Macroeconomic Measurement III: Price Level and Inflation

Chapter 6

Measuring the Price Level

- Price level
  - Average level of prices in the economy
- Used in at least 3 ways:
  - As a policy target (e.g. to monitor inflation rate)
  - To index payments (e.g. Social Security)
  - To translate from nominal to real variables (e.g. to calculate real wage growth)

How to Measure the Price Level?

- Want to summarize the overall price level of the economy into one number
- Challenge:
  - How should we weight the importance of various goods?
    - Price of gas has drastically increased over the last year, but price of computers has fallen…

Measuring the Price Level

- Two mainstream approaches
  - CPI method
    - Looks at goods that consumers buy
  - GDP price deflator method
    - Looks at goods that enter GDP

CPI Method

- CPI is calculated as a weighted average of prices entering a typical consumption basket of a US household
- Weights of various goods given by the corresponding shares of these goods in the basket

GDP Deflator Method

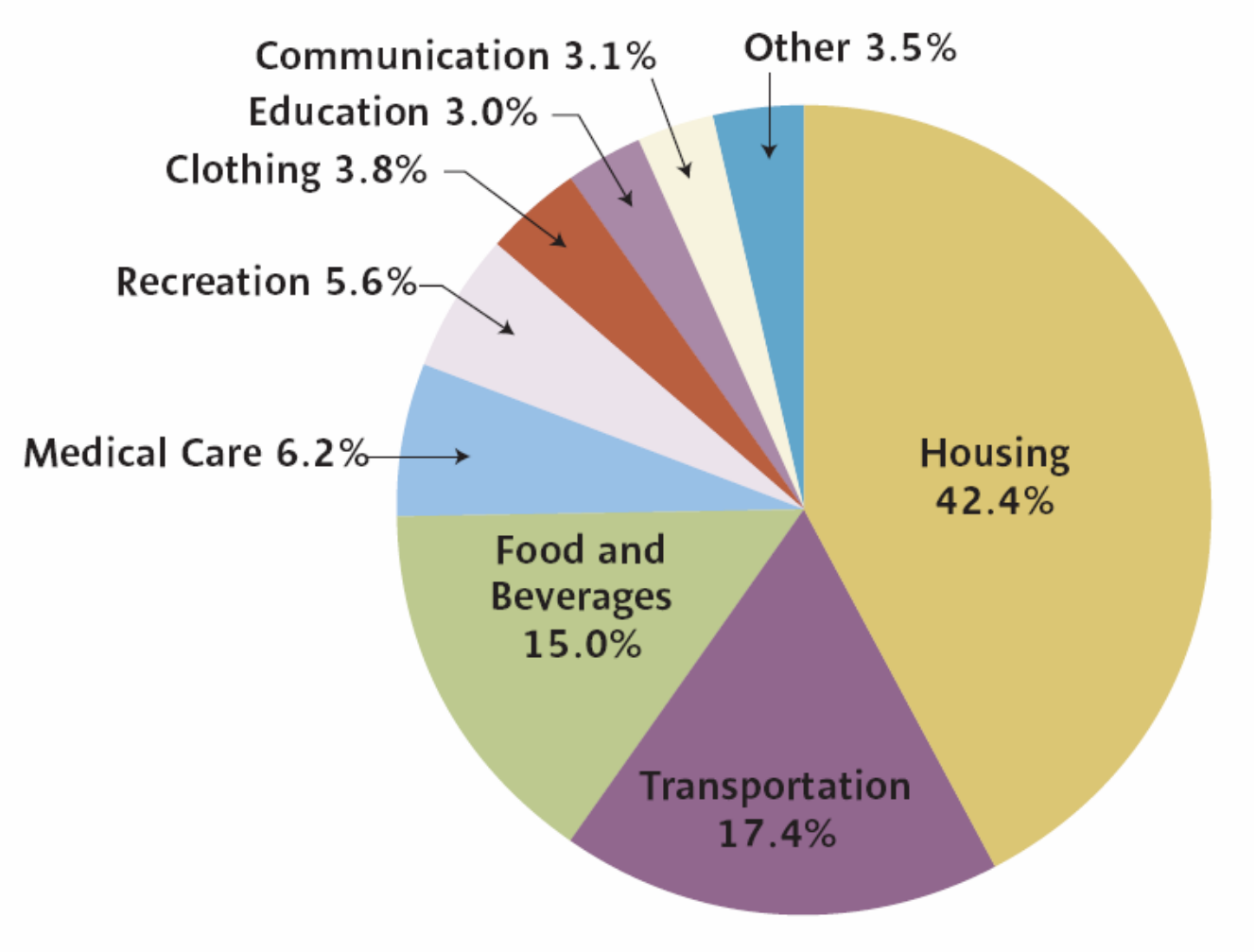
- GDP deflator is calculated as a weighted average of prices of goods entering GDP
- Weights given by the corresponding shares of these goods in GDP

