The Data of Macroeconomics

It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to fit facts.

—Sherlock Holmes

Scientists, economists, and detectives have much in common: they all want to figure out what’s going on in the world around them. To do this, they rely on theory and observation. They build theories in an attempt to make sense of what they see happening. They then turn to more systematic observation to evaluate the theories’ validity. Only when theory and evidence come into line do they feel they understand the situation. This chapter discusses the types of observation that economists use to develop and test their theories.

Casual observation is one source of information about what’s happening in the economy. When you go shopping, you notice whether prices are rising, falling, or staying the same. When you look for a job, you learn whether firms are hiring. Every day, as we go about our lives, we participate in some aspect of the economy and get some sense of economic conditions.

A century ago, economists monitoring the economy had little more to go on than such casual observations. Such fragmentary information made economic policymaking difficult. One person’s anecdote would suggest the economy was moving in one direction, while another’s would suggest otherwise. Economists needed some way to combine many individual experiences into a coherent whole. There was an obvious solution: as the old quip goes, the plural of “anecdote” is “data.”

Today, economic data offer a systematic and objective source of information, and almost every day you can hear or read a story about some newly released statistic. Most of these statistics are produced by the government. Various government agencies survey households and firms to learn about their economic activity—how much they are earning, what they are buying, what prices they are charging, how much they are producing, and so on. From these surveys, the government computes various statistics that summarize the state of the economy. Economists use these statistics to study the economy; policymakers use them to monitor developments and formulate policies.
This chapter focuses on the three statistics that economists and policymakers use most often. Gross domestic product, or GDP, tells us the nation’s total income and the total expenditure on its output of goods and services. The consumer price index, or CPI, measures the level of prices. The unemployment rate tells us the fraction of workers who are unemployed. In the following pages, we see how these statistics are computed and what they tell us about the economy.

2-1 Measuring the Value of Economic Activity: Gross Domestic Product

Gross domestic product, or GDP, is often considered the best measure of how well an economy is performing. In the United States, this statistic is computed every three months by the Bureau of Economic Analysis, a part of the U.S. Department of Commerce, from a large number of primary data sources. These primary sources include both (1) administrative data, which are byproducts of government functions such as tax collection, education programs, defense, and regulation, and (2) statistical data, which come from government surveys of, for example, retail establishments, manufacturing firms, and farms. The purpose of GDP is to summarize all these data with a single number representing the dollar value of economic activity in a given period of time.

There are two ways to view this statistic. One way to view GDP is as the total income of everyone in the economy; another way is as the total expenditure on the economy’s output of goods and services. From either viewpoint, it is clear why GDP is a gauge of economic performance. GDP measures something people care about—their incomes. Similarly, an economy with a large output of goods and services can better satisfy the demands of households, firms, and the government.

How can GDP measure both the economy’s income and its expenditure on output? The reason is that these two quantities are really the same: for the economy as a whole, income must equal expenditure. That fact, in turn, follows from an even more fundamental one: because every transaction has a buyer and a seller, every dollar of expenditure by a buyer must become a dollar of income to a seller. When Jack paints Jill’s house for $10,000, that $10,000 is income to Jack and expenditure by Jill. The transaction contributes $10,000 to GDP, regardless of whether we are adding up all income or all expenditure.

To understand the meaning of GDP more fully, we turn to national income accounting, the system used to measure GDP and many related statistics.

Income, Expenditure, and the Circular Flow

Imagine an economy that produces a single good, bread, from a single input, labor. Figure 2-1 illustrates all the economic transactions that occur between households and firms in this economy.
The inner loop in Figure 2-1 represents the flows of bread and labor. The households sell their labor to the firms. The firms use the labor of their workers to produce bread, which the firms in turn sell to the households. Hence, labor flows from households to firms, and bread flows from firms to households.

The outer loop in Figure 2-1 represents the corresponding flow of dollars. The households buy bread from the firms. The firms use some of the revenue from these sales to pay the wages of their workers, and the remainder is the profit belonging to the owners of the firms (who themselves are part of the household sector). Hence, expenditure on bread flows from households to firms, and income in the form of wages and profit flows from firms to households.

GDP measures the flow of dollars in this economy. We can compute it in two ways. GDP is the total income from the production of bread, which equals the sum of wages and profit—the top half of the circular flow of dollars. GDP is also the total expenditure on purchases of bread—the bottom half of the circular flow of dollars. To compute GDP, we can look at either the flow of dollars from firms to households or the flow of dollars from households to firms.
These two ways of computing GDP must be equal because, by the rules of accounting, the expenditure of buyers on products is income to the sellers of those products. Every transaction that affects expenditure must affect income, and every transaction that affects income must affect expenditure. For example, suppose that a firm produces and sells one more loaf of bread to a household. Clearly this transaction raises total expenditure on bread, but it also has an equal effect on total income. If the firm produces the extra loaf without hiring any more labor (such as by making the production process more efficient), then profit increases. If the firm produces the extra loaf by hiring more labor, then wages increase. In both cases, expenditure and income increase equally.

**Stocks and Flows**

Many economic variables measure a quantity of something—a quantity of money, a quantity of goods, and so on. Economists distinguish between two types of quantity variables: stocks and flows. A stock is a quantity measured at a given point in time, whereas a flow is a quantity measured per unit of time.

A bathtub, shown in Figure 2-2, is the classic example used to illustrate stocks and flows. The amount of water in the tub is a stock: it is the quantity of water in the tub at a given point in time. The amount of water coming out of the faucet is a flow: it is the quantity of water being added to the tub per unit of time. Note that we measure stocks and flows in different units.

We say that the bathtub contains 50 gallons of water but that water is coming out of the faucet at 5 gallons per minute.

GDP is probably the most important flow variable in economics: it tells us how many dollars are flowing around the economy’s circular flow per unit of time. When someone says that the U.S. GDP is $17 trillion, this means that it is $17 trillion per year. (Equivalently, we could say that U.S. GDP is $539,000 per second.)

Stocks and flows are often related. In the bathtub example, these relationships are clear. The stock of water in the tub represents the accumulation of the flow out of the faucet, and the flow of water represents the change in the stock. When building theories to explain economic variables, it is often useful to determine whether the variables are stocks or flows and whether any relationships link them.

Here are some examples of related stocks and flows that we study in future chapters:

- A person’s wealth is a stock; his income and expenditure are flows.
- The number of unemployed people is a stock; the number of people losing their jobs is a flow.
- The amount of capital in the economy is a stock; the amount of investment is a flow.
- The government debt is a stock; the government budget deficit is a flow.
Rules for Computing GDP

In an economy that produces only bread, we can compute GDP by adding up the total expenditure on bread. Real economies, however, include the production and sale of a vast number of goods and services. To compute GDP for such a complex economy, it will be helpful to have a more precise definition: Gross domestic product (GDP) is the market value of all final goods and services produced within an economy in a given period of time. To see how this definition is applied, let’s discuss some of the rules that economists follow in constructing this statistic.

Adding Apples and Oranges

The U.S. economy produces many different goods and services—hamburgers, haircuts, cars, computers, and so on. GDP combines the value of these goods and services into a single measure. The diversity of products in the economy complicates the calculation of GDP because different products have different values.

