic status of a family by looking at what it can afford to spend or by looking at what its members earn, we can measure the status of a national economy by looking at expenditures or at income. In the end, we'll see that these add up to the same thing, giving a single measure of the total value of everything produced in the economy.

The most commonly used metric for measuring the value of a national economy is **gross domestic product**, or **GDP**. Gross domestic product is the sum of the market values of all final goods and services produced within a country in a given period of time. That's a mouthful of a definition. Before we look at how economists calculate GDP, let's briefly unpack its component parts.

gross domestic product (GDP) the sum of the market values of all final goods and services produced within a country in a given period of time

Unpacking the definition of GDP

LO 7.1 Justify the importance of using the market value of final goods and services to calculate GDP, and explain why each component of GDP is important.

The definition of GDP has four important pieces:

- *market value,*
- of *final* goods and services,
- produced *within a country,*
- in a *given period of time.*

Let's take each piece one at a time, and explain its importance.

"Market values." If we measured the output of economies by listing every single good and service, we wouldn't learn much—680 million jars of peanut butter, 103 million copies of Microsoft Word, 421 million haircuts, and so on. The list would go on for

thousands of pages. It wouldn't be very interesting. Nor would it be useful for comparing the overall size of national economies, which tend to make different things. Say we want to compare the U.S. economy, which produces lots of peanut butter, with the Mexican economy, which produces lots of tortillas. How do we do it?

Clearly, we need to translate the production of peanut butter, tortillas, software, haircuts, and all the other goods and services into a common unit so we can add them up. That common unit is their *market value*—in the U.S., measured in dollars.

"Final goods and services." Consider the 800 or so peanuts that end up in your jar of peanut butter. Suppose our Georgia peanut farmer sells them to the Atlanta wholesaler for 12 cents. The wholesaler sells them to the Ohio peanut butter factory for 24 cents. The peanut butter factory sells the jar of peanut butter to the grocery store for $1.85. Finally, the grocery store sells it to you for $3.40 in an 18-ounce jar. How much does this process contribute to GDP?

If we simply add up all the transactions, we might think that the jar of peanut butter contributed $5.61 to GDP ($0.12 + $0.24 + $1.85 + $3.40). But, if that were true, producing the jar of peanut butter would contribute more to GDP than its final selling price. That can't be right. If it were, we could grow the economy just by trading the same jar of peanut butter for the same dollar, over and over again, and adding up each "transaction."

To avoid double-counting, we should ignore the price of *intermediate* goods and services—that is, goods and services used only to produce something else, like the raw peanuts that were sold to the peanut butter factory. Instead, we want to count only expenditures on *final goods and services*—those that get sold to the consumer. In this case, the only final good was the jar of peanut butter you bought at the store. Its price was $3.40, so that is how much your purchase contributed to GDP.

"Produced within a country." The goods and services that count toward GDP are defined in terms of the *location of production,* not the citizenship of the producer. So, if a U.S. company owns a factory in Mexico, the value of the goods produced in that factory will count toward Mexican GDP, not U.S. GDP. A U.S. citizen working in France will contribute to French GDP. Likewise, a French or Mexican citizen working in the United States will contribute to U.S. GDP.

gross national product (GNP) the sum of the market values of all final goods and services produced and capital owned by the permanent residents of a country in a given period of time

What if we want to measure the value of what is produced by all U.S. companies regardless of their location? In this case, we use a metric called **gross national product (GNP)**. GNP is the sum of the market values of all final goods and services produced and capital owned by the *permanent residents* of a country in a given period of time, no matter where in the world the production occurs. It is similar to GDP except that it (1) includes *worldwide* income earned by a country's enterprises and permanent residents and (2) excludes production by foreign nationals working domestically.

"Given period of time." In theory, we could calculate the output of the economy over any time period—a day, a month, a year. When you hear people talking about GDP, they're usually referring to an annual figure. However, a year is a long time to wait for an update on how the economy is doing, so GDP is usually calculated on a *quarterly* basis—that is, four times a year.

Typically, what we really want to know is an estimate of annual GDP, using the most recent quarterly information. We can't just multiply this quarter's GDP by four, however,

because the economy seldom rolls along at the same pace all year. For instance, December usually has more economic activity than other months due to people buying presents and traveling. Therefore, we need to adjust quarterly GDP estimates to account for these seasonal patterns. That's why quarterly GDP is typically shown as a *seasonally adjusted estimate at an annual rate.* By taking account of predictable seasonal patterns, we can have a good guess at what annual GDP will be if the economy continues at its current pace.

Production equals expenditure equals income

LO 7.2 Explain the equivalence of the expenditure and income approaches to valuing an economy.

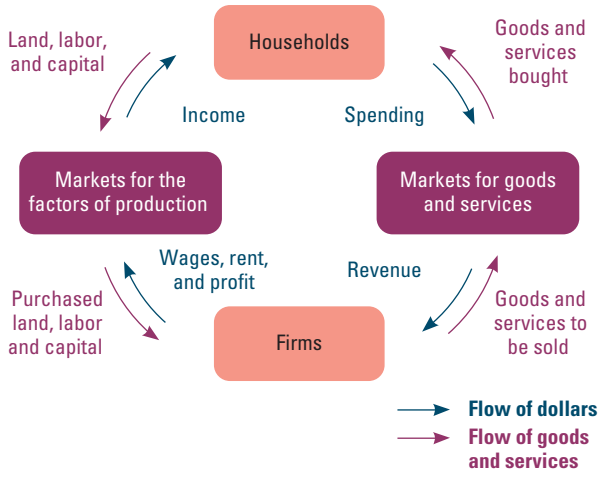
Now that we have defined the term gross domestic product, how do we go about measuring it? First of all, let's zero in on what we really mean when we talk about the size of an economy: the amount of "stuff" people in the economy are making. Economists refer to this "stuff" as either *output* or *production,* and it includes both goods and services. Indeed, about three-quarters of U.S. output is services, not goods. As we've seen, though, there's not much point in simply listing thousands of pages of goods and services. So how do we put a dollar value on it? There are two ways of approaching this problem.

The market value of a good or service is the price at which it is bought and sold. If we add up all the money people spend buying final goods and services—being careful to omit spending on intermediate goods so as not to double-count—the sum will be the market value of all output sold in the economy. In other words, we can measure total output by measuring total *expenditure.*

Of course, every transaction has not only a buyer who spends on a good or service but also a seller who earns income from the sale. Thus, expenditures by one person translate directly into *income* for someone else. So, we can also measure production by adding up everyone's income. This may sound familiar if you remember the *circular flow model* of the economy that was presented in Chapter 1 and is repeated here in Figure 7-1.

Households buy things from firms in the market for goods and services. Firms then use some of the money they earn in revenue to pay wages to workers and rent to

FIGURE 7-1
Circular flow diagram



landowners in the market for the factors of production. In each of these transactions, expenditures by one party are income for another.

The circular flow model is a major simplification of the economy. (What about the money paid in taxes, or the money that is saved instead of spent, for example?) Yet it shows that we should get to the same figure for GDP regardless of whether we measure expenditure or income in an economy:

National production = National expenditure = National income

This equality is a crucial idea in the study of macroeconomics.

Approaches to Measuring GDP

LO 7.3 Explain the three approaches that are used to calculate GDP, and list the categories of spending that are included in the expenditure approach.

The equality of production, expenditure, and income would hold true in a literal, straightforward way if we lived in *closed economy*—an economy in which all goods were produced and sold domestically and everything was consumed as soon as it was made. The actual economy is more complicated, but the basic equality still holds—as long as we're a little more careful about how we define each part.

One complication is international trade. Once we start to consider imports and exports, we see that expenditure in one country can translate into income in *another* country. Also, what happens when goods are produced, but not sold? In this section, we will consider the various approaches to measuring GDP, and see how economists deal with these complications.

The expenditure approach

To measure output using the *expenditure method,* we start by breaking expenditure down into categories. We don't want to double-count, so we *don't* include intermediate products, like raw peanuts and the labor of peanut factory workers, which firms buy only to transform into final goods and services. But we *do* include the following:

- Most final goods and services are bought by people who intend to *consume* them, such as a family buying groceries or clothes or haircuts.
- Firms buy some goods as an *investment* in future production, such as a farmer buying a new tractor to help him grow peanuts, or a peanut butter factory buying new peanut-grinding machinery. The reason we count these is that the tractor and the machinery are not "used up" in producing a jar of peanut butter in the same way that raw peanuts are.
- We also want to count *government* purchases, which includes everything from fighter planes, to asphalt for road repair, to those plastic bins that go through the scanner at airport security checkpoints.
- If we're interested in the output of the U.S. economy, then clearly we want to count goods and services produced in the U.S. and bought by foreigners, which are called *exports.* But we *don't* want to count expenditure by Americans on items produced outside of the U.S, which are called *imports.* For that reason, we subtract the amount of imports from the amount of exports, and use the result—*net exports*—to calculate expenditures.

To find total expenditure we add together these four categories: consumption, investment, government purchases, and net exports. Let's look at each in more detail.

Consumption. The first category, **consumption**, measures spending on goods and services by private individuals and households. It includes almost anything you'd buy for yourself, from basic, nondurable goods (like food and clothing), to durable goods (like computers and cars), to services (like tutoring and plumbing). If you pay rent or college tuition, those expenses are also included in consumption.

consumption spending on goods and services by private individuals and households

Note that what is consumed has to be *new.* This requirement avoids the illogical conclusion that we could grow the economy simply by reselling the same jar of peanut butter over and over again. If you buy a used camera on eBay, for example, the camera itself is not counted toward the size of the economy, because the original purchase of the camera was already recorded in GDP when it was sold new. However, the fee the seller pays to eBay *is* counted as consumption, and so is the price the seller pays FedEx to deliver the camera to you.

Investment. The second category, **investment**, includes any goods that are bought by people or firms who plan to use those purchases to produce other goods and services in the future, rather than consuming them. It includes *capital goods,* which are items like machines or tools that will be used for production of other goods or services. It also includes buildings and structures, like warehouses, that will be involved in providing goods and services.

investment spending on productive inputs, such as factories, machinery, and inventories

It's worth noting that newly built houses are also counted as investment. In contrast, if you rent a house, the expenditure falls under consumption. Why the difference? A newly built house will provide a place to live (or to rent out) now and for years to come, just as a newly built factory will generate output now and in future years. But when you *rent* a house, you are paying its owner for the service of letting you live there. You are consuming "place-to-live" services, but you're not making an investment because the house belongs to someone else and won't generate future revenues for you.

Again, note that investment goods are counted only if they are *new.* We don't count buying an existing factory or second-hand tools as investment. Nor do we count an individual's purchase of an existing house. (The services of the realtor selling you the house, though, would be counted toward consumption.)

POTENTIALLY CONFUSING

You may have heard people talk about their "investments"—stocks, bonds, mutual funds, and other products bought and sold in the financial markets. While it may seem as if these financial products should be counted under the "I" (investment) term in GDP, *they do not get counted as a part of GDP,* for two reasons. First, if you buy a share of General Motors stock through the New York Stock Exchange, your money does not go to General Motors. Instead, you are buying stock from some other investor, who has decided to sell his stock in General Motors. (We'll cover how economists think about buying stocks and making other financial "investments" in "The Basics of Finance" chapter.)

