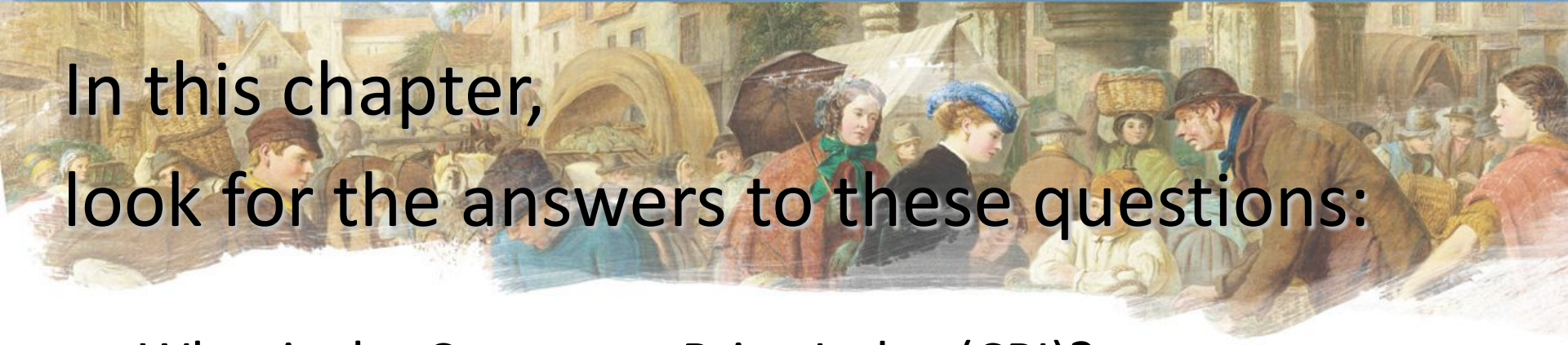
Measuring the Cost of Living

PRINCIPLES OF
Economics

N. Gregory Mankiw



In this chapter, look for the answers to these questions:

- What is the Consumer Price Index (CPI)? How is it calculated? What's it used for?
- What are the problems with the CPI? How serious are they?
- How does the CPI differ from the GDP deflator?
- How can we use the CPI to compare dollar amounts from different years? Why would we want to do this, anyway?
- How can we correct interest rates for inflation?

Measuring Price Level and Inflation

In the previous chapter, we introduced the **GDP deflator** as a measure of the price level.

It is the broadest measure of price level, as it include the price of every final g&s.

However, for some purposes, we want a narrower measure…

The Consumer Price Index (CPI)

- an average of the prices of the goods and services purchased by the typical urban family of four.
- measures the typical consumer's cost of living

The Consumer Price Index (CPI)

- ***Data***
- USA: Bureau of the Census (BLS)
- http://www.bls.gov/
- composite CPI, CPI (A), CPI (B) etc.

- releases the information every month

(1) How the CPI Is Calculated

1. ***Fix the "basket."***
   The government statistical agency (Bureau of Labor Statistics, BLS, in USA) surveys consumers to determine what's in the typical consumer's "shopping basket."
2. ***Find the prices.***
   The government statistical agency (such as BLS) collects data on the prices of all the goods in the basket.
3. ***Compute the basket's cost.***
   Use the prices to compute the total cost of the basket.

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.

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

EXAMPLE

basket: {4 pizzas, 10 lattes}

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

Compute CPI in each year using 2007 base year:

2007: 100 x (\$60/\$60) = 100

2008: 100 x (\$69/\$60) = 115

2009: 100 x (\$78/\$60) = 130

Inflation rate:

$$15\% = \frac{115-100}{100} \times 100\%$$

$$13\% = \frac{130-115}{115} \times 100\%$$

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?