Suppose, for example, that the economy produces four apples and three oranges. How do we compute GDP? We could simply add apples and oranges and conclude that GDP equals seven pieces of fruit. But this makes sense only if we think apples and oranges have equal value, which is generally not true. (This would be even clearer if the economy produces four watermelons and three grapes.)

To compute the total value of different goods and services, the national income accounts use market prices because these prices reflect how much people are willing to pay for a good or service. Thus, if apples cost $0.50 each and oranges cost $1.00 each, GDP would be

\[
\text{GDP} = (\text{Price of Apples} \times \text{Quantity of Apples}) + (\text{Price of Oranges} \times \text{Quantity of Oranges})
\]

\[
= ($0.50 \times 4) + ($1.00 \times 3)
\]

\[
= $5.00.
\]

GDP equals $5.00—the value of all the apples, $2.00, plus the value of all the oranges, $3.00.

Used Goods

When the Topps Company makes a pack of baseball cards and sells it for $2, that $2 is added to the nation’s GDP. But when a collector sells a rare Mickey Mantle card to another collector for $500, that $500 is not part of GDP. GDP measures the value of currently produced goods and services. The sale of the Mickey Mantle card reflects the transfer of an asset, not an addition to the economy’s income. Thus, the sale of used goods is not included as part of GDP.

The Treatment of Inventories

Imagine that a bakery hires workers to produce more bread, pays their wages, and then fails to sell the additional bread. How does this transaction affect GDP?

The answer depends on what happens to the unsold bread. Let’s first suppose that the bread spoils. In this case, the firm has paid more in wages but has not received any additional revenue, so the firm’s profit is reduced by the amount that wages have increased. Total expenditure in the economy hasn’t changed because
no one buys the bread. Total income hasn’t changed either—although more is distributed as wages and less as profit. Because the transaction affects neither expenditure nor income, it does not alter GDP.

Now suppose, instead, that the bread is put into inventory (perhaps as frozen dough) to be sold later. In this case, the national income accounts treat the transaction differently. The owners of the firm are assumed to have “purchased” the bread for the firm’s inventory, and the firm’s profit is not reduced by the additional wages it has paid. Because the higher wages paid to the firm’s workers raise total income, and the greater spending by the firm’s owners on inventory raises total expenditure, the economy’s GDP rises.

What happens later when the firm sells the bread out of inventory? This case is much like the sale of a used good. There is spending by bread consumers, but there is inventory disinvestment by the firm. This negative spending by the firm offsets the positive spending by consumers, so the sale out of inventory does not affect GDP.

The general rule is that when a firm increases its inventory of goods, this investment in inventory is counted as an expenditure by the firm owners. Thus, production for inventory increases GDP just as much as does production for final sale. A sale out of inventory, however, is a combination of positive spending (the purchase) and negative spending (inventory disinvestment), so it does not influence GDP. This treatment of inventories ensures that GDP reflects the economy’s current production of goods and services.

**Intermediate Goods and Value Added** Many goods are produced in stages: raw materials are processed into intermediate goods by one firm and then sold to another firm for final processing. How should we treat such products when computing GDP? For example, suppose a cattle rancher sells one-quarter pound of meat to McDonald’s for $1, and then McDonald’s sells you a hamburger for $3. Should GDP include both the meat and the hamburger (a total of $4) or just the hamburger ($3)?

The answer is that GDP includes only the value of final goods. Thus, the hamburger is included in GDP but the meat is not: GDP increases by $3, not by $4. The reason is that the value of intermediate goods is already included as part of the market price of the final goods in which they are used. To add the intermediate goods to the final goods would be double counting—that is, the meat would be counted twice. Hence, GDP is the total value of final goods and services produced.

One way to compute the value of all final goods and services is to sum the value added at each stage of production. The value added of a firm equals the value of the firm’s output less the value of the intermediate goods that the firm purchases. In the case of the hamburger, the value added of the rancher is $1 (assuming that the rancher bought no intermediate goods), and the value added of McDonald’s is $3 − $1, or $2. Total value added is $1 + $2, which equals $3. For the economy as a whole, the sum of all value added must equal the value of all final goods and services. Hence, GDP is also the total value added of all firms in the economy.

**Housing Services and Other Imputations** Although most goods and services are valued at their market prices when computing GDP, some are not sold in the marketplace and therefore do not have market prices. If GDP is to include the value of these goods and services, we must use an estimate of their value. Such an estimate is called an imputed value.
Imputations are especially important for determining the value of housing. A person who rents a house is buying housing services and providing income for the landlord; the rent is part of GDP, both as expenditure by the renter and as income for the landlord. Many people, however, own their homes. Although they do not pay rent to a landlord, they are enjoying housing services similar to those that renters purchase. To take account of the housing services enjoyed by homeowners, GDP includes the “rent” that these homeowners “pay” to themselves. Of course, homeowners do not in fact pay themselves this rent. The Department of Commerce estimates what the market rent for a house would be if it were rented and includes that imputed rent as part of GDP. This imputed rent is included both in the homeowner’s expenditure and in the homeowner’s income.

Imputations also arise in valuing government services. For example, police officers, firefighters, and senators provide services to the public. Assigning a value to these services is difficult because they are not sold in a marketplace and therefore do not have a market price. The national income accounts include these services in GDP by valuing them at their cost. That is, the wages of these public servants are used as a measure of the value of their output.

In many cases, an imputation is called for in principle but, to keep things simple, is not made in practice. Because GDP includes the imputed rent on owner-occupied houses, one might expect it also to include the imputed rent on cars, lawn mowers, jewelry, and other durable goods owned by households. Yet the value of these rental services is left out of GDP. In addition, some of the output of the economy is produced and consumed at home and never enters the marketplace. For example, meals cooked at home are similar to meals cooked at a restaurant, yet the value added when a person prepares a meal at home is left out of GDP.

Finally, no imputation is made for the value of goods and services sold in the underground economy. The underground economy is the part of the economy that people hide from the government either because they wish to evade taxation or because the activity is illegal. Examples include domestic workers paid “off the books” and the illegal drug trade. The size of the underground economy varies widely from country to country. In the United States, the underground economy is estimated to be less than 10 percent of the official economy, whereas in some developing nations, such as Thailand, Nigeria, and Bolivia, the underground economy is more than half as large as the official one.

Because the imputations necessary for computing GDP are only approximate, and because the value of many goods and services is left out altogether, GDP is an imperfect measure of economic activity. These imperfections are most problematic when comparing standards of living across countries. Yet as long as the magnitude of these imperfections remains fairly constant over time, GDP is useful for comparing economic activity from year to year.

Real GDP Versus Nominal GDP

Economists use the rules just described to compute GDP, which values the economy’s total output of goods and services. But is GDP a good measure of economic well-being? Consider once again the economy that produces only
apples and oranges. In this economy, GDP is the sum of the value of all the apples produced and the value of all the oranges produced. That is,

\[
 GDP = (\text{Price of Apples} \times \text{Quantity of Apples}) \\
+ (\text{Price of Oranges} \times \text{Quantity of Oranges}).
\]

Economists call the value of goods and services measured at current prices nominal GDP. Notice that nominal GDP can increase either because prices rise or because quantities rise.

It is easy to see that GDP computed this way is not a good gauge of economic well-being. That is, this measure does not accurately reflect how well the economy can satisfy the demands of households, firms, and the government. If all prices doubled without any change in quantities, nominal GDP would double. Yet it would be misleading to say that the economy’s ability to satisfy demands has doubled because the quantity of every good produced remains the same.

