



CHAPTER 23

Measuring a Nation's Income

When you finish school and start looking for a full-time job, your experience will, to a large extent, be shaped by prevailing economic conditions. In some years, firms throughout the economy are expanding their production of goods and services, employment is rising, and jobs are easy to find. In other years, firms are cutting back production, employment is declining, and finding a good job takes a long time. Not surprisingly, any college graduate would rather enter the labor force in a year of economic expansion than in a year of economic contraction.

Because the health of the overall economy profoundly affects all of us, changes in economic conditions are widely reported by the media. Indeed, it is hard to pick up a newspaper, check an online news service, or turn on the TV without seeing some newly reported statistic about the economy. The statistic might measure the total income of everyone in the economy (gross domestic product, or GDP), the rate at which average prices are rising or



microeconomics

the study of how households and firms make decisions and how they interact in markets

macroeconomics

the study of economy-wide phenomena, including inflation, unemployment, and economic growth

falling (inflation/deflation), the percentage of the labor force that is out of work (unemployment), total spending at stores (retail sales), or the imbalance of trade between the United States and the rest of the world (the trade deficit). All these statistics are *macroeconomic*. Rather than telling us about a particular household, firm, or market, they tell us something about the entire economy.

As you may recall from Chapter 2, economics is divided into two branches: microeconomics and macroeconomics. **Microeconomics** is the study of how individual households and firms make decisions and how they interact with one another in markets. **Macroeconomics** is the study of the economy as a whole. The goal of macroeconomics is to explain the economic changes that affect many households, firms, and markets simultaneously. Macroeconomists address diverse questions: Why is average income high in some countries while it is low in others? Why do prices sometimes rise rapidly while at other times they are more stable? Why do production and employment expand in some years and contract in others? What, if anything, can the government do to promote rapid growth in incomes, low inflation, and stable employment? These questions are all macroeconomic in nature because they concern the workings of the entire economy.

Because the economy as a whole is a collection of many households and many firms interacting in many markets, microeconomics and macroeconomics are closely linked. The basic tools of supply and demand, for instance, are as central to macroeconomic analysis as they are to microeconomic analysis. Yet studying the economy in its entirety raises some new and intriguing challenges.

In this and the next chapter, we discuss some of the data that economists and policymakers use to monitor the performance of the overall economy. These data reflect the economic changes that macroeconomists try to explain. This chapter considers *gross domestic product*, which measures the total income of a nation. GDP is the most closely watched economic statistic because it is thought to be the best single measure of a society's economic well-being.

23-1 The Economy's Income and Expenditure

If you were to judge how a person is doing economically, you might first look at her income. A person with a high income can more easily afford life's necessities and luxuries. It is no surprise that people with higher incomes enjoy higher standards of living—better housing, better healthcare, fancier cars, more opulent vacations, and so on.

The same logic applies to a nation's overall economy. When judging whether the economy is doing well or poorly, it is natural to look at the total income that everyone in the economy is earning. That is the task of GDP.

GDP measures two things at once: the total income of everyone in the economy and the total expenditure on the economy's output of goods and services. GDP can perform the trick of measuring both total income and total expenditure because these two things are really the same. *For an economy as a whole, income must equal expenditure.*

Why is this true? An economy's income is the same as its expenditure because every transaction has two parties: a buyer and a seller. Every dollar of spending by some buyer is a dollar of income for some seller. Suppose, for instance, that Karen pays Doug \$100 to mow her lawn. In this case, Doug is a seller of a service and Karen is a buyer. Doug earns \$100 and Karen spends \$100. Thus, the

transaction contributes equally to the economy's income and to its expenditure. GDP, whether measured as total income or total expenditure, rises by \$100.

Another way to see the equality of income and expenditure is with the circular-flow diagram in Figure 1. As you may recall from Chapter 2, this diagram describes all the transactions between households and firms in a simple economy. It simplifies matters by assuming that all goods and services are bought by households and that households spend all of their income. In this economy, when households buy goods and services from firms, these expenditures flow through the markets for goods and services. When the firms in turn use the money they receive from sales to pay workers' wages, landowners' rent, and firm owners' profit, this income flows through the markets for the factors of production. Money continuously flows from households to firms and then back to households.

GDP measures this flow of money. We can compute it for this economy in one of two ways: by adding up the total expenditure by households or by adding up the total income (wages, rent, and profit) paid by firms. Because all expenditure in the economy ends up as someone's income, GDP is the same regardless of how we compute it.

The actual economy is, of course, more complicated than the one illustrated in Figure 1. Households do not spend all of their income; they pay some of it to the government in taxes, and they save some for use in the future. In addition, households do not buy all goods and services produced in the economy; some goods and services are bought by governments, and some are bought by firms that plan

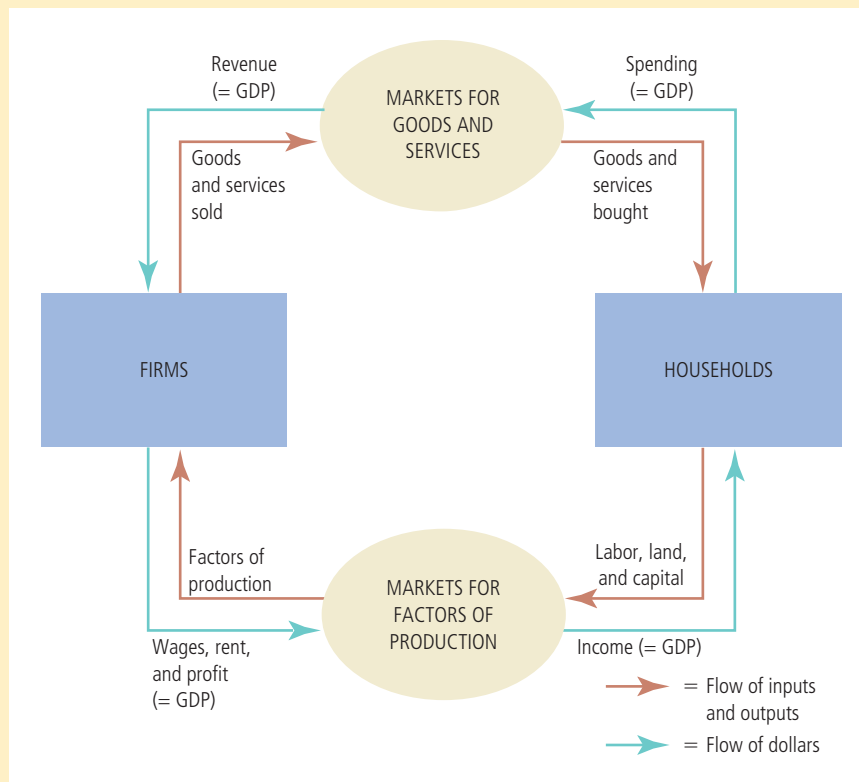


FIGURE 1

The Circular-Flow Diagram

Households buy goods and services from firms, and firms use their revenue from sales to pay wages to workers, rent to landowners, and profit to firm owners. GDP equals the total amount spent by households in the market for goods and services. It also equals the total wages, rent, and profit paid by firms in the markets for the factors of production.

to use them in the future to produce their own output. Yet the basic lesson remains the same: Regardless of whether a household, government, or firm buys a good or service, the transaction has a buyer and a seller. Thus, for the economy as a whole, expenditure and income are always the same.

Quick Quiz What two things does GDP measure? How can it measure two things at once?

23-2 The Measurement of GDP

Having discussed the meaning of gross domestic product in general terms, let's be more precise about how this statistic is measured. Here is a definition of GDP that focuses on GDP as a measure of total expenditure:

gross domestic product (GDP)

the market value of all final goods and services produced within a country in a given period of time

- **Gross domestic product (GDP)** is the market value of all final goods and services produced within a country in a given period of time.

