The Consumer Price Index (CPI)

- measures the typical consumer’s cost of living
- the basis of cost of living adjustments (COLAs) in many contracts and in Social Security
How the CPI Is Calculated

1. *Fix the (          ).*
The Bureau of Labor Statistics (BLS) surveys consumers to determine what’s in the typical consumer’s “shopping basket.”

2. *Find the (          ).*
The BLS collects data on the prices of all the goods in the basket.

3. *Compute the (          ).*
Use the prices to compute the total cost of the basket.

4. *Choose a base year and compute the index.*
The CPI in any year equals 100 \times \frac{\text{cost of basket in current year}}{\text{cost of basket in base year}}

5. *Compute the inflation rate.*
The percentage change in the CPI from the preceding period.

\[
\text{Inflation rate} = \frac{\text{CPI this year} - \text{CPI last year}}{\text{CPI last year}} \times 100\%
\]
EXAMPLE

basket: \{4 pizzas, 10 lattes\}

<table>
<thead>
<tr>
<th>year</th>
<th>price of pizza</th>
<th>price of latte</th>
<th>cost of basket</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>$10</td>
<td>$2.00</td>
<td>$60</td>
</tr>
<tr>
<td>2008</td>
<td>$11</td>
<td>$2.50</td>
<td>$69</td>
</tr>
<tr>
<td>2009</td>
<td>$12</td>
<td>$3.00</td>
<td>$78</td>
</tr>
</tbody>
</table>

Compute CPI in each year using 2007 base year:

\[
\text{CPI 2007: } 100 \times \left( \frac{\text{cost of basket}}{\text{base year cost of basket}} \right) = 100 \\
\text{CPI 2008: } 100 \times \left( \frac{\$69}{\$60} \right) = 115 \\
\text{CPI 2009: } 100 \times \left( \frac{\$78}{\$60} \right) = 130
\]

\[
\text{Inflation rate: } \frac{130 - 115}{115} \times 100\% = 13\% \\
\text{Inflation rate: } \frac{115 - 100}{100} \times 100\% = 15\%
\]

MEASURING THE COST OF LIVING

ACTIVE LEARNING

1. Calculate the CPI

CPI basket:
\{10 lbs beef, 20 lbs chicken\}

The CPI basket cost $120 in 2004, the base year.

A. Compute the CPI in 2005.

B. What was the CPI inflation rate from 2005-2006?
**ACTIVE LEARNING 1**

**Answers**

CPI basket:
{10 lbs beef, 20 lbs chicken}

The CPI basket cost $120 in 2004, the base year.

A. Compute the CPI in 2005:

Cost of CPI basket in 2005
\[= (\$5 \times 10) + (\$5 \times 20) = \$150\]

CPI in 2005 = 100 x \(\frac{\$150}{\$120}\) = 125


<table>
<thead>
<tr>
<th>Year</th>
<th>Price of beef</th>
<th>Price of chicken</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>$4</td>
<td>$4</td>
</tr>
<tr>
<td>2005</td>
<td>$5</td>
<td>$5</td>
</tr>
<tr>
<td>2006</td>
<td>$9</td>
<td>$6</td>
</tr>
</tbody>
</table>

B. What was the inflation rate from 2005-2006?

Cost of CPI basket in 2006
\[= (\$9 \times 10) + (\$6 \times 20) = \$210\]

CPI in 2006 = 100 x \(\frac{\$210}{\$120}\) = 175

CPI inflation rate = \(\frac{175 - 125}{125}\) = 40%
What’s in the CPI’s Basket?

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>43%</td>
</tr>
<tr>
<td>Transportation</td>
<td>17%</td>
</tr>
<tr>
<td>Food &amp; Beverages</td>
<td>15%</td>
</tr>
<tr>
<td>Medical care</td>
<td>6%</td>
</tr>
<tr>
<td>Recreation</td>
<td>6%</td>
</tr>
<tr>
<td>Education and communication</td>
<td>6%</td>
</tr>
<tr>
<td>Apparel</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
</tr>
</tbody>
</table>

CPI basket: {10# beef, 20# chicken}

2004-5: Households bought CPI basket.