A better measure of economic well-being would tally the economy’s output of goods and services without being influenced by changes in prices. For this purpose, economists use real GDP, which is the value of goods and services measured using a constant set of prices. That is, real GDP shows what would have happened to expenditure on output if quantities had changed but prices had not.

To see how real GDP is computed, imagine we want to compare output in 2014 with output in subsequent years for our apple-and-orange economy. We could begin by choosing a set of prices, called base-year prices, such as the prices that prevailed in 2014. Goods and services are then added up using these base-year prices to value the different goods in each year. Real GDP for 2014 would be

\[
 \text{Real GDP} = (2014 \text{ Price of Apples} \times 2014 \text{ Quantity of Apples}) \\
+ (2014 \text{ Price of Oranges} \times 2014 \text{ Quantity of Oranges}).
\]

Similarly, real GDP in 2015 would be

\[
 \text{Real GDP} = (2014 \text{ Price of Apples} \times 2015 \text{ Quantity of Apples}) \\
+ (2014 \text{ Price of Oranges} \times 2015 \text{ Quantity of Oranges}).
\]

And real GDP in 2016 would be

\[
 \text{Real GDP} = (2014 \text{ Price of Apples} \times 2016 \text{ Quantity of Apples}) \\
+ (2014 \text{ Price of Oranges} \times 2016 \text{ Quantity of Oranges}).
\]

Notice that 2014 prices are used to compute real GDP for all three years. Because the prices are held constant, real GDP varies from year to year only if the quantities produced vary. Because a society’s ability to provide economic satisfaction for its members ultimately depends on the quantities of goods and services produced, real GDP provides a better measure of economic well-being than does nominal GDP.
The GDP Deflator

From nominal GDP and real GDP we can compute a third statistic: the GDP deflator. The GDP deflator, also called the implicit price deflator for GDP, is the ratio of nominal GDP to real GDP:

\[
\text{GDP Deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}}.
\]

The GDP deflator reflects what’s happening to the overall level of prices in the economy.

To better understand this, consider again an economy with only one good, bread. If \( P \) is the price of bread and \( Q \) is the quantity sold, then nominal GDP is the total number of dollars spent on bread in that year, \( P \times Q \). Real GDP is the number of loaves of bread produced in that year times the price of bread in some base year, \( P_{\text{base}} \times Q \). The GDP deflator is the price of bread in that year relative to the price of bread in the base year, \( P/P_{\text{base}} \).

The definition of the GDP deflator allows us to separate nominal GDP into two parts: one part measures quantities (real GDP) and the other measures prices (the GDP deflator). That is,

\[
\text{Nominal GDP} = \text{Real GDP} \times \text{GDP Deflator}.
\]

Nominal GDP measures the current dollar value of the output of the economy. Real GDP measures output valued at constant prices. The GDP deflator measures the price of output relative to its price in the base year. We can also write this equation as

\[
\text{Real GDP} = \frac{\text{Nominal GDP}}{\text{GDP Deflator}}.
\]

In this form, you can see how the deflator earns its name: it is used to deflate (that is, take inflation out of) nominal GDP to yield real GDP.

Chain-Weighted Measures of Real GDP

We have been discussing real GDP as if the prices used to compute this measure never change from their base-year values. If this were truly the case, over time the prices would become more and more dated. For instance, the price of computers has fallen substantially in recent years, while the price of a year at college has risen. When valuing the production of computers and education, it would be misleading to use the prices that prevailed ten or twenty years ago.

To solve this problem, the Bureau of Economic Analysis used to periodically update the prices used to compute real GDP. About every five years, a new base year was chosen. The prices were then held fixed and used to measure year-to-year changes in the production of goods and services until the base year was updated once again.

In 1995, the Bureau announced a new policy for dealing with changes in the base year. In particular, it now uses chain-weighted measures of real GDP.
With these new measures, the base year changes continuously over time. In essence, average prices in 2014 and 2015 are used to measure real growth from 2014 to 2015, average prices in 2015 and 2016 are used to measure real growth from 2015 to 2016, and so on. These various year-to-year growth rates are then put together to form a “chain” that can be used to compare the output of goods and services between any two dates.

This new chain-weighted measure of real GDP is better than the more traditional measure because it ensures that the prices used to compute real GDP are never far out of date. For most purposes, however, the differences are not significant. It turns out that the two measures of real GDP are highly correlated with each other. As a practical matter, both measures of real GDP reflect the same thing: economy-wide changes in the production of goods and services.

**F Y I**

**Two Arithmetic Tricks for Working with Percentage Changes**

For manipulating many relationships in economics, there is an arithmetic trick that is useful to know: The percentage change of a product of two variables is approximately the sum of the percentage changes in each of the variables.

To see how this trick works, consider an example. Let $P$ denote the GDP deflator and $Y$ denote real GDP. Nominal GDP is $P \times Y$. The trick states that

\[
\text{Percentage Change in } (P \times Y) \approx (\text{Percentage Change in } P) + (\text{Percentage Change in } Y).
\]

For instance, suppose that in one year, real GDP is 100 and the GDP deflator is 2; the next year, real GDP is 103 and the GDP deflator is 2.1. We can calculate that real GDP rose by 3 percent and that the GDP deflator rose by 5 percent. Nominal GDP rose from 200 the first year to 216.3 the second year, an increase of 8.15 percent. Notice that the growth in nominal GDP (8.15 percent) is approximately the sum of the growth in the GDP deflator (5 percent) and the growth in real GDP (3 percent).\(^1\)

A second arithmetic trick follows as a corollary to the first: The percentage change of a ratio is approximately the percentage change in the numerator minus the percentage change in the denominator. Again, consider an example. Let $Y$ denote GDP and $L$ denote the population, so that $Y/L$ is GDP per person. The second trick states that

\[
\text{Percentage Change in } (Y/L) \approx (\text{Percentage Change in } Y) - (\text{Percentage Change in } L).
\]

For instance, suppose that in the first year, $Y$ is 100,000 and $L$ is 100, so $Y/L$ is 1,000; in the second year, $Y$ is 110,000 and $L$ is 103, so $Y/L$ is 1,068. Notice that the growth in GDP per person (6.8 percent) is approximately the growth in income (10 percent) minus the growth in population (3 percent).

\(^1\)Mathematical note: The proof that this trick works begins with the product rule from calculus:

\[
d(PY) = Y \cdot dP + P \cdot dY.
\]

Now divide both sides of this equation by $PY$ to obtain:

\[
d(PY)/(PY) = dP/P + dY/Y.
\]

Notice that all three terms in this equation are percentage changes.
The Components of Expenditure

Economists and policymakers care not only about the economy’s total output of goods and services but also about the allocation of this output among alternative uses. The national income accounts divide GDP into four broad categories of spending:

- Consumption \((C)\)
- Investment \((I)\)
- Government purchases \((G)\)
- Net exports \((NX)\).

Thus, letting \(Y\) stand for GDP,

\[ Y = C + I + G + NX. \]

GDP is the sum of consumption, investment, government purchases, and net exports. Each dollar of GDP falls into one of these categories. This equation is an identity—an equation that must hold because of the way the variables are defined. It is called the national income accounts identity.