This definition might seem simple enough. But in fact, many subtle issues arise when computing an economy's GDP. Let's therefore consider each phrase in this definition with some care.

23-2a "GDP Is the Market Value . . ."

You have probably heard the adage "You can't compare apples and oranges." Yet GDP does exactly that. GDP adds together many different kinds of products into a single measure of the value of economic activity. To do this, it uses market prices. Because market prices measure the amount people are willing to pay for different goods, they reflect the value of those goods. If the price of an apple is twice the price of an orange, then an apple contributes twice as much to GDP as does an orange.

23-2b "... of All ..."

GDP tries to be comprehensive. It includes all items produced in the economy and sold legally in markets. GDP measures the market value of not just apples and oranges but also pears and grapefruit, books and movies, haircuts and healthcare, and on and on.

GDP also includes the market value of the housing services provided by the economy's stock of housing. For rental housing, this value is easy to calculate—the rent equals both the tenant's expenditure and the landlord's income. Yet many people own their homes and, therefore, do not pay rent. The government includes this owner-occupied housing in GDP by estimating its rental value. In effect, GDP is based on the assumption that the owner is renting the house to herself. The imputed rent is included both in the homeowner's expenditure and in her income, so it adds to GDP.

There are some products, however, that GDP excludes because measuring them is so difficult. GDP excludes most items produced and sold illicitly, such as illegal drugs. It also excludes most items that are produced and consumed at home and, therefore, never enter the marketplace. Vegetables you buy at the grocery store are part of GDP; vegetables you grow in your garden are not.

These exclusions from GDP can at times lead to paradoxical results. For example, when Karen pays Doug to mow her lawn, that transaction is part of GDP. But suppose Doug and Karen marry. Even though Doug may continue to mow Karen's lawn, the value of the mowing is now left out of GDP because Doug's service is no longer sold in a market. Thus, their marriage reduces GDP.

23-2c "... Final ..."

When International Paper makes paper, which Hallmark then uses to make a greeting card, the paper is called an *intermediate good* and the card is called a *final good*. GDP includes only the value of final goods. This is done because the value of intermediate goods is already included in the prices of the final goods. Adding the market value of the paper to the market value of the card would be double counting. That is, it would (incorrectly) count the paper twice.

An important exception to this principle arises when an intermediate good is produced and, rather than being used, is added to a firm's inventory of goods for use or sale at a later date. In this case, the intermediate good is taken to be "final" for the moment and its value as inventory investment is included as part of GDP. Thus, additions to inventory add to GDP, and when the goods in inventory are later used or sold, the reductions in inventory subtract from GDP.

23-2d "... Goods and Services ..."

GDP includes both tangible goods (food, clothing, cars) and intangible services (haircuts, housecleaning, doctor visits). When you buy a CD by your favorite band, you are buying a good, and the purchase price is part of GDP. When you pay to hear a concert by the same band, you are buying a service, and the ticket price is also part of GDP.

23-2e "... Produced ..."

GDP includes goods and services currently produced. It does not include transactions involving items produced in the past. When Ford produces and sells a new car, the value of the car is included in GDP. When one person sells a used car to another person, the value of the used car is not included in GDP.

23-2f "... Within a Country ..."

GDP measures the value of production within the geographic confines of a country. When a Canadian citizen works temporarily in the United States, her production is part of U.S. GDP. When an American citizen owns a factory in Haiti, the production at her factory is not part of U.S. GDP. (It is part of Haiti's GDP.) Thus, items are included in a nation's GDP if they are produced domestically, regardless of the nationality of the producer.

23-2g "... In a Given Period of Time."

GDP measures the value of production that takes place within a specific interval of time. Usually, that interval is a year or a quarter (three months). GDP measures the economy's flow of income, as well as its flow of expenditure, during that interval.

When the government reports the GDP for a quarter, it usually presents GDP "at an annual rate." This means that the figure reported for quarterly GDP is the amount of income and expenditure during the quarter multiplied by 4. The government uses this convention so that quarterly and annual figures on GDP can be compared more easily.

In addition, when the government reports quarterly GDP, it presents the data after they have been modified by a statistical procedure called *seasonal adjustment*. The unadjusted data show clearly that the economy produces more goods and services during some times of the year than during others. (As you might guess, December's holiday shopping season is a high point.) When monitoring the condition of the economy, economists and policymakers often want to look beyond these regular seasonal changes. Therefore, government statisticians adjust the quarterly data to take out the seasonal cycle. The GDP data reported in the news are always seasonally adjusted.

Now let's repeat the definition of GDP:

- Gross domestic product (GDP) is the market value of all final goods and services produced within a country in a given period of time.

This definition focuses on GDP as total expenditure in the economy. But don't forget that every dollar spent by a buyer of a good or service becomes a dollar of income to the seller of that good or service. Therefore, in addition to applying this definition, the government adds up total income in the economy. The two ways of calculating GDP give almost exactly the same answer. (Why "almost"? The two measures should be precisely the same, but data sources are not perfect. The difference between the two calculations of GDP is called the *statistical discrepancy*.)

It should be apparent that GDP is a sophisticated measure of the value of economic activity. In advanced courses in macroeconomics, you will learn more about the subtleties that arise in its calculation. But even now you can see that each phrase in this definition is packed with meaning.

Quick Quiz Which contributes more to GDP—the production of a pound of hamburger or the production of a pound of caviar? Why?

23-3 The Components of GDP

Spending in the economy takes many forms. At any moment, the Smith family may be having lunch at Burger King; Ford may be building a car factory; the Navy may be procuring a submarine; and British Airways may be buying an airplane from Boeing. GDP includes all of these various forms of spending on domestically produced goods and services.

To understand how the economy is using its scarce resources, economists study the composition of GDP among various types of spending. To do this, GDP (which we denote as Y) is divided into four components: consumption (C), investment (I), government purchases (G), and net exports (NX):

$$Y = C + I + G + NX.$$

This equation is an *identity*—an equation that must be true because of how the variables in the equation are defined. In this case, because each dollar of expenditure included in GDP is placed into one of the four components of GDP, the total of the four components must be equal to GDP. Let's look at each of these four components more closely.

FYI

Other Measures of Income



When the U.S. Department of Commerce computes the nation's GDP every three months, it also computes various other measures of income to get a more complete picture of what's happening in the economy. These other measures differ from GDP by excluding or including certain categories of income. What follows is a brief description of five of these income measures, ordered from largest to smallest.

- **Gross national product (GNP)** is the total income earned by a nation's permanent residents (called *nationals*). It differs from GDP in that it includes income that our citizens earn abroad and excludes income that foreigners earn here. For example, when a Canadian citizen works temporarily in the United States, her production is part of U.S. GDP, but it is not part of U.S. GNP. (It is part of Canada's GNP.) For most countries, including the United States, domestic residents are responsible for most domestic production, so GDP and GNP are quite close.
- **Net national product (NNP)** is the total income of a nation's residents (GNP) minus losses from depreciation. *Depreciation* is the wear and tear on the economy's stock of equipment and structures, such as trucks rusting and old computer models becoming obsolete. In the national income accounts prepared by the Department of Commerce, depreciation is called the "consumption of fixed capital."
- **National income** is the total income earned by a nation's residents in the production of goods and services. It is almost identical to net national product. These two measures differ because of the

statistical discrepancy that arises from problems in data collection.