A second problem is that including stock purchases in GDP calculations would be another type of double-counting. If we added to GDP every time someone bought shares, we could make the economy seem to be growing simply by having people resell the same shares over and over again—just like passing the same jar of peanut butter back and forth.

Finally, our definition of investment also includes a less-obvious type of "purchase": spending on inventories. When we equated production, income, and expenditure, we

inventory the stock of goods that a company produces now but does not sell immediately

raised the question of how to deal with goods that are produced but not sold. **Inventory** is the answer: It's the stock of goods that a company produces now, but keeps to sell at a future time. If Ford manufactures a car this year, but the car sits on the lot until next year, the car becomes part of Ford's inventory. If Apple makes a batch of iPads, but keeps them in a warehouse until it's time to release the new model for public sale, they become part of Apple's inventory.

When a good is added to a company's inventory, we treat it as if the producing company has "bought" it, to keep in stock for the future. The value of that "sale" is included in our calculation of investment for the year. What happens next year when a consumer buys the iPad? We don't want to count the same iPad toward GDP in two different years. So, its value will be subtracted from Apple's inventory at the same time as it is counted as consumption. These two transactions cancel out, meaning the purchase results in no net increase in GDP.

government purchases spending on goods and services by all levels of government

Government purchases. The next category of spending, **government purchases**, represents goods and services bought by all levels of government. This includes both "consumption"-type purchases on goods (for instance, buying new bulbs to go in street lights) and services (buying the labor of government workers who repair street lights). It also includes "investment"-type purchases (for instance, buying a truck that government workers will use to repair street lights in the future). In fact, the technical name for this category of spending is "government consumption expenditures and gross investment." We'll stick with the term *government purchases* because it's less of a mouthful.

However, one important category of government spending does *not* count as a government purchase: spending that simply *transfers* resources to individuals, through Social Security or similar programs. When an elderly person spends money from her Social Security check to buy groceries, the spending will then be counted as private consumption, and the payment to the elderly person from the government does not count toward government purchases.

Net exports. The three categories of spending we've considered—consumption, investment, and government purchases—include spending on goods and services produced abroad as well as those produced domestically. Let's think about the GDP of the United States. Our calculation of consumption will include instances when people in the U.S. buy goods made abroad—say, a sweater imported from Scotland. If we're trying to measure the value of the goods produced *within the U.S.*, we don't want to count this spending. On the flip side, we don't want to miss spending by people in other countries on goods or services made in the U.S. and exported for sale abroad.

These two forces work in opposite directions: Domestic spending on imports should get subtracted from our GDP calculations, while international spending on exports should get added. We can simplify these international transactions by combining exports and imports into one term, called **net exports** or "NX." Net exports represents the value of goods and services produced domestically and consumed abroad minus the value of goods and services produced abroad and consumed domestically. If exports are higher than imports, NX will be positive. If imports are higher than exports, NX will be negative.

net exports exports minus imports; the value of goods and services produced domestically and consumed abroad minus the value of goods and services produced abroad and consumed domestically

When we add together spending in all four categories—consumption, investment, government purchases, and net exports—the total will be equal to expenditures on all goods and services produced in a country, which in turn is equal to the value of that production. This equation is represented as follows.

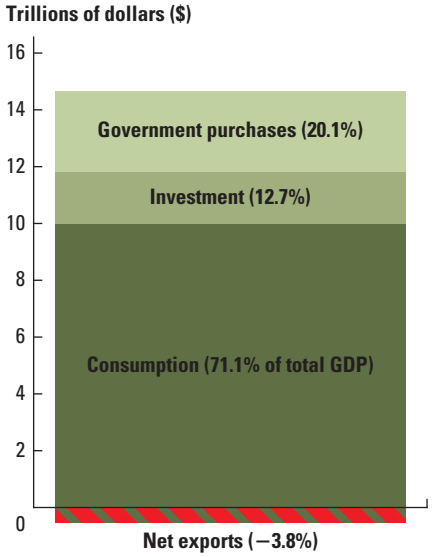
Equation 7-1

$$\text{Expenditure} = C + I + G + NX = \text{Production}$$

As you can see in Figure 7-2, consumption is by far the largest single category of expenditure in the U.S., but investment and government purchases are also significant. We can

FIGURE 7-2

U.S. GDP breakdown This figure shows the *expenditure method* of calculating GDP which adds together consumption, investment, government purchases, and net exports (exports minus imports). In the U.S., imports are currently higher than exports, so the value of net exports is negative and is subtracted from the total.



Source: Table 1.10, Gross Domestic Income by Type of Income (2011), http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1.

also see that U.S. residents *buy* more goods from abroad than they *sell* to people abroad. That's why net exports is a negative number, −3.8 percent of total 2011 GDP. In other words, in 2011 U.S. consumers spent more abroad than U.S. producers earned from foreigners buying U.S.-made goods, and the size of that difference was equal to 3.8 percent of GDP. If exports had been higher than imports, this number would have been positive.

Figuring out what goes into GDP and what isn't counted in the expenditure method takes a little practice. To help you keep track, Table 7-1 summarizes some of the examples presented in this chapter.

The income approach

A different way to think about the value of a national economy is to add up the income earned by everyone in the country. To value an economy this way, we add up wages earned by workers, interest earned on capital investments, rents earned on land and property, and profits earned by firms (plus a couple of additional technical adjustments). These cover all the types of income earned by people in a country, which can be shown in an equation as:

Equation 7-2

$$\text{Income} = \text{Wages} + \text{Interest} + \text{Rental income} + \text{Profits}$$

This *income method* will give us the same result as the expenditure method in an economy without any imports and exports. In every transaction, there is not only a buyer who spends but also a seller who earns the same amount in income. If you spend $20 on gasoline, that same $20 is both expenditure to you and income to the owner of the gas station. The expenditure approach added up everything on one side of this transaction. Now, the income approach adds up everything on the *other side* of the transaction, which comes out to the same amount.

What happens, though, when you want to add to the equation any trades that occur *outside* of the country? The term *net exports* is what allows us to equate expenditure and income in an economy that trades internationally. Figure 7-3 shows how we can think

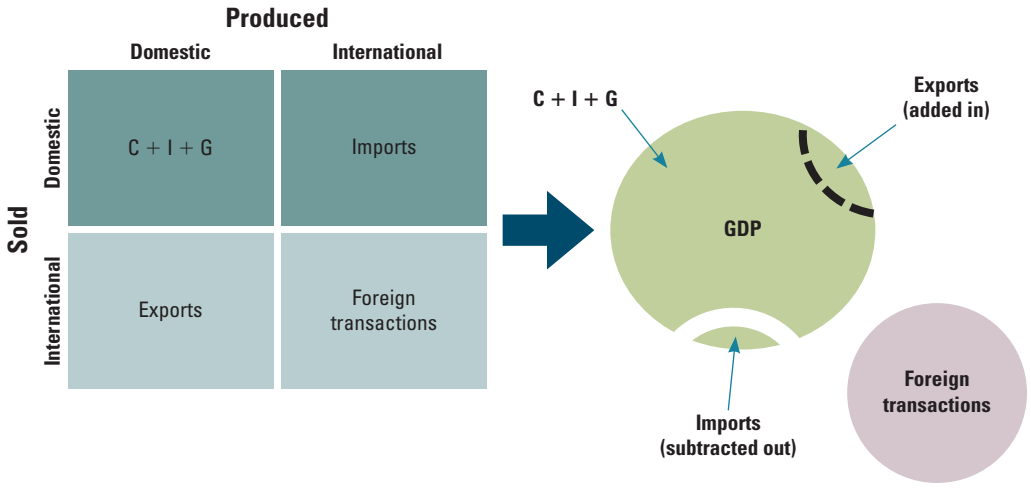
TABLE 7-1

Is it GDP?

Situation	GDP Category	Why?
Buying a new digital camera	Consumption	Purchasing a *new* good or service always counts toward GDP.
Buying a used camera on eBay	Not counted	As a used good, the camera does not count toward GDP, as it was already counted when new. The fees paid to eBay for selling the camera count as consumption, though.
Buying a new house	Investment	Since the house can increase or fall in value, it makes sense to think of it as an investment.
Renting an apartment	Consumption	You are paying the owner of the house for a service, so it is counted as consumption.
Apple makes a new batch of iPads but doesn't sell them until next year	Investment	Counted as a part of investment, as Apple is holding these phones as a part of its inventory.
Buying shares of General Motors stock	Not counted	Shares of stock are a transfer of money from one owner of the stock to another. Including stocks would cause a double-counting problem.
TSA buys plastic bins for airport security	Government spending	Any consumption or investment purchases made by the government are counted in GDP as government spending.
Babysitting for your neighbor	Not counted	In principle, it should be included in GDP, but such income is often not reported to the IRS so can't be included in official statistics.

FIGURE 7-3

Adding up expenditures and income in the expenditure approach Everything that is produced domestically is added to GDP, whether it is purchased for consumption, investment, by the government, or by people abroad (exports). Goods that are produced internationally but bought domestically, otherwise known as imports, are subtracted from GDP because they represent expenditure leaving the country. Transactions between foreign producers and foreign buyers do not involve domestic production or expenditure and therefore do not figure into GDP calculations.



about the income and expenditure approaches using the visual tool of a two-by-two matrix: When goods produced in the United States are exported, that's expenditure by other countries and income for the U.S. When people in the U.S. spend money on goods made in another country, that's expenditure in the U.S. and income for the other country.

The "value-added" approach

Before we move on, we should mention a third approach that economists sometimes use to measure economic output: the *value-added approach.* We have seen that the expenditure approach solves the double-counting problem by considering only transactions that represent final, and not intermediate, goods and services. For example, we count a consumer's purchase of a jar of peanut butter from a store, but not a peanut butter factory's purchase of peanuts from a peanut wholesaler. What if, instead, we looked at *all* transactions, but counted only the *value they add* to the economy?

To see the reasoning behind this approach, let's stick with peanut butter. At each stage of the peanut butter production process, we're going to look at the difference between the sale value of the product and the value of the inputs that went into it. This difference represents the "value added" at that stage of production. For instance:

- The farmer *adds value* to the economy by taking seeds, land, and water and growing peanuts. Just for simplicity, imagine the farmer didn't pay anything for his inputs. The value added to the economy is the $0.12 the farmer gets from selling his peanuts to the wholesaler, minus the value of the inputs, which we are imagining to be zero.
- If the wholesaler buys that $0.12 in peanuts, and sells them to a peanut butter factory for $0.24, then the wholesaler has added $0.12 ($0.24 − $0.12) in value to the economy by helping to link up farmers and factories.
- The peanut butter factory adds value by pressing the peanuts into butter and putting it into jars. If the factory is able to get $1.85 per jar, it has added $1.61 ($1.85 − $0.24) in value to the economy.
- The grocery store adds value by transporting jars to a convenient location in your neighborhood, where clerks are on hand to allow you to purchase it for the final price of $3.40 per jar, a value added of $1.55 ($3.40 − $1.85).

