

## CHAPTER 7

### Price level and Inflation

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What is “**price level**”?

Def. **Price level** is the cost of a given market basket

What is “**price index**”?

Def. **Price index** is the ratio of the cost of a given market basket in two different periods.

This is a “weighted average” price, as we will see.

#### Summary

What is price level as opposed to price index?

How to measure inflation and deflation

#### Constructing a Price Index

In order to construct a price index we need to do the following:

- 1) **Pick a base year**, i.e., a year of comparison.
- 2) **Pick a market basket** consisting of a set of fixed goods and quantities.



#### Measuring the Price Level



- 3) Calculate the cost of the same market basket in two different years.

- 4) Divide the cost of the market basket of the current year by that of the base year.

Example:

Suppose 2000 is the base year and we have a market basket consisting of two goods: **bread (b)** and **wine (w)**, with prices, p, and quantities, Q:

In **2000 (base year)**:

$$p_b = \$1, Q_b = 6 \quad \text{and} \quad p_w = \$7, Q_w = 1$$

In **2009 (current year)**:

$$p_b = \$2, Q_b = 5 \quad \text{and} \quad p_w = \$6, Q_w = 4$$

$$P = \frac{6 (\$2) + 1 (\$6)}{6 (\$1) + 1 (\$7)} = \frac{\$18}{\$13} = 1.38 = \frac{138}{100}$$

Prices are up by 38%.

This index is called **Laspeyres index**.

We use the symbol  $P_L$  for this index.

We have two choices for fixing the market basket:

1) We can fix it according to the base year's market basket and calculate the price index (P):

$$P = \frac{\text{Cost of the base year market basket in 2009}}{\text{Cost of the base year market basket in the base year}}$$

Second choice:

2) We can fix the market basket according to the current year and calculate the price index (P):

$$P = \frac{\text{Cost of the current year market basket in 2009}}{\text{Cost of the current year market basket in the base year}}$$

$$P = \frac{6 + 1}{6 + 1}$$

$$P = \frac{6 (\$2) + 1 (\$6)}{6 (\$1) + 1 (\$7)}$$

$$P = \frac{5 + 4}{5 + 4}$$

$$P = \frac{5 (\$2) + 4 (\$6)}{5 (\$1) + 4 (\$7)}$$

$$P = \frac{5 (\$2) + 4 (\$6)}{5 (\$1) + 4 (\$7)} = \frac{\$34}{\$33} = 1.03 = \frac{103}{100}$$

Prices are up by 3%.

This index is called **Paasche index**.

We use the symbol  $P_p$  for this index.

### Types of Price Indices

There are three basic price indices used in the US:

#### 1) Consumer price index (CPI):

CPI measures changes in the price of a market basket “typically” used by consumers.

**CPI is a “modified Laspeyres index”.**

See <http://www.bls.gov/ppi/ppicppi.htm>

### The Index Number Problem:

$$P_L = 1.38$$

$$P_p = 1.03$$

This is called the index number problem.

The choice of the market basket gives two different results that are both logical.

BLS still uses 1982-84 as the base year.

Check the current rate of inflation at BLS:  
<http://www.bls.gov/news.release/cpi.nr0.htm>

Note: both  $P_L$  and  $P_p$  are “weighted averages.”

Def. Weighted average means the prices are multiplied by quantities.

It is not a simple average!

#### 2) Producer price index (PPI)

- PPI used to be called “wholesale price index.”
- PPI measures changes in the price at the wholesale level.
- PPI includes:
  - raw material
  - intermediate goods
  - finished goods

See BLS: “[Producer Price Indexes](#)”

### 3) **GDP price index** or price deflator

This is also called “chain-type annual weights GDP price”

It is calculated using both Laspeyres and Paasche indexes.

(It is the geometric average of  $P_L$  and  $P_P$ :  $\sqrt{P_L \times P_P}$ )

Remember:

$$\text{Real GDP} = \text{Nominal GDP} / \text{GDP Price Deflator}$$

### **Inflation and Deflation**

Def . **Inflation** means a rise in the price level.

Def . **Deflation** means a fall in the price level.

Def. **Disinflation** means a slow down in the rate of inflation.

### **Controversy Over CPI**

Some argue that CPI is overestimated, since using an old and fixed market basket creates biases:

#### 1) **Substitution bias:**

People substitute cheaper goods for more expensive goods. CPI does not reflect this fact.

#### 2) **New goods or technology bias:**

New goods, reflecting new technology, are not included in the market basket.  
Examples: DVDs, iPods and Blu-ray players.

