PRICES, THE CPI, AND INFLATION
When you have completed your study of this chapter, you will be able to:

1. Explain what the Consumer Price Index (CPI) is and how it is calculated.

2. Explain the limitations of the CPI as a measure of the cost of living.

3. Adjust money values for inflation and calculate real wage rates and real interest rates.
Consumer Price Index (CPI)

A measure of the average of the prices paid by urban consumers for a fixed market basket of consumer goods and services.
Reading the CPI Numbers

The CPI is defined to equal 100 for a period called the reference base period.

Reference base period

A period for which the CPI is defined to equal 100. Currently, the reference base period is 1982-1984.
In August 2002, the CPI was 181.

The average of the prices paid by urban consumers for a fixed market basket of consumer goods and services was 81 percent higher in September 2002 than it was on the average during 1982-1984.
22.1 THE CONSUMER PRICE INDEX

Constructing the CPI

Three stages:

• Selecting the CPI basket
• Conducting the monthly price survey
• Calculating the CPI
22.1 THE CONSUMER PRICE INDEX

The CPI Basket

Make the relative importance of the items in the CPI basket the same as in the budget of an average urban household.

CPI-U
  • Measures the average price paid by all urban households.

CPI-W
  • Measures the average price paid by urban wage earners and clerical workers.
Figure 22.1 shows the CPI basket. This shopping cart is filled with the items that an average household buys.
The Monthly Price Survey

Each month, BLS employees check the prices of the 80,000 goods and services in the CPI basket in 30 metropolitan areas.
22.1 THE CONSUMER PRICE INDEX

Calculating the CPI

The CPI calculation has three steps:

- Find the cost of the CPI basket at base period prices.
- Find the cost of the CPI basket at current period prices.
- Calculate the CPI for the base period and the current period.
Table 22.1 shows the consumer price index: a simplified CPI calculation.

(a) The cost of the CPI basket at base period prices: 2000

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price</th>
<th>Cost of CPI basket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oranges</td>
<td>10</td>
<td>$1 each</td>
<td>$10</td>
</tr>
<tr>
<td>Haircuts</td>
<td>5</td>
<td>$8 each</td>
<td>$40</td>
</tr>
</tbody>
</table>

Cost of CPI basket at base period prices: $50

(b) The cost of the CPI basket at current period prices: 2003

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price</th>
<th>Cost of CPI basket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oranges</td>
<td>10</td>
<td>$2 each</td>
<td>$20</td>
</tr>
<tr>
<td>Haircuts</td>
<td>5</td>
<td>$10 each</td>
<td>$50</td>
</tr>
</tbody>
</table>

Cost of CPI basket at current period prices: $70
22.1 THE CONSUMER PRICE INDEX

\[
\text{CPI} = \frac{\text{Cost of CPI basket at current period prices}}{\text{Cost of CPI basket at base period prices}} \times 100
\]

For 2000, the CPI is: $\frac{\$50}{\$50} \times 100 = 100$

For 2003, the CPI is: $\frac{\$70}{\$50} \times 100 = 140$
22.1 THE CONSUMER PRICE INDEX

Measuring Inflation

Inflation rate

The percentage change in the price level from one year to the next.

\[
\text{Inflation rate} = \frac{\text{CPI in current year} - \text{CPI in previous year}}{\text{CPI in previous year}} \times 100
\]

\[
\text{Inflation rate} = \frac{140 - 120}{120} \times 100 = 16.7 \text{ percent}
\]
22.1 THE CONSUMER PRICE INDEX

Figure 22.2 shows the CPI in part (a) and the inflation rate in part (b).

(a) CPI: 1972–2002

(b) CPI inflation rate: 1972–2002
In part (a), the price level has increased every year. The rate of increase was rapid during the early 1980s and slower during the 1990s.
In part (b), the inflation rate was high during the early 1980s, but low during the 1990s.
Monthly Price Changes, 1918-2003

The graph shows the monthly price changes from 1918 to 2003. The y-axis represents the 1 month percent change, while the x-axis represents the month over time. The data indicates fluctuations in price changes, with some months showing significant rises and falls.
Summary of US Price Level and Inflation Data, 1665-estimated 2013

US Price Levels 1665 to estimated 2013, with 2002 = 100

Estimated Yearly Inflation or Deflation Rate 1665 to 1914, in Percent

The Biased CPI

The main sources of bias in the CPI are:

- New goods bias
- Quality change bias
- Commodity substitution bias
- Outlet substitution bias
New Goods Bias

- New goods do a better job than the old goods that they replace, but cost more.
- The arrival of new goods puts an upward bias into the CPI and its measure of the inflation rate.