CPI Method

- '*Typical basket*' is constructed from a periodic survey of household expenditures
- Given the basket and prices of goods, the CPI price level index is calculated from the following formula

$$\text{CPI} = \frac{\text{Price of 'typical basket' in current period}}{\text{Price of 'typical basket' in base period}} \times 100$$

Composition of the CPI in the US



Example: CPI Method

- Typical consumption basket of a household is: 3 apples and 2 oranges. Compute the CPI Index and the inflation rate in year 1991 from the following price data:

	Year		
	1990	1991	1992
Apples	$1	$2	$4
Oranges	$2	$1	$1

Solution

	Year		
	1990	1991	1992
Apples	$1	$2	$4
Oranges	$2	$1	$1

$$CPI_N = \frac{\text{value of the basket in prices from year N}}{\text{value of the basket in prices from base year}} * 100$$

$$CPI_{1990} = \frac{3*\$1 + 2*\$2}{3*\$1 + 2*\$2} * 100 = 100$$

$$CPI_{1991} = \frac{3*\$2 + 2*\$1}{3*\$1 + 2*\$2} * 100 = 114$$

$$\text{Inflation}_{1991} = \frac{114 - 100}{100} * 100\% = 14\%$$

GDP Deflator Method

- The GDP deflator price index is calculated from the following formula:

$$\text{GDP deflator} = \frac{\text{Nominal GDP in year t}}{\text{Constant Price GDP in year t}} \times 100$$

Example: GDP Deflator Method

- A country produces only 2 final goods: apples and oranges. Calculate GDP price deflator and inflation in year 1991 using the following data:

Year		Apples	Oranges
1990	**Quantity**	**2**	**2**
	Prices	$5	$ 2
1991	**Quantity**	**3**	**1**
	Prices	$ 5	$ 3
1992	**Quantity**	**3**	**2**
	Prices	$ 5	$ 4