Consumption consists of household expenditures on goods and services. Goods are tangible items, and they in turn are divided into durables and non-durables. Durable goods are goods that last a long time, such as cars and TVs. Nondurable goods are goods that last only a short time, such as food and clothing. Services include various intangible items that consumers buy, such as haircuts and doctor visits.

Investment consists of items bought for future use. Investment is divided into three subcategories: business fixed investment, residential fixed investment, and inventory investment. Business fixed investment, also called nonresidential fixed investment, is the purchase by firms of new structures, equipment, and intellectual property products. (Intellectual property products include software, research and development, and entertainment, literary, and artistic originals.) Residential investment is the purchase of new housing by households and landlords. Inventory investment is the increase in firms’ inventories of goods (if inventories are falling, inventory investment is negative).

Government purchases are the goods and services bought by federal, state, and local governments. This category includes such items as military equipment, highways, and the services provided by government workers. It does not include transfer payments to individuals, such as Social Security and welfare. Because transfer payments reallocate existing income and are not made in exchange for goods and services, they are not part of GDP.

The last category, net exports, accounts for trade with other countries. Net exports are the value of goods and services sold to other countries (exports) minus the value of goods and services that foreigners sell us (imports). Net exports are positive when the value of our exports is greater than the value of our imports and negative when the value of our imports is greater than the value of our exports. Net exports represent the net expenditure from abroad on our goods and services, which provides income for domestic producers.
Newcomers to macroeconomics are sometimes confused by how macroeconomists use familiar words in new and specific ways. One example is the term “investment.” The confusion arises because what looks like investment for an individual may not be investment for the economy as a whole. The general rule is that the economy’s investment does not include purchases that merely reallocate existing assets among different individuals. Investment, as macroeconomists use the term, creates a new physical asset, called capital, which can be used in future production.

Let’s consider some examples. Suppose we observe these two events:

- Smith buys himself a 100-year-old Victorian house.
- Jones builds herself a brand-new contemporary house.

What is total investment here? Two houses, one house, or zero?

A macroeconomist seeing these two transactions counts only the Jones house as investment. Smith’s transaction has not created new housing for the economy; it has merely reallocated existing housing to Smith from the previous owner. By contrast, because Jones has added new housing to the economy, her new house is counted as investment.

Similarly, consider these two events:

- Gates buys $5 million in IBM stock from Buffett on the New York Stock Exchange.
- General Motors sells $10 million in stock to the public and uses the proceeds to build a new car factory.

Here, investment is $10 million. The first transaction reallocates ownership of shares in IBM from Buffett to Gates; the economy’s stock of capital is unchanged, so there is no investment as macroeconomists use the term. By contrast, because General Motors is using some of the economy’s output of goods and services to add to its stock of capital, its new factory is counted as investment.

FYI

GDP and Its Components

In 2013, the GDP of the United States totaled about $16.8 trillion. This number is so large that it is almost impossible to comprehend. We can make it easier to understand by dividing it by the 2013 U.S. population of 316 million. In this way, we obtain GDP per person—the amount of expenditure for the average American—which equaled $53,142 in 2010.

How did this GDP get used? Table 2-1 shows that about two-thirds of it, or $36,382 per person, was spent on consumption. Investment was $8,446 per person. Government purchases were $9,887 per person, $2,438 of which was spent by the federal government on national defense.

The average American bought $8,722 of goods imported from abroad and produced $7,149 of goods that were exported to other countries. Because the average American imported more than he exported, net exports were negative. Furthermore, because the average American earned less from selling to foreigners than he spent on foreign goods, he must have financed the difference by taking out loans from foreigners (or, equivalently, by selling them some of his assets). Thus, the average American borrowed $1,573 from abroad in 2013.
Other Measures of Income

The national income accounts include other measures of income that differ slightly in definition from GDP. It is important to be aware of the various measures, because economists and the media often refer to them.

To see how the alternative measures of income relate to one another, we start with GDP and modify it in various ways. To obtain gross national product (GNP), we add to GDP receipts of factor income (wages, profit, and rent) from the rest of the world and subtract payments of factor income to the rest of the world:

\[
\text{GNP} = \text{GDP} + \text{Factor Payments from Abroad} - \text{Factor Payments to Abroad}
\]

Whereas GDP measures the total income produced domestically, GNP measures the total income earned by nationals (residents of a nation). For instance, if a Japanese resident owns an apartment building in New York, the rental income he earns is part of U.S. GDP because it is earned in the United States. But because this rental income is a factor payment to abroad, it is not part of U.S. GNP. In the United States, factor payments from abroad and factor payments to abroad are similar in size—each representing about 4 percent of GDP—so GDP and GNP are quite close.
To obtain net national product (NNP), we subtract from GNP the depreciation of capital—the amount of the economy’s stock of plants, equipment, and residential structures that wears out during the year:

\[
\text{NNP} = \text{GNP} - \text{Depreciation}.
\]

In the national income accounts, depreciation is called the consumption of fixed capital. It equals about 16 percent of GNP. Because the depreciation of capital is a cost of producing the output of the economy, subtracting depreciation shows the net result of economic activity.

Net national product is approximately equal to another measure called national income. The two differ by a small correction called the statistical discrepancy, which arises because different data sources may not be completely consistent.

\[
\text{National Income} = \text{NNP} - \text{Statistical Discrepancy}.
\]

National income measures how much everyone in the economy has earned.

The national income accounts divide national income into six components, depending on who earns the income. The six categories, and the percentage of national income paid in each category in 2013, are the following:

- **Compensation of employees** (61%). The wages and fringe benefits earned by workers.
- **Proprietors’ income** (9%). The income of noncorporate businesses, such as small farms, mom-and-pop stores, and law partnerships.
- **Rental income** (4%). The income that landlords receive, including the imputed rent that homeowners “pay” to themselves, less expenses, such as depreciation.
- **Corporate profits** (15%). The income of corporations after payments to their workers and creditors.
- **Net interest** (3%). The interest domestic businesses pay minus the interest they receive, plus interest earned from foreigners.
- **Taxes on production and imports** (8%). Certain taxes on businesses, such as sales taxes, less offsetting business subsidies. These taxes place a wedge between the price that consumers pay for a good and the price that firms receive.

A series of adjustments take us from national income to personal income, the amount of income that households and noncorporate businesses receive. Four of these adjustments are most important. First, we subtract taxes on production and imports because these taxes never enter anyone’s income. Second, we reduce national income by the amount that corporations earn but do not pay out, either because the corporations are retaining earnings or because they are paying taxes to the government. This adjustment is made by subtracting corporate profits (which equal the sum of corporate taxes, dividends, and retained earnings) and adding back dividends. Third, we increase national income by the net amount the government pays out in transfer payments. This adjustment equals
government transfers to individuals minus social insurance contributions paid to
the government. Fourth, we adjust national income to include the interest that
households earn rather than the interest that businesses pay. This adjustment is
made by adding personal interest income and subtracting net interest. (The dif-
fERENCE BETWEEN PERSONAL INTEREST AND NET INTEREST ARISING IN PART BECAUSE INTEREST
ON THE GOVERNMENT DEBT IS PART OF THE INTEREST THAT HOUSEHOLDS EARN BUT IS NOT
PART OF THE INTEREST THAT BUSINESSES PAY OUT.) Thus,

\[
\text{Personal Income} = \text{National Income} - \text{Indirect Business Taxes} - \text{Corporate Profits} - \text{Social Insurance Contributions} - \text{Net Interest} + \text{Dividends} + \text{Government Transfers to Individuals} + \text{Personal Interest Income.}
\]

Next, if we subtract personal taxes, we obtain \textit{disposable personal income}:

\[
\text{Disposable Personal Income} = \text{Personal Income} - \text{Personal Taxes.}
\]

We are interested in disposable personal income because it is the amount house-
holds and noncorporate businesses have available to spend after satisfying their
tax obligations to the government.

