

CHAPTER 7

Price level and Inflation

Sasan Fayazmanesh

Summary

What is price level as opposed to price index?

How to measure inflation and deflation

Measuring the Price Level



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.

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.



- 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)**:

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

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):

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

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

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

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

Prices are up by 38%.

This index is called **Laspeyres index**.

We use the symbol P_L for this index.

Second choice:

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

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

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

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

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

Prices are up by 3%.

This index is called **Paasche index**.

We use the symbol P_p for this index.

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.

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!

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 Laspeyres index, it uses the market basket composition of the base year.

BLS still uses 1982-84 market basket. Check the current rate of inflation at BLS:

<http://www.bls.gov/news.release/cpi.nr0.htm>

2) Producer price index (PPI)

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

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:

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

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.

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.

Inflation and Deflation

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

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

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

Rate of Inflation

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

$$\Delta P/P = (CPI_1 - CPI_0) / CPI_0$$

Example:

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

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

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.

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

$$w = W / \text{CPI}$$

Example:

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

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

What is the % Δ in real wage?

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

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

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 = $\frac{\text{Nominal wage}}{\text{Price of meat}}$

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

Another example:

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

Real wage expressed in bread =

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

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

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.

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:

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

Explanation for

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

Apply quotient rule to:

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

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

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

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:

$$\text{Expected rate of interest} = \text{Real rate of interest} + \text{Expected rate of inflation.}$$

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

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

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.

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:

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

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

Next stop: Chapter 8!