

Macroeconomic Measurement III: Price Level and Inflation

Chapter 6

1

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)

2

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...

3

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

4

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

5

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

6

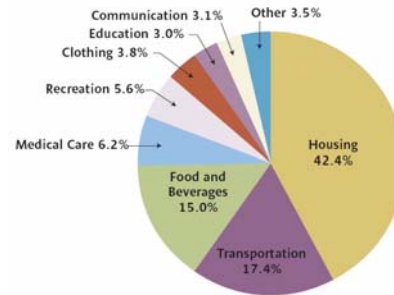
CPI Method

- '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

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

7

Composition of the CPI in the US



8

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

9

Solution

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

$$\text{CPI}_N = \frac{\text{value of the basket in prices from year N}}{\text{value of the basket in prices from base year}} \times 100$$

$$\text{CPI}_{1990} = \frac{3 * \$1 + 2 * \$2}{3 * \$1 + 2 * \$2} * 100 = 100$$

$$\text{CPI}_{1991} = \frac{3 * \$2 + 2 * \$1}{3 * \$1 + 2 * \$2} * 100 = 114$$

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

10

GDP Deflator Method

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

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

11

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

12

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 = $3 * \$5 + 1 * \$2 = 17$

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

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

Inflation₁₉₉₁ = $\frac{105.9 - 100}{100} * 100\% = 5.9\%$

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

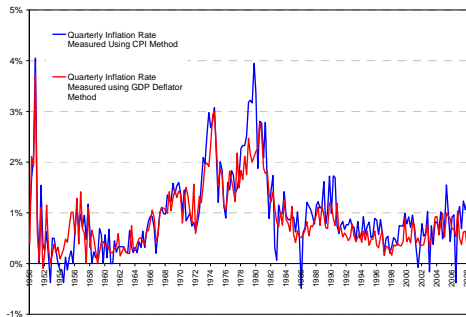
15

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)

14

US Quarterly Inflation Rate, 1950-2008



15

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

16

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:

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

17

Example

- Calculate the real wage:

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

18

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

19

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

20

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

21

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:
 - $\$X * (CPI_{\text{tomorrow}} / CPI_{\text{today}})$ principal
 - $r\%$ of $\$X * (CPI_{\text{tomorrow}} / CPI_{\text{today}})$ interest

22

Example

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

23

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?

24

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
 - $\$X(1+\pi) + r\%$ of $\$X(1+\pi) = \$X(1+\pi)(1+r)$ tomorrow

25

Calculating Real Rate of Interest r

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

26

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			

27

Calculating *Implied* Real Interest Rate

- Fill in the table (use the approximate formula)

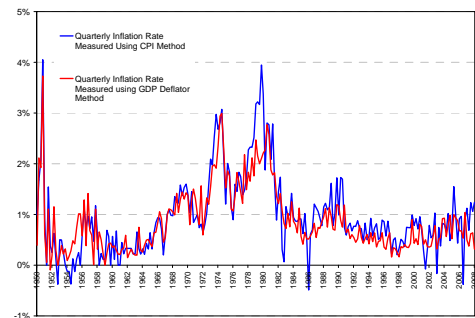
	1990	1991	1992
Nominal Interest rate	7%	2%	3%
Inflation	5%	10%	-10%
Real interest rate	2%	-8%	13%

28

Social Costs of Inflation

29

US Quarterly Inflation Rate, 1950-2008



30

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

31

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

32

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%**

33

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

34

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

35

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)

36