ACTIVE LEARNING 1
Answers

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:

Cost of CPI basket in 2005
= ($5 x 10) + ($5 x 20) = $150

CPI in 2005 = 100 x ($150/$120) = 125

ACTIVE LEARNING *1*
Answers

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

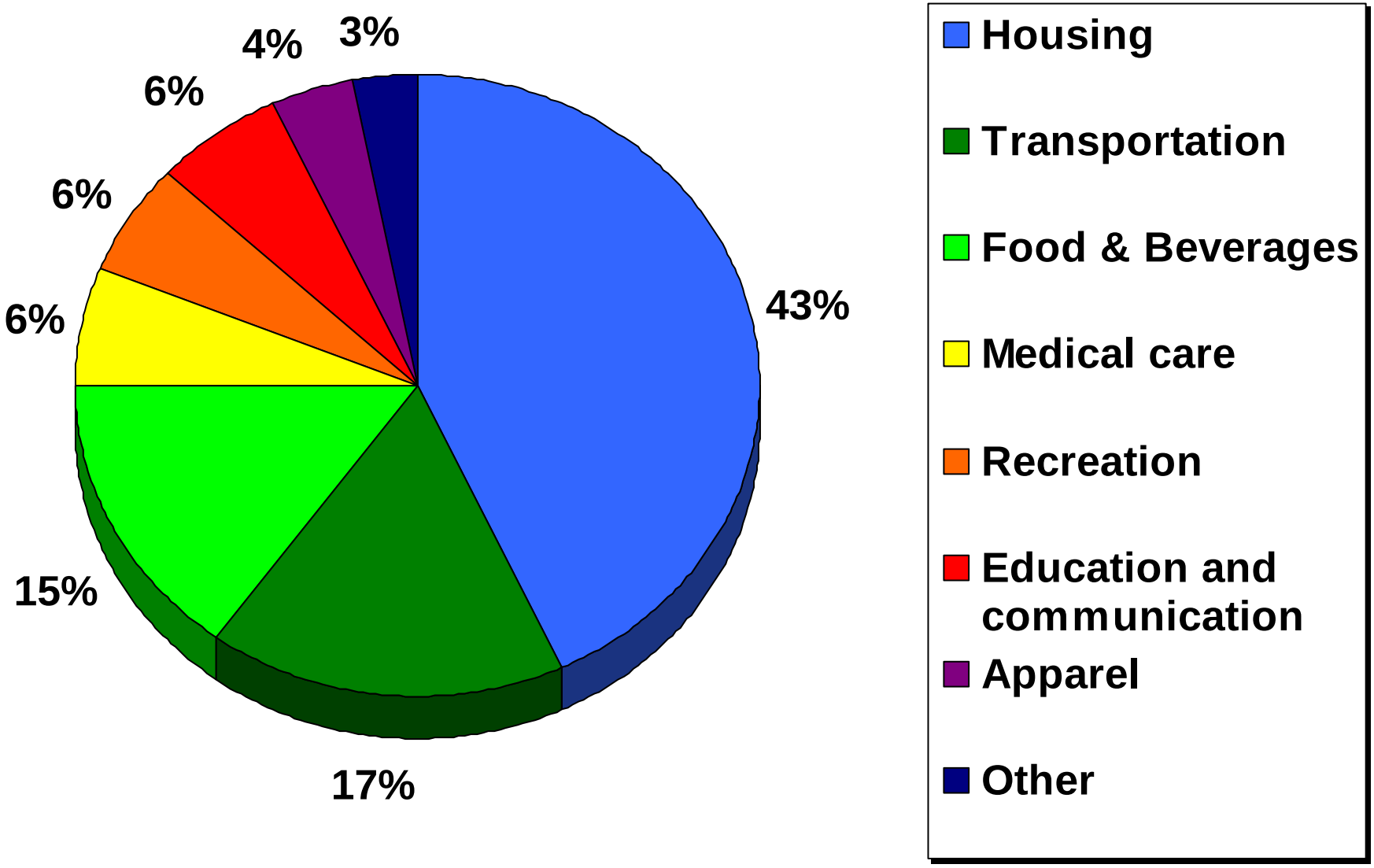
B. What was the inflation rate from 2005-2006?

Cost of CPI basket in 2006
= ($9 x 10) + ($6 x 20) = $210

CPI in 2006 = 100 x ($210/$120) = 175

CPI inflation rate = (175 – 125)/125 = 40%

What's in the US CPI's Basket?



