CHAPTER

24

Measuring the Cost of Living

Goals

In this chapter you will

- Learn how the consumer price index (CPI) is constructed
- Consider why the CPI is an imperfect measure of the cost of living
- Compare the CPI and the GDP deflator as a measure of the overall price level
- See how to use a price index to compare dollar amounts from different times
- Learn the distinction between real and nominal interest rates

Outcomes

After accomplishing these goals, you should be able to

- List the five steps necessary to calculate the inflation rate
- Discuss three reasons why the CPI may be biased
- Describe two differences between the CPI and GDP deflator
- Explain the relationship among the real interest rate, the nominal interest rate, and the inflation rate

Strive for a Five

Chapter 24 has material tested on the macroeconomics AP exam, specifically:

- Inflation
- The costs of inflation
- The consumer price index, the producer price index, and the GDP deflator
- Creating a price index and calculating for inflation
- Demand-pull and cost-push inflation
- Nominal interest and real interest rates

Key Terms

- *Consumer price index*—The ratio of the value of the fixed basket purchased by the typical consumer to the basket's value in the base year multiplied by 100
- *Inflation rate*—The percent change in a price index
- *GDP deflator*—The ratio of nominal GDP to real GDP multiplied by 100
- *Basket* (of goods and services)—The quantities of each item purchased by the typical consumer
- *Base year*—The benchmark year against which other years are compared
- *Bureau of Labor Statistics*—The government agency responsible for tracking prices
- *Producer price index*—The ratio of the value of a fixed basket of goods and services purchased by firms to the basket's value in the base year multiplied by 100
- *Cost of living*—The income necessary to maintain a constant standard of living
- *Standard of living*—Material well-being
- *Substitution bias*—The inability of the CPI to account for consumers' substitution toward relatively cheaper goods and services
- *Nominal GDP*—Output valued at current prices
- *Real GDP*—Output valued at base-year prices
- *Indexed contract*—A contract that requires that a dollar amount be automatically corrected for inflation
- *Cost-of-living allowance (COLA)*—An automatic increase in income in order to maintain a constant standard of living
- *Nominal interest rate*—The interest rate uncorrected for the effects of inflation
- *Real interest rate*—The interest rate corrected for the effects of inflation

Chapter Overview

Context and Purpose

Chapter 24 is the second chapter of a two-chapter sequence that deals with how economists measure output and prices in the macroeconomy. Chapter 23 addressed how economists measure output. Chapter 24 develops how economists measure the overall price level in the macroeconomy.

The purpose of Chapter 24 is twofold: first, to show you how to generate a price index and, second, to teach you how to employ a price index to compare dollar figures from

different points in time and to adjust interest rates for inflation. In addition, you will learn some of the shortcomings of using the consumer price index as a measure of the cost of living.

Chapter Review

Introduction To compare the income of a worker in, say, 1930 to the income of a worker today, we must first convert the dollar amount of each of their incomes into a comparable measure of purchasing power because there has been inflation over this time period. This chapter explains how economists correct economic variables for the effects of inflation. Inflation is generally measured by the consumer price index (CPI).

The Consumer Price Index

The consumer price index is a measure of the overall cost of the goods and services bought by a typical consumer. It is calculated by the *Bureau of Labor Statistics.*

There are five steps to calculating a CPI:

- *Fix the basket.* Estimate the *quantities* of the products purchased by the typical consumer (i.e., the *basket of goods and services*).
- *Find the prices.* Locate the prices of each item in the basket for each point in time (each year for an annual CPI).
- *Compute the basket's cost.* Use the prices and quantities to calculate the cost of the basket for each year.
- *Choose a base year and compute the index.* Choose a year as the benchmark against which the other years can be compared (i.e., the *base year*). The choice of the base year is arbitrary. Make a ratio of the cost of the basket for each year to the cost in the base year. Multiply each ratio by 100. Each resulting number is the value of the index for that year.
- *Compute inflation.* Inflation is the percentage change in the price index from the preceding year. For example:

$$\text{Inflation rate in 2007} = \left[\frac{(\text{CPI in year 2007} - \text{CPI in year 2006})}{\text{CPI in year 2006}}\right] \times 100$$

The actual CPI is calculated both monthly and annually. In addition, the Bureau of Labor Statistics calculates a producer price index (PPI), which measures the cost of a basket of goods and services purchased by firms. Changes in the PPI usually precede changes in the CPI because firms often pass on higher costs in the form of higher consumer prices.

The major categories in the CPI basket are housing (43 percent), transportation (17 percent), food and beverages (15 percent), medical care (6 percent), recreation (6 percent), education and communication (6 percent), apparel (4 percent), and other goods and services (3 percent).