<table>
<thead>
<tr>
<th>Year</th>
<th>Beef</th>
<th>Chicken</th>
<th>Cost of CPI basket</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>$4</td>
<td>$4</td>
<td>$120</td>
</tr>
<tr>
<td>2005</td>
<td>$5</td>
<td>$5</td>
<td>$150</td>
</tr>
<tr>
<td>2006</td>
<td>$9</td>
<td>$6</td>
<td>$210</td>
</tr>
</tbody>
</table>

2006: Households bought {5 lbs beef, 25 lbs chicken}.

A. Compute cost of the 2006 household basket.

B. Compute % increase in cost of household basket over 2005-6, compare to CPI inflation rate.
A C T I V E  L E A R N I N G  2  
Answers

CPI basket:  
{10# beef,  
20# chicken}

Household basket in 2006:  
{5# beef,  
25# chicken}

<table>
<thead>
<tr>
<th>Year</th>
<th>beef</th>
<th>chicken</th>
<th>cost of CPI basket</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>$4</td>
<td>$4</td>
<td>$120</td>
</tr>
<tr>
<td>2005</td>
<td>$5</td>
<td>$5</td>
<td>$150</td>
</tr>
<tr>
<td>2006</td>
<td>$9</td>
<td>$6</td>
<td>$210</td>
</tr>
</tbody>
</table>

A. Compute cost of the 2006 household basket.  
($9 \times 5) + ($6 \times 25) = $195

B. Compute % increase in cost of household basket over 2005-6, compare to CPI inflation rate.  
Rate of increase:  
\[
\frac{($195 - $150)}{$150} = 30\% 
\]
CPI inflation rate from previous problem = 40%
Problems with the CPI:  
*Substitution Bias*

- Over time, some prices rise faster than others.
- Consumers substitute toward goods that become relatively cheaper.
- The ( ) misses this substitution because it uses a fixed basket of goods.
- Thus, the CPI overstates increases in the cost of living.

Problems with the CPI:  
*Introduction of ( )*

- The introduction of new goods increases variety, allows consumers to find products that more closely meet their needs.
- In effect, dollars become more valuable.
- The CPI misses this effect because it uses a fixed basket of goods.
- Thus, the CPI overstates increases in the cost of living.
**Problems with the CPI:**

*Unmeasured (  ) Change*

- Improvements in the quality of goods in the basket increase the value of each dollar.
- The BLS tries to account for quality changes but probably misses some, as quality is hard to measure.
- Thus, the CPI overstates increases in the cost of living.

---

**Problems with the CPI**

- Each of these problems causes the CPI to overstate cost of living increases.
- The BLS has made technical adjustments, but the CPI probably still overstates inflation by about 0.5 percent per year.
- This is important because Social Security payments and many contracts have COLAs tied to the CPI.
Two Measures of Inflation, 1950-2007

Contrasting the CPI and GDP Deflator

Imported consumer goods:
- included in CPI
- excluded from GDP deflator

Capital goods:
- excluded from CPI
- included in GDP deflator (if produced domestically)

The basket:
- CPI uses fixed basket
- GDP deflator uses basket of currently produced goods & services
This matters if different prices are changing by different amounts.
In each scenario, determine the effects on the CPI and the GDP deflator.

A. Starbucks raises the price of Frappuccinos.

B. Caterpillar raises the price of the industrial tractors it manufactures at its Illinois factory.

C. Armani raises the price of the Italian jeans it sells in the U.S.

---

**CPI vs. GDP deflator**

A. Starbucks raises the price of Frappuccinos.  
The CPI and GDP deflator both rise.

B. Caterpillar raises the price of the industrial tractors it manufactures at its Illinois factory.  
The GDP deflator rises, the CPI does not.