Quality Change Bias

- Better cars and CD players cost more than the versions they replace.
- A price rise that is a payment for improved quality is not inflation but might get measured as inflation.
Commodity Substitution Bias

- If the price of beef rises faster than the price of chicken, people buy more chicken and less beef.
- The CPI basket doesn’t change to allow for the effects of substitution between goods.

Outlet Substitution Bias

- If prices rise more rapidly, people use discount stores more frequently.
- The CPI basket doesn’t change to allow for the effects of outlet substitution.
The Magnitude of the Bias

The Boskin Commission estimated the bias to be 1.1 percentage points per year.

If the inflation rate reported is 3.1 percent, the true inflation rate is probably 2.0 percent.

To reduce the bias, the BLS has decided to increase the frequency of its Consumer Expenditure Survey and to revise the CPI basket every two years.
Two Consequences of the CPI Bias

Two main consequences of the upward bias in the CPI are:

• Distortion of private agreements
• Increases in government outlays

Distortion of private agreements

Many private agreements, such as wage contracts, are linked to the CPI.

If the CPI is biased, these agreements might deliver an outcome different from that intended by the parties.
Table 22.2 shows a three-year wage deal.

<table>
<thead>
<tr>
<th></th>
<th>Fixed increase (percent)</th>
<th>CPI increase (percent)</th>
<th>Wage rate (dollars per hour)</th>
<th>True price increase (percent)</th>
<th>Intended wage rate (dollars per hour)</th>
<th>Wage bias (dollars per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initially</td>
<td></td>
<td></td>
<td>28.00</td>
<td>1.9</td>
<td>28.00</td>
<td>—</td>
</tr>
<tr>
<td>After 1 year</td>
<td>2</td>
<td>3</td>
<td>29.40</td>
<td>1.9</td>
<td>29.09</td>
<td>0.31</td>
</tr>
<tr>
<td>After 2 years</td>
<td>2</td>
<td>3</td>
<td>30.87</td>
<td>1.9</td>
<td>30.23</td>
<td>0.64</td>
</tr>
<tr>
<td>After 3 years</td>
<td>2</td>
<td>3</td>
<td>32.41</td>
<td>1.9</td>
<td>31.40</td>
<td>1.01</td>
</tr>
</tbody>
</table>

In this example, the wage rate rises by $1.01 more than the agreement intended because of CPI bias.
Increases in Government Outlays

Close to a third of federal government outlays are linked directly to the CPI.

The CPI is used to adjust:

- 48 million Social Security benefit payments
- 22 million food stamp payments
- 4 million pensions for retired military personnel, federal civil servants, and their surviving spouses
- the budget for 27 million school lunches
The GDP Deflator: A Better Measure?

In principle, the GDP deflator is not subject to the biases of the CPI because it uses the basket of goods and services produced in the current year and the preceding year.

In practice, the GDP deflator suffers from some of the CPI’s problems because the Commerce Department does not directly measure the physical quantities of all the goods and services that are produced.
Instead, to estimate quantities, the Commerce Department divides expenditures by price indexes. And one of these price indexes is the CPI. So the biased CPI injects a bias into the GDP deflator.
Figure 22.3 shows the two measures of inflation in part (a) and the corresponding two measures of the price level in part (b).
The two measures of the inflation rate in part (a) fluctuate together, but the CPI measure rises more rapidly than the GDP deflator measure.
In part (b), and the price levels get farther apart.

Both measures probably overstate the inflation rate.
22.3 NOMINAL AND REAL VALUES

Dollars and Cents at Different Dates

To compare dollar amounts at different dates, we need to know the CPI at those dates.

