LECTURE NOTES ON
MACROECONOMIC PRINCIPLES

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Ch 24 Measuring the Cost of Living

Introduction

In 1931, the New York Yankees paid Babe Ruth an annual salary of $80,000.

In 2010, the New York Yankees paid Alex Rodriguez an annual salary of $33 million.

But then again, in 1931 an ice cream cone cost a nickel and a movie ticket cost a quarter. More generally, the cost of living has risen greatly since then.

This chapter focuses on the **consumer price index** or the CPI as a measure of the cost of living.

The **inflation rate** is the percentage rate of change in the CPI.

Once we understand how the CPI is constructed and how it has behaved in the US, we can return to the question: who was really paid more, after adjusting for inflation, Ruth or Rodriguez?

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The Consumer Price Index

The CPI is computed by the Bureau of Labor Statistics (BLS), a division of the Department of Labor, to measure the overall cost of goods and services bought by a typical consumer.

How the CPI is Measured

Table 1 highlights the 5 steps involved in measuring the CPI:

1. Survey consumers to determine the relevant "basket of goods."
2. Record the price of each good in each year.
3. Compute the cost of the basket in each year.
4. Choose a base year and compute the **CPI** for the current year:

$$\text{CPI} = \frac{\text{Cost of the Basket in the Current Year}}{\text{Cost of the Basket in a Base Year}} \times 100$$

5. Compute the **inflation rate** as the percentage change in the CPI from one year to the next:

$$\text{Inflation Rate} = \frac{\text{CPI in Current Year} - \text{CPI in Previous Year}}{\text{CPI in Previous Year}} \times 100$$

The example in Table 1 assumes, for simplicity, that the basket includes only two goods. Figure 1 illustrates in more detail what is really in the CPI basket.

In addition to the CPI, the BLS also computes the **producer price index** or the PPI, to measure the cost of goods and services bought by the typical firm.

Problems in Measuring the Cost of Living

Three problems prevent the CPI from being a perfect measure of the cost of living:

1. Substitution bias.
2. The introduction of new goods.
3. Unmeasured quality change.

Substitution bias arises because in any given year the prices of some goods rise faster than others:

- The basket holds the quantity of each good purchased fixed.
- But, in fact, consumers tend to substitute less expensive goods for more expensive goods.

Does substitution bias cause the CPI to overstate or understand the true change in the cost of living?

To answer this question, return to the example from Table 1:

- There, the price of hot dogs rises at a faster rate than the price of hamburgers.
- The CPI holds the number of hot dogs and the number of hamburgers fixed.
- But, in reality, consumers are likely to buy more hamburgers and fewer hot dogs.
- Hence the true, changing basket of goods is less expensive than the fixed basket used in computing the CPI.
- The CPI therefore *overstates* the true change in the cost of living.

When **new goods are introduced**, the true cost of achieving a given level of consumer satisfaction falls.

- Before VCRs and DVD players were invented, if you wanted to see a movie, you had to either go to a theater or wait for it to come on TV.
- Even after those new goods were introduced, you could still go to the theater or watch movies on TV, but you could also rent or buy the video.
- So a given number of dollars spent watching movies could yield a higher level of consumer satisfaction.
- In that sense, the cost of living goes down when new goods are introduced, but that effect does not get captured by the CPI.
- So it again the CPI *overtstates* the true change in the cost of living.

Unmeasured quality change: many types of goods improve in quality over time.

- A new cellphone purchased today is a lot better than a cellphone purchased two or three years ago, even if it sells at a higher price.
- The BLS tries to correct for this quality change.
- But to the extent that it underestimates the extent of quality change, it again *overstates* the true change in the cost of living.

Many economists believe that the because of the combined effects of these three problems, the inflation rate based on the CPI overstates the true increase in the cost of living by about 0.5 percentage points per year. These effects are important, since for example, Social Security benefits get adjusted upwards automatically in a way that is tied to the CPI inflation rate.

The GDP Deflator and the CPI

Usually, the GDP deflator and the CPI move together, as shown in Figure 2.

One difference, however, arises because:

- The GDP deflator reflects the prices of all goods *produced* domestically.
- Whereas the CPI reflects the prices of all goods *consumed* domestically.

So let's ask: what happens when the price of an imported good rises?

- The CPI increases.
- But the GDP deflator does not.
- This effect is particularly important when the price of imported oil rises.

What happens when the price of a domestically-produced *capital* (investment) good rises?

- The GDP deflator increases.
- But the CPI does not.

A second and more subtle difference arises because:

- The GDP deflator is based on the prices of goods as currently produced.
- Whereas the CPI is based on the prices of a fixed basket of goods.
- So differences arise when the prices of different goods are rising or falling at different rates.

Correcting Economic Variables for the Effects of Inflation

Dollar Figures at Different Points in Time

Let's go back to the question from the beginning: after correcting for inflation, who was paid more, Ruth ($80,000) in 1931 or Rodriguez ($33 million) in 2010?