- **Personal income** is the income that households and noncorporate businesses receive. Unlike national income, it excludes *retained earnings*, which is income that corporations have earned but have not paid out to their owners. It also subtracts indirect business taxes (such as sales taxes), corporate income taxes, and contributions for social insurance (mostly Social Security taxes). In addition, personal income includes the interest income that households receive from their holdings of government debt and the income that households receive from government transfer programs, such as welfare and Social Security.
- **Disposable personal income** is the income that households and noncorporate businesses have left after satisfying all their obligations to the government. It equals personal income minus personal taxes and certain nontax payments (such as traffic tickets).

Although the various measures of income differ in detail, they almost always tell the same story about economic conditions. When GDP grows rapidly, these other measures of income usually grow rapidly. And when GDP falls, these other measures usually fall as well. For monitoring fluctuations in the overall economy, it does not matter much which measure of income we use. ▲

23-3a Consumption

Consumption is spending by households on goods and services, with the exception of purchases of new housing. Goods include durable goods, such as automobiles and appliances, and nondurable goods, such as food and clothing. Services include such intangible items as haircuts and medical care. Household spending on education is also included in consumption of services (although one might argue that it would fit better in the next component).

consumption

spending by households on goods and services, with the exception of purchases of new housing

23-3b Investment

Investment is the purchase of goods that will be used in the future to produce more goods and services. It is the sum of purchases of capital equipment, inventories, and structures. Investment in structures includes expenditure on new housing. By convention, the purchase of a new house is the one form of household spending categorized as investment rather than consumption.

investment

spending on capital equipment, inventories, and structures, including household purchases of new housing

As mentioned earlier in this chapter, the treatment of inventory accumulation is noteworthy. When Apple produces a computer and adds it to its inventory instead of selling it, Apple is assumed to have "purchased" the computer for itself. That is,

the national income accountants treat the computer as part of Apple's investment spending. (If Apple later sells the computer out of inventory, Apple's inventory investment will then be negative, offsetting the positive expenditure of the buyer.) Inventories are treated this way because one aim of GDP is to measure the value of the economy's production, and goods added to inventory are part of that period's production.

Notice that GDP accounting uses the word *investment* differently from how you might hear the term in everyday conversation. When you hear the word *investment*, you might think of financial investments, such as stocks, bonds, and mutual funds—topics that we study later in this book. By contrast, because GDP measures expenditure on goods and services, here the word *investment* means purchases of goods (such as capital equipment, structures, and inventories) used to produce other goods and services in the future.

23-3c Government Purchases

government purchases
spending on goods and services by local, state, and federal governments

Government purchases include spending on goods and services by local, state, and federal governments. It includes the salaries of government workers as well as expenditures on public works. Recently, the U.S. national income accounts have switched to the longer label *government consumption expenditure and gross investment*, but in this book, we will use the traditional and shorter term *government purchases*.

The meaning of government purchases requires a bit of clarification. When the government pays the salary of an Army general or a schoolteacher, that salary is part of government purchases. But when the government pays a Social Security benefit to a person who is elderly or an unemployment insurance benefit to a worker who was recently laid off, the story is very different: These are called *transfer payments* because they are not made in exchange for a currently produced good or service. Transfer payments alter household income, but they do not reflect the economy's production. (From a macroeconomic standpoint, transfer payments are like negative taxes.) Because GDP is intended to measure income from, and expenditure on, the production of goods and services, transfer payments are not counted as part of government purchases.

23-3d Net Exports

net exports
spending on domestically produced goods by foreigners (exports) minus spending on foreign goods by domestic residents (imports)

Net exports equal the foreign purchases of domestically produced goods (exports) minus the domestic purchases of foreign goods (imports). A domestic firm's sale to a buyer in another country, such as Boeing's sale of an airplane to British Airways, increases net exports.

The *net* in *net exports* refers to the fact that imports are subtracted from exports. This subtraction is made because other components of GDP include imports of goods and services. For example, suppose that a household buys a \$40,000 car from Volvo, the Swedish carmaker. This transaction increases consumption by \$40,000 because car purchases are part of consumer spending. It also reduces net exports by \$40,000 because the car is an import. In other words, net exports include goods and services produced abroad (with a minus sign) because these goods and services are included in consumption, investment, and government purchases (with a plus sign). Thus, when a domestic household, firm, or government buys a good or service from abroad, the purchase reduces net exports, but because it also raises consumption, investment, or government purchases, it does not affect GDP.

TABLE 1

GDP and Its Components

This table shows total GDP for the U.S. economy in 2012 and the breakdown of GDP among its four components. When reading this table, recall the identity $Y = C + I + G + NX$.

	Total (in billions of dollars)	Per Person (in dollars)	Percent of Total
Gross domestic product, Y	\$15,676	\$49,923	100 %
Consumption, C	11,119	35,411	71
Investment, I	2,059	6,557	13
Government purchases, G	3,064	9,758	20
Net exports, NX	-567	-1,806	-4

Source: U.S. Department of Commerce. Parts may not sum to totals due to rounding.

case study**The Components of U.S. GDP**

Table 1 shows the composition of U.S. GDP in 2012. In this year, the GDP of the United States was over \$15 trillion. Dividing this number by the 2012 U.S. population of 314 million yields GDP per person (sometimes called GDP per capita). In 2012 the income and expenditure of the average American was \$49,923.

Consumption made up 71 percent of GDP, or \$35,411 per person. Investment was \$6,557 per person. Government purchases were \$9,758 per person. Net exports were -\$1,806 per person. This number is negative because Americans spent more on foreign goods than foreigners spent on American goods.

These data come from the Bureau of Economic Analysis, the part of the U.S. Department of Commerce that produces the national income accounts. You can find more recent data on GDP on its website, <http://www.bea.gov>. ▀

Quick Quiz List the four components of expenditure. Which is the largest?

23-4 Real versus Nominal GDP

As we have seen, GDP measures the total spending on goods and services in all markets in the economy. If total spending rises from one year to the next, at least one of two things must be true: (1) the economy is producing a larger output of goods and services, or (2) goods and services are being sold at higher prices. When studying changes in the economy over time, economists want to separate these two effects. In particular, they want a measure of the total quantity of goods and services the economy is producing that is not affected by changes in the prices of those goods and services.

To do this, economists use a measure called *real GDP*. Real GDP answers a hypothetical question: What would be the value of the goods and services produced this year if we valued these goods and services at the prices that prevailed in some specific year in the past? By evaluating current production using prices that are fixed at past levels, real GDP shows how the economy's overall production of goods and services changes over time.

IN THE NEWS

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The BEA Changes the Definitions of Investment and GDP

In 2013, the Bureau of Economic Analysis announced that it would expand the definitions of investment and GDP to include the production of various forms of intellectual property. This article discusses the change. Because the new data were not yet available as this book was going to press, all the data presented here use the traditional, narrower definitions.

Yes, Lady Gaga's Songs Contribute to GDP

By Osagie Imasogie and Thaddeus J. Kobylarz

The U.S. government recently announced a welcome revision to the way it estimates gross domestic product. Starting July 31, the Bureau of Economic Analysis will record expenditures for “R&D and for entertainment,

literary and artistic originals as fixed investment,” grouping them with expenditures for software into a new investment category called “intellectual property products.”

What does this mean for GDP? Until this change, as Wellesley economist Daniel Sichel recently told NPR, “If Lady Gaga did a concert and sold concert tickets, the concert tickets would count as GDP,” but the money she spent writing and recording an album wouldn’t. That didn’t make sense, because as Mr. Sichel



pointed out, the money an artist invests in a film or song is “really quite analogous to a factory investing in a new machine.” The same is clearly true of money invested in R&D for new drugs or smartphones.

Taken together, these new revisions are even more significant than the 1999 revision that added expenditures for computer software to the national accounts. Why? First, by expanding the list of intellectual-property investments used to calculate GDP to

To see more precisely how real GDP is constructed, let’s consider an example.