The *cost of living* is the amount by which incomes must rise in order to maintain a constant *standard of living.* There are three problems with using the CPI to measure changes in the cost of living:

- *Substitution bias:* Over time, some prices rise more than others. Consumers will substitute toward goods that have become relatively less expensive. The CPI, however, is based on a fixed basket of purchases. Because the CPI fails to acknowledge the consumer's substitution of less expensive products for more expensive products, the CPI overstates the increase in the cost of living.
- *Introduction of new goods:* When new goods are introduced, a dollar has increased in value because it can buy a greater variety of products. Because the CPI is based on a fixed consumer basket, it does not reflect this increase in the purchasing power of the dollar (equivalent to a reduction in prices). Thus, again, the CPI overstates the increase in the cost of living.
- *Unmeasured quality change:* If the quality of a good rises from year to year, as with tires and computers, then the value of a dollar is rising even if actual prices are constant. This is equivalent to a reduction in prices. To the degree that an increase in quality is

not accounted for by the Bureau of Labor Statistics, the CPI overstates the increase in the cost of living. The opposite is true for a deterioration of quality.

Economists believe that these three factors have caused the CPI to overestimate inflation by about 1 percent each year. This small overestimation of inflation may cause overpayment of Social Security benefits because Social Security benefits are tied to the CPI. Recent technical changes to the CPI may have reduced the upward bias in the CPI by about one-half.

Recall that the *GDP deflator* is the ratio of *nominal GDP* (current output valued at current prices) to *real GDP* (current output valued at base-year prices). Thus, the GDP deflator is a price index, too. It differs from the CPI in two ways:

- First, the basket of goods is different. The GDP deflator utilizes the prices of all goods and services produced domestically. The CPI utilizes the prices of goods and services *bought by consumers* only, regardless of where the goods were produced. Therefore, a change in the price of foreign oil, which raises the price of gasoline, is captured by the CPI but not by the GDP deflator, while a change in the price of a domestically produced nuclear missile is captured by the GDP deflator but not by the CPI.
- Second, the GDP deflator utilizes the quantities of goods and services in *current* output, so the "basket" changes each year. The CPI utilizes the quantities in a *fixed* basket, so the basket changes only when the Bureau of Labor Statistics chooses. Although the CPI and GDP deflator should track each other very closely, the CPI may tend to rise slightly faster due to its inherent substitution bias and the bias associated with the introduction of new goods.

Correcting Economic Variables for the Effects of Inflation

Economists use the CPI to correct *dollar figures*, such as income, and *interest rates* for the effects of inflation.

We correct income for inflation so that we can compare income from different years. The general formula for comparing dollar values from different years is as follows:

$$\text{Value in year X dollars} = \text{Value in year Y dollars} \times (\text{CPI in year X}/\text{CPI in year Y})$$

In words, to make the above conversion, multiply the dollar value you wish to adjust by the ratio of the ending price level to the starting price level. Your value will now be measured in dollars consistent with the ending price level.

For example, suppose your aunt earned $17,000 in 1969 and earned $55,000 in 1994. Over those 25 years, has her standard of living increased?

CPI in 1969 = 36.7

CPI in 1994 = 148.2

$17,000 × (148.2/36.7) = $68,649 > $55,000

A $17,000 salary in 1969 would buy as much as a $68,649 salary in 1994. Since your aunt only earned $55,000 in 1994, her real income fell and her standard of living actually decreased.

When a dollar amount, for example a Social Security payment, is automatically adjusted for inflation, we say that it has been *indexed* for inflation. A contract with this provision is said to contain a *COLA* or *cost-of-living allowance.*

We also correct interest rates for inflation. A correction is necessary because, if prices have risen during the term of a loan, the dollars used for repayment will not buy as much as the dollars originally borrowed.

The nominal interest rate is the interest rate uncorrected for the effects of inflation. The real interest rate is the interest rate corrected for the effects of inflation. The formula for correcting the nominal interest rate for inflation is:

$$\text{real interest rate} = \text{nominal interest rate} - \text{inflation rate}$$

For example, if the bank paid you a nominal interest rate of 4 percent on your account, and if the inflation rate were 3 percent, the real interest rate on your account would be only 1 percent: 4% – 3% = 1%.

Helpful Hints

1. Your particular consumption basket may not be typical. Since the GDP deflator and the CPI are based on different baskets of goods and services, each will provide a slightly different measurement of the cost of living. Continuing in this same line of thinking, your particular consumption basket may differ from the typical consumption basket used by the Bureau of Labor Statistics when they calculate the CPI. For example, when you are a young adult, your basket may be more heavily weighted toward electronics and clothing. If clothing prices are rising faster than average, young people may have a greater increase in the cost of living than is suggested by the CPI. In like manner, when you become old, your consumption basket may be more heavily weighted toward medicine and travel. Exceptional increases in these prices may cause the cost of living for the elderly to rise more quickly than suggested by the CPI.