\section*{Seasonal Adjustment}

Because real GDP and the other measures of income reflect how well the econ-
yomy is performing, economists are interested in studying the quarter-to-quarter
fluctuations in these variables. Yet when we start to do so, one fact leaps out: all
these measures of income exhibit a regular seasonal pattern. The output of the
economy rises during the year, reaching a peak in the fourth quarter (October,
November, and December) and then falling in the first quarter (January, February,
and March) of the next year. These regular seasonal changes are substantial. From
the fourth quarter to the first quarter, real GDP falls on average about 8 percent.\textsuperscript{2}

It is not surprising that real GDP follows a seasonal cycle. Some of these
changes are attributable to changes in our ability to produce: for example,
building homes is more difficult during the cold weather of winter than during
other seasons. In addition, people have seasonal tastes: they have preferred times
for such activities as vacations and Christmas shopping.

When economists study fluctuations in real GDP and other economic variables, they often want to eliminate the portion of fluctuations due to predictable seasonal changes. You will find that most of the economic statistics reported are *seasonally adjusted*. This means that the data have been adjusted to remove the regular seasonal fluctuations. (The precise statistical procedures used are too elaborate to discuss here, but in essence they involve subtracting those changes in income that are predictable just from the change in season.) Therefore, when you observe a rise or fall in real GDP or any other data series, you must look beyond the seasonal cycle for the explanation.\(^3\)

**CASE STUDY**

**The New, Improved GDP of 2013**

The Bureau of Economic Analysis regularly updates the procedures used to calculate GDP and the many other statistics in the national income accounts. An especially important revision occurred in 2013. Here are some questions you might ask about it.

Q: Do I really need to read about this? Data revision sounds boring.

A: Normally, it is. But this time is different. The BEA made some interesting changes.

Q: Okay, what changes?\(^3\)

A: First of all, think about some old movie you like watching, such as *Titanic* or *Star Wars*.

Q: Yeah, those are good films. What about them?

A: When they were produced many years ago, the BEA’s national income accountants had to figure out how to treat the expenditures of the production companies on actors, film crews, sets, and so on.

Q: What did they do?

A: They treated those expenditures as spending on intermediate goods. Ticket sales were considered the final good. As a result, a movie’s contribution to GDP in the year it was created was only the revenue earned from ticket sales that year.

Q: That sounds reasonable. What’s wrong with it?

A: A popular movie such as *Titanic* or *Star Wars* can be watched by viewers and thus generate income for its creators for many years. A person who owns the rights to a movie has something of value, just as if he owned a factory or a house. So, in 2013, the BEA changed its mind and decided that expenditures

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on filming a movie would be treated like expenditures on building a factory or a house. These expenditures are now added to the investment component of GDP.

Q: What about other forms of entertainment?

A: The same is true for the production of other artistic works that are expected to have a long life, such as books, music recordings, and TV shows. They are all now part of investment. Expenditures to produce short-lived entertainment like newspapers and radio shows, however, are not treated as capital investments.

Q: Did anything else change?

A: Yes. The treatment of research and development changed in much the same way as the treatment of artistic products. When firms spend money on research and development, they are building up a valuable stock of knowledge that they can use in the future. Before 2013, research and development was treated as an intermediate good. Now, spending on research and development is counted as investment.

Q: Why did these changes occur only recently?

A: Traditionally, capital has been viewed as tangible items produced in the past and used in the production process. Think of a farmer’s tractor or a woodworker’s lathe. But the modern economy is very different from the one when the national income accounts were first devised. As the economy has evolved away from agriculture and manufacturing, production is increasingly based on less tangible intellectual capital, including artistic works and the knowledge from research and development. The national income accounts needed to keep pace with the changing world.

Q: Are these data revisions a big deal?

A: Counting the production of entertainment originals as investment added about 0.5 percent to GDP. Counting research and development as investment added about 2 percent more.

Q: Does this change mean we cannot compare GDP before the change with GDP afterwards?

A: The BEA knows that people like to compare GDP over time, so when it makes a conceptual change like this, it also revises all the old data to be consistent with the newer procedures. In a sense, by changing to the new, better treatment of artistic works and research and development, the BEA discovered additional GDP for previous years. Of course, this extra GDP was really there all along but just wasn’t being counted.

Q: You’re right. That was more interesting than I expected. Is there a broader lesson here?

A: Yes. The construction of macroeconomic data is often based on judgment calls, which can be reevaluated and revised over time. Whenever you use these data, keep in mind that they are not perfect, even if they are the best we have.
Measuring the Cost of Living: The Consumer Price Index

A dollar today doesn’t buy as much as it did twenty years ago. The cost of almost everything has gone up. This increase in the overall level of prices is called inflation, and the percentage change in the price level from one period to the next is called the inflation rate. Inflation is a primary concern of economists and policymakers. In later chapters we examine in detail the causes and effects of inflation. Here we discuss how economists measure changes in the cost of living.

The Price of a Basket of Goods

The most commonly used measure of the level of prices is the consumer price index (CPI). The Bureau of Labor Statistics, which is part of the U.S. Department of Labor, has the job of computing the CPI. It begins by collecting the prices of thousands of goods and services. Just as GDP turns the quantities of many goods and services into a single number measuring the value of production, the CPI turns the prices of many goods and services into a single index measuring the overall level of prices.

How should economists aggregate the many prices in the economy into a single index that reliably measures the price level? They could simply compute an average of all prices. But this approach would treat all goods and services equally. Because people buy more chicken than caviar, the price of chicken should have a greater weight in the CPI than the price of caviar. The Bureau of Labor Statistics weights different items by computing the price of a basket of goods and services purchased by a typical consumer. The CPI is the price of this basket of goods and services relative to the price of the same basket in some base year.

For example, suppose that the typical consumer buys five apples and two oranges every month. Then the basket of goods consists of five apples and two oranges, and the CPI is

$$\text{CPI} = \frac{(5 \times \text{Current Price of Apples}) + (2 \times \text{Current Price of Oranges})}{(5 \times \text{2014 Price of Apples}) + (2 \times \text{2014 Price of Oranges})}.$$

In this CPI, 2014 is the base year. The index tells us how much it costs now to buy five apples and two oranges relative to how much it cost to buy the same basket of fruit in 2014.

The consumer price index is the most closely watched index of prices, but it is not the only such index. Another is the producer price index, which measures the price of a typical basket of goods bought by firms rather than consumers. In addition to these overall price indexes, the Bureau of Labor Statistics computes price indexes for specific types of goods, such as food, housing, and energy. Another statistic, sometimes called core inflation, measures the increase in price of a consumer basket that excludes food and energy products. Because food and energy prices exhibit substantial short-run volatility, core inflation is sometimes viewed as a better gauge of ongoing inflation trends.
How the CPI Compares to the GDP and PCE Deflators

Earlier in this chapter we saw another measure of prices—the implicit price deflator for GDP, which is the ratio of nominal GDP to real GDP. The GDP deflator and the CPI give somewhat different information about what's happening to the overall level of prices in the economy. There are three key differences between the two measures.