23-4a A Numerical Example

Table 2 shows some data for an economy that produces only two goods: hot dogs and hamburgers. The table shows the prices and quantities produced of the two goods in the years 2013, 2014, and 2015.

To compute total spending in this economy, we would multiply the quantities of hot dogs and hamburgers by their prices. In the year 2013, 100 hot dogs are sold at a price of \$1 per hot dog, so expenditure on hot dogs equals \$100. In the same year, 50 hamburgers are sold for \$2 per hamburger, so expenditure on hamburgers also equals \$100. Total expenditure in the economy—the sum of expenditure on hot dogs and expenditure on hamburgers—is \$200. This amount, the production of goods and services valued at current prices, is called **nominal GDP**.

The table shows the calculation of nominal GDP for these three years. Total spending rises from \$200 in 2013 to \$600 in 2014 and then to \$1,200 in 2015. Part of this rise is attributable to the increase in the quantities of hot dogs and hamburgers, and part is attributable to the increase in the prices of hot dogs and hamburgers.

To obtain a measure of the amount produced that is not affected by changes in prices, we use **real GDP**, which is the production of goods and services valued at constant prices. We calculate real GDP by first designating one year as a *base year*. We then use the prices of hot dogs and hamburgers in the base year to compute the value of goods and services in all the years. In other words, the prices in the base year provide the basis for comparing quantities in different years.

Suppose that we choose 2013 to be the base year in our example. We can then use the prices of hot dogs and hamburgers in 2013 to compute the value of goods

nominal GDP

the production of goods and services valued at current prices

real GDP

the production of goods and services valued at constant prices

include R&D and the arts and entertainment industry, the present U.S. economy is shown to be roughly 3%—or \$400 billion—larger than thought. (That doesn't mean we'll see a dramatic increase in GDP after July; the GDP figures going back to 1929 will also be adjusted, lessening the impact of the change on current growth rates.)

Second, the revision reflects the economy's quiet transformation from one based principally on industry to one decidedly based on knowledge and information. Third, this revision opens the door to further changes in the GDP calculation methodology, since the Bureau of Economic Analysis has in essence conceded that the GDP indicator, as now defined, has fallen behind today's economic realities.

This change is more than an arcane issue of interest only to economists. Government GDP figures are used to determine fundamental policy matters that affect everyday citizens' lives, such as budget decisions and

funding for federal programs. GDP numbers also constitute a shorthand for evaluating the performance of the national economy.

A clear goal of the BEA's decision is to better reflect the role of intellectual property as a key contributor to the national economy. This change in the measurement of GDP will affect both policy decisions regarding intellectual property and how we perceive ourselves as a society.

Right now there are pivotal cases before the U.S. Supreme Court on the legitimate scope and subject matter of patent protection, including in the growing field of genetics where at least 25% of all human genes have already been patented by private companies. Crucial decisions similarly confront us on the educational funding and direction, particularly in relation to science, technology, engineering and math and early childhood education.

In the past two decades, intellectual property has emerged as the principal driver of

economic growth in the U.S. and other developed countries. IP is now, in many respects, the new global currency. This is largely the result of America's successful effort to internationalize its views regarding the economic importance of IP protection, notwithstanding the continuing challenge of piracy. In short, America's place as a world economic leader depends on its ability to cultivate a sufficiently creative "mint" by which to generate, and profit from, this new global currency.

The government's new GDP measure suggests that economists are rightly adjusting to this new landscape. Whereas traditionalists have long counted land, labor and capital as the primary factors of production, economists are increasingly recognizing the productive significance of more intangible factors. This includes IP and, more generally, intellectual capital. ▲

Source: *The Wall Street Journal*, May 28, 2013.

TABLE 2

Real and Nominal GDP

This table shows how to calculate real GDP, nominal GDP, and the GDP deflator for a hypothetical economy that produces only hot dogs and hamburgers.

Prices and Quantities				
Year	Price of Hot Dogs	Quantity of Hot Dogs	Price of Hamburgers	Quantity of Hamburgers
2013	\$1	100	\$2	50
2014	\$2	150	\$3	100
2015	\$3	200	\$4	150
Calculating Nominal GDP				
2013	(\$1 per hot dog × 100 hot dogs) + (\$2 per hamburger × 50 hamburgers) = \$200			
2014	(\$2 per hot dog × 150 hot dogs) + (\$3 per hamburger × 100 hamburgers) = \$600			
2015	(\$3 per hot dog × 200 hot dogs) + (\$4 per hamburger × 150 hamburgers) = \$1,200			
Calculating Real GDP (base year 2013)				
2013	(\$1 per hot dog × 100 hot dogs) + (\$2 per hamburger × 50 hamburgers) = \$200			
2014	(\$1 per hot dog × 150 hot dogs) + (\$2 per hamburger × 100 hamburgers) = \$350			
2015	(\$1 per hot dog × 200 hot dogs) + (\$2 per hamburger × 150 hamburgers) = \$500			
Calculating the GDP Deflator				
2013	(\$200 / \$200) × 100 = 100			
2014	(\$600 / \$350) × 100 = 171			
2015	(\$1,200 / \$500) × 100 = 240			

and services produced in 2013, 2014, and 2015. Table 2 shows these calculations. To compute real GDP for 2013, we use the prices of hot dogs and hamburgers in 2013 (the base year) and the quantities of hot dogs and hamburgers produced in 2013. (Thus, for the base year, real GDP always equals nominal GDP.) To compute real GDP for 2014, we use the prices of hot dogs and hamburgers in 2013 (the base year) and the quantities of hot dogs and hamburgers produced in 2014. Similarly, to compute real GDP for 2015, we use the prices in 2013 and the quantities in 2015. When we find that real GDP has risen from \$200 in 2013 to \$350 in 2014 and then to \$500 in 2015, we know that the increase is attributable to an increase in the quantities produced because the prices are being held fixed at base-year levels.

To sum up: *Nominal GDP uses current prices to place a value on the economy's production of goods and services. Real GDP uses constant base-year prices to place a value on the economy's production of goods and services.* Because real GDP is not affected by changes in prices, changes in real GDP reflect only changes in the amounts being produced. Thus, real GDP is a measure of the economy's production of goods and services.

Our goal in computing GDP is to gauge how well the overall economy is performing. Because real GDP measures the economy's production of goods and services, it reflects the economy's ability to satisfy people's needs and desires. Thus, real GDP is a better gauge of economic well-being than is nominal GDP. When economists talk about the economy's GDP, they usually mean real GDP rather than nominal GDP. And when they talk about growth in the economy, they measure that growth as the percentage change in real GDP from one period to another.

23-4b The GDP Deflator

As we have just seen, nominal GDP reflects both the quantities of goods and services the economy is producing and the prices of those goods and services. By contrast, by holding prices constant at base-year levels, real GDP reflects only the quantities produced. From these two statistics, we can compute a third, called the GDP deflator, which reflects only the prices of goods and services.

The **GDP deflator** is calculated as follows:

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

Because nominal GDP and real GDP must be the same in the base year, the GDP deflator for the base year always equals 100. The GDP deflator for subsequent years measures the change in nominal GDP from the base year that cannot be attributable to a change in real GDP.

The GDP deflator measures the current level of prices relative to the level of prices in the base year. To see why this is true, consider a couple of simple examples. First, imagine that the quantities produced in the economy rise over time but prices remain the same. In this case, both nominal and real GDP rise at the same rate, so the GDP deflator is constant. Now suppose, instead, that prices rise over time but the quantities produced stay the same. In this second case, nominal GDP rises but real GDP remains the same, so the GDP deflator rises. Notice that, in both cases, the GDP deflator reflects what's happening to prices, not quantities.