To see the final value added, simply sum up the value added at each stage of the process: $0.12 + $0.12 + $1.61 + $1.55 = $3.40. You'll notice that this is the same as the final price of the peanut butter in the store, which is what is counted in the expenditure method. The value-added approach is an alternative, and equally valid, way of avoiding the problem of double-counting the peanuts. The value-added approach lets us break down the total value paid and see how much of it was created at each step of the production process.

The value-added approach is especially useful when thinking about services involved in the resale of existing goods. We've already seen, for example, that resale of used cameras, existing houses, and shares of company stock do not count toward GDP—but the related services provided by eBay, realtors, and stockbrokers do. Added value helps us to think about why this is so. A stockbroker adds value by handling the paperwork associated with purchasing shares of stock. A realtor adds value by publicizing the fact that a house is for sale, showing potential purchasers around, and helping negotiate a sale. eBay adds value by connecting buyers with sellers. In general, any intermediary involved in the sale of used goods adds value by sourcing those goods and making them available for sale in a convenient way.

Why are there three approaches to calculating GDP, and how do you know when to use one instead of another? All three approaches end up with the same number, but

each provides a slightly different picture of how the different pieces make up the big picture. Do you want to know about consumer activity versus government purchases? The expenditure approach highlights that data. The income approach highlights information about the relative importance of different factors of production. Calculating the value added at each stage of production avoids the problem of double-counting and is especially useful in clarifying the resale of existing goods. Many countries use all three approaches to calculate GDP so that policy-makers and researchers can get a full picture of economic activity.

✓ CONCEPT CHECK

- ❒ Why are only final goods and services counted under GDP? Why are sales of used goods not counted? **[LO 7.1]**
- ❒ Why is total income in a country equal to total expenditures on goods produced in that country? **[LO 7.2]**
- ❒ What is the difference between consumption spending and investment spending? **[LO 7.3]**
- ❒ Under which category of expenditure do inventories fall? **[LO 7.3]**
- ❒ Does the sale of intermediate goods count toward GDP in the expenditure approach? **[LO 7.3]**
- ❒ How do GDP calculations account for the value added in the sale of an existing house by a realtor? **[LO 7.3]**

Using GDP to Compare Economies

U.S. GDP increased from $12.5 trillion in 2005 to $14 trillion in 2009. Does this mean that people in the United States produced more goods and services in 2009 than in 2005? Or does it mean that we just paid more for the same things, because prices were higher? GDP is a function of both the quantity of goods and services produced (output) and their market value (prices).

Often, an increase in GDP is the result of growth in both components—an increase in output *and* an increase in prices. If we want to use GDP to compare the health of a national economy over time, or to compare economies of different countries, we need to know how much of the growth to attribute to each factor.

Real versus nominal GDP

LO 7.4 Explain the difference between real and nominal GDP, and calculate the GDP deflator.

real GDP GDP calculation in which goods and services are valued at constant prices

nominal GDP GDP calculation in which goods and services are valued at current prices

GDP enables us to track changes in the value of output over time. But if you compare levels of just GDP in different years, you can't be sure whether differences are due to changes in production, or prices, or both. To zero in on changes in production, we need a new measure. We use the term *real GDP* to refer to GDP measurement that focuses solely on output, controlling for price changes. Formally, **real GDP** is calculated based on goods and services valued at *constant prices.* Those constant prices are given for a specific year. We might, for example, measure real GDP by valuing output in 2014 at the prices that prevailed in 2010.

If we report GDP *without* controlling for price changes, we are talking about *nominal GDP.* **Nominal GDP** is calculated based on goods and services valued at *current prices* (current at the time of production). Thus, in nominal GDP measurement, output for 2014 would be valued in 2014 prices.

Calculating nominal and real GDP. To see the difference between real and nominal GDP measures in practice, let's imagine an economy with only two goods: pizza and spaghetti. For ease of discussion, let's call this fictional economy "Pizzetta." Suppose that in 2010, Pizzetta produced 5 million pizzas at a price of $10 each and 20 million plates of spaghetti at a price of $8. Table 7-2 shows this output. In 2011, the number of pizzas and plates of spaghetti increased to 6 million and 22 million, respectively, and prices stayed the same. In 2012, Pizzetta produced the same number of pizzas and plates of spaghetti, but prices increased. In 2013, both quantity and prices increased.

In order to calculate nominal GDP, we simply multiply the quantity of each good produced in a given year by its price in that year, as shown in column 6 of Table 7-2. We can see that Pizzetta's nominal GDP increased between 2010 and 2011, and again in 2012 and 2013. What doesn't nominal GDP tell us? If we looked just at nominal GDP, we wouldn't be able to tell that in one year (2011) the increase was due to larger output, while in another year (2012) the increase was due only to an increase in prices with no increase in output.

To calculate real GDP (GDP valued at constant prices), we have to choose a *base year*. In the base year, nominal GDP and real GDP are equal. In every other year, we multiply the quantity of a good produced in that year by its price in the base year. In essence, we are holding prices constant, while allowing quantities to rise and fall. This method

TABLE 7-2 Calculating real versus nominal GDP growth

Nominal GDP **is the sum of the market values of all final goods and services, which we calculate by multiplying the quantity of each output by its market price in the current year. To calculate** ***real GDP,*** **we want to value those goods and services at their prices in the base year. When prices stay the same, nominal GDP and real GDP increase at the same rate. If prices rise, nominal GDP will be higher than real GDP.**

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year	**Pizzas** (millions)	**Price of pizza** ($)	**Spaghetti** (millions)	**Price of spaghetti** ($)	**Nominal GDP** (millions of $)	**Real GDP in 2010 prices** (millions of $)	**What's happening**
2010 (base year)	5	10	20	8	(5 × $10) + (20 × $8) = **$210**	(5 × $10) + (20 × $8) = **$210**	In the base year, nominal GDP and real GDP are equal by definition.
2011	6	10	22	8	(6 × $10) + (22 × $8) = **$236**	(6 × $10) + (22 × $8) = **$236**	When output rises and prices stay constant, nominal and real GDP rise at the same rate.
2012	6	12	22	10	(6 × $12) + (22 × $10) = **$292**	(6 × $10) + (22 × $8) = **$236**	When prices rise and output stays constant, nominal GDP rises but real GDP does not.
2013	7	13	25	11	(7 × $13) + (25 × $11) = **$366**	(7 × $10) + (25 × $8) = **$270**	When both output and prices rise, nominal and real GDP rise at different rates.

isolates increases in output from increases in prices. Suppose we pick 2010 as our base year. We can see in Table 7-2 that in 2011, the increase in real GDP is actually the same as the increase in nominal GDP ($236 million). That makes sense: Prices didn't change between the two years, so base-year prices are the same as current-year prices.

Between 2011 and 2012, however, we see the difference between nominal and real GDP show up. Nominal GDP increases, because prices increased. (Prices of pizza and spaghetti increased by $2 each.) But real GDP stays constant, because output stayed constant.

Between 2012 and 2013, both nominal *and* real GDP increase, because both prices *and* output increased. However, the increase in real GDP ($34 million) is smaller than the increase in nominal GDP ($74 million). What does that tell us? It indicates that only $34 million of the $74 million growth in nominal GDP is due to rising output; the rest is due to rising prices.

In summary, real GDP isolates changes in an economy's output, while nominal GDP encompasses changes in both output and prices. As a result, economists and policymakers typically use real GDP numbers as a reference point.

The GDP deflator

GDP deflator a measure of the overall change in prices in an economy, using the ratio between real and nominal GDP

Calculating real GDP allows us to isolate output growth from price increases. But what if it's price increases that we're interested in? The **GDP deflator** is a measure of the overall change in prices in an economy, using the ratio between real and nominal GDP. We calculate the GDP deflator as follows:

Equation 7-3

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

We saw in the previous section that the difference between nominal and real GDP is the difference between current prices and base-year prices. If we want to know about how prices have changed, we could always directly compare the price of each good in the current and base years. But that would be much like listing every good and service instead of reporting total GDP: It's not incorrect, but it's long, boring, and doesn't do much to summarize what's going on in the economy as a whole. The GDP deflator is one way of summarizing how prices have changed across the entire economy. It takes changes in the price of each individual good and service, and sums them up according to how much of that good or service was produced. In other words, the GDP deflator is a weighted average of all of the individual price changes in the economy.

The GDP deflator equation gives us the ratio between the base-year value of current output and the current-year value of current output. In the base year, the GDP deflator is always equal to 100, because current prices *are* base-year prices. Thus, in the base year, nominal GDP equals real GDP. If prices rise, nominal GDP will be higher than real GDP, and the deflator will be greater than 100. So, if the GDP deflator is 115 in a given year, we infer that the overall price level is 15 percent higher than it was in the base year. If prices fall, the deflator will be less than 100. Similarly, if we are looking at a year before the base year, when prices were lower, the deflator will be less than 100. Table 7-3 shows the GDP deflator for the imaginary Pizzetta in 2010–2013.

The GDP deflator gets its name from its relationship to inflation. *Inflation* is an idea we'll discuss at length in future chapters; in fact, we have an entire chapter devoted to the topic. For now, it's enough to note that inflation describes how fast the overall level of prices is changing. Inflation is defined in terms of a year-to-year increase in prices, rather than an increase over a base year. So, we can calculate inflation by looking at the increase in the GDP deflator between any two years. For instance, as shown in Table 7-3, the inflation rate in Pizzetta between 2012 and 2013 is:

Year	Nominal GDP (millions of $)	Real GDP (millions of $)	Deflator	Inflation
2010	210	210	$\frac{\$210}{\$210} \times 100 = \mathbf{100}$	———
2011	236	236	$\frac{\$236}{\$236} \times 100 = \mathbf{100}$	$(100 - 100)/100 = \mathbf{0\%}$
2012	292	236	$\frac{\$292}{\$236} \times 100 = \mathbf{123}$	$(123 - 100)/100 = \mathbf{23\%}$
2013	366	270	$\frac{\$366}{\$270} \times 100 = \mathbf{136}$	$(136 - 123)/123 = \mathbf{10.6\%}$

TABLE 7-3

Calculating the GDP deflator and inflation rates

Using the values of nominal and real GDP, we can calculate the GDP deflator, a measure of price changes over time. It is set to 100 for a base year; as prices increase, the value of the deflator increases as well. With the GDP deflator we can calculate inflation, the percentage change of prices.

$$\text{Inflation rate} = \left[\frac{(\text{Deflator}_{2013} - \text{Deflator}_{2012})}{\text{Deflator}_{2012}}\right] \times 100$$
$$= \frac{(136-123)}{123} \times 100$$
$$= 10.6\%$$

The GDP deflator is one simple way of measuring changes in the price level. It allows us to "deflate" nominal GDP by controlling for price changes. In official government statistics, the GDP deflator is actually calculated using a somewhat more elaborate method called a *chain-weighted index*. The basic intuition is the same as the simpler approach we've described here.[1] We'll return to the idea of changes in the overall price level in the "Cost of Living" chapter.

Using GDP to assess economic health

LO 7.5 Calculate and explain the meanings of GDP per capita and the real GDP annual growth rate.