To answer this question, ask first: how many "baskets" of goods could Ruth buy in 1931?

$$\text{Number of Baskets Bought by Ruth in 1931} = \frac{\$80{,}000 \text{ in } 1931}{\text{Cost of Each Basket in } 1931}$$

Now ask, how much would this same number of baskets have cost in 2010?

$$\begin{aligned} &2010 \text{ Cost of the Baskets Bought by Ruth in } 1931 \\ &= \text{Cost of Each Basket in } 2010 \times \text{Number of Baskets Bought by Ruth in } 1931 \\ &= \text{Cost of Each Basket in } 2010 \times \frac{\$80{,}000 \text{ in } 1931}{\text{Cost of Each Basket in } 1931} \end{aligned}$$

This last formula can be rewritten as:

$$\begin{aligned} &2010 \text{ Cost of the Baskets Bought by Ruth in } 1931 \\ &= \frac{\text{Cost of Each Basket in } 2010}{\text{Cost of Each Basket in a Base Year}} \times 100 \\ &\times \frac{\text{Cost of Each Basket in a Base Year}}{\text{Cost of Each Basket in } 1931} \times \frac{1}{100} \times \$80{,}000 \text{ in } 1931 \end{aligned}$$

But now it simplifies to:

$$2010 \text{ Cost of the Baskets Bought by Ruth in } 1931 = \frac{\text{CPI in } 2010}{\text{CPI in } 1931} \times \$80{,}000 \text{ in } 1931$$

This equation is true more generally:

$$\text{Value in this Year's Dollars} = \text{Value in a Past Year's Dollars} \times \frac{\text{CPI This Year}}{\text{CPI in the Past Year}}$$

It turns out that

CPI in 1931 = 15.2

CPI in 2010 = 218 (note: Mankiw uses the CPI for 2009, which was 214.5).

And so, doing the math:

$$\text{Value of Ruth's Salary in 2010 Dollars} = \$80{,}000 \text{ in } 1931 \text{ Dollars} \times \frac{218}{15.2} = \$1{,}147{,}368$$

Even after adjusting for inflation, Rodriguez's salary is much, much higher!

But, interestingly, President Herbert Hoover's 1931 salary was $75,000. Let's convert that into 2010 dollars in the same way:

$$\text{Value of Hoover's Salary in 2010 Dollars} = \$75{,}000 \text{ in } 1931 \text{ Dollars} \times \frac{218}{15.2} = \$1{,}075{,}658$$

After adjusting for inflation, Hoover's salary is more than twice as large as the $400,000 earned in 2010 by President Barack Obama.

Indexation

Indexation refers to the automatic correction by law or contract of a dollar amount for the effects of inflation.

As noted above, Social Security benefits are indexed, that is, adjusted every year based on the percentage increase in the CPI.

Union contracts often specify indexed wages that increase each year based on the inflation rate. Such a provision is often referred to as a *cost-of-living allowance* (COLA).

Real and Nominal Interest Rates

Since bank accounts, bonds, automobile loans, and mortgages all make or require dollar payments at different points in time, the interest rates on these investments or loans must also be corrected for the effects of inflation to gauge their true economic significance.

Suppose, for example, that you deposit $1,000 in a bank account that pays interest at a 10% annual rate:

- One year from now, you will have $1,100: your original $1,000 plus $100 interest.
- But let's say that the inflation rate over the next year is 3%.
- You have 10% more dollars, but those dollars buy 3% less.
- Your "real" return is actually 10% - 3% =7%.

In this example, the **nominal interest rate**, that is, the interest rate as it is usually reported without correcting for inflation, is 10%.

But the **real interest rate**, corrected for the effects of inflation, is 7%.

In general:

$$\text{Real Interest Rate} = \text{Nominal Interest Rate} - \text{Inflation Rate}$$

Note that the real interest rate can even be negative: if the nominal interest rate on your bank account is 10%, but the inflation rate turns about to be 12%, the real interest rate is 10%-12%=-2%.

Most frequently, prices rise over time, so that the inflation rate is positive. But sometimes, as in the US economy during the Great Depression of the 1930s and in Japan during the last decade, prices actually fall over time, so that the inflation rate is negative. These are periods of *deflation* as opposed to inflation.

Which is bigger: the nominal interest rate or the real interest rate?

- Under inflation, the nominal interest rate is bigger than the real interest rate since the value of dollars is falling over time.
- Under deflation, the real interest rate is bigger than the nominal interest rate since the value of dollars is rising over time.

Figure 3 shows the relationship between nominal and real interest rates in the US:

- During the 1970s, nominal interest rates were high but real interest rates were low. Why? Because inflation was high.
- During the 1980s and 1990s, nominal interest rates were low but real interest rates were high. Why? Because inflation was low.

This is an important lesson for personal finance and investing: when evaluating the payoff on an investment or the interest rate on a loan, you need to make a judgment on what the inflation rate will be over the lifetime of the investment or loan, to convert the nominal interest rate into a real interest rate.