Let's now return to our numerical example in Table 2. The GDP deflator is computed at the bottom of the table. For the year 2013, nominal GDP is \$200 and real GDP is \$200, so the GDP deflator is 100. (The deflator is always 100 in the base year.) For the year 2014, nominal GDP is \$600 and real GDP is \$350, so the GDP deflator is 171.

GDP deflator

a measure of the price level calculated as the ratio of nominal GDP to real GDP times 100

Economists use the term *inflation* to describe a situation in which the economy's overall price level is rising. The *inflation rate* is the percentage change in some measure of the price level from one period to the next. Using the GDP deflator, the inflation rate between two consecutive years is computed as follows:

$$\text{Inflation rate in year 2} = \frac{\text{GDP deflator in year 2} - \text{GDP deflator in year 1}}{\text{GDP deflator in year 1}} \times 100.$$

Because the GDP deflator rose in year 2014 from 100 to 171, the inflation rate is $100 \times (171 - 100)/100$, or 71 percent. In 2015, the GDP deflator rose to 240 from 171 the previous year, so the inflation rate is $100 \times (240 - 171)/171$, or 40 percent.

The GDP deflator is one measure that economists use to monitor the average level of prices in the economy and thus the rate of inflation. The GDP deflator gets its name because it can be used to take inflation out of nominal GDP—that is, to “deflate” nominal GDP for the rise that is due to increases in prices. We examine another measure of the economy's price level, called the consumer price index, in the next chapter, where we also describe the differences between the two measures.

case study

Real GDP over Recent History

Now that we know how real GDP is defined and measured, let's look at what this macroeconomic variable tells us about the recent history of the United States. Figure 2 shows quarterly data on real GDP for the U.S. economy since 1965.

The most obvious feature of these data is that real GDP grows over time. The real GDP of the U.S. economy in 2012 was almost four times its 1965 level. Put differently, the output of goods and services produced in the United States has

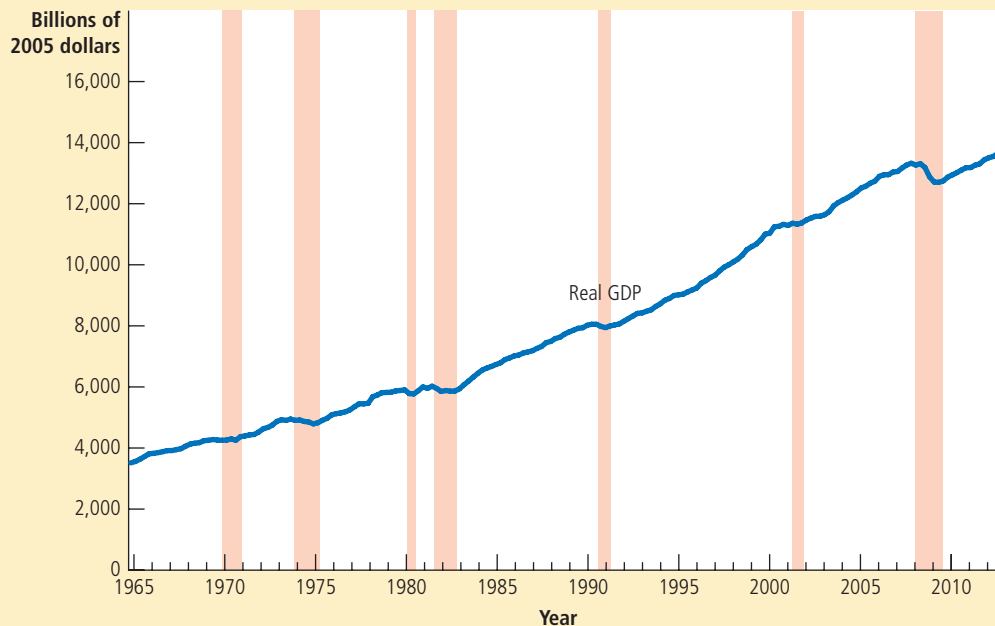


FIGURE 2

Real GDP in the United States

This figure shows quarterly data on real GDP for the U.S. economy since 1965. Recessions—periods of falling real GDP—are marked with the shaded vertical bars.

Source: U.S. Department of Commerce.

grown on average about 3 percent per year. This continued growth in real GDP enables most Americans to enjoy greater economic prosperity than their parents and grandparents did.

A second feature of the GDP data is that growth is not steady. The upward climb of real GDP is occasionally interrupted by periods during which GDP declines, called *recessions*. Figure 2 marks recessions with shaded vertical bars. (There is no ironclad rule for when the official business cycle dating committee will declare that a recession has occurred, but an old rule of thumb is two consecutive quarters of falling real GDP.) Recessions are associated not only with lower incomes but also with other forms of economic distress: rising unemployment, falling profits, increased bankruptcies, and so on.

Much of macroeconomics is aimed at explaining the long-run growth and short-run fluctuations in real GDP. As we will see in the coming chapters, we need different models for these two purposes. Because the short-run fluctuations represent deviations from the long-run trend, we first examine the behavior of key macroeconomic variables, including real GDP, in the long run. Then in later chapters, we build on this analysis to explain short-run fluctuations. ▲

Quick Quiz Define real GDP and nominal GDP. Which is a better measure of economic well-being? Why?

23-5 Is GDP a Good Measure of Economic Well-Being?

Earlier in this chapter, GDP was called the best single measure of the economic well-being of a society. Now that we know what GDP is, we can evaluate this claim.

As we have seen, GDP measures both the economy's total income and the economy's total expenditure on goods and services. Thus, GDP per person tells us the income and expenditure of the average person in the economy. Because most people would prefer to receive higher income and enjoy higher expenditure, GDP per person seems a natural measure of the economic well-being of the average individual.

Yet some people dispute the validity of GDP as a measure of well-being. When Senator Robert Kennedy was running for president in 1968, he gave a moving critique of such economic measures:

[Gross domestic product] does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our courage, nor our wisdom, nor our devotion to our country. It measures everything, in short, except that which makes life worthwhile, and it can tell us everything about America except why we are proud that we are Americans.

Much of what Robert Kennedy said is correct. Why, then, do we care about GDP?

The answer is that a large GDP does in fact help us to lead good lives. GDP does not measure the health of our children, but nations with larger GDP can afford better healthcare for their children. GDP does not measure the quality of

their education, but nations with larger GDP can afford better educational systems. GDP does not measure the beauty of our poetry, but nations with larger GDP can afford to teach more of their citizens to read and enjoy poetry. GDP does not take account of our intelligence, integrity, courage, wisdom, or devotion to country, but all of these laudable attributes are easier to foster when people are less concerned about being able to afford the material necessities of life. In short, GDP does not directly measure those things that make life worthwhile, but it does measure our ability to obtain many of the inputs into a worthwhile life.

GDP is not, however, a perfect measure of well-being. Some things that contribute to a good life are left out of GDP. One is leisure. Suppose, for instance, that everyone in the economy suddenly started working every day of the week, rather than enjoying leisure on weekends. More goods and services would be produced, and GDP would rise. Yet despite the increase in GDP, we should not conclude that everyone would be better off. The loss from reduced leisure would offset the gain from producing and consuming a greater quantity of goods and services.

Because GDP uses market prices to value goods and services, it excludes the value of almost all activity that takes place outside markets. In particular, GDP omits the value of goods and services produced at home. When a chef prepares a delicious meal and sells it at her restaurant, the value of that meal is part of GDP. But if the chef prepares the same meal for her family, the value she has added to the raw ingredients is left out of GDP. Similarly, child care provided in day-care centers is part of GDP, whereas child care by parents at home is not. Volunteer work also contributes to the well-being of those in society, but GDP does not reflect these contributions.