Solution

Nominal GDP in 1990 $= 2*\$5 + 2*\$2 = 14$

Real GDP in 1990 (in prices from 1990) $= 2*\$5 + 2*\$2 = 14$

Nominal GDP in 1991 $= 3*\$5 + 1*\$3 = 18$

Real GDP in 1991 $= 3*\$5 + 1*\$2 = 17$

$$\text{GDP deflator in 1990} = \frac{14}{14}*100 = 100$$

$$\text{GDP deflator in 1991} = \frac{18}{17}*100 = 105.9$$

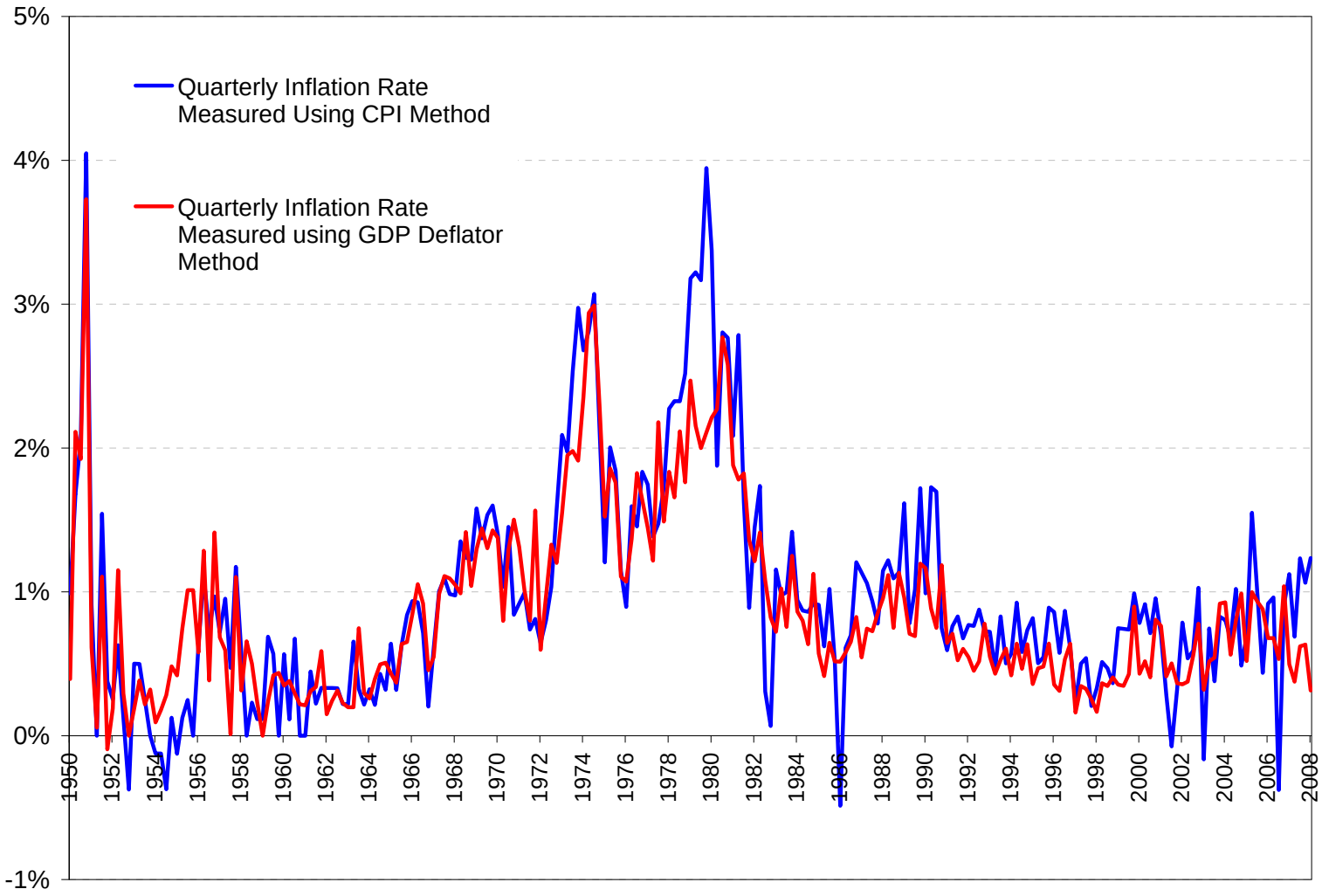
$$\text{Inflation}_{1991} = \frac{105.9\text{-}100}{100}*100\% = 5.9\%$$

Year		Apples	Oranges
1990	**Q**	**2**	**2**
	P	$5	$ 2
1991	**Q**	**3**	**1**
	P	$ 5	$ 3
1992	**Q**	**3**	**2**
	P	$ 5	$ 4

Comparison

- GDP deflator: Includes all final goods produced by the economy; corresponding weights change from year-to-year depending on the weight in the GDP; excludes imported goods
- CPI: Includes household purchases of *some* goods that are part of GDP, but *additionally* includes used goods and imported goods; weights stay fixed for a longer period of time (usually for about 5 years)

US Quarterly Inflation Rate, 1950-2008



Application I:
Using Price Indexes to Translate Nominal Variables to Real

Real Value of a Variable

- When referring to dollar value variables, real means that we correct for dollar's changing purchasing power
- Using the price index, we can easily obtain a measure of the real value of any variable:

$$\text{Real value} = \frac{\text{Nominal value}}{\text{Price index}} \times 100$$

Example

- Calculate the real wage:

	1990	1991	1992
Nominal wage	$60	$66	$72
CPI	100	110	120
Real Wage			

Example

- Calculate the real wage:

	1990	1991	1992
Nominal wage	$60	$66	$72
CPI	100	110	120
Real Wage	60/100*100 =60	66/110*100 =60	72/120*100 =60

Application II:
Using Price Indexes to Calculate Real Rate of Interest

Nominal Interest Rate

- Nominal interest is a charge paid for having money (price of money)
- Typically it is quoted as a rate on a principal
  - Nominal interest rate of i% means
    - For having $X principal today, you will pay tomorrow:
      - $X principal
      - i% of $X as nominal interest

Real Interest Rate

- *Real* interest is also a charge for having money, but adjusted for dollar's purchasing power (*real* price of money)
  - Real interest of r% means
    - For having $X principal today, you will pay tomorrow:
      - $X*($CPI_{tomorrow}/CPI_{today}$) principal
      - r% of $X*($CPI_{tomorrow}/CPI_{today}$) interest

Example

- *Nominal interest rate 8% means:*
  - Have \$100, tomorrow you will have to pay back \$100 + 8% of \$100 = \$108
- When inflation rate is 5% (i.e. $CPI_{tomorrow}/CPI_{today}=1.05$), then the real interest rate of 3% means
  - Have \$100, tomorrow you will have to pay back \$105 + 3% of \$105 = \$108.15

Calculating Real Rate of Interest *r*

- Suppose we are given nominal interest and the inflation rate
  - Nominal interest rate = i
  - Inflation = π
- How to calculate the *implied* real interest rate?

Calculating Real Rate of Interest *r*

- Need to compare tomorrow's repayment
- If nominal interest rate is i, we have to repay:
  - $X+i% of $X = $X(1+i) tomorrow
- If real interest rate is r, inflation rate is π we have to repay
  - $X(1+ π) + r % of $X(1+ π) = $X(1+ π)(1+r) tomorrow

Calculating Real Rate of Interest *r*

- Implied repayment is the same if and only if:
  - $X(1+i)=$X(1+ π) (1+r)
- Thus r=(1+i)/(1+ π)-1
  - The following approximation is valid when i and π are small (1%-10%)
    - (1+i)/(1+ π)-1 ≈ i- π

Calculating *Implied* Real Interest Rate

- Fill in the table (use the approximate formula)

	1990	1991	1992
Nominal Interest rate	7%	2%	3%
Inflation	5%	10%	-10%
Real interest rate			