How do we use GDP to compare economies? We could, of course, simply look at the GDPs of two countries side-by-side to see their relative sizes. High GDP means a big economy. Figure 7-4 shows the GDPs of a number of countries around the world. As you can see, the United States has the largest economy by far, followed by China.

However, if what we really want to know is the income of an average individual in these countries, GDP will paint a misleading picture. The reason is that the populations of the countries are quite different sizes. China's GDP is just over one-third as high as that of the United States, but its population is more than four times as large. India has just under four times as many people as the United States, but only one-tenth the GDP. The total income earned in China and India is spread across far more people, so the average person has lower income. Meanwhile, Norway has a much smaller economy than the U.S., but because its population is also much smaller, the average Norwegian is actually richer than the average American.

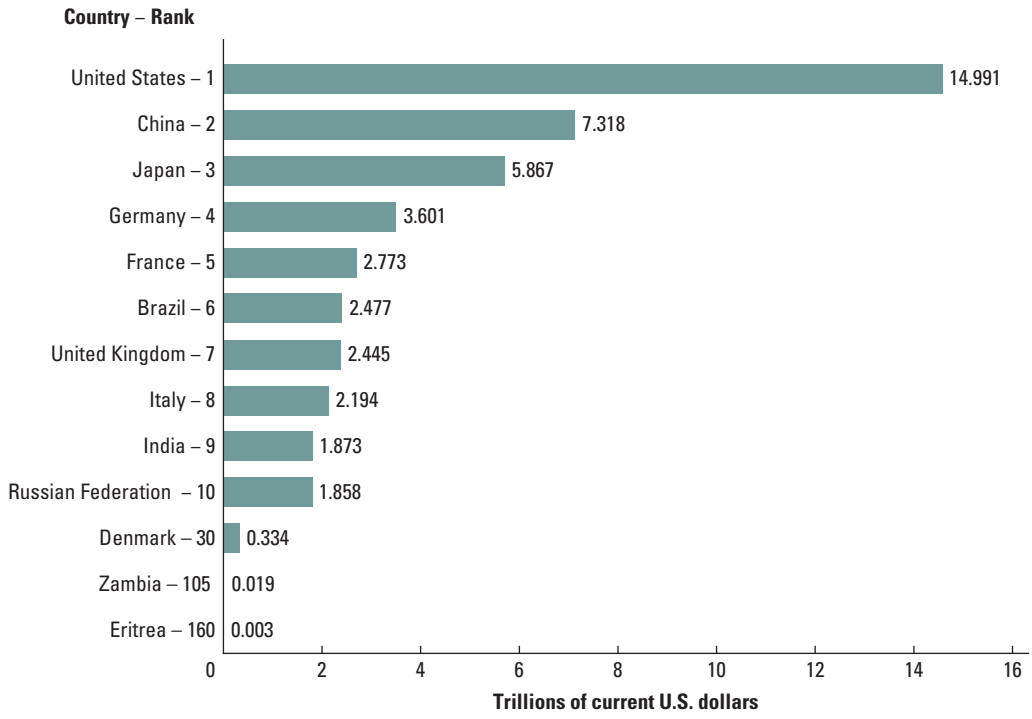
GDP per capita. If we want get an idea of how much is produced *per person* in a country, we need to divide GDP by population size. This measure is called **GDP per capita**. ("Per capita" simply means per person.) Figure 7-5 shows GDP per capita in each country in the world. When we compare this map to Figure 7-4, the most noticeable pattern is that the wealthy but small countries of Europe and the Middle East rise to the top, while populous countries like China, Brazil, and India move down.

GDP per capita a country's GDP divided by its population

GDP per capita is a useful measure. Knowing, for example, that GDP per capita in Switzerland is $67,246 while in Haiti it is only $673 suggests a lot about differences in life in these two countries. However, GDP per capita doesn't tell us everything. First, it

FIGURE 7-4

GDP around the world (2011) The top 10 countries in terms of overall nominal GDP include rich countries—with both large populations (the United States) and small (the United Kingdom)—as well as some poorer countries with large populations (China and India).



Source: World Bank World Development Indicators 2012, World Bank.

is a measure of *average* income; it doesn't tell us anything about how that income is distributed. A country with deep poverty and a rich elite could have higher GDP per capita than a country where everyone has a moderate standard of living.

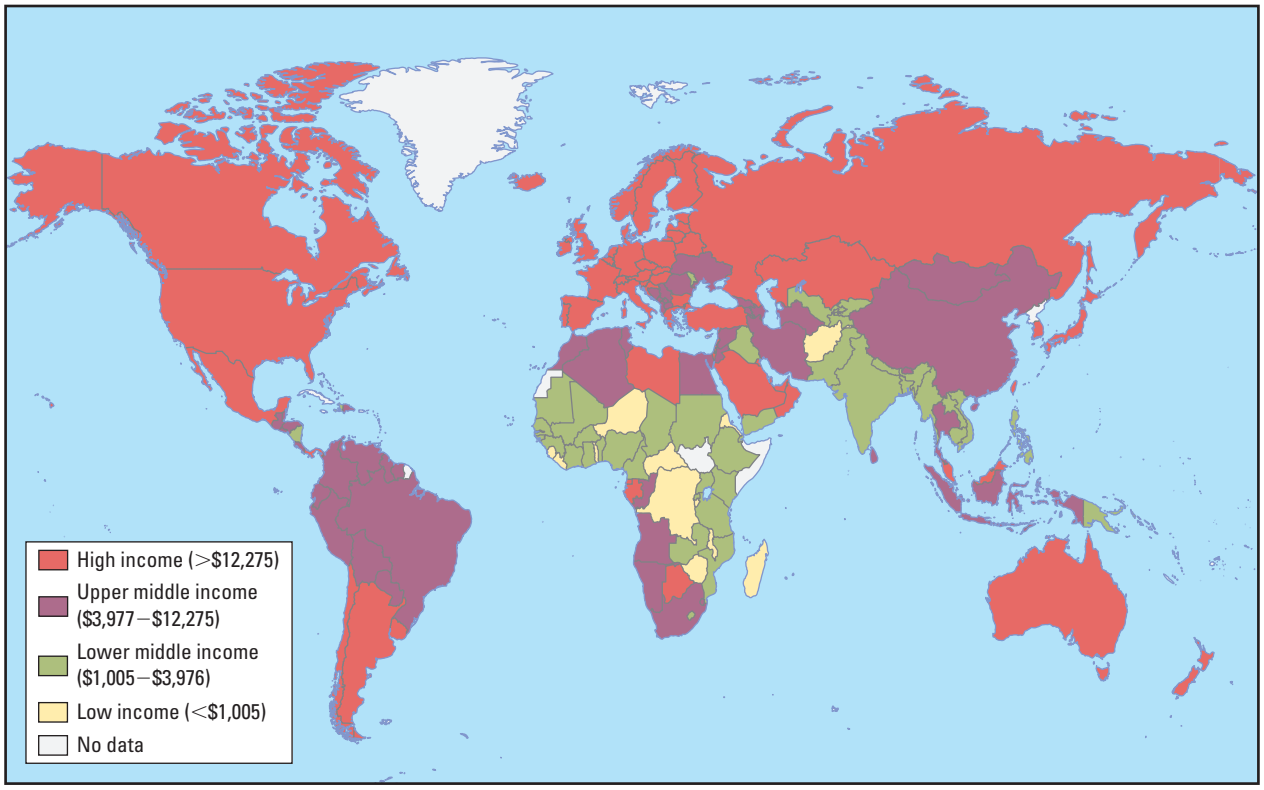
Second, it doesn't tell us what you can buy with a given amount of money in that country. The same goods might be more expensive in some countries than in others. For instance, GDP per capita in the United States and the Netherlands are both about $47,000. But many goods and services are more expensive in the Netherlands than in the United States. A dollar in the Netherlands won't buy you as much as it would in the U.S. When we account for this difference in the cost of living, the real value of GDP per capita in the Netherlands falls to about $41,000, which is *lower* than in the United States.

Conversely, many poor countries are cheaper to live in than rich ones. This doesn't mean that every single thing costs less, but that overall, the cost of living is lower. Looking at GDP per capita without accounting for differences in the cost of living makes poor countries look even poorer than they really are. In the United States or the Netherlands, for example, it would be almost impossible to survive on an income of $3,000 per year. In parts of Tanzania or Bangladesh, on the other hand, it would buy you a decent basic lifestyle. We will return to the subject of how to account for these differences in price levels in the next chapter. For now, just remember that GDP per capita is only a start in understanding people's real ability to consume goods and services.

GDP growth rates. One of the most common uses of GDP is to track changes in an economy over time. We usually talk about changes in GDP in terms of the *growth rate.* This is often measured as the percent change in real GDP from one time period to the next, typically annually or quarterly at an annual rate. For instance, if U.S. real GDP

FIGURE 7-5

Global GDP per capita (in 2010 U.S. dollars)



Sources: The World Bank, *World Development Indicators 2010* Data Set, data.worldbank.org. Map made by StatPlanet: http://www.statsilk.com/maps/world-stats-open-data.

grew from $14 trillion in one year to $14.5 trillion (in constant dollars) the next, the annual growth rate would be:

$$\text{GDP growth rate} = \left[\frac{(\$14.5 \text{ trillion} - \$14 \text{ trillion})}{\$14 \text{ trillion}}\right] \times 100 = 3.6\%$$

If the economy shrinks, the growth rate will be negative. For instance, the U.S. economy shrunk between 2008 and 2009, with a negative annual real GDP growth rate of −2.4 percent.

We can think about GDP growth rates in several ways. Let's think first about how economic growth changes year to year for the same country. A shrinking economy is a big deal. It means that people are actually producing less than they did the year before.

We have special terms for a period in which the economy contracts. A **recession** is a period of significant decline in economic activity. There is no hard-and-fast rule about what constitutes a "significant decline," but a recession is usually marked by falling GDP, rising unemployment, and an increased number of bankruptcies. A **depression** is a severe or extended recession. Again, there is no hard-and-fast rule about when a recession becomes a depression. An old joke, heard from both Harry Truman and Ronald Reagan, says that a recession is when your neighbor loses his job; a depression is when you lose yours.

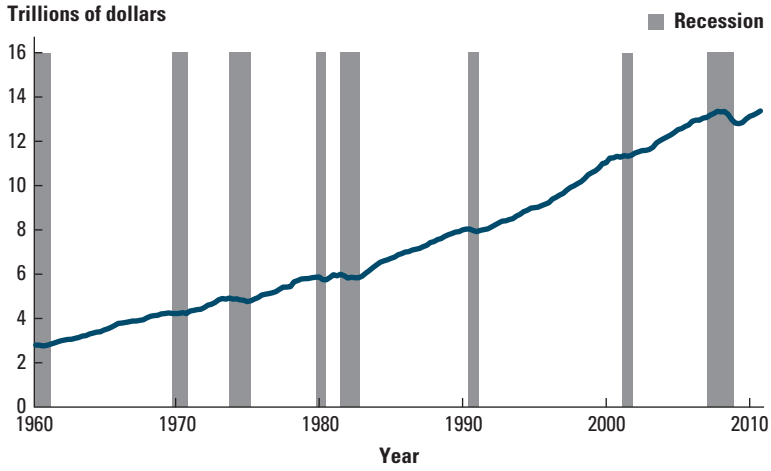
recession a period of significant economic decline

depression a particularly severe or extended recession

In the U.S., a recession or depression is considered "official" when a committee of economists at an organization called the National Bureau of Economic Research (NBER) calls it one. The country often feels the effects of a recession long before they register in government statistics: People start losing their jobs, and businesses experience

FIGURE 7-6

U.S. real GDP over time Real GDP has been steadily rising since 1960, and has more than quadrupled in value over the past 50 years. The grey bars show recessions, when economic activity slows.