C. Armani raises the price of the Italian jeans it sells in the U.S.  
The CPI rises, the GDP deflator does not.
Correcting Variables for Inflation:
Comparing Dollar Figures from Different Times

- Inflation makes it harder to compare dollar amounts from different times.

- Example: the minimum wage
  - $1.15 in Dec 1964
  - $5.85 in Dec 2007

- Did min wage have more purchasing power in Dec 1964 or Dec 2007?

- To compare, use CPI to convert 1964 figure into “today’s dollars”…

### Correcting Variables for Inflation:
Comparing Dollar Figures from Different Times

<table>
<thead>
<tr>
<th>Amount in today’s dollars</th>
<th>Amount in year ( T ) dollars</th>
<th>Price level today</th>
<th>Price level in year ( T )</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7.78</td>
<td>$1.15</td>
<td>211.7</td>
<td>31.3</td>
</tr>
</tbody>
</table>

- In our example,
  - year \( T = 12/1964 \), “today” = 12/2007
  - Min wage = $1.15 in year \( T \)
  - CPI = 31.3 in year \( T \), CPI = 211.7 today

\[
\text{The minimum wage in 1964 was } \$7.78 \text{ in today’s (2007) dollars.}
\]

\[
\$7.78 = \frac{1.15 \times 211.7}{31.3}
\]
Correcting Variables for Inflation: Comparing Dollar Figures from Different Times

- Researchers, business analysts and policymakers often use this technique to convert a time series of current-dollar (nominal) figures into constant-dollar (real) figures.
- They can then see how a variable has changed over time after correcting for inflation.
- Example: the minimum wage, from Jan 1950 to Dec 2007…

The U.S. Minimum Wage in Current Dollars and Today’s Dollars, 1950-2007
Annual tuition and fees, average of all public four-year colleges & universities in the U.S.

- 1986-87: $1,414  (1986 CPI = 109.6)
- 2006-07: $5,834  (2006 CPI = 203.8)

After adjusting for inflation, did students pay more for college in 1986 or in 2006? Convert the 1986 figure to 2006 dollars and compare.

**Solution**

Convert 1986 figure into “today’s dollars”

$1,414 \times \left( \frac{203.8}{109.6} \right) = \$2,629$

Even after correcting for inflation, tuition and fees were much lower in 1986 than in 2006!
Correcting Variables for Inflation:  
**Indexation**

A dollar amount is **indexed** for inflation if it is automatically corrected for inflation by law or in a contract.

For example, the increase in the CPI automatically determines

- the COLA in many multi-year labor contracts
- the adjustments in Social Security payments and federal income tax brackets

---

**Correcting Variables for Inflation:  
Real vs. Nominal Interest Rates**

The nominal interest rate:

- the interest rate **not** corrected for inflation
- the rate of growth in the dollar value of a deposit or debt

The real interest rate:

- corrected for inflation
- the rate of growth in the purchasing power of a deposit or debt

Real interest rate  
= (nominal interest rate) – (inflation rate)
Correcting Variables for Inflation:
Real vs. Nominal Interest Rates

Example:

- Deposit $1,000 for one year.
- Nominal interest rate is 9%.
- During that year, inflation is 3.5%.
- Real interest rate
  \[= \text{Nominal interest rate} - \text{Inflation}\]
  \[= 9.0\% - 3.5\% = 5.5\%\]
- The purchasing power of the $1000 deposit has grown 5.5%.

Real and Nominal Interest Rates in the U.S.,
1950-2007
The Consumer Price Index is a measure of the cost of living. The CPI tracks the cost of the typical consumer’s “basket” of goods & services.

The CPI is used to make Cost of Living Adjustments and to correct economic variables for the effects of inflation.

The real interest rate is corrected for inflation and is computed by subtracting the inflation rate from the nominal interest rate.