(2) Problems with the CPI: *Substitution Bias*

- Over time, some prices rise faster than others. They do not change by the same percentage.
- Consumers substitute toward goods that become relatively cheaper.
- The CPI misses this substitution because it uses a fixed basket of goods.
- Thus, the CPI overstates increases in the cost of living.

ACTIVE LEARNING 2

Substitution bias

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

2004-5:
Households
bought CPI basket.

	beef	*chicken*	*cost of CPI basket*
2004	$4	$4	$120
2005	$5	$5	$150
2006	$9	$6	$210

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, and compare to CPI inflation rate.

ACTIVE LEARNING 2
Answers

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

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

	beef	*chicken*	*cost of CPI basket*
2004	$4	$4	$120
2005	$5	$5	$150
2006	$9	$6	$210

A. Compute cost of the 2006 household basket.

($9 x 5) + ($6 x 25) = $195

ACTIVE LEARNING 2
Answers

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

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

	beef	*chicken*	*cost of CPI basket*
2004	$4	$4	$120
2005	$5	$5	$150
2006	$9	$6	$210

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

Rate of increase: ($195 – $150)/$150 = 30%

CPI inflation rate = 40% (from previous problem)

Problems with the CPI:
Introduction of New Goods

- The introduction of new goods increases variety, allows consumers to find products that more closely meet their needs.
- In effect, dollars become more "valuable" when more goods are available.
- 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

- Each of these problems causes the CPI to overstate cost of living increases.
- The government statistical agency (such as BLS) has made technical adjustments, but the CPI probably still overstates inflation by about 0.5 percent per year.

(3) Contrasting the CPI & 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.

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. A local manufacturer raises the price on industrial tractors it produces.

C. Armani raises the price of the Italian jeans it sells in Hong Kong.

ACTIVE LEARNING *3*
Answers

A. Starbucks raises the price of Frappuccinos.

The CPI and GDP deflator both rise.

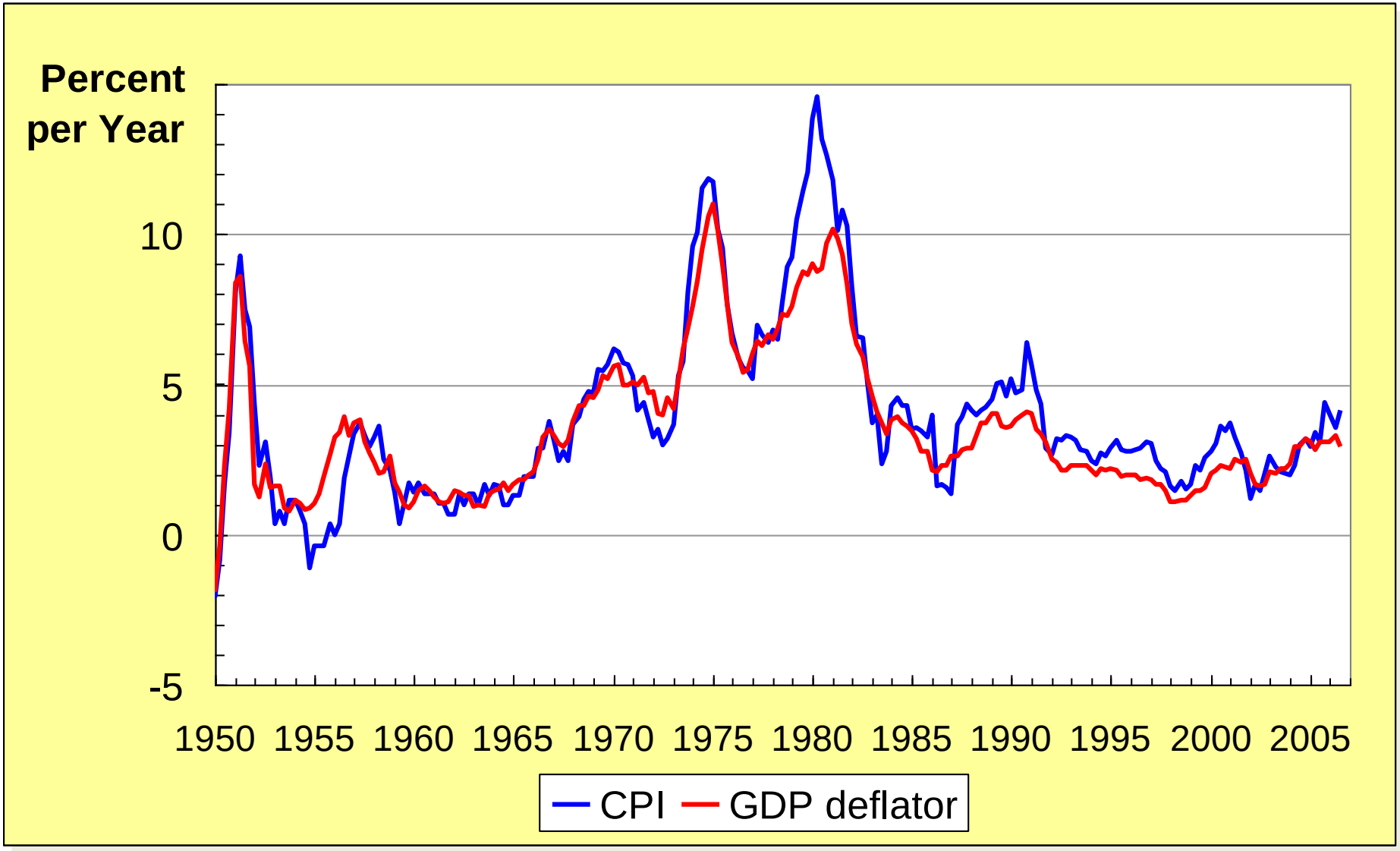
B. A local manufacturer raises the price on industrial tractors it produces.