Sources: Bureau of Economic Analysis, http://www.bea.gov/national/index.htm#gdp (quarterly real GDP); and http://www.nber.org/cycles/cyclesmain.html (recession dates).

falling sales. In the 2008 recession, for instance, the news media were using the word "recession" for almost a year before the NBER confirmed it.

Recessions are actually not as uncommon as you might think. Figure 7-6 shows that there were eight periods of recession in the United States in the 50 years between 1960 and 2010. You can also see that, overall, U.S. real GDP grew significantly and quite steadily over this same period. The 1990s and early 2000s were particularly recession-free decades, with only two brief and relatively mild dips in GDP. The 2008 recession involved a much deeper dip in GDP and lasted much longer.

Another way we can look at economic growth is to compare how fast different countries are growing. High growth rates are not necessarily associated with high total GDP or high GDP per capita, as Figure 7-7 shows. We can see that real GDP growth in the world's rich countries, such as the United States and Europe, has been relatively slow in recent years (albeit from a much higher starting level). Much more rapid growth has occurred in middle-income and poorer countries, led by China and followed by South Asia and East Africa.

✓ CONCEPT CHECK

- ❒ What is the difference between real and nominal GDP? **[LO 7.4]**
- ❒ What does it mean if country A has higher GDP than country B, but country B has higher GDP per capita? **[LO 7.5]**

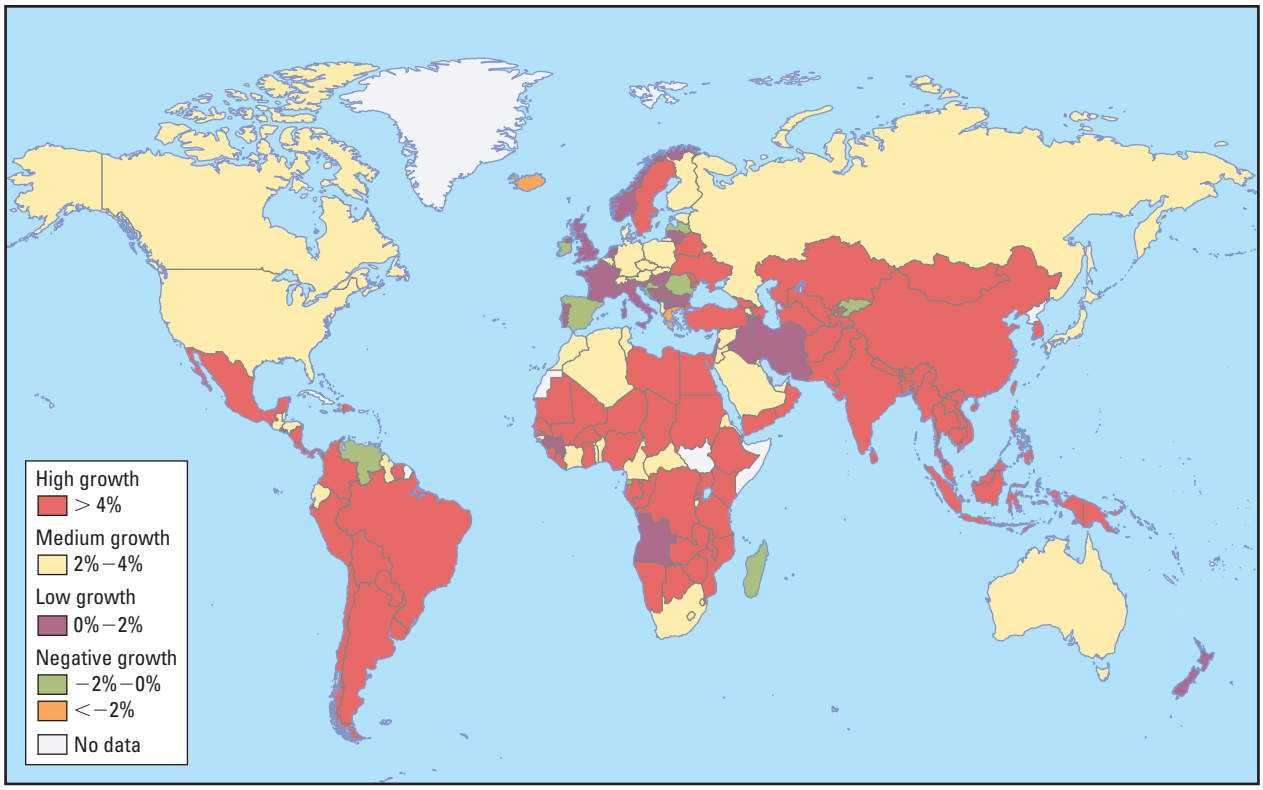
Limitations of GDP Measures

GDP is a powerful and versatile way of measuring the size of an economy. How much do people produce in different countries? What is the average income per person? Is the economy growing? How quickly? The uses of GDP in answering these questions make it one of the most important measures in a macroeconomist's toolbox.

However, we can't expect *everything* important to be measured by just one number. In this section, we'll talk about some types of economic activity that are excluded from GDP by design. We'll also look at which aspects of economic well-being are and are not captured by GDP. GDP is a powerful start on describing the health and direction of an economy, but we can get an even richer picture by supplementing it with other metrics.

FIGURE 7-7

GDP growth around the world (2010) In contrast with the map of overall income, poorer countries grew faster than more developed countries, on average.



Source: StatWorld, http://www.statsilk.com/maps/world-stats-open-data.

Data challenges

LO 7.6 Discuss some limitations to GDP, including its measurement of home production, the underground economy, environmental degradation, and well-being.

When critics argue that we should look beyond GDP, they point out that GDP calculations leave out some important types of economic activity. GDP measures the market value of final goods and services, but it doesn't include anything that is not traded in a market or that isn't reported to the government. That means that three major categories of economic activity are not counted as part of GDP: home production, the underground economy, and nonmarket externalities such as environmental degradation.

Home production. In general, goods and services that are both produced and consumed within one household—which we call *home production*—are not included in GDP. If you eat out, your meal is part of GDP; if you eat at home, it's not. If you hire a cleaning service to clean your home, that's part of GDP; if you clean your own home, it's not.

Similarly, the same goods might or might not be part of GDP, depending on whether you sell them or consume them yourself. If you grow vegetables in your garden and sell them at a farmers market, that's part of GDP; if you eat them yourself, it's not. If your grandmother knits a sweater and gives it to you for your birthday, that's not part of GDP; if your grandmother sells her knitting on eBay or Etsy, it is.

Home production is a major component of economic activity in most places and can change how one country compares to another. In relatively poor countries, many people grow their own food on small farms and may make their own tools and clothes. In these

instances, the official GDP measure may be missing a significant percentage of real production. Even in wealthy countries, much of the value of caretaking work—raising children or caring for elderly parents—is uncounted. Some economists have made efforts to quantify the value of this work. For more detail, read the From Another Angle box "Valuing homemakers."

FROM ANOTHER ANGLE

Valuing homemakers

If you were to compare the GDP growth of the United States and Germany between the 1970s and the 1990s, you'd find that the U.S. economy grew more than Germany's. Does this mean that life got better in the U.S. during that period relative to life in Germany? Estimates of home production cast an interesting light on this question.

One major difference between the United States and Germany over those three decades is the change in the number of people in the workforce. In the 1970s, comparable proportions of Germans and Americans were in paid employment; by the 1990s, a higher proportion of Americans had jobs. This difference can be largely explained by the rising rate of female participation in the U.S. labor force. A larger workforce makes for a larger GDP.

But the larger GDP does not necessarily mean that the United States is better off. The women who stayed at home in the 1970s weren't sitting around doing nothing. They were running households and raising families, growing and making goods for home consumption, doing volunteer work in their communities, and so on. Although these are valuable activities, a mother or father who stays home to look after children and bake cookies contributes nothing to GDP. But when she or he goes out to work, hires someone to look after the children, and buys cookies at the store, that adds to GDP. Therefore, we can't automatically conclude from the rise in U.S. GDP relative to Germany's that more goods and services were being produced in the U.S. in the 1990s. Could it be that some goods and services simply moved from the uncounted area of home production to the documented area of GDP?

Studies suggest this may, in fact, be the case. When you add up paid work, home production, and volunteer work, Americans and Germans put in about the same number of hours per week. But workers in Germany spend 5.3 hours less on paid work and 6 hours more on household production than do Americans. Estimating home production suggests that a lower German employment rate does not necessarily imply lower overall production or a lower standard of living.

Consideration of home production can also change the way we view recessions. U.S. GDP dropped in 2008, but home production went up. Feeling a financial squeeze, people substituted home-cooked meals for restaurant meals, planted gardens, and did their own repairs rather than hire someone. When the economy was doing well, people's choices suggest that they preferred to hire others to do these tasks, so the recession clearly reduced people's well-being. But economist Nancy Folbre, who has led efforts to quantify the value of home production, argues that it might not have reduced well-being by nearly as much as official GDP statistics suggest.

Sources: http://economix.blogs.nytimes.com/2009/05/04/including-home-production-gdp-might-not-look-so-bad; http://www.nber.org/papers/w8797.pdf; http://www.economics.harvard.edu/faculty/alesina/files/Work%20and%20Leisure%20in%20the%20U.S.%20and%20Europe.pdf.

The underground economy. Many goods and services are sold below the radar, outside of official records. These transactions make up the *underground economy.*

On the extreme end, there is trade in goods and services that are themselves illegal—banned drugs, restricted weapons, endangered animals and plants, and so on. Sales

of illegal goods and services are part of what is called the *black market.* Because black-market transactions are illegal, they are, of course, not reported to the government or tax authorities. As a result, they don't show up in government statistics, and they don't get counted as part of the official GDP. In principle, though, black market activities belong in the GDP calculation.

At the less extreme end are economic transactions that are otherwise legal but are sometimes not reported to the government. Failure to report can be either accidental or deliberate (to avoid paying taxes). For instance, were you ever hired to mow a neighbor's lawn, or babysit, or run errands for a few bucks when you were in high school? If you didn't report those amounts to the IRS,[2] you were participating in what's known as the *grey market*—so called because it sits somewhere between the black market and the documented economy.

Grey-market transactions aren't counted in GDP for the same reason that black-market transactions aren't counted: If it's not reported, it doesn't show up in government statistics. And, if it doesn't show up in government statistics, it can't be counted in GDP.