Another thing that GDP excludes is the quality of the environment. Imagine that the government eliminated all environmental regulations. Firms could then produce goods and services without considering the pollution they create, and GDP might rise. Yet well-being would most likely fall. The deterioration in the quality of air and water would more than offset the gains from greater production.

GDP also says nothing about the distribution of income. A society in which 100 people have annual incomes of \$50,000 has GDP of \$5 million and, not surprisingly, GDP per person of \$50,000. So does a society in which 10 people earn \$500,000 and 90 suffer with nothing at all. Few people would look at those two situations and call them equivalent. GDP per person tells us what happens to the average person, but behind the average lies a large variety of personal experiences.

In the end, we can conclude that GDP is a good measure of economic well-being for most—but not all—purposes. It is important to keep in mind what GDP includes and what it leaves out.



Bloomberg/Getty Images

GDP reflects the factory's production, but not the harm it inflicts on the environment.

case study

International Differences in GDP and the Quality of Life

One way to gauge the usefulness of GDP as a measure of economic well-being is to examine international data. Rich and poor countries have vastly different levels of GDP per person. If a large GDP leads to a higher standard of living, then we should observe GDP to be strongly correlated with various measures of the quality of life. And, in fact, we do.

Table 3 shows twelve of the world's most populous countries ranked in order of GDP per person. The table also shows life expectancy, the average years of schooling among adults, and the percentage of the population that reports

IN THE NEWS

The Underground Economy

The gross domestic product misses many transactions that take place in the underground economy.

Searching for the Hidden Economy

By Doug Campbell

Here is the brief, unremarkable story of how I recently came to participate in the underground economy:

Mid-afternoon on the iciest day this past winter, a man knocked at my front door. "Shovel your walk?" he asked. "Only \$5."

Outside, it was a bone-chilling 15 degrees. "Sold," I said. A half-hour later I handed over a five-dollar bill and thanked him for saving me the trouble.

Officially, this was an unofficial transaction—off the books, with no taxes paid or safety regulations followed. (At least, I assume this hired hand didn't bother to report that income or register with the proper authorities.) As such, it was technically

illegal. And, of course, it's the sort of thing that happens all the time.

International Differences in the Underground Economy

Country	Underground Economy as a Percentage of GDP
Bolivia	68 percent
Zimbabwe	63
Peru	61
Thailand	54
Mexico	33
Argentina	29
Sweden	18
Australia	13
United Kingdom	12
Japan	11
Switzerland	9
United States	8

Source: Friedrich Schneider. Figures are for 2002.



The size of the official U.S. economy, as measured by Gross Domestic Product (GDP), was almost \$12 trillion in 2004. Measurements of the unofficial economy—not including illegal activities like drug dealing and prostitution—differ substantially. But it's generally agreed to be significant, somewhere between 6 percent and 20 percent of GDP. At the midpoint, this would be about \$1.5 trillion a year.

Broadly defined, the underground, gray, informal, or shadow economy involves otherwise legal transactions that go unreported or unrecorded. That's a wide net, capturing everything from babysitting fees, to bartering home repairs with a neighbor, to failing to report pay from moonlighting gigs. The "underground" label tends to make it sound much more sinister than it really is.

TABLE 3

GDP and the Quality of Life

The table shows GDP per person and three other measures of the quality of life for twelve major countries.

Country	Real GDP per Person	Life Expectancy	Average Years of Schooling	Satisfied with Water Quality (% of population)
United States	\$43,017	79 years	12 years	90
Germany	35,854	80	12	95
Japan	32,295	83	12	88
Russia	14,561	69	10	53
Mexico	13,245	77	9	68
Brazil	10,162	74	7	83
China	7,746	74	8	73
Indonesia	3,716	69	6	87
India	3,468	65	4	63
Pakistan	2,550	65	5	55
Nigeria	2,069	52	5	47
Bangladesh	1,529	69	5	70

Source: Human Development Report 2011, United Nations. Real GDP is for 2011, expressed in 2005 dollars. Average years of schooling is among adults 25 years and older.

Criminal activities make up a large portion of what could be termed the total underground economy. Many studies have been done on the economics of drug dealing, prostitution, and gambling. But because money from crime is almost never recovered, many policymakers are more interested in portions of the underground economy that otherwise would be legal if not hidden from authorities. Things like shoveling walks.

Despite its intrigue, the informal economy's importance and consequences remain in debate. The reason: "You're trying to measure a phenomenon whose entire purpose is to hide itself from observation," says Ed Feige, an economist at the University of Wisconsin.

This uncertainty poses problems for policymakers. Without knowing the precise size, scope, and causes of the underground economy, how can they decide what—if anything—to do about it?

Was the man who shoveled my walk engaging in a socially positive or negative activity? Was I? Suffice it to say, some economists have dedicated their entire careers to answering questions about the underground



A Shadowy Enterprise?

economy—and still there is nothing close to a consensus about its size or description. . . .

Economists generally agree that the shadow economy is worse in developing nations, whose webs of bureaucratic red tape and corruption are notorious. For instance, [economist Friedrich] Schneider in 2003 published "shadow economy" estimates (defined broadly as all market-based, legal production of goods and services deliberately concealed from the authorities) for countries including: Zimbabwe, estimated at a whopping 63.2 percent of GDP, Thailand's at 54.1 percent, and Bolivia's at 68.3 percent. Among former Soviet bloc nations, Georgia led the way with a

68 percent of GDP shadow economy, and together those nations had an average 40.1 percent of GDP underground. This contrasts with an average of 16.7 percent among Western nations. . . .

In his 2003 book, *Reefer Madness: Sex, Drugs and Cheap Labor in the American Black Market*, investigative writer Eric Schlosser invokes Adam Smith's "invisible hand" theory that men pursuing

their own self-interest will generate benefits for society as a whole. This invisible hand has produced a fairly sizable underground economy, and we cannot understand our entire economic system without understanding how the hidden underbelly functions, too. "The underground is a good measure of the progress and the health of nations," Schlosser writes. "When much is wrong, much needs to be hidden." Schlosser's implication was that much is wrong in the United States. If he had taken a more global view, he might have decided relatively little is hidden here. ▲

Source: "Region Focus," Federal Reserve Bank of Richmond, Spring 2005.

being satisfied with the quality of water they have available. These data show a clear pattern. In rich countries, such as the United States, Germany, and Japan, people can expect to live to about 80 and have 12 years of schooling; about 9 out of 10 people are satisfied with the quality of water they have to drink. In poor countries, such as Bangladesh, Nigeria, and Pakistan, people typically die 10 to 20 years earlier and have less than half as much schooling; about a third to a half of the population is unsatisfied with the quality of water locally available.

Data on other aspects of the quality of life tell a similar story. Countries with low GDP per person tend to have more infants with low birth weight, higher rates of infant mortality, higher rates of maternal mortality, and higher rates of child malnutrition. In countries with low GDP per person, fewer school-age children are actually in school, those who are in school must learn with fewer teachers per student, and illiteracy among adults is more common. These countries also tend to have fewer televisions, fewer telephones, fewer paved roads, fewer households with electricity, and fewer opportunities to access the Internet. International data leave no doubt that a nation's GDP per person is closely associated with its citizens' standard of living. ▲

Quick Quiz Why should policymakers care about GDP?

IN THE NEWS

Measuring Macroeconomic Well-Being

*Can we do better than using gross domestic product?***Nations Seek Success Beyond GDP**

By Mark Whitehouse

Money isn't everything. But in measuring the success of nations, it isn't easy to find a substitute.

Political leaders are increasingly expressing dissatisfaction with gross domestic product—a monetary measure of all the goods and services a country produces—as a gauge of a nation's success in raising living standards.

In November, British Prime Minister David Cameron announced plans to build measures of national well-being that would take into account factors such as peoples' life satisfaction, following a similar effort by French President Nicolas Sarkozy.