The GDP deflator rises, the CPI does not.

C. Armani raises the price of the Italian jeans it sells in the Hong Kong.

The CPI rises, the GDP deflator does not.

Two Measures of Inflation, 1950-2007



(4) Another measure: The Producer Price Index

- **Producer price index (*PPI*)**
  An average of the prices received by producers of goods and services at all stages of the production process.

- Changes in PPI can give an early warning of future movements in the CPI.

Which of the following is a better measure of the average of the prices of all goods and services included in GDP?

a. The Consumer Price Index.

b. The Producer Price Index.

c. The GDP deflator.

d. The inflation rate.

Which of the following is a better measure of the average of the prices of all goods and services included in GDP?

a. The Consumer Price Index.

b. The Producer Price Index.

c. **The GDP deflator.**

d. The inflation rate.

Which market basket below specifically targets intermediate goods?

a. The basket used by the Consumer Price Index.

b. The basket used by the GDP deflator.

c. The basket used by the Producer Price Index.

d. All of the above.

Which market basket below specifically targets intermediate goods?

a. The basket used by the Consumer Price Index.

b. The basket used by the GDP deflator.

c. **The basket used by the Producer Price Index.**

d. All of the above.

(5) 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 in the U.S.
  - $1.15 in Dec 1964
  - $5.85 in Dec 2007
- Did minimum 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

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

- In our example,
  - year ***T*** = 12/1964, "today" = 12/2007
  - Minimum 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.

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

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.