Even though black- and grey-market transactions don't get reported, researchers try to quantify them to get a sense for what's missing in our GDP calculations. It turns out that the underground economy accounts for a significant portion of the total economy in many countries. On average across the world, the underground economy is worth about one-third of GDP. This average hides wide variations, though. In the United States, for example, the underground economy has been valued at only around 7 or 8 percent of GDP. It is estimated at more than half of GDP in Nigeria, and more than two-thirds in some Latin American countries.[3]

The typical explanation for this pattern reflects the cost of doing business legally. In some countries you have to pay extremely high taxes, or pay bribes to officials to cut through bureaucratic red tape. When the cost of doing business legally is high, people are much more likely to conduct their business through other channels. In such countries, GDP may significantly underestimate the true size of the economy. In the case of Nigeria, it would mean increasing the official GDP figure by 50 percent.[4]

Environmental externalities. Suppose an electricity company causes air pollution by burning coal. The electricity generated ends up being counted in GDP. It may appear in the price paid by households for their electricity. Or it may be wrapped up in the price of goods and services that other firms make using the electricity as an input.

Some economists feel that GDP, as a metric, is missing the costs associated with pollution. They argue that we need to account for the *negative externalities* of economic activities. In a sense, we can think of the value of negative externalities as *negative output.* They are final "goods" that do harm to people, and therefore have negative value, but don't otherwise get counted in production or expenditure measures.

Increasingly, those who deal with economic statistics are trying to incorporate the value of negative externalities into GDP. Some countries have tried to calculate **green GDP**. This alternative measure of GDP subtracts the environmental costs of production from the positive outputs normally counted in GDP.

green GDP an alternative measure of GDP that subtracts the environmental costs of production from the positive outputs normally counted in GDP

In some countries that are growing rapidly, such as China and India, there are few regulations to guard against environmental degradation. When the Chinese government attempted to calculate green GDP in 2007, it came up with some shocking results. Once adjusted for pollution, the soaring GDP growth rates in many provinces in China dropped to almost zero. This was such an inconvenient finding that the government abandoned the green-GDP project. The Chinese government is not alone in its concerns about the political implications of GDP measures. For more about the intersection of politics and national accounting, read the From Another Angle box "The political intrigues of GDP measurement."

FROM ANOTHER ANGLE

The politics of green GDP

Since GDP is widely viewed as the measure of the overall health of the economy, politicians have an incentive to make GDP numbers look as strong as possible, to help their reelection chances. As a result, the question of what is the best way to measure the economy isn't left to number-crunching economists—it can also be deeply political.

A perfect example of this is green GDP. Recognizing that GDP may not capture the negative externalities of environmental production, officials in the U.S. Bureau of Economic Analysis (BEA) started to work on how to measure a more "complete" measure of economic activity. This idea started off with the typical GDP equation: C + I + G + NX. What made the new GDP calculation "green" was that it would weigh the value of this production against its overall environmental costs. Included in those costs would be the consumption of nonrenewable resources—such as pumping oil and mining coal—and some of the costs from pollution.

You may have noticed that we don't see this figure reported in the news. Why not? The BEA needed funding to continue the project, which needed the approval of Congress. The National Academy of Science supported the proposal, but members of Congress nixed it. It seems they were worried that measuring green GDP might suggest the economy was shrinking rather than growing, and that industry—which has powerful lobbies—would get the blame.

By contrast, a similar French effort had top-level support. Former President Nicholas Sarkozy recruited several prominent economists—including two Nobel laureates, Amartya Sen and Joseph Stiglitz—to serve on the grandly named "Commission on the Measurement of Economic and Social Progress."

The commission published a 300-page report in September 2009, outlining 12 recommendations. These included measures of the state of health, education, the environment, and income inequality that could be used to build a more inclusive measure of overall well-being. This measure was never officially calculated. But we can guess roughly what it might show by seeing how France scores in other, already-crafted measures such as the Better Life Index from the OECD (Organisation for Economic Co-operation and Development): France ranked 18th among 34 OECD member countries. That ranking is seven positions *lower* than how France stands when the same countries are ranked by the size of their GDP per capita.

If President Sarkozy had been hoping for a new metric that would make the French feel good about their country on the world stage, then this type of calculation would have fallen far short. As we have seen, the traditional measurement of GDP is more than just a metric favored by economists—it can be quite useful for politicians as well.

Sources: www.oecd.org/thebetterlifeindex; http://www.nytimes.com/2010/05/16/magazine/16GDP-t.html?pagewanted=all; http://www.stiglitz-sen-fitoussi.fr/en/index.htm.

GDP vs. well-being

GDP tells us a lot about the living standards in a country, but it can't tell us everything. Suppose you are offered the chance to live in a country that you know nothing about. You could quickly learn more by finding out the country's average income as measured by its GDP per capita. Which data would you turn to next to find out about the quality of life there? Quality of life is a nuanced idea, and it's hard to capture perfectly with any number. However, metrics like infant or child mortality (how many babies and children die), literacy rates (how many people can read), and life expectancy (how long people live) can give us a fuller picture of the well-being of a country's inhabitants.

You might assume that countries with high GDP per capita are likely to do well on these other metrics. The wealthier a country is, the more easily it can afford good health care and education for its people. Broadly speaking, you would be right. As Table 7-4

shows, GDP per capita is highly correlated with these quality of life measures. However, the correlation is not perfect: Look at Equatorial Guinea in Africa. Countries that are much poorer than Equatorial Guinea—such as Brazil, Bulgaria, and China—nonetheless seem to do a much better job of caring for the health of their children and elderly.

There are good reasons to expect that GDP per capita might not perfectly correlate with people's well-being. Let's take an obvious example: When people take more vacation or leisure time, they aren't working to manufacture goods or provide services. More time off from work may reduce GDP, but vacations generally make people happier. In this sense, pursuing GDP growth as the highest priority can be in opposition to improving quality of life in other ways, at least in the short term.

If what we care about is not so much the output of an economy but the happiness of the people who comprise it, can we measure happiness directly? Economists and others are trying to do this in a systematic way. These efforts are just underway, though, and nobody is suggesting that such measures replace GDP. One of the measures they've developed is the Life Satisfaction Index. (See the final column in Table 7-4.) It suggests that the correlation between GDP per capita and happiness is, indeed, far from perfect. For example, people in Bulgaria seem to be less happy than we might expect from their average income; people in Mali seem to be happier. For more on measuring happiness, read the Real Life box "Can money buy you happiness?"

TABLE 7-4 GDP compared with other measures of well-being

While GDP is commonly used to measure average income in a country, it can't capture all aspects of quality of life. Overall, metrics of well-being and quality of life like infant mortality, literacy, and life expectancy are correlated with GDP per capita, but in extreme cases, like that of Equatorial Guinea, they can diverge dramatically.

Country	GDP per capita (Current U.S. $)	Literacy rate (% of population over 15)	Life expectancy at birth (Years)	Child mortality (Deaths per 1,000 under age 5)	Life satisfaction index (0 to 10)
Norway	**79,089** (4)	———	**80.5** (13)	**4** (8)	**8.1** (6)
United States	**45,989** (12)	———	**78** (36)	**8** (37)	**7.8** (10)
Equatorial Guinea	**15,397** (44)	**93** (49)	**50.1** (172)	**167** (189)	———
Brazil	**8,230** (61)	**90.0** (63)	**72.2** (102)	**29** (109)	**7.6** (24)
Bulgaria	**6,423** (69)	**98.3** (28)	**72.7** (94)	**12** (61)	**4.4** (111)
China	**3,744** (103)	**93.7** (43)	**72.7** (95)	**26** (102)	**5.2** (94)
Mali	**691** (160)	**26.2** (130)	**50** (184)	**193** (195)	**3.7** (120)
	Value (country rank)				

Sources: **2009 World Bank WDI, http://data.worldbank.org/data-catalog/world-development-indicators (GDP per capita); http://www.earth.columbia.edu/sitefiles/file/Sachs%20Writing/2012/World%20Happiness%20Report.pdf (Life Satisfaction Index), 2010; U.N. World Population Prospects, 2010 Revision, http://esa.un.org/wpp/Excel-Data/mortality.htm (Life Expectancy, Child Mortality).**

REAL LIFE

Can money buy you happiness?

Everyone has heard the saying, "Money can't buy you happiness." But is it actually true? The answer turns out to depend on how much money, and how you define happiness.

First, how can we tell whether someone is happy? Researchers have generally relied on just asking people how they feel. Studies show consistently that people who are married tend to be happier, as do people who are religious, and people who are in good health. Income seems to matter a lot, too.

However, we need to remember the difference between *causation* and *correlation.* The fact that wealth and life satisfaction are correlated doesn't mean that having more money *causes* happiness. In fact, when you look at the same country over time, people don't necessarily get happier as the country they live in gets richer. For instance, the United States has much higher GDP per capita now than it did 50 years ago. But researchers have found that Americans are not noticeably happier than they were 50 years ago. One possible explanation for this puzzle is that people naturally tend to compare their lifestyles and material wealth to those of their peers, rather than to their parents or grandparents.

How about the relationship between money and happiness for individuals within a country? Research in the United States has found that there *is* a correlation between happiness and money—up to a point. That point happens to be an income level of about $75,000 per year. Below that income level, more money appears to be related to higher levels of happiness on average. Above that income level, it's much less clear—whether money buys happiness seems to depend on the way in which you ask people if they're happy.

Typically, researchers use two distinct methods. One is to ask something like, "How satisfied are you with your life as a whole these days?" This measure, usually called *life satisfaction*, continues to rise with income. In other words, someone earning $750,000 is likely to tell a researcher that she is more satisfied than someone earning $75,000.

The other method is to ask people about the emotions they felt *on the previous day.* For example, did you feel happiness yesterday? Enjoyment? Anger? Stress? Worry? Here, we find that overall someone earning $75,000 is more likely to have experienced positive emotions than someone earning $25,000. But despite what you would think, someone earning $750,000 did not report more positive emotions, and less negativity, than someone earning $75,000. Although money doesn't always buy happiness, it seems to help up to a certain point.

Sources: Angus Deaton, "Income, health, and well-being around the world: Evidence from the Gallup World Poll," *Journal of Economic Perspectives,* 2008; http://economix.blogs.nytimes.com/2009/03/10/the-happiest-states-of-america/; http://www.princeton.edu/~deaton/downloads/deaton_kahneman_high_income_improves_evaluation_August2010.pdf.

✓ CONCEPT CHECK

- ❒ What is home production? **[LO 7.6]**
- ❒ Why might GDP fall if environmental damages caused by production were taken into account? **[LO 7.6]**
- ❒ What supplemental metrics are commonly used to measure quality of life alongside GDP per capita? **[LO 7.6]**

Conclusion

GDP is a powerful and versatile metric. There are good reasons that it is one of the most commonly used tools in macroeconomics. It gives a simple measure of the size of an economy and the average income of its participants. It also allows us to make comparisons over time or across countries. The system of national income accounts gives us a picture of how output, expenditure, and income are linked, and a framework for adding up the billions of daily transactions that occur in an economy.

Comparing nominal and real GDP allows us to disentangle the role of increasing prices versus increasing output in a growing economy. The GDP deflator and the inflation rate track changes in overall price levels over time—which, as we'll see in the next chapter, is a major task in macroeconomics. GDP per capita gives us a sense of the average income within a country, although it doesn't tell us about the distribution of income or quality of life. Finally, calculating real GDP growth rates shows us which direction the economy is moving, and is an important indicator of recession or depression.

