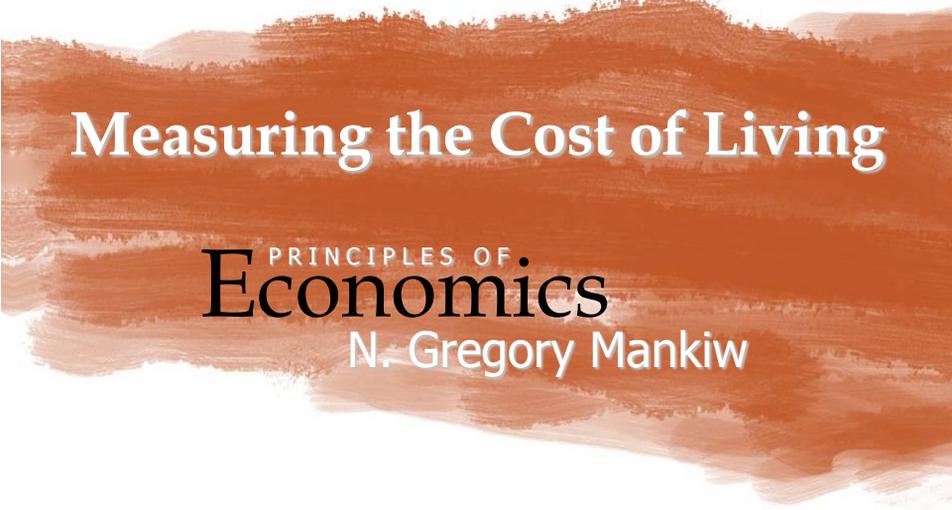


## CHAPTER 24



# Measuring the Cost of Living

PRINCIPLES OF  
**Economics**  
N. Gregory Mankiw

## 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.

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## How the CPI Is Calculated

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.

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

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**EXAMPLE**

basket: {4 pizzas, 10 lattes}

year	price of pizza	price of latte	cost of basket
2007	\$10	\$2.00	$\$10 \times 4 + \$2 \times 10 = \$60$
2008	\$11	\$2.50	$\$11 \times 4 + \$2.5 \times 10 = \$69$
2009	\$12	\$3.00	$\$12 \times 4 + \$3 \times 10 = \$78$

Compute CPI in each year using 2007 as the base year:

$$\begin{array}{l}
 2007: 100 \times (\$60/\$60) = 100 \\
 2008: 100 \times (\$69/\$60) = 115 \\
 2009: 100 \times (\$78/\$60) = 130
 \end{array}
 \left. \begin{array}{l} \\ \\ \\ \end{array} \right\}
 \begin{array}{l}
 15\% = \frac{115 - 100}{100} \times 100\% \\
 13\% = \frac{130 - 115}{115} \times 100\%
 \end{array}$$

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**ACTIVE LEARNING 1****Calculate the CPI**

CPI basket:

{10 lbs beef,  
20 lbs chicken}

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

	price of beef	price of chicken
2004	\$4	\$4
2005	\$5	\$5
2006	\$9	\$6

- A. Compute the CPI in 2005.
- B. What was the CPI inflation rate from 2005-2006?

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## ACTIVE LEARNING 1

## Answers

CPI basket:

{10 lbs beef,  
20 lbs chicken}

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

	<i>price of beef</i>	<i>price of chicken</i>
2004	\$4	\$4
2005	\$5	\$5
2006	\$9	\$6

**A.** Compute the CPI in 2005:

Cost of CPI basket in 2005

$$= (\$5 \times 10) + (\$5 \times 20) = \$150$$

$$\text{CPI in 2005} = 100 \times (\$150/\$120) = 125$$

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## ACTIVE LEARNING 1

## Answers

CPI basket:

{10 lbs beef,  
20 lbs chicken}

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

	<i>price of beef</i>	<i>price of chicken</i>
2004	\$4	\$4
2005	\$5	\$5
2006	\$9	\$6

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

Cost of CPI basket in 2006

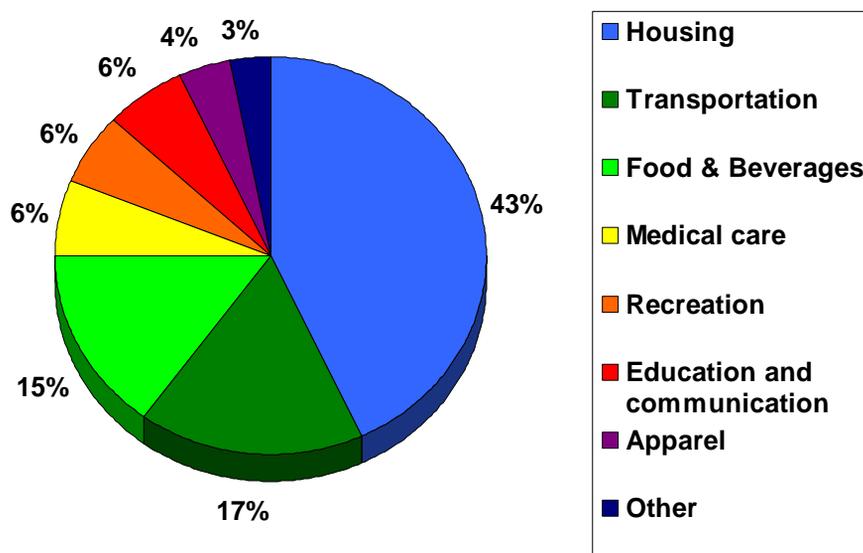
$$= (\$9 \times 10) + (\$6 \times 20) = \$210$$