### **Rate of Inflation**

The rate of inflation simply shows the percentage change in CPI:

$$\Delta P/P = (\text{CPI}_1 - \text{CPI}_0) / \text{CPI}_0$$

Example:

Suppose the CPI in 2006 was 120 and in 2007 was 150. Then the rate of inflation between the two years was:

$$\% \Delta \text{ in CPI} = (150 - 120) / 120 = 25\%$$

### 3) **Quality change bias:**

Goods continuously improve in quality. This is not reflected in the CPI market basket.

### 4) **Growth in discounting bias:**

The trend is toward buying more and more at discount stores.

CPI assumes that people buy from all kinds of stores, including small stores.

Note: CPI rising does not mean that the rate of inflation is rising:

Year 2006: CPI = 120

Year 2007: CPI = 150

Year 2008: CPI = 160

Rate of inflation between 2006-07:  
 $(150 - 120) / 120 = 25\%$

Rate of inflation between 2007-08:  
 $(160 - 150) / 150 = 6.6\%$

### Nominal Wage and Real Wage

CPI is used to deflate nominal wage:

Def. **Nominal wage**: wage measured in current dollars, unadjusted for inflation

Def. **Real wage**: wage measured in constant dollars, adjusted for inflation. This is the real buying power.

$$\text{Real wage} = \frac{\text{Nominal wage}}{\text{CPI}} \times 100$$

$$w = (W / \text{CPI}) \times 100$$

Another example:

Suppose nominal wage is \$8/hour and the price of bread is \$2/loaf.

**Real wage expressed in bread =**

$$\frac{\text{Nominal wage}}{\text{Price of bread}} = \frac{\$8/\text{labor}}{\$2/\text{loaf}} =$$

$$= 4 \text{ loafs of bread / labor}$$

Example:

In 2000: Nominal wage = \$8/hour & CPI = 100

In 2008: Nominal wage = \$9/hour & CPI = 120

What is the %  $\Delta$  in real wage?

$$w_{2008} = \frac{W_{2008}}{\text{CPI}} \times 100 = \$9/1.20 = \$7.5$$

$$\begin{aligned} \% \Delta w &= (w_{2008} - w_{2000}) / w_{2000} \\ &= (\$7.5 - \$8) / \$8 = -\$0.5 / \$8 = -6.25\% \end{aligned}$$

### COLAs

CPI is also used to measure the cost of living adjustments or COLAs.

For example, those on Social Security or on government pension plans have their income **indexed** automatically to the rate of inflation.

Def. **Indexation** means payments are tied to the rate of inflation.

Note: real wage, or ability to buy, can be expressed in actual goods that one can buy: How much meat, potatoes or corn can I buy with this wage?

Example:

**Real wage expressed in meat =  $\frac{\text{Nominal wage}}{\text{Price of meat}}$**

$$w = \frac{W}{P_{\text{meat}}} = \frac{\$10/\text{labor}}{\$2/\text{lb of meat}} = \frac{5 \text{ lb of meat}}{\text{labor}}$$

### Nominal Interest Rate and Real Interest Rate

One can also use CPI to calculate how much one earns in interest rate in real terms.

**Real interest rate = nominal interest rate - rate of inflation**

$$i_r = i_n - \Delta p/p = i_n - \Delta \text{CPI}/\text{CPI}_0$$

Example:

Suppose the nominal rate of interest is 2% and the inflation rate is 3%. Then:

$$\text{Real rate of interest} = 2\% - 3\% = -1\%$$

### Inflation and Distribution of Income

Does inflation hurt everyone?

No ! It hurts

- 1) those who are on a fixed income not indexed to the rate of inflation.
- 2) the lender (creditor) who underestimated the rate of inflation.

Explanation for

$$\text{Real interest rate} = \text{Nominal interest rate} - \text{Rate of inflation}$$

Apply quotient rule to:

$$\text{Real interest} = \frac{\text{Nominal interest}}{\text{CPI}}$$

$$\% \Delta \text{ in Real interest} = \% \Delta \text{ in Nominal interest} - \% \Delta \text{ in CPI}$$

$$\text{Real interest rate} = \text{Nominal interest rate} - \text{Rate of inflation}$$

Example:

A lender (creditor) lends to a borrower (debtor) at 6%, assuming the rate of inflation will be 5%.

If the rate of inflation turns out to be 7%, the lender loses money:

$$i_r = i_n - (\Delta p/p)$$

$$i_r = 6\% - 7\% = -1\%$$

### Expected Rate of Interest

If you expect some rate of inflation, then you add that rate to the real rate of interest you wish to receive:

**Expected rate of interest = Real rate of interest +  
Expected rate of  
inflation.**

$$i_e = i_r + (\Delta p/p)_e$$

$(\Delta p/p)_e$  is also called **inflation premium**.

Next stop: Chapter 8!