2-2 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 *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.

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[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 *Fisher index*.

FIGURE **2-3**
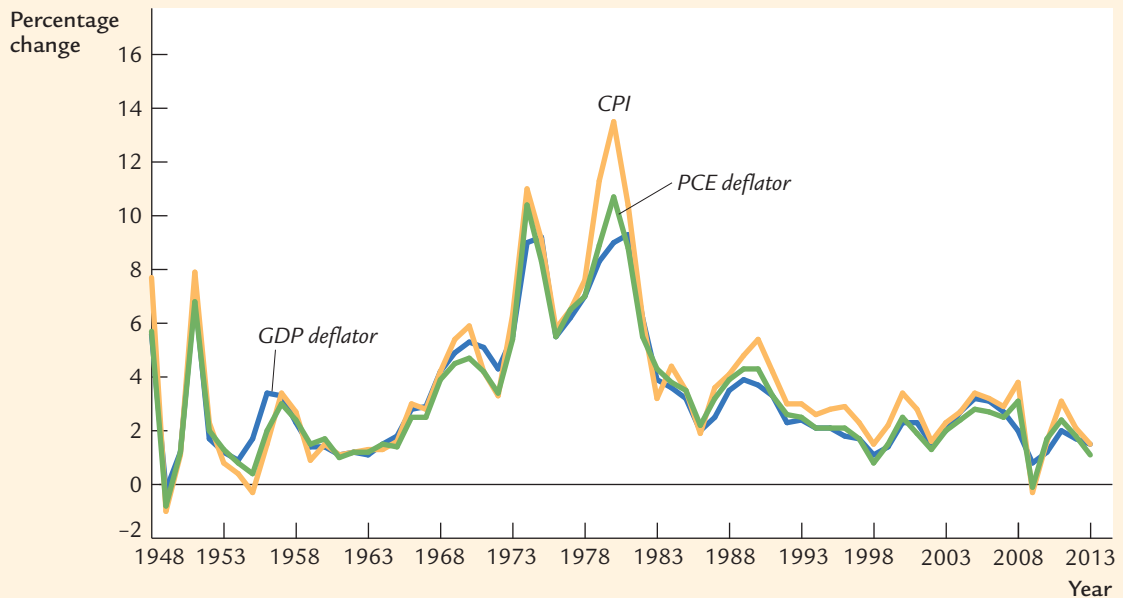
Percentage change

Three Measures of Inflation 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.

Data from: U.S. Department of Commerce, U.S. Department of Labor.

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,

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.

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[5]For further discussion of these issues, see Matthew Shapiro and David Wilcox, "Mismeasurement in the Consumer Price Index: An Evaluation," *NBER Macroeconomics Annual,* 1996, and the symposium on "Measuring the CPI" in the Winter 1998 issue of the *Journal of Economic Perspectives.*

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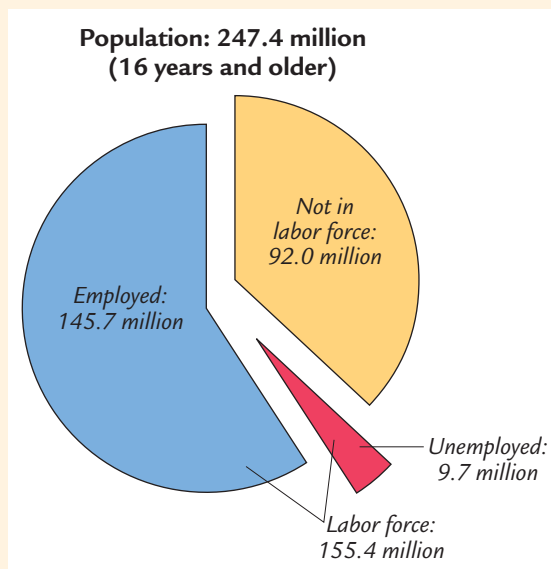
Figure 2-4 shows the breakdown of the population into the three categories for April 2014. The statistics broke down as follows:

$$\text{Labor Force} = 145.7 + 9.7 = 155.4 \text{ million.}$$

$$\text{Unemployment Rate} = (9.7/155.4) \times 100 = 6.2\%.$$

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

FIGURE 2-4

Population: 247.4 million (16 years and older)

Employed: 145.7 million

Not in labor force: 92.0 million

Unemployed: 9.7 million

Labor force: 155.4 million

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.
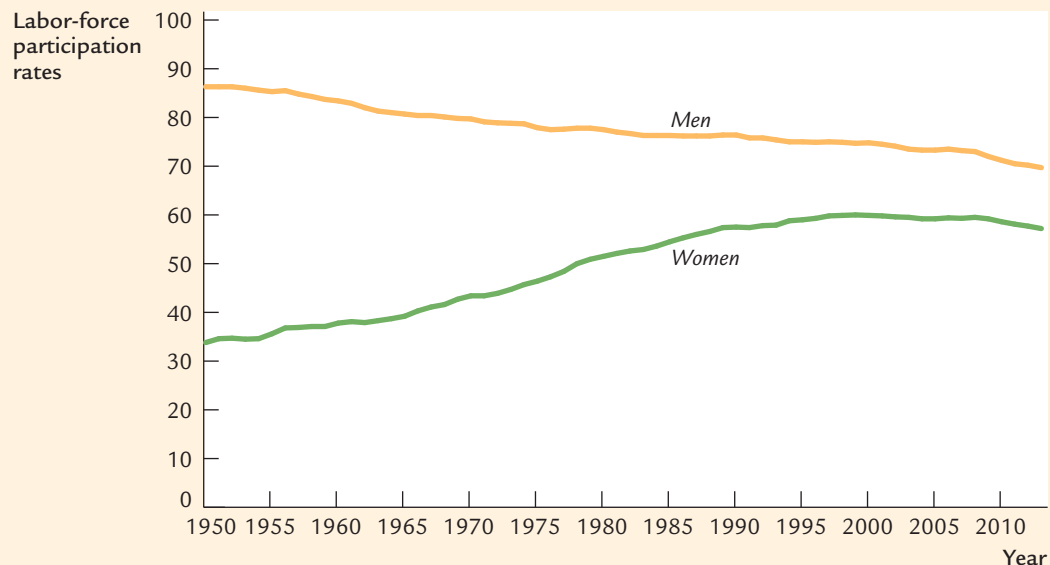
Men, Women, and Labor-Force Participation

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 tech-nologies, such as the washing machine, clothes dryer, refrigerator, freezer, and

FIGURE 2-5

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.

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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[6]George Perry, "Gauging Employment: Is the Professional Wisdom Wrong?" *Brookings Papers on Economic Activity* (2005): 2.

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.