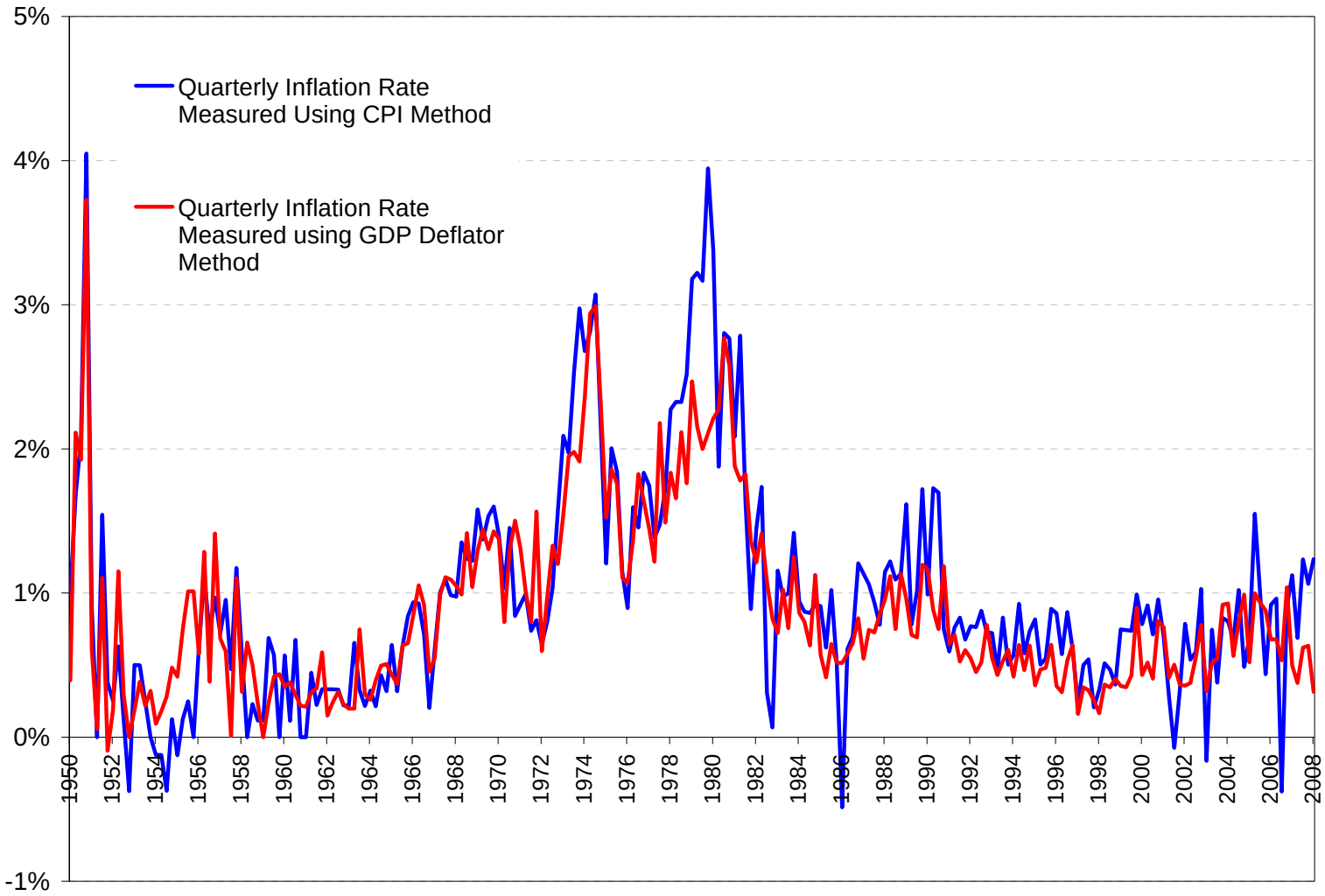
Calculating *Implied* Real Interest Rate

- Fill in the table (use the approximate formula)

	1990	1991	1992
Nominal Interest rate	7%	2%	3%
Inflation	5%	10%	-10%
Real interest rate	2%	-8%	13%

Social Costs of Inflation

US Quarterly Inflation Rate, 1950-2008



Facts and Myths About Inflation

- Myths
  - Inflation erodes the average purchasing power of income in the economy
- Facts
  - Inflation redistributes income from one group to another
  - Wastes resources devoted to mitigate its consequences

Redistributive Effects of Inflation

- *Unexpected* inflation can redistribute income
  - Away from those who are awaiting future payments
  - Toward those who are obligated to make future payments
- Accurately expected rate of inflation does *not* redistribute income, because an adjustment to the contract can be made ahead of time

Example

- Mr. Wimpy wants to borrow from Mr. Watson
- Since expected inflation is 5%, they both agree on 20% nominal interest rate
  - Mr. Watson expects to get implied real interest rate of 15%
- Later, the inflation turns out to be 50%
  - Mr. Watson actual real return=20%-50%=-30%

Unexpected vs. Expected Inflation

- Mr. Watson's decision was made on the basis of the expected real interest rate of 15%
- Ex-post real interest rate turned out to be -30%
  - If 50% inflation was correctly anticipated, Mr. Watson would request 65% nominal interest rate

Resource Cost of Inflation

- Inflation imposes an opportunity cost on the society and on each of its members
  - The cost is equal to the sacrificed goods and services to cope with inflation
  - Think about a restaurant that has to replace all menus to change prices

Conclusions

- If inflation is moderate and expected, the costs are low
  - Extremely high levels of inflation are still costly (referred to as hyperinflation)
- Unexpected inflation, due to its redistributive effects and uncertainty of redistribution it creates is not desirable
  - Can be avoided by indexing, but it is a somewhat costly solution due to measurement issues (e.g. US Social Security indexing)