The first difference is that the GDP deflator measures the prices of all goods and services produced, whereas the CPI measures the prices of only the goods and services bought by consumers. Thus, an increase in the price of goods bought only by firms or the government will show up in the GDP deflator but not in the CPI.

The second difference is that the GDP deflator includes only those goods produced domestically. Imported goods are not part of GDP and do not show up in the GDP deflator. Hence, an increase in the price of Toyotas made in Japan and sold in this country affects the CPI, because the Toyotas are bought by consumers, but it does not affect the GDP deflator.

The third and most subtle difference results from the way the two measures aggregate the many prices in the economy. The CPI assigns fixed weights to the prices of different goods, whereas the GDP deflator assigns changing weights. In other words, the CPI is computed using a fixed basket of goods, whereas the GDP deflator allows the basket of goods to change over time as the composition of GDP changes. The following example shows how these approaches differ. Suppose that major frosts destroy the nation’s orange crop. The quantity of oranges produced falls to zero, and the price of the few oranges that remain on grocers’ shelves is driven sky-high. Because oranges are no longer part of GDP, the increase in the price of oranges does not show up in the GDP deflator. But because the CPI is computed with a fixed basket of goods that includes oranges, the increase in the price of oranges causes a substantial rise in the CPI.

Economists call a price index with a fixed basket of goods a Laspeyres index and a price index with a changing basket a Paasche index. Economic theorists have studied the properties of these different types of price indexes to determine which is a better measure of the cost of living. The answer, it turns out, is that neither is clearly superior. When prices of different goods are changing by different amounts, a Laspeyres (fixed basket) index tends to overstate the increase in the cost of living because it does not take into account the fact that consumers have the opportunity to substitute less expensive goods for more expensive ones. By contrast, a Paasche (changing basket) index tends to understate the increase in the cost of living. Although it accounts for the substitution of alternative goods, it does not reflect the reduction in consumers’ welfare that may result from such substitutions.

The example of the destroyed orange crop shows the problems with Laspeyres and Paasche price indexes. Because the CPI is a Laspeyres index, it overstates the impact of the increase in orange prices on consumers: by using a fixed basket of goods, it ignores consumers’ ability to substitute apples for oranges. By contrast, because the GDP deflator is a Paasche index, it understates the impact on
consumers: the GDP deflator shows no rise in prices, yet surely the higher price of oranges makes consumers worse off.\(^4\)

In addition to the CPI and the GDP deflator, another noteworthy measure of inflation is the implicit price deflator for personal consumption expenditures, or PCE deflator. The PCE deflator is calculated like the GDP deflator but, rather than being based on all of GDP, it is based on only the consumption component of GDP. That is, the PCE deflator is the ratio of nominal consumer spending to real consumer spending.

The PCE deflator resembles the CPI in some ways and the GDP deflator in others. Like the CPI, the PCE deflator includes only the prices of goods and services that consumers buy; it excludes the prices of goods and services that are part of investment and government purchases. Also like the CPI, the PCE deflator includes the prices of imported goods. But like the GDP deflator, the PCE deflator allows the basket of goods to change over time as the composition of consumer spending changes. Because of this mix of attributes, the Federal Reserve uses the PCE deflator as its preferred gauge of how quickly prices are rising.

Luckily, the differences among these various measures of inflation are usually small in practice. Figure 2-3 shows inflation as measured by the CPI, the GDP deflator, and the PCE deflator for each year from 1948 to 2013. All three measures usually tell the same story about how quickly prices are rising.

**Does the CPI Overstate Inflation?**

The consumer price index is a closely watched measure of inflation. Policymakers in the Federal Reserve monitor it, along with many other variables, when setting monetary policy. In addition, many laws and private contracts have cost-of-living allowances, called \(\text{COLAs}\), which use the CPI to adjust for changes in the price level. For instance, Social Security benefits are adjusted automatically every year so that inflation will not erode the living standard of the elderly.

Because so much depends on the CPI, it is important to ensure that this measure of the price level is accurate. Many economists believe that, for a number of reasons, the CPI tends to overstate inflation.

One problem is the substitution bias we have already discussed. Because the CPI measures the price of a fixed basket of goods, it does not reflect the ability of consumers to substitute toward goods whose relative prices have fallen. Thus, when relative prices change, the true cost of living rises less rapidly than does the CPI.

A second problem is the introduction of new goods. When a new good is introduced into the marketplace, consumers are better off because they have more products from which to choose. In effect, the introduction of new goods increases the real value of the dollar. Yet this increase in the purchasing power of the dollar is not reflected in a lower CPI.

\(^4\)Because a Laspeyres index overstates inflation and a Paasche index understates it, one might strike a compromise by taking an average of the two measured rates of inflation. This is the approach taken by another type of index, called a \(\text{Fisher index}\).
A third problem is unmeasured changes in quality. When a firm changes the quality of a good it sells, not all of the good’s price change reflects a change in the cost of living. The Bureau of Labor Statistics does its best to account for changes in the quality of goods over time. For example, if Ford increases the horsepower of a particular car model from one year to the next, the CPI will reflect the change: the quality-adjusted price of the car will not rise as fast as the unadjusted price. Yet many changes in quality, such as comfort or safety, are hard to measure. If unmeasured quality improvement (rather than unmeasured quality deterioration) is typical, then the measured CPI rises faster than it should.

Because of these measurement problems, some economists have suggested revising laws to reduce the degree of indexation. For example, Social Security benefits could be indexed to CPI inflation minus 1 percent. Such a change would provide a rough way of offsetting these measurement problems. At the same time, it would automatically slow the growth in government spending.

In 1995, the Senate Finance Committee appointed a panel of economists to study the magnitude of the measurement error in the CPI. The panel concluded that the CPI was biased upward by 0.8 to 1.6 percentage points per year.

**Figure 2-3**

This figure shows the percentage change in the CPI, the GDP deflator, and the PCE deflator for every year from 1948 to 2013. These measures of prices diverge at times, but they usually tell the same story about how quickly prices are rising. Both the CPI and the GDP deflator show that prices rose slowly in most of the 1950s and 1960s, that they rose much more quickly in the 1970s, and that they have risen slowly again since the mid-1980s.

with their “best estimate” being 1.1 percentage points. This report led to some changes in the way the CPI is calculated, so the bias is now thought to be under 1 percentage point. The CPI still overstates inflation, but not by as much as it once did.\(^5\)

### 2-3 Measuring Joblessness: The Unemployment Rate

One aspect of economic performance is how well an economy uses its resources. Because an economy’s workers are its chief resource, keeping workers employed is a paramount concern of economic policymakers. The unemployment rate is the statistic that measures the percentage of those people wanting to work who do not have jobs. Every month, the U.S. Bureau of Labor Statistics computes the unemployment rate and many other statistics that economists and policymakers use to monitor developments in the labor market.