2. Dollar values can be adjusted backward in time as well as adjusted forward. In the earlier section, there is a numerical example that converts $17,000 of income in 1969 into the amount of income that would be necessary in 1994 to generate the same purchasing power. We discovered that it would take $68,649 for your aunt to have the same standard of living in 1994 as she had in 1969. Because she only made $55,000 in 1994, we argued that her standard of living actually fell over the 25-year period.

   Alternatively, we can convert her 1994 salary of $55,000 into its equivalent purchasing power measured in 1969 dollars and compare the resulting figure with her $17,000 income in 1969. We arrive at the same conclusion—she was better off in 1969.

   $$\$55{,}000 \times (36.7/148.2) = \$13{,}620 < \$17{,}000$$

   Her $55,000 income in 1994 is equivalent to (or generates the same standard of living as) a $13,620 income in 1969. Since she actually made $17,000 in 1969, she had a higher standard of living in 1969.

3. When correcting interest rates for inflation, think like a lender. If you loan someone $100 for one year, and you charge them 7 percent interest, you will receive $107 at the end of the year. Did you receive 7 additional dollars of purchasing power? Suppose inflation was 4 percent. You would need to receive $104 at the end of the year just to break even. That is, you would need $104 just to be able to buy the same set of goods and services that you could have purchased for $100 at the time you granted the loan. In this sense, you received only 3 additional dollars of purchasing power for having made the $100 loan, or a 3 percent real return. Thus, the real interest rate on the loan is 3 percent. Using your formula:

   $$7\% - 4\% = 3\%$$

Self-Test

Multiple-Choice Questions

1. In the CPI, goods and services are weighted according to
   a. how long a market has existed for each good or service.
   b. the extent to which the government regards each good or service as a necessity.
   c. how much consumers buy of each good or service.
   d. the number of firms that produce and sell each good or service.
   e. the extend to which each good or service is involved in creating jobs in the economy.

2. For any given year, the CPI is the price of the basket of goods and services in the
   a. given year divided by the price of the basket in the base year, then multiplied by 100.
   b. given year divided by the price of the basket in the previous year, then multiplied by 100.
   c. base year divided by the price of the basket in the given year, then multiplied by 100.
   d. previous year divided by the price of the basket in the given year, then multiplied by 100.
   e. given year minus the price in the previous year.

3. The inflation rate is calculated
   a. by determining the change in the price index from the preceding period.
   b. by adding up the price increases of all goods and services.
   c. by computing a simple average of the price increases for all goods and services.
   d. by determining the percentage increase in the price index from the preceding period.
   e. by subtracting the CPI numbers from two consecutive years.

4. For an imaginary economy, the value of the consumer price index was 140 in 2006 and 149.1 in 2007. The economy's inflation rate for 2007 was
   a. 6.1 percent.
   b. 6.5 percent.
   c. 9.1 percent.
   d. 49.1 percent.
   e. 140 percent.

5. Which of the following changes in the price index produces the greatest rate of inflation: 106 to 112, 112 to 118, 118 to 124, or 124 to 130?
   a. 106 to 112
   b. 112 to 118
   c. 118 to 124
   d. 124 to 130
   e. All of these changes produce the same rate of inflation.

6. Suppose that in 2010, the producer price index increases by 2 percent. As a result, economists most likely will predict that
   a. GDP will increase in 2011.
   b. the producer price index will increase by more than 2 percent in 2011.
   c. interest rates will decrease in the future.
   d. the consumer price index will increase in the future.
   e. the consumer price index will decrease in the future.

7. One of the widely acknowledged problems with using the consumer price index as a measure of the cost of living is that the CPI
   a. fails to account for consumer spending on housing.
   b. accounts only for consumer spending on food, clothing, and energy.
   c. fails to account for the fact that consumers spend larger percentages of their incomes on some goods and smaller percentages of their incomes on other goods.
   d. fails to account for the introduction of new goods.
   e. fails to account for recent large increases in energy prices.

8. When the quality of a good improves while its price remains the same, the purchasing power of the dollar
   a. increases, so the CPI overstates the change in the cost of living if the quality change is not accounted for.
   b. increases, so the CPI understates the change in the cost of living if the quality change is not accounted for.
   c. decreases, so the CPI overstates the change in the cost of living if the quality change is not accounted for.
   d. decreases, so the CPI understates the change in the cost of living if the quality change is not accounted for.
   e. remains the same as these two forces offset each other.