Their efforts cut to the core of what economics is supposed to be about: What makes us better off? How can we all have more of it? Anyone hoping for a clear-cut answer, though, is likely to be disappointed.

"There is more to life than GDP, but it will be hard to come up with a single measure to replace it and we are not sure that a single measure is the answer," said Paul Allin, director of the Measuring National Well-Being Project at

the U.K.'s Office of National Statistics. "Maybe we live in a multidimensional world and we have to get used to handling a reasonable number of bits of information."

After a session on creating a national success indicator at the annual meeting of the American Economic Association on Friday, Carol Graham, fellow at the Brookings Institution, summed up the situation thus: "It's like a new science. There's still a lot of work to be done."

For much of the past four decades, economists have puzzled over a paradox that cast doubt on GDP as the world's main indicator of success.

People in richer countries didn't appear to be any happier than people in poor countries. In research beginning in the 1970s, University of Pennsylvania economist Richard Easterlin found no evidence of a link between countries' income—as measured by GDP per person—and peoples' reported levels of happiness.

More recent research suggests GDP isn't quite so bad. Using more data and different statistical techniques, three economists at the University of Pennsylvania's Wharton School—Daniel Sacks, Betsey Stevenson and Justin Wolfers—found that a given percentage increase in GDP per person tends to



coincide with a similar increase in reported well-being. The correlation held across different countries and over time.

Still, for measuring the success of policy, GDP is far from ideal. Making everybody work 120 hours a week could radically boost a country's GDP per capita, but it wouldn't make people happier. Removing pollution limits could boost GDP per hour worked, but wouldn't necessarily lead to a world we'd want to live in.

One approach is to enhance GDP with other objective factors such as inequality, leisure and life expectancy. In a paper presented Saturday at the American Economic Association meeting, Stanford economists Peter Klenow and Charles Jones found that doing so can make a big difference.

By their calculation, accounting for longer life expectancy, additional leisure time and lower levels of inequality makes living standards in France and Germany look almost the same as those in the U.S., which otherwise leads the pack by a large margin.

Mr. Klenow points out that the calculation is fraught with difficulties. For one, many

23-6 Conclusion

This chapter has discussed how economists measure the total income of a nation. Measurement is, of course, only a starting point. Much of macroeconomics is aimed at revealing the long-run and short-run determinants of a nation's GDP. Why, for example, is GDP higher in the United States and Japan than in India and Nigeria? What can the governments of the poorest countries do to promote more rapid GDP growth? Why does GDP in the United States rise rapidly in some years and fall in others? What can U.S. policymakers do to reduce

countries have poor data on crucial factors such as life expectancy.

For the purpose of comparing well-being across countries, asking people how they feel might be better than monetary measures. Angus Deaton, an economist at Princeton University, notes that placing values on the extremely different goods and services

consumed in the U.S. and, say, Tajikistan, can be impossible to do in a comparable way. Just asking people about their situation could be much easier and no less accurate.

Surveys already play a meaningful role in the way many countries assess their performance, from consumer confidence in the U.S. to the Netherlands's Life Situation Index,

which accounts for factors such as relationships and community involvement.

As part of its effort to gauge well-being, the U.K. plans to add more subjective questions to its household surveys.

But surveys can also send misleading policy signals. Mr. Wolfers, for example, has found that surveys of women's subjective well-being in the U.S. suggest that they are less happy than they were four decades ago, despite improvements in wages, education and other objective measures. That, he says, doesn't mean the feminist movement should be reversed. Rather, it could be related to rising expectations or greater frankness among the women interviewed.

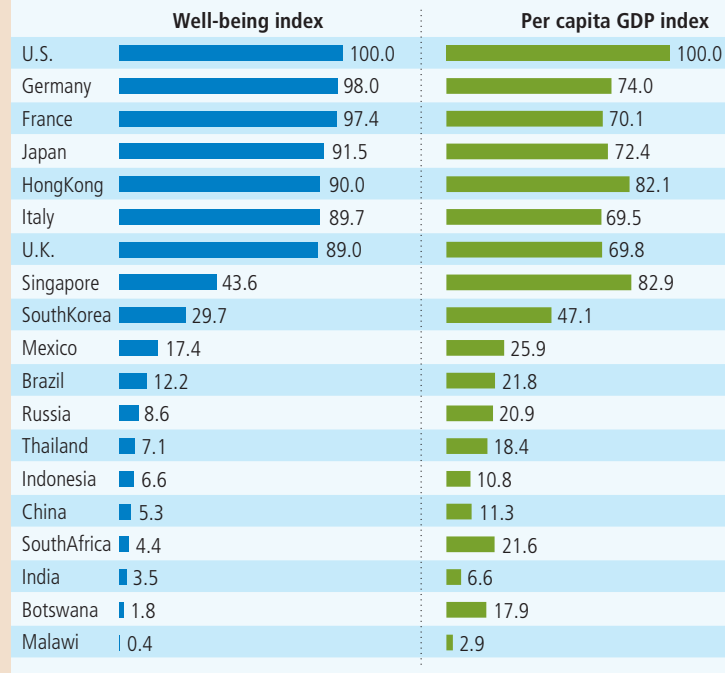
Peoples' true preferences are often revealed more by what they do than by what they say. Surveys suggest people with children tend to be less happy than those without, yet people keep having children—and nobody would advocate mass sterilization to improve overall well-being.

"What we care about in the world is not just happiness," says Mr. Wolfers. "If you measure just one part of what makes for a full life you're going to end up harming the other parts."

For the time being, that leaves policy makers to choose the measures of success that seem most appropriate for the task at hand. That's not ideal, but it's the best economics has to offer. ▲

Happily ever after

More wealth doesn't always translate into greater quality of life, when factors such as leisure and length of life are included.



Note: 2000 data.

Source: Peter Klenow and Charles Jones, Stanford University

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Source: *The Wall Street Journal*, January 10, 2011.

the severity of these fluctuations in GDP? These are the questions we will take up shortly.

At this point, it is important to acknowledge the significance of just measuring GDP. We all get some sense of how the economy is doing as we go about our lives. But the economists who study changes in the economy and the policymakers who formulate economic policies need more than this vague sense—they need concrete data on which to base their judgments. Quantifying the behavior of the economy with statistics such as GDP is, therefore, the first step to developing a science of macroeconomics.

Summary

- Because every transaction has a buyer and a seller, the total expenditure in the economy must equal the total income in the economy.
- Gross domestic product (GDP) measures an economy's total expenditure on newly produced goods and services and the total income earned from the production of these goods and services. More precisely, GDP is the market value of all final goods and services produced within a country in a given period of time.
- GDP is divided among four components of expenditure: consumption, investment, government purchases, and net exports. Consumption includes spending on goods and services by households, with the exception of purchases of new housing. Investment includes spending on new equipment and structures, including households' purchases of new housing. Government purchases include spending on goods and services by local, state, and federal governments. Net exports equal the value of goods and services produced domestically and sold abroad (exports) minus the value of goods and services produced abroad and sold domestically (imports).
- Nominal GDP uses current prices to value the economy's production of goods and services. Real GDP uses constant base-year prices to value the economy's production of goods and services. The GDP deflator—calculated from the ratio of nominal to real GDP—measures the level of prices in the economy.
- GDP is a good measure of economic well-being because people prefer higher to lower incomes. But it is not a perfect measure of well-being. For example, GDP excludes the value of leisure and the value of a clean environment.