$$\text{CPI in 2006} = 100 \times (\$210/\$120) = 175$$

$$\text{CPI inflation rate} = (175 - 125)/125 = 40\%$$

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## What's in the CPI's Basket?



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### ACTIVE LEARNING 2 Substitution bias

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

2004-5:  
Households  
bought CPI basket.

	<i>beef</i>	<i>chicken</i>	<i>cost of CPI basket</i>
2004	\$4	\$4	\$120
2005	\$5	\$5	\$150
2006	\$9	\$6	\$210

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

- Compute cost of the 2006 household basket.
- Compute % increase in cost of household basket over 2005-6, compare to CPI inflation rate.

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## ACTIVE LEARNING 2

## Answers

CPI basket:

{10# beef,  
20# chicken}

Household

basket in 2006:

{5# beef,  
25# chicken}

	<i>beef</i>	<i>chicken</i>	<i>cost of CPI basket</i>
2004	\$4	\$4	\$120
2005	\$5	\$5	\$150
2006	\$9	\$6	\$210

A. Compute cost of the 2006 household basket.

$$(\$9 \times 5) + (\$6 \times 25) = \$195$$

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## ACTIVE LEARNING 2

## Answers

CPI basket:

{10# beef,  
20# chicken}

Household

basket in 2006:

{5# beef,  
25# chicken}

	<i>beef</i>	<i>chicken</i>	<i>cost of CPI basket</i>
2004	\$4	\$4	\$120
2005	\$5	\$5	\$150
2006	\$9	\$6	\$210

B. Compute % increase in cost of household basket over 2005-6, compare to CPI inflation rate.

$$\text{Rate of increase: } (\$195 - \$150)/\$150 = 30\%$$

$$\text{CPI inflation rate from previous problem} = 40\%$$

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## 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.

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## 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.

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## 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.

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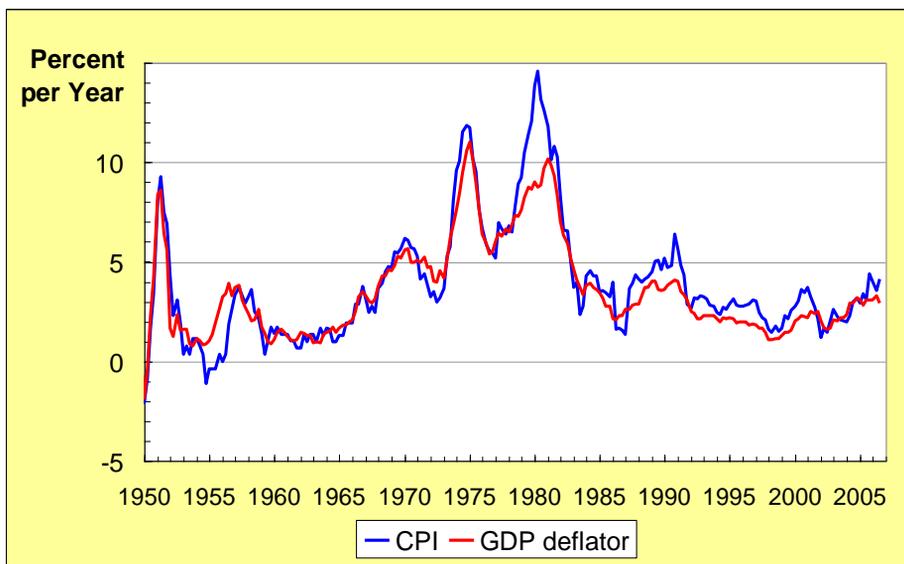
## Problems with the CPI

- 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.

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## Two Measures of Inflation, 1950-2007



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## 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.

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### ACTIVE LEARNING 3

## CPI vs. GDP deflator

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.

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### ACTIVE LEARNING 3

## Answers

- 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.*

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## 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”...