In the next chapter, we'll dig deeper into the tools that economists use to measure price changes and the cost of living. When we combine these tools with GDP, we have a menu of macroeconomic metrics that will allow us to describe and analyze national and international economies.

◄ Mobile Window on the World—Scan this code with your smartphone to find more applications of the chapter content. (Need a barcode reader? Try ScanLife, available in your app store.)

Visit your mobile app store and download ► the Karlan and Morduch Study Econ app.

Key Terms

macroeconomics, p. 157
gross domestic product (GDP), p. 157
gross national product (GNP), p. 158
consumption, p. 161
investment, p. 161
inventory, p. 162
government purchases, p. 162
net exports, p. 162
real GDP, p. 166
nominal GDP, p. 166
GDP deflator, p. 168
GDP per capita, p. 169
recession, p. 171
depression, p. 171
green GDP, p. 175

Summary

LO 7.1 Justify the importance of using the market value of final goods and services to calculate GDP, and explain why each component of GDP is important.

Most goods and services go through several production steps and may pass through multiple firms before ending up in the hands of the consumer. However, when calculating GDP, we should consider only the value of the final good or service, in order to avoid double-counting. The value added by each step of the production process will be included in the price of the final product.

The most commonly used variable for measuring the value of a national economy is gross domestic product, or GDP. GDP is the sum of the market values of all final goods and services produced within a country in a given period of time. The goods and services that count toward GDP are defined in terms of the location of production, not the citizenship of the producer. GDP is usually calculated on an annual and quarterly (three-month) basis; only new goods and services being produced within that time period are counted. Quarterly GDP estimates are typically given as a seasonally adjusted annual rate, which projects what annual GDP will be based on the current quarter's output if the economy continues to follow expected seasonal patterns.

LO 7.2 Explain the equivalence of the expenditure and income approaches to valuing an economy.

Economists can think about the size of a national economy in three different ways: how much is produced (output), how much is spent (expenditure), and how much income is earned (income). All three of these methods add up to the same thing. Total output is the *value* of the things produced in an economy in dollar terms, which is the same as the price for which those outputs sell, which is the same as what people spent to buy those outputs. Therefore, the value of output is equal to expenditures. Every transaction has both a buyer and a seller, so expenditures by one person translate directly into income for someone else; therefore, income equals expenditure.

LO 7.3 Explain the three approaches that are used to calculate GDP, and list the categories that are included in the expenditure approach.

The *expenditure* approach of calculating the size of an economy involves adding up all spending on goods and services produced in an economy, and subtracting spending on imports. We can break expenditures into four categories: *Consumption* (C) measures spending on goods and services to be consumed by private individuals and families. *Investment* (I) includes any goods that are bought in order to produce other goods and services in the future. *Government purchases* (G) are goods and services bought by all levels of government, for either consumption or investment. Finally, *net exports* (NX) is foreign spending on domestically produced goods and services minus domestic spending on foreign-produced goods and services. The sum of these categories and the equivalence of income (Y) and expenditure gives us the equation $Y = C + I + G + NX$.

The income approach adds up the income earned by everyone in a country—including wages (earned by workers), interest (earned on capital investments), rental income (earned on land and property), and profits (earned by firms).

The *value-added* approach accounts for the value that is added at each stage of production in the economy. This approach allows economists to investigate the contribution of each transaction in the economy to overall GDP. It also solves the double-counting problem because only part of the value of each transaction is registered, and it does not register the total price of intermediate goods and services.

Many countries use all three approaches to calculate GDP so that policy-makers and researchers can get a full picture of economic activity.

LO 7.4 Explain the difference between real and nominal GDP, and calculate the GDP deflator.

GDP is a function of both the quantity of goods and services produced (output) and their market value (prices); an increase in GDP can result from growth in either or both components. To isolate the role of growing output, we can control for price changes. *Real GDP* is calculated based on goods and services valued at constant prices. *Nominal GDP* is calculated based on goods and services valued at current prices. If we want to measure price changes, we can calculate the GDP deflator, a measure that summarizes the overall increase in prices in an economy using the ratio between real and nominal GDP.

LO 7.5 Calculate and explain the meanings of GDP per capita and the real GDP annual growth rate.

GDP per capita is total GDP divided by the population of a country. It tells us the average income or productivity per person in the economy. To track changes in an economy over time, we can calculate the real GDP growth rate, measured as the percent change in real GDP from one time period to the next, typically annually or quarterly at an annual rate. When the economy shrinks, the growth rate is negative, and is one of the major indicators used to determine whether the economy is in a recession or depression.

LO 7.6 Discuss some limitations to GDP, including its measurement of home production, the underground economy, environmental degradation, and well-being.

GDP is a rough measure of the average standard of living in a country, but does not tell us about the distribution of wealth. Furthermore, three important segments of the economy are not included in GDP by design: home production (goods and services that are produced and consumed within a household); the underground economy (illegal transactions, or legal transactions that simply aren't reported to the government); and externalities (such as pollution) that are not fully accounted for in regular production or consumption measures. Higher GDP is often associated with other indicators of higher well-being, such as health, education, and life satisfaction, but does not guarantee those things.

Review Questions

1. U.S. car dealers sell both used cars and new cars each year. However, only the sales of the new cars count toward GDP. Why does the sale of used cars not count? **[LO 7.1]**

2. There is an old saying, "You can't compare apples and oranges." When economists calculate GDP, are they able to compare apples and oranges? Explain. **[LO 7.1]**
3. When Americans buy goods produced in Canada, Canadians earn income from American expenditures. Does the value of this Canadian output and American expenditure get counted under the GDP of Canada or the United States? Why? **[LO 7.2]**
4. Economists sometimes describe the economy as having a "circular flow." In the most basic form of the circular flow model, companies hire workers and pay them wages. Workers then use these wages to buy goods and services from companies. How does the circular flow model explain the equivalence of the expenditure and income methods of valuing an economy? **[LO 7.2]**
5. In 2011, the average baseball player earned $3 million per year. Suppose that these baseball players spend all of their income on goods and services each year, and they save nothing. Argue why the sum of the incomes of all baseball players must equal the sum of expenditures made by the baseball players. **[LO 7.2]**
6. Determine whether each of the following counts as consumption, investment, government purchases, net exports, or none of these, under the expenditure approach to calculating GDP. Explain your answer. **[LO 7.3]**
   a. The construction of a court house.
   b. A taxicab ride.
   c. The purchase of a taxicab by a taxicab company.
   d. A student buying a textbook.
   e. The trading of municipal bonds (a type of financial investment offered by city or state governments).
   f. A company's purchase of foreign minerals.
7. If car companies produce a lot of cars this year but hold the new models back in warehouses until they release them in the new-model year, will this year's GDP be higher, lower, or the same as it would have been if the cars had been sold right away? Why? Does the choice to reserve the cars for a year change which category of expenditures they fall under? **[LO 7.3]**
8. The value-added method involves taking the price of intermediate outputs (i.e., outputs that will in turn be used in the production of another good) and subtracting the cost of producing each one. In this way, only the value that is added at each step (the sale value minus the value that went into producing it) is summed up. Explain why this method gives us the same result as the standard method of counting only the value of final goods and services. **[LO 7.3]**
9. Imagine a painter is trying to determine the value she adds when she paints a picture. Assume that after spending $200 on materials, she sells one copy of her painting for $500. She then spends $50 to make 10 copies of her painting, each of which sells for $100. What is the value-added of her painting? What if a company then spends $10 per copy to sell 100 more copies, each for $50? What is the value the painter adds then? If it's unknown how many copies the painting will sell in the future, can we today determine the value-added? Why or why not? **[LO 7.3]**
10. In a press conference, the president of a small country displays a chart showing that GDP has risen by 10 percent every year for five years. He argues that this growth shows the brilliance of his economic policy. However, his chart uses nominal GDP numbers. What might be wrong with this chart? If you were a reporter at the press conference, what questions could you ask to get a more accurate picture of the country's economic growth? **[LO 7.4]**
11. Suppose that the GDP deflator grew by 10 percent from last year to this year. That is, the inflation rate this year was 10 percent. In words, what does this mean happened in the economy? What does this inflation rate imply about the growth rate in real GDP? **[LO 7.4]**
12. An inexperienced researcher wants to examine the average standard of living in two countries. In order to do so, he compares the GDPs in those two countries. What are two reasons why this comparison does not lead to an accurate measure of the countries' average standards of living? **[LO 7.4, 7.5]**
13. In 2010, according to the International Monetary Fund, India had the world's 10th highest nominal GDP, the 135th highest nominal GDP per capita, and the 5th highest real GDP growth rate. What does each of these indicators tell us about the Indian economy and how life in India compares to life in other countries? **[LO 7.5]**
14. China is a rapidly growing country. It has high levels of bureaucracy and business regulation, low levels of environmental regulation, and a strong tradition of entrepreneurship. Discuss several reasons why official GDP estimates in China might miss significant portions of the country's economic activity. **[LO 7.6]**

15. Suppose a college student is texting while driving and gets into a car accident causing $2,000 worth of damage to her car. Assuming the student repairs her car, does GDP rise, fall, or stay constant with this accident? What does your answer suggest about using GDP as a measure of well-being? **[LO 7.6]**

Problems and Applications

1. Suppose a gold miner finds a gold nugget and sells the nugget to a mining company for $500. The mining company melts down the gold, purifies it, and sells it to a jewelry maker for $1,000. The jewelry maker fashions the gold into a necklace which it sells to a department store for $1,500. Finally, the department store sells the necklace to a customer for $2,000. How much has GDP increased as a result of these transactions? **[LO 7.1, 7.3]**
2. Table 7P-1 shows the price of inputs and the price of outputs at each step in the production process of making a shirt. Assume that each of these steps takes place within the country. **[LO 7.1, 7.3]**
   a. What is the total contribution of this shirt to GDP, using the standard expenditure method?
   b. If we use a value-added method (i.e., summing the value added by producers at each step of the production process, equal to the price of inputs minus the price of outputs), what is the contribution of this shirt to GDP?
   c. If we mistakenly added the price of both intermediate and final outputs without adjusting for value added, what would we find that this shirt contributes to GDP? By how much does this overestimate the true contribution?
3. The U.S. government gives income support to many families living in poverty. How does each of the following aspects of this policy contribute to GDP? **[LO 7.2]**
   a. Does this government's expenditure on income support count as part of GDP? If so, in which category of expenditure does it fall?
   b. When the families buy groceries with the money they've received, does this expenditure count as part of GDP? If so, in which category does it fall?
   c. If the families buy new houses with the money they've received, does this count as part of GDP? If so, in which category does it fall?
4. Given the following information about each economy, either calculate the missing variable or determine that it cannot be calculated. **[LO 7.2, 7.3]**
   a. If C = $20.1 billion, I = $3.5 billion, G = $5.2 billion, and NX = −$1 billion, what is total income?
   b. If total income is $1 trillion, G = $0.3 trillion, and C = $0.5 trillion, what is I?
   c. If total expenditure is $675 billion, C = $433 billion, I = 105 billion, and G = $75 billion, what is NX? How much are exports? How much are imports?
5. Using Table 7P-2, calculate the following. **[LO 7.2, 7.3]**
   a. Total gross domestic product and GDP per person.
   b. Consumption, investment, government purchases, and net exports, each as a percentage of total GDP.
   c. Consumption, investment, government purchases, and net exports per person.
6. Determine which category each of the following economic activities falls under: consumption (C), investment (I), government purchases (G), net exports (NX), or not included in GDP. **[LO 7.3]**
   a. The mayor of Chicago authorizes the construction of a new stadium using public funds.
   b. A student pays rent on her apartment.