#### The Household Survey

The unemployment rate comes from a survey of about 60,000 households called the Current Population Survey. Based on the responses to survey questions, each adult (age 16 and older) in each household is placed into one of three categories:

- **Employed.** This category includes those who at the time of the survey worked as paid employees, worked in their own business, or worked as unpaid workers in a family member’s business. It also includes those who were not working but who had jobs from which they were temporarily absent because of, for example, vacation, illness, or bad weather.

- **Unemployed.** This category includes those who were not employed, were available for work, and had tried to find employment during the previous four weeks. It also includes those waiting to be recalled to a job from which they had been laid off.

- **Not in the labor force.** This category includes those who fit neither of the first two categories, such as a full-time student, homemaker, or retiree.

Notice that a person who wants a job but has given up looking—a discouraged worker—is counted as not being in the labor force.

The labor force is the sum of the employed and unemployed, and the unemployment rate is the percentage of the labor force that is unemployed. That is,

\[
\text{Labor Force} = \text{Number of Employed} + \text{Number of Unemployed}
\]

and

\[
\text{Unemployment Rate} = \frac{\text{Number of Unemployed}}{\text{Labor Force}} \times 100.
\]

A related statistic is the labor-force participation rate, the percentage of the adult population that is in the labor force:

\[
\text{Labor-Force Participation Rate} = \frac{\text{Labor Force}}{\text{Adult Population}} \times 100.
\]

The Bureau of Labor Statistics computes these statistics for the overall population and for groups within the population: men and women, whites and blacks, teenagers and prime-age workers.

Figure 2-4 shows the breakdown of the population into the three categories for April 2014. The statistics broke down as follows:

Labor Force = 145.7 + 9.7 = 155.4 million.

Unemployment Rate = (9.7/155.4) \times 100 = 6.2\%.

Labor-Force Participation Rate = (155.4/247.4) \times 100 = 62.8\%.

**FIGURE 2-4**

**The Three Groups of the Population** When the Bureau of Labor Statistics surveys the population, it places all adults into one of three categories: employed, unemployed, or not in the labor force. This figure shows the number of people in each category in April 2014.

Data from: U.S. Department of Labor.
Hence, almost two-thirds of the adult population was in the labor force and about 6.2 percent of those in the labor force did not have a job.

**CASE STUDY**

**Men, Women, and Labor-Force Participation**

The data on the labor market collected by the Bureau of Labor Statistics reflect not only economic developments, such as the booms and busts of the business cycle, but also a variety of social changes. Longer-term social changes in the roles of men and women in society, for example, are evident in the data on labor-force participation.

Figure 2-5 shows the labor-force participation rates of men and women in the United States from 1950 to 2013. Just after World War II, men and women had very different economic roles. Only 34 percent of women were working or looking for work, in contrast to 86 percent of men. Since then, the difference between the participation rates of men and women has gradually diminished, as growing numbers of women have entered the labor force and some men have left it. Data for 2013 show that more than 57 percent of women were in the labor force, in contrast to 70 percent of men. As measured by labor-force participation, men and women are now playing more equal roles in the economy.

There are many reasons for this change. In part, it is due to new technologies, such as the washing machine, clothes dryer, refrigerator, freezer, and

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**FIGURE 2-5**

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
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<tbody>
<tr>
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<td>90</td>
<td>34</td>
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<tr>
<td>1955</td>
<td>80</td>
<td>30</td>
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<td>1960</td>
<td>70</td>
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<tr>
<td>2010</td>
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</tbody>
</table>

**Labor-Force Participation** Over the past several decades, the labor-force participation rate for women has risen, while the rate for men has declined.

*Data from: U.S. Department of Labor.*
dishwasher, which have reduced the amount of time required to complete routine household tasks. In part, it is due to improved birth control, which has reduced the number of children born to the typical family. And in part, this change in women’s role is due to changing political and social attitudes. Together, these developments have had a profound impact, as demonstrated by these data.

Although the increase in women’s labor-force participation is easily explained, the fall in men’s participation may seem puzzling. There are several developments at work. First, young men now stay in school longer than their fathers and grandfathers did. Second, older men now retire earlier and live longer. Third, with more women employed, more fathers now stay at home to raise their children. Full-time students, retirees, and stay-at-home fathers are all counted as out of the labor force.

Figure 2-5 shows that, in the most recent decade, the labor-force participation rate declined for both men and women. This phenomenon is examined in a case study in Chapter 7. We will see that this recent decline is due in part to the start of retirement for the large baby-boom generation and in part to the weak economy in the aftermath of the financial crisis of 2008–2009.

### The Establishment Survey

When the Bureau of Labor Statistics (BLS) reports the unemployment rate every month, it also reports a variety of other statistics describing conditions in the labor market. Some of these statistics, such as the labor-force participation rate, are derived from the Current Population Survey. Other statistics come from a separate survey of about 160,000 business establishments that employ over 40 million workers. When you read a headline that says the economy created a certain number of jobs last month, that statistic is the change in the number of workers that businesses report having on their payrolls.

Because the BLS conducts two surveys of labor-market conditions, it produces two measures of total employment. From the household survey, it obtains an estimate of the number of people who say they are working. From the establishment survey, it obtains an estimate of the number of workers firms have on their payrolls.

One might expect these two measures of employment to be identical, but that is not the case. Although they are positively correlated, the two measures can diverge, especially over short periods of time. An example of a large divergence occurred in the early 2000s, as the economy recovered from the recession of 2001. From November 2001 to August 2003, the establishment survey showed a decline in employment of 1.0 million, while the household survey showed an increase of 1.4 million. Some commentators said the economy was experiencing a “jobless recovery,” but this description applied only to the establishment data, not to the household data.

Why might these two measures of employment diverge? Part of the explanation is that the surveys measure different things. For example, a person who
runs his or her own business is self-employed. The household survey counts that person as working, whereas the establishment survey does not because that person does not show up on any firm’s payroll. As another example, a person who holds two jobs is counted as one employed person in the household survey but is counted twice in the establishment survey because that person would show up on the payrolls of two firms.

Another part of the explanation for the divergence is that surveys are imperfect. For example, when new firms start up, it may take some time before those firms are included in the establishment survey. The BLS tries to estimate employment at start-ups, but the model it uses to produce these estimates is one possible source of error. A different problem arises from how the household survey extrapolates employment among the surveyed households to the entire population. If the BLS uses incorrect estimates of the size of the population, these errors will be reflected in its estimates of household employment. One possible source of incorrect population estimates is changes in the rate of immigration, both legal and illegal.

In the end, the divergence between the household and establishment surveys from 2001 to 2003 remains a mystery. Some economists believe that the establishment survey is the more accurate one because it has a larger sample. Yet one study suggests that the best measure of employment is an average of the two surveys.\(^6\)

More important than the specifics of these surveys or this particular episode when they diverged is the broader lesson: all economic statistics are imperfect. Although they contain valuable information about what is happening in the economy, each one should be interpreted with a healthy dose of caution and a bit of skepticism.

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**2-4 Conclusion: From Economic Statistics to Economic Models**

The three statistics discussed in this chapter—gross domestic product, the consumer price index, and the unemployment rate—quantify the performance of the economy. Public and private decisionmakers use these statistics to monitor changes in the economy and to formulate appropriate policies. Economists use these statistics to develop and test theories about how the economy works.

In the chapters that follow, we examine some of these theories. That is, we build models that explain how these variables are determined and how economic policy affects them. Having learned how to measure economic performance, we are now ready to learn how to explain it.