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

Amount in today's dollars	=	Amount in year $T$ dollars	x	$\frac{\text{Price level today}}{\text{Price level in year } T}$
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- 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

*The minimum wage  
in 1964 was \$7.78  
in today's (2007) dollars.*

$$\$7.78 = \$1.15 \times \frac{211.7}{31.3}$$

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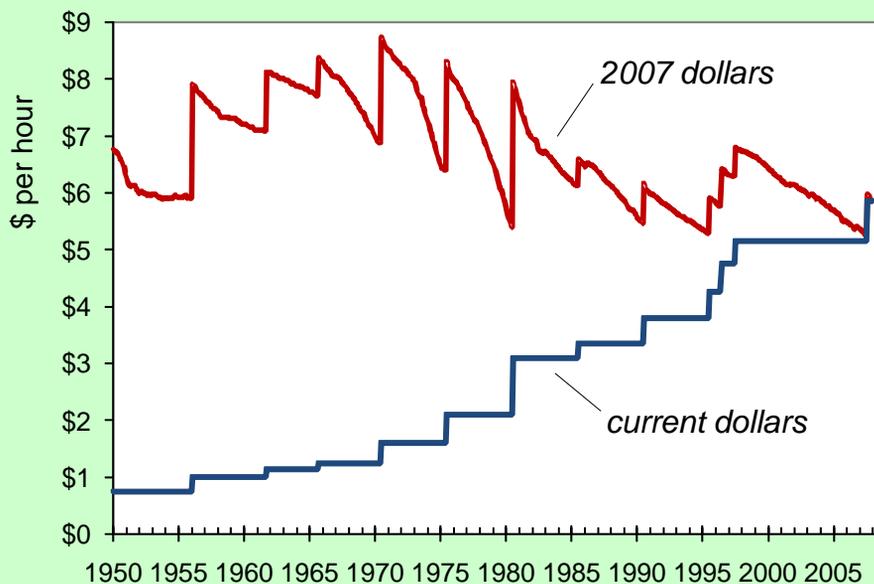
## Correcting Variables for Inflation: Comparing Dollar Figures from Different Times

- 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...

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### The U.S. Minimum Wage in Current Dollars and Today's Dollars, 1950-2007



## ACTIVE LEARNING 4

### Converting to “today’s dollars”

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.

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## ACTIVE LEARNING 4

### Answers

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)

#### Solution

Convert 1986 figure into “today’s dollars”

$$\$1,414 \times (203.8/109.6) = \underline{\$2,629}$$

Even after correcting for inflation, tuition and fees were much lower in 1986 than in 2006!

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## 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

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## 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**

$$= (\text{nominal interest rate}) - (\text{inflation rate})$$

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

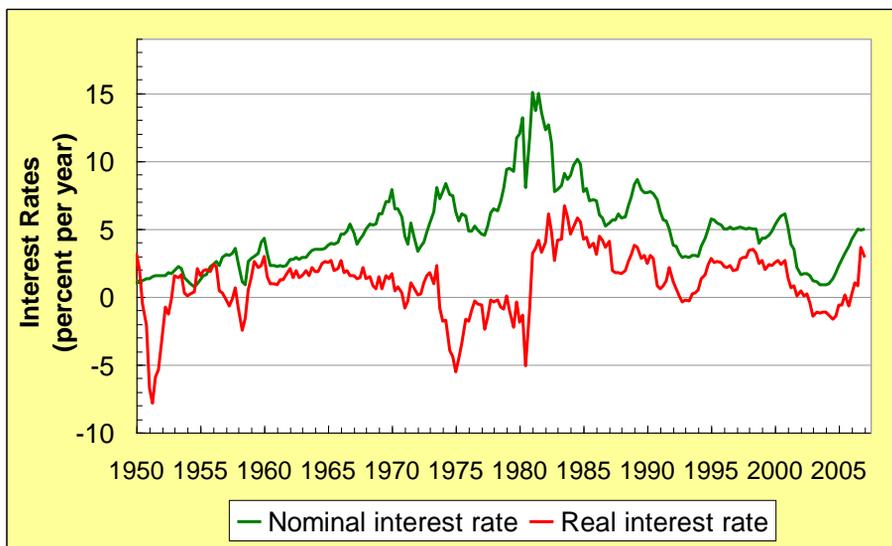
Example:

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

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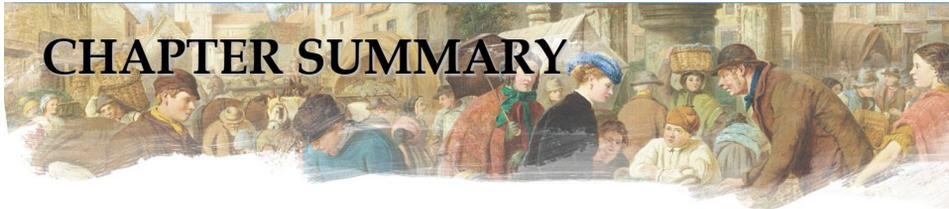
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## Real and Nominal Interest Rates in the U.S., 1950-2007



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- 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.