30

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 x (203.8/109.6) = $2,629

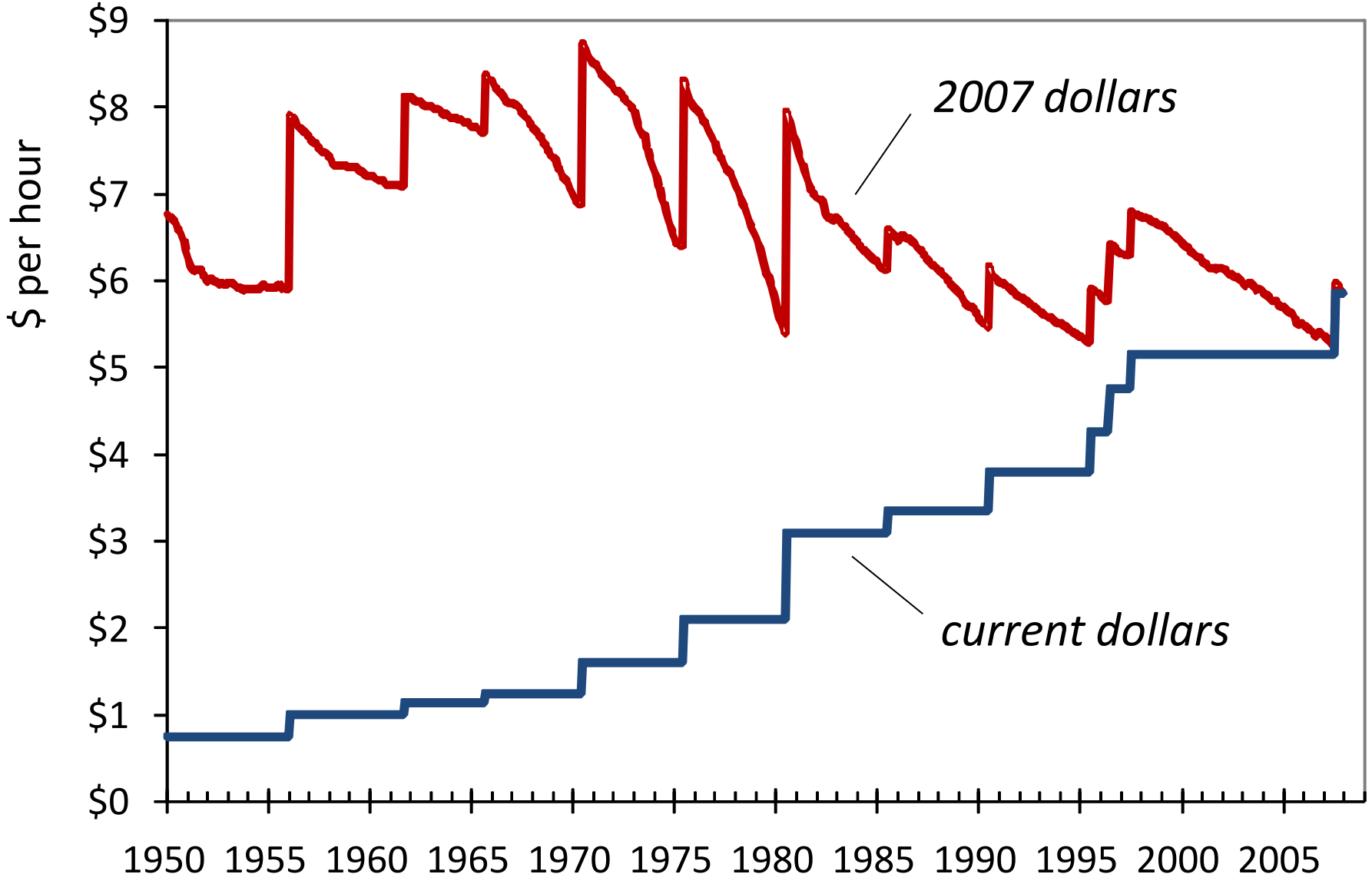
Even after correcting for inflation, tuition and fees were much lower in 1986 than in 2006!

31

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



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 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