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Summary

1. Gross domestic product (GDP) measures the income of everyone in the economy and, equivalently, the total expenditure on the economy’s output of goods and services.

2. Nominal GDP values goods and services at current prices. Real GDP values goods and services at constant prices. Real GDP rises only when the amount of goods and services has increased, whereas nominal GDP can rise either because output has increased or because prices have increased. The GDP deflator is the ratio of nominal to real GDP and measures the overall level of prices.

3. GDP is the sum of four categories of expenditure: consumption, investment, government purchases, and net exports. This relationship is called the national income accounts identity.

4. The consumer price index (CPI) measures the price of a fixed basket of goods and services purchased by a typical consumer relative to the same basket in a base year. Like the GDP deflator and the personal consumption expenditure (PCE) deflator, the CPI measures the overall level of prices, but unlike the deflators, it does not allow the basket of goods and services to change over time as consumers respond to changes in relative prices.

5. The labor-force participation rate shows the fraction of adults who are working or want to work. The unemployment rate shows the fraction of those in the labor force who do not have a job.

Key Concepts

- Gross domestic product (GDP)
- National income accounting
- Stocks and flows
- Value added
- Imputed value
- Nominal versus real GDP
- GDP deflator
- National income accounts identity
- Consumption
- Investment
- Government purchases
- Net exports
- Consumer price index (CPI)
- PCE deflator
- Labor force
- Unemployment rate
- Labor-force participation rate

Questions for Review

1. List the two things that GDP measures. How can GDP measure two things at once?
2. What are the four components of GDP? Give an example of each.
3. What does the consumer price index measure? List three ways in which it differs from the GDP deflator.
4. How are the CPI and the PCE deflator similar, and how are they different?
5. List the three categories used by the Bureau of Labor Statistics to classify everyone in the economy. How does the BLS compute the unemployment rate?
6. Describe the two ways the BLS measures total employment.
1. Go to the website of the Bureau of Economic Analysis and find the growth rate of real GDP for the most recent quarter. Go to the website of the Bureau of Labor Statistics and find the inflation rate over the past year and the unemployment rate for the most recent month. How do you interpret these data?

2. A farmer grows a bushel of wheat and sells it to a Miller for $1. The Miller turns the wheat into flour and then sells the flour to a Baker for $3. The Baker uses the flour to make bread and sells the bread to an Engineer for $6. The Engineer eats the bread. What is the value added by each person? What is the bread’s contribution to GDP?

3. Suppose a woman marries her butler. After they are married, her husband continues to wait on her as before, and she continues to support him as before (but as a husband rather than as an employee). How does the marriage affect GDP? How do you think it should affect GDP?

4. Place each of the following transactions in one of the four components of expenditure: consumption, investment, government purchases, and net exports.
   b. Boeing sells an airplane to American Airlines.
   c. Boeing sells an airplane to Air France.
   d. Boeing sells an airplane to Amelia Earhart.
   e. Boeing builds an airplane to be sold next year.

5. Find data on GDP and its components, and compute the percentage of GDP for the following components for 1950, 1980, and the most recent year available.
   a. Personal consumption expenditures
   b. Gross private domestic investment
   c. Government purchases
   d. Net exports
   e. National defense purchases
   f. Imports

Do you see any stable relationships in the data? Do you see any trends? (Hint: You can find the data at http://www.bea.gov, which is the Website of the Bureau of Economic Analysis.)

6. • Tina is the sole owner of Tina’s Lawn Mowing, Incorporated (TLM). In one year, TLM collects $1,000,000 from customers to mow their lawns. TLM’s equipment depreciates in value by $125,000. TLM pays $600,000 to its workers, who pay $140,000 in taxes on this income. TLM pays $50,000 in corporate income taxes and pays Tina a dividend of $150,000. Tina pays taxes of $60,000 on this dividend income. TLM retains $75,000 of earnings in the business to finance future expansion. How much does this economic activity contribute to each of the following?
   a. GDP
   b. NNP
   c. National income
   d. Compensation of employees
   e. Proprietors’ income
   f. Corporate profits
   g. Personal income
   h. Disposable personal income

7. • Consider an economy that produces and consumes hot dogs and hamburgers. In the following table are data for two different years.

<table>
<thead>
<tr>
<th>Good</th>
<th>2010 Quantity</th>
<th>2010 Price</th>
<th>2015 Quantity</th>
<th>2015 Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot dogs</td>
<td>200</td>
<td>$2</td>
<td>250</td>
<td>$4</td>
</tr>
<tr>
<td>Hamburgers</td>
<td>200</td>
<td>$3</td>
<td>500</td>
<td>$4</td>
</tr>
</tbody>
</table>

   a. Using 2010 as the base year, compute the following statistics for each year: nominal GDP, real GDP, the implicit price deflator for GDP, and a fixed-weight price index such as the CPI.
   b. By what percentage did prices rise between 2010 and 2015? Give the answer for each good and also for the two measures of the overall price level. Compare the answers given by the Laspeyres and Paasche price indexes. Explain the difference.
8. Abby consumes only apples. In year 1, red apples cost $1 each, green apples cost $2 each, and Abby buys 10 red apples. In year 2, red apples cost $2, green apples cost $1, and Abby buys 10 green apples.
   a. Compute a consumer price index for apples for each year. Assume that year 1 is the base year in which the consumer basket is fixed. How does your index change from year 1 to year 2?
   b. Compute Abby’s nominal spending on apples in each year. How does it change from year 1 to year 2?
   c. Using year 1 as the base year, compute Abby’s real spending on apples in each year. How does it change from year 1 to year 2?
   d. Defining the implicit price deflator as nominal spending divided by real spending, compute the deflator for each year. How does the deflator change from year 1 to year 2?
   e. Suppose that Abby is equally happy eating red or green apples. How much has the true cost of living increased for Abby? Compare this answer to your answers to parts (a) and (d). What does this example tell you about the Laspeyres and Paasche price indexes?

9. An economy has 100 people divided among the following groups: 25 have full-time jobs, 20 have one part-time job, 5 have two part-time jobs, 10 would like to work and are looking for jobs, 10 would like to work but are so discouraged they have given up looking, 10 are running their own businesses, 10 are retired, and 10 are small children.
   a. Calculate the labor force and the labor-force participation rate.
   b. Calculate the number of unemployed and the unemployment rate.
   c. Calculate total employment in two ways: as measured by the household survey and as measured by the establishment survey.

10. In a speech that Senator Robert Kennedy gave when he was running for president in 1968, he said the following about GDP:
    [It] 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.
    Was Robert Kennedy right? If so, why do we care about GDP?

11. Consider whether each of the following events is likely to increase or decrease real GDP. In each case, do you think the well-being of the average person in society most likely changes in the same direction as real GDP? Why or why not?
   a. A hurricane in Florida forces Disney World to shut down for a month.
   b. The discovery of a new, easy-to-grow strain of wheat increases farm harvests.
   c. Increased hostility between unions and management sparks a rash of strikes.
   d. Firms throughout the economy experience falling demand, causing them to lay off workers.
   e. Congress passes new environmental laws that prohibit firms from using production methods that emit large quantities of pollution.
   f. More high school students drop out of school to take jobs mowing lawns.
   g. Fathers around the country reduce their workweeks to spend more time with their children.