Convert the price of a 2-cent stamp in 1902 into its 2002 equivalent:

Price of stamp in 2002 dollars = \[ \frac{\text{Price of stamp in 1902 dollars} \times \frac{\text{CPI in 2002}}{\text{CPI in 1902}}}{9} \]

= 2 cents \times \frac{180.3}{9} = 40 \text{ cents}
US First Class Postage Rates in Current and Constant (2002) cents for First Ounce, 1863 to 2003

Until 1845, postage was based on number of sheets in a letter and distance traveling. From 1845 until 1863, postage was based on weight and distance. From 1863 to 1885, price was for the first half ounce. Beginning 1975, price for each additional ounce is less than for the first ounce.

Source of current-cent prices: http://www.usps.com/history/hs4_5.htm#DOM

Legend:
- Orange: Non Inflation-adjusted Cents
- Blue: Constant (2002) Cents
Nominal and Real Values in Macroeconomics

Macroeconomics makes a big issue of the distinction between nominal values and real values:

- Nominal GDP and real GDP
- Nominal wage rate and real wage rate
- Nominal interest rate and real interest rate

We studied the distinction between and calculation of nominal and real GDP in Chapter 5. Here, we’ll look at the other two.
Nominal and Real Wage Rates

Nominal wage rate
The average hourly wage rate measured in current dollars.

Real wage rate
The average hourly wage rate measured in the dollars of a given reference base year.
To calculate the real wage rate, we divide the nominal wage rate by the CPI and multiply by 100. That is:

$$\text{Real wage rate in 2002} = \frac{\text{Nominal wage rate in 2002}}{\text{CPI in 2002}} \times 100$$

Real wage rate in 2002 = \frac{14.76}{180.3} \times 100 = $8.19

The $8.19 amount is in 1982-1984 dollars.
Figure 22.4 shows nominal and real wage rates: 1972–2002.

The nominal wage rate has increased every year since 1972.

The real wage rate decreased during the late 1970s and increased during the late 1990s.
Summary of President and Congress Pay Data


Data prior to 1913 should be considered approximations. This chart assumes the presidential pay increase to $400,000 in January 2001 remains through 2010 and yearly inflation is the average of CBO and OMB early 2002 estimates. Starting in 1949 presidents also have had a $50,000 per year expense account, worth about $380,000 that year in dollars of 2000. Source of current-dollar presidential pay: Congressional Quarterly's Guide to the Presidency, at http://www.cq.com/docs/nepres/ html. Calculations for 1789-1913 use data from John J. McCusker, "How Much Is That in Real Money?" revised. Proceedings of the American Antiquarian Society (2001), Table A-1.
Presidents Ranked from Highest Paid to Lowest Paid in Inflation-adjusted Dollars

- William H. Taft
- Woodrow Wilson
- William McKinley
- Grover Cleveland
- McKinley/T. Roosevelt
- Benjamin Harrison
- Theodore Roosevelt
- Franklin D. Roosevelt
- Richard M. Nixon
- Grover Cleveland
- Herbert Hoover
- Garfield/Arthur
- Rutherford B. Hayes
- Harding/Coolidge
- Calvin Coolidge
- Nixon/Gerald Ford
- Harry Truman
- Dwight D. Eisenhower
- Kennedy/Johnson
- Zachary Taylor
- Ulysses S. Grant
- James K. Polk
- John Tyler
- Lyndon B. Johnson
- James Garfield
- Franklin Pierce
- James Buchanan
- Andrew Jackson
- Martin Van Buren
- John Quincy Adams
- Washington
- George W. Bush
- Abraham Lincoln
- James Monroe
- Thomas Jefferson
- President 1804
- John Adams
- Ronald Reagan
- President 1804
- James Madison
- Lincoln/A. Johnson
- George H. W. Bush
- William J. Clinton

-$0$  $250,000$  $500,000$  $750,000$  $1,000,000$  $1,250,000$  $1,500,000$
Nominal and Real Interest Rates

Nominal interest rate
The percentage return on a loan expressed in dollars.

Real interest rate
The percentage return on a loan expressed in purchasing power—the nominal interest rate adjusted for the effects of inflation.

Real interest rate = Nominal interest rate – Inflation rate
Figure 22.5 shows real and nominal interest rates: 1972–2002.

During the 1970s, the real interest rate became negative.