TABLE 7P-1

	Cotton farmer ($)	Fabric maker ($)	Sewing and printing ($)
Inputs	0	1.10	3.50
Value of output	1.10	3.50	18.00

TABLE 7P-2

Sector	Value (millions)
Consumption	$770,000
Investment	$165,000
Government spending	$220,000
Net exports	−$ 55,000
Population	50

c. Parents pay college tuition for their son.
d. Someone buys a new Toyota car produced in Japan.
e. Someone buys a used Toyota car.
f. Someone buys a new General Motors car produced in the United States.
g. A family buys a house in a newly constructed housing development.
h. The U.S. Army pays its soldiers.
i. A Brazilian driver buys a Ford car produced in the United States.
j. The Department of Motor Vehicles buys a new machine for printing driver's licenses.
k. An apple picked in Washington State in October is bought at a grocery store in Mississippi in December.
l. Hewlett-Packard produces a computer and sends it to a warehouse in another state for sale next year.

7. Table 7P-3 shows economic activity for a very tiny country. Using the expenditure approach determine the following. **[LO 7.3]**
   a. Consumption.
   b. Investment.
   c. Government purchases.
   d. Net exports.
   e. GDP.
8. During the recent recession sparked by financial crisis, the U.S. economy suffered tremendously. Suppose that, due to the recession, the U.S. GDP dropped from $14 trillion to $12.5 trillion. This decline in GDP was due to a drop in consumption of $1 trillion and a drop in investment of $500 billion. The U.S. government, under the current president, responded to this recession by increasing government purchases. **[LO 7.3]**
   a. Suppose that government spending had no impact on consumption, investment, or net exports. If the current presidential administration wanted to bring GDP back up to $14 trillion, how much would government spending have to rise?
   b. Many economists believe that an increase in government spending doesn't just directly increase GDP, but that it also leads to an increase in consumption. If government spending rises by $1 trillion, how much would consumption have to rise in order to bring GDP back to $14 trillion?
9. Assume Table 7P-4 summarizes the income of Paraguay. **[LO 7.3]**
   a. Calculate profits.
   b. Calculate the GDP of Paraguay using the income approach.
   c. What would GDP be if you were to use the value-added approach?
   d. What would GDP be if you were to use the expenditure approach?
10. Table 7P-5 shows the prices of the inputs and outputs for the production of a road bike. **[LO 7.3]**

TABLE 7P-3

Activity	Total value (thousands of $)
Families buy groceries	600
Electronics company sells HD projectors	100
Personal trainer gives Zumba class	5
Custard stand sells pistachio ice cream	2
Police department buys new cars	500
Mayor leads creation of new education budget	300
Elevator construction company builds new factory	600
Local businessperson purchases corn from Mexico	400
Sports-gear company sells hockey gloves to Canadian team	200
Bike store sells used carbon-fiber bikes	200
Local stockbroker executes trades for clients	2,000

TABLE 7P-4

Category	Value (billions of $)
Wages	8.3
Interest	0.7
Total business expenditures	21.0
Total business revenues	30.0

TABLE 7P-5

Raw materials	Manufacturing	Construction	Sale by the retailer
• Rubber for one tire ($20) • Aluminum for the frame ($80) • Other component materials ($70)	• Tire maker sells tires for $30 each • Bike frame and components maker sell their products for a total of $250	• Bike mechanic puts everything together and sells the bike for $350	• Retailer sells the bike for $500

a. What value is added by the supplier of the raw materials?
b. What value is added by the tire maker?
c. What value is added by the maker of the frame and components?
d. What value is added by the bike mechanic?
e. What value is added by the bike store?
f. What is the total contribution of the bike to GDP?
g. What is the difference between your answer in part f and the sum of the answers for parts a through e?

11. Imagine that the U.S. produces only three goods: apples, bananas, and carrots. The quantities produced and the prices of the three goods are listed in Table 7P-6. **[LO 7.4]**
    a. Calculate the GDP of the United States in this three-goods version of its economy.
    b. Suppose that a drought hits Washington. This drought causes the quantity of apples produced to fall to 2. Assuming that all prices remain constant, calculate the new U.S. GDP.
    c. Assume, once again, that the quantities produced and the prices of the three goods are as listed in Table 7P-6. Now, given this situation, carrot sellers decide that the price of carrots is too low, so they agree to raise the price. What must be the new price of carrots if the U.S. GDP is $60?

TABLE 7P-6

Goods	Quantities produced	Prices ($)
Apples	5	2.00
Bananas	10	1.00
Carrots	20	1.50

12. Based on Table 7P-7, calculate nominal GDP, real GDP, the GDP deflator, and the inflation rate in each year, and fill in the missing parts of the table. Use 2010 as the base year. **[LO 7.4]**
13. Suppose that the British economy produces two goods: laptops and books. The quantity produced and the prices of these items for 2010 and 2011 are shown in Table 7P-8. **[LO 7.4]**
    a. Let's assume that the base year was 2010, so that real GDP in 2010 equals nominal GDP in 2010. If the real GDP in Britain was $15,000 in 2010, what was the price of books?
    b. Using your answer from part a, if the growth rate in nominal GDP was 10 percent, how many books must have been produced in 2011?
    c. Using your answers from parts a and b, what is the real GDP in 2011? What was the growth rate in real GDP between 2010 and 2011?
14. Based on Table 7P-9, calculate nominal GDP per capita in 2008 and 2009, and the real GDP growth rate between the two years. Which countries look like they experienced recession in 2008–2009? **[LO 7.5]**

TABLE 7P-7

Year	Quantity of oranges	Price of orange ($)	Quantity of beach balls	Price of beach ball ($)	Nominal GDP ($)	Real GDP ($)	GDP deflator	Inflation rate (%)
2010	500	1.00	850	5.00				
2011	600	1.50	900	7.50				
2012	750	1.65	1,000	8.25				

TABLE 7P-8

Year	Quantities produced	Price ($)
2010	Laptops = 50 Books = 1,000	Laptops = 200 Books = ?
2011	Laptops = 100 Books = ?	Laptops = $150 Books = 10

TABLE 7P-9

	2008			2009		
	Nominal GDP (billions of $)	Real GDP (billions of $)	Population	Nominal GDP (billions of $)	Real GDP (billions of $)	Population
Argentina	328.03	383.48	39,746,000	310.17	386.68	40,134,000
Egypt	162.44	123.21	75,200,000	188.61	128.97	76,800,000
Germany	3,651.62	2,100.54	82,013,000	3,338.68	2,002.46	81,767,000
Ghana	28.53	11.27	22,532,000	26	11.8	23,108,000
United States	14,319	13,228.65	304,718,000	14,119	12,880.53	307,374,000

15. Table 7P-10 describes the real GDP and population of a fictional country in 2009 and 2010. **[LO 7.5]**
    a. What is the real GDP per capita in 2009 and 2010?
    b. What is the growth rate in real GDP?
    c. What is the growth rate in population?
    d. What is the growth rate in real GDP per capita?
16. Table 7P-11 shows data on population and expenditures in five countries, as well as the value of home production, the underground economy, and environmental externalities in each. **[LO 7.5, 7.6]**
    a. Calculate GDP and GDP per capita in each country.
    b. Calculate the size of home production, the underground economy, and environmental externalities in each country as a percentage of GDP.
    c. Calculate total and per capita "GDP-plus" in each country by including the value of home production, the underground economy, and environmental externalities.
    d. Rank countries by total and per capita GDP, and again by total and per capita "GDP-plus." Compare the two lists. Are the biggest and the smallest economies the same or different?
17. Suppose a parent was earning $20,000 per year working at a local firm. The parent then decides to quit his job in order to care for his child, who was being watched by a babysitter for $10,000 per year. Does GDP rise, fall, or stay constant with this action, and how much does GDP change (if at all)? **[LO 7.6]**

TABLE 7P-10

Year	Real GDP (billions of $)	Population (millions)
2009	10	1.0
2010	12	1.1

TABLE 7P-11

Country	C ($)	I ($)	G ($)	Net exports ($)
Bohemia	9,800,000,000	230,000,000	950,000,000	−120,000,000
Silesia	450,000,000	78,000,000	100,000,000	13,000,000
Bavaria	2,125,000,000	319,000,000	597,000,000	134,000,000
Saxony	2,750,000,000	75,000,000	1,320,000,000	−45,000,000
Ottoman Empire	6,225,000,000	567,000,000	1,435,000,000	1,000,000

Country	Population	Home production ($)	Underground economy ($)	Environmental externalities ($)
Bohemia	1,200,000	1,250,000,000	5,770,000,000	−1,560,000,000
Silesia	160,000	75,000,000	128,000,000	−45,000,000
Bavaria	425,000	386,000,000	1,450,000,000	−523,000,000
Saxony	760,000	146,000,000	250,000,000	−820,000,000
Ottoman Empire	800,000	432,000,000	654,000,000	−396,300,000

Chapter Endnotes

1. To find out more about the chain-weighted index, see this explanation from the Federal Reserve: http://www.frbsf.org/publications/economics/letter/2002/el2002-22.pdf.
2. Below certain thresholds, some earnings from self-employment don't need to be reported, so failure to report isn't necessarily against the tax laws. In any case, if they're not reported, those activities are not captured in GDP calculations.
3. http://www.econ.jku.at/members/Schneider/files/publications/2011/IEJ_NewEstimates_ShadEc_World.pdf.
4. Ibid.

Chapter Sources

http://www.nationalpeanutboard.org/classroom-funfacts.php

http://www.google.com/products/catalog?hl=en&q=peanut+butter+creamy&bav=on.2,or.r_gc.r_pw.,cf.osb&um=1&ie=UTF-8&tbm=shop&cid=4012369132325874587&sa=X&ei=6ceWT5CTIcHX0QGtqJ3KDg&ved=0CJcBEJwVKAAwAQ

http://www.nytimes.com/2010/08/16/business/global/16yuan.html

http://data.worldbank.org/indicator/NY.GDP.MKTP.KD?page=5 [China GDP stats]

http://data.worldbank.org/indicator/SI.POV.DDAY [China poverty stats]

http://www.bea.gov/national/pdf/NIPAhandbookch1-4.pdf

http://www.bea.gov/newsreleases/national/gdp/2011/pdf/gdp4q10_3rd.pdf

http://nordhaus.econ.yale.edu/documents/Env_Accounts_052609.pdf

http://lsfiwi.wiso.uni-potsdam.de/projekte/schattenwirtschaft/Working%20Group%207/03%20Buehn_Schneider_Shadow_Economies_potsdam2010.pdf

http://www.nytimes.com/2007/08/26/world/asia/26china.html?pagewanted=2