9. An important difference between the GDP deflator and the consumer price index is that
   a. the GDP deflator reflects the prices of goods and services bought by producers, whereas the consumer price index reflects the prices of goods and services bought by consumers.
   b. the GDP deflator reflects the prices of all final goods and services produced domestically, whereas the consumer price index reflects the prices of goods and services bought by consumers.
   c. the GDP deflator reflects the prices of all final goods and services produced by a nation's citizens, whereas the consumer price index reflects the prices of all final goods and services bought by consumers.
   d. the GDP deflator reflects the prices of all final goods and services bought by producers and consumers, whereas the consumer price index reflects the prices of all final goods and services bought by consumers.
   e. the GDP deflator reflects the prices of intermediate goods and services bought by producers and consumers, whereas the consumer price index reflects the prices of all final goods and services bought by producers and consumers.

10. Julie earned a salary of $60,000 in 2001 and $80,000 in 2006. The consumer price index was 177 in 2001 and 221.25 in 2006. Julie's salary
    a. increased in nominal dollars but decreased in real dollars.
    b. increased in real dollars but decreased in nominal dollars.
    c. increased in both nominal and real dollars.
    d. decreased in both nominal and real dollars.
    e. increased in nominal dollars and remained the same in real dollars.

11. Which of the following statements is correct about the relationship between the nominal interest rate and the real interest rate?
    a. The real interest rate is the nominal interest rate times the rate of inflation.
    b. The real interest rate is the nominal interest rate minus the rate of inflation.
    c. The real interest rate is the nominal interest rate plus the rate of inflation.
    d. The real interest rate is the nominal interest rate divided by the rate of inflation.
    e. The real interest rate is always higher than the nominal interest rate.

12. Suppose that over the past year, the real interest rate was 5 percent and the inflation rate was 3 percent. It follows that
    a. the dollar value of savings increased at 5 percent, and the purchasing power of savings increased at 2 percent.
    b. the dollar value of savings increased at 5 percent, and the purchasing power of savings increased at 8 percent.
    c. the dollar value of savings increased at 8 percent, and the purchasing power of savings increased at 2 percent.
    d. the dollar value of savings increased at 8 percent, and the purchasing power of savings increased at 5 percent.
    e. the dollar value of savings increased at 8 percent, and the purchasing power of savings decreased by 5 percent.

Free Response Questions

1. Jay and Joyce meet George, the banker, to work out the details of a mortgage. They all expect that inflation will be 2 percent over the term of the loan, and they agree on a nominal interest rate of 6 percent. As it turns out, the inflation rate is 5 percent over the term of the loan.
   a. What was the expected real interest rate?
   b. What was the actual real interest rate?
   c. Who benefited and who lost because of the unexpected inflation?

2. In a simple economy, people consume only two goods, food and clothing. The market basket of goods used to compute the CPI consists of fifty units of food and ten units of clothing.

	Food	Clothing
2002 price per unit	$4	$10
2003 price per unit	$6	$20

   a. What are the percentage increases in the price of food and in the price of clothing?
   b. What is the percentage increase in the CPI?
   c. Do these price changes affect all consumers to the same extent? Explain.

Solutions

Multiple-Choice Questions

1. c TOP: CPI
2. a TOP: CPI
3. d TOP: Inflation rate
4. b TOP: Inflation rate
5. a TOP: Inflation rate
6. d TOP: PPI/CPI
7. d TOP: CPI/Introduction of new goods
8. a TOP: CPI/Quality change
9. b TOP: CPI/GDP deflator
10. c TOP: Comparing dollar figures
11. b TOP: Nominal interest rate | Real interest rate
12. d TOP: Nominal interest rate | Real interest rate

Free Response Questions

1. a. The expected real interest rate was 4 percent (6 − 2).
   b. The actual real interest rate was 1 percent (6 − 5).
   c. George, the banker, lost because he received less real interest income than he expected. Jay and Joyce gained because they paid less real interest income than they expected.

   TOP: Real interest rate
2. a. The price of food increased by 50 percent ([6-4]/4 x 100). The price of clothing increased by 100 percent ([20-10]/10 x 100).
   b. In 2002, the market basket cost $300 (4x50 + 10x10); in 2003, it cost $500 (6x50 + 20x10). The percentage increase in the CPI is 66.7 percent ([500-300]/300 x 100).
   c. Because the price of clothing increased relatively more than the price of food, people who purchase a lot of clothing and little food became worse off relative to people who purchase a lot of food and little clothing.

   TOP: CPI