The nominal interest rate increased during the high-inflation 1980s.
The Costs of Inflation

- The costs of inflation are less obvious than those of unemployment, yet people certainly fear it.
- **Inflation and Real Wages:** Inflation does *not* typically erode real wages in the US, because increases in nominal wages compensate for the rising prices.
<table>
<thead>
<tr>
<th>Reasons for Wages to Increase</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher productivity</td>
<td>2%</td>
</tr>
<tr>
<td>Compensation for higher prices</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>5%</td>
</tr>
</tbody>
</table>
The Costs of Inflation

• The Illusion of Traditional “Fair” Prices: Inflation does not necessarily lead to unfair prices.
• The Importance of Relative Prices: Inflation is not usually to blame when some goods become more expensive relative to others.
## Pure Inflation

<table>
<thead>
<tr>
<th>Item</th>
<th>Last Year’s Price</th>
<th>This Year’s Price</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candy bar</td>
<td>$0.50</td>
<td>$0.55</td>
<td>10%</td>
</tr>
<tr>
<td>Movie ticket</td>
<td>6.00</td>
<td>6.60</td>
<td>10</td>
</tr>
<tr>
<td>Automobile</td>
<td>9,000</td>
<td>9,900</td>
<td>10</td>
</tr>
</tbody>
</table>
# REAL INFLATION

<table>
<thead>
<tr>
<th>Item</th>
<th>Last Year’s Price</th>
<th>This Year’s Price</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candy bar</td>
<td>$0.50</td>
<td>$0.50</td>
<td>0%</td>
</tr>
<tr>
<td>Movie ticket</td>
<td>6.00</td>
<td>7.50</td>
<td>25</td>
</tr>
<tr>
<td>Automobile</td>
<td>9,000</td>
<td>9,450</td>
<td>5</td>
</tr>
</tbody>
</table>
Inflation as a Redistributor of Income and Wealth

- Because inflation does not proceed evenly, it redistributes income and wealth in arbitrary, unfair ways.
- It systematically discriminates against people on fixed incomes, and it may favor borrowers at the expense of lenders.
Real versus Nominal Interest Rates

• Nominal rate of interest = Real interest rate + expected rate of inflation
• Real rate of interest = Nominal interest rate - expected rate of inflation
Real versus Nominal Interest Rates

• Inflation that is accurately anticipated need not redistribute wealth between borrowers and lenders.
  – The nominal interest rate will include an adequate inflation premium, above the real interest rate.

• If the actual inflation rate turns out to be different from the expected rate unanticipated redistribution will occur.
Inflation Distorts Measurements

- Many laws and regulations that were designed for an inflation-free economy malfunction when inflation is high.
- These costs of inflation are not purely redistributive.
- Society as a whole loses when mutually beneficial transactions are prohibited by dysfunctional legislation.
Examples of Extreme Inflation – Hyperinflation

Inflation Rates over time for Select Countries

Percent change in the CPI (1995=100)

Year

Bolivia  Brazil  France  Israel  United States
Examples of Extreme Inflation – Hyperinflation

Inflation Rates over time for Select Countries

Percent change in the CPI (1995=100)

Bolivia  Brazil  France  Israel  United States
Examples of Extreme Inflation – Hyperinflation

Inflation Rates over time for Select Countries

Year

-5000 0 5000 10000 15000

Percent change in the CPI (1995=100)


Bolivia Brazil France Israel United States
Inflation Distorts Measurements

Examples of Inflation Distortions

• Confusing real and nominal interest rates
  – Hides the true economic cost of borrowing money.
  – Many Americans viewed the 12% mortgage interest rates that banks charged in 1980 as scandalously high while they saw the 7% mortgage rates of 1998 as a great bargain.
  – In truth, however, the real interest rate in 1998 (about 5%) was well above the bargain-basement real rates in 1980 (about 2%).
Other Costs of Inflation

- The uncertainty created by inflation may inhibit long-term contracts.
- Inflation may impose real costs on shoppers, whose level of information about relative prices deteriorates.
The Costs of Low versus High Inflation

- Inflation creates fewer social problems if
  - It is low rather than high.
  - It is steady (and therefore relatively predictable) rather than variable.
U.S. INFLATION RATE, 1870-1998

- Post-Civil War deflation
- World War I
- Great Depression
- World War II
- Postwar adjustment
- Inflation of the 1970s
- Disinflation of the 1980s
- Vietnam War inflation
- Post-1950

Year: 1870-2000
Percentage Inflation Rate