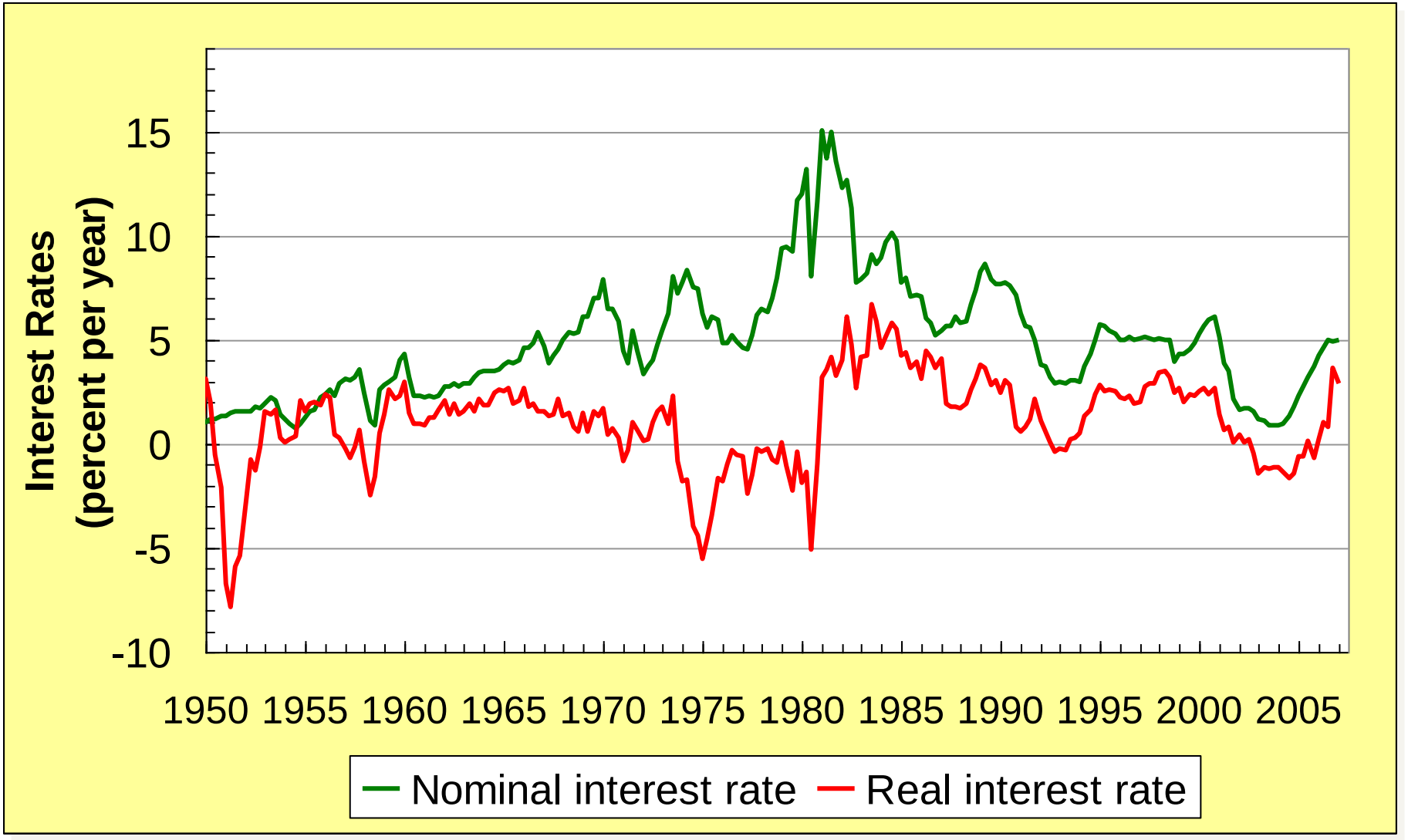
Real interest rate
= (nominal interest rate) – (inflation rate)

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
  = Nominal interest rate – 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



If the inflation rate turns out to be higher than expected, then:

a. Borrowers pay lenders a higher real interest rate than they expected.

b. Borrowers pay lenders a lower real interest rate than they expected.

c. Borrowers pay only a nominal interest rate but not a real interest rate.

d. Borrowers pay only a real interest rate but not a nominal interest rate.

If the inflation rate turns out to be higher than expected, then:

a. Borrowers pay lenders a higher real interest rate than they expected.

b. **Borrowers pay lenders a lower real interest rate than they expected.**

c. Borrowers pay only a nominal interest rate but not a real interest rate.

d. Borrowers pay only a real interest rate but not a nominal interest rate.

CHAPTER SUMMARY

- 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.