Key Concepts

microeconomics, *p.* 484

macroeconomics, *p.* 484

gross domestic product (GDP), *p.* 486

consumption, *p.* 489

investment, *p.* 489

government purchases, *p.* 490

net exports, *p.* 490

nominal GDP, *p.* 492

real GDP, *p.* 492

GDP deflator, *p.* 494

Questions for Review

1. Explain why an economy's income must equal its expenditure.
2. Which contributes more to GDP—the production of an economy car or the production of a luxury car? Why?
3. A farmer sells wheat to a baker for \$2. The baker uses the wheat to make bread, which is sold for \$3. What is the total contribution of these transactions to GDP?
4. Many years ago, Peggy paid \$500 to put together a record collection. Today, she sold her albums at a garage sale for \$100. How does this sale affect current GDP?
5. List the four components of GDP. Give an example of each.
6. Why do economists use real GDP rather than nominal GDP to gauge economic well-being?
7. In the year 2013, the economy produces 100 loaves of bread that sell for \$2 each. In the year 2014, the economy produces 200 loaves of bread that sell for \$3 each. Calculate nominal GDP, real GDP, and the GDP deflator for each year. (Use 2013 as the base year.) By what percentage does each of these three statistics rise from one year to the next?
8. Why is it desirable for a country to have a large GDP? Give an example of something that would raise GDP and yet be undesirable.

Quick Check Multiple Choice

1. If the price of a hot dog is \$2 and the price of a hamburger is \$4, then 30 hot dogs contribute as much to GDP as _____ hamburgers.
 - a. 5
 - b. 15
 - c. 30
 - d. 60
2. Angus the sheep farmer sells wool to Barnaby the knitter for \$20. Barnaby makes two sweaters, each of which has a market price of \$40. Collette buys one of them, while the other remains on the shelf of Barnaby's store to be sold later. What is GDP here?
 - a. \$40
 - b. \$60
 - c. \$80
 - d. \$100

3. Which of the following does NOT add to U.S. GDP?
 - a. Air France buys a plane from Boeing, the U.S. aircraft manufacturer.
 - b. General Motors builds a new auto factory in North Carolina.
 - c. The city of New York pays a salary to a policeman.
 - d. The federal government sends a Social Security check to your grandmother.
4. An American buys a pair of shoes manufactured in Italy. How do the U.S. national income accounts treat the transaction?
 - a. Net exports and GDP both rise.
 - b. Net exports and GDP both fall.
 - c. Net exports fall, while GDP is unchanged.
 - d. Net exports are unchanged, while GDP rises.
5. Which is the largest component of GDP?
 - a. consumption
 - b. investment
 - c. government purchases
 - d. net exports
6. If all quantities produced rise by 10 percent and all prices fall by 10 percent, which of the following occurs?
 - a. Real GDP rises by 10 percent, while nominal GDP falls by 10 percent.
 - b. Real GDP rises by 10 percent, while nominal GDP is unchanged.
 - c. Real GDP is unchanged, while nominal GDP rises by 10 percent.
 - d. Real GDP is unchanged, while nominal GDP falls by 10 percent.

Problems and Applications

1. What components of GDP (if any) would each of the following transactions affect? Explain.
 - a. A family buys a new refrigerator.
 - b. Aunt Jane buys a new house.
 - c. Ford sells a Mustang from its inventory.
 - d. You buy a pizza.
 - e. California repaves Highway 101.
 - f. Your parents buy a bottle of French wine.
 - g. Honda expands its factory in Marysville, Ohio.
2. The government purchases component of GDP does not include spending on transfer payments such as Social Security. Thinking about the definition of GDP, explain why transfer payments are excluded.
3. As the chapter states, GDP does not include the value of used goods that are resold. Why would including such transactions make GDP a less informative measure of economic well-being?
4. Below are some data from the land of milk and honey.
 - a. Did economic well-being rise more in 2014 or 2015? Explain.
5. Consider an economy that produces only chocolate bars. In year 1, the quantity produced is 3 bars and the price is \$4. In year 2, the quantity produced is 4 bars and the price is \$5. In year 3, the quantity produced is 5 bars and the price is \$6. Year 1 is the base year.
 - a. What is nominal GDP for each of these three years?
 - b. What is real GDP for each of these years?
 - c. What is the GDP deflator for each of these years?
 - d. What is the percentage growth rate of real GDP from year 2 to year 3?
 - e. What is the inflation rate as measured by the GDP deflator from year 2 to year 3?
 - f. In this one-good economy, how might you have answered parts (d) and (e) without first answering parts (b) and (c)?
6. Consider the following data on U.S. GDP:

Year	Price of Milk	Quantity of Milk	Price of Honey	Quantity of Honey
2013	\$1	100 quarts	\$2	50 quarts
2014	\$1	200	\$2	100
2015	\$2	200	\$4	100

- a. Compute nominal GDP, real GDP, and the GDP deflator for each year, using 2013 as the base year.
- b. Compute the percentage change in nominal GDP, real GDP, and the GDP deflator in 2014 and 2015 from the preceding year. For each year, identify the variable that does not change. Explain why your answer makes sense.

Year	Nominal GDP (in billions of dollars)	GDP Deflator (base year 2005)
2012	15,676	115.4
2002	10,642	92.2

- a. What was the growth rate of nominal GDP between 2002 and 2012? (*Hint:* The growth rate of a variable X over an N -year period is calculated as $100 \times [(X_{\text{final}}/X_{\text{initial}})^{1/N} - 1]$.)
- b. What was the growth rate of the GDP deflator between 2002 and 2012?
- c. What was real GDP in 2002 measured in 2005 prices?

- d. What was real GDP in 2012 measured in 2005 prices?
 - e. What was the growth rate of real GDP between 2002 and 2012?
 - f. Was the growth rate of nominal GDP higher or lower than the growth rate of real GDP? Explain.
7. Revised estimates of U.S. GDP are usually released by the government near the end of each month. Find a newspaper article that reports on the most recent release, or read the news release yourself at <http://www.bea.gov>, the website of the U.S. Bureau of Economic Analysis. Discuss the recent changes in real and nominal GDP and in the components of GDP.
 8. A farmer grows wheat, which she sells to a miller for \$100. The miller turns the wheat into flour, which she sells to a baker for \$150. The baker turns the wheat into bread, which she sells to consumers for \$180. Consumers eat the bread.
 - a. What is GDP in this economy? Explain.
 - b. *Value added* is defined as the value of a producer's output minus the value of the intermediate goods that the producer buys to make the output. Assuming there are no intermediate goods beyond those described above, calculate the value added of each of the three producers.
 - c. What is total value added of the three producers in this economy? How does it compare to the economy's GDP? Does this example suggest another way of calculating GDP?
 9. Goods and services that are not sold in markets, such as food produced and consumed at home, are generally not included in GDP. Can you think of how this might

cause the numbers in the second column of Table 3 to be misleading in a comparison of the economic well-being of the United States and India? Explain.

10. The participation of women in the U.S. labor force has risen dramatically since 1970.
 - a. How do you think this rise affected GDP?
 - b. Now imagine a measure of well-being that includes time spent working in the home and taking leisure. How would the change in this measure of well-being compare to the change in GDP?
 - c. Can you think of other aspects of well-being that are associated with the rise in women's labor-force participation? Would it be practical to construct a measure of well-being that includes these aspects?
11. One day, Barry the Barber, Inc., collects \$400 for haircuts. Over this day, his equipment depreciates in value by \$50. Of the remaining \$350, Barry sends \$30 to the government in sales taxes, takes home \$220 in wages, and retains \$100 in his business to add new equipment in the future. From the \$220 that Barry takes home, he pays \$70 in income taxes. Based on this information, compute Barry's contribution to the following measures of income.
 - a. gross domestic product
 - b. net national product
 - c. national income
 - d. personal income
 - e. disposable personal income

Go to CengageBrain.com to purchase access to the proven, critical Study Guide to accompany this text, which features additional notes and context, practice tests, and much more.