

Chapter 11 Lesson(s) Plan / Outline

Chapter 11: Measuring the Cost of Living

Introduction

Introduce the Topic

In the previous chapter, we learned how economists measure output, or national income. In this chapter, we go on to learn about how economists measure the overall price level in the economy. In this chapter we will look how Consumer Price Index (CPI) is computed, what are the main components of CPI, what are the drawbacks of using CPI, how can we compare dollars over time as well as the difference between real and nominal inflation.

Ask Students What They Already Know. Start a Discussion.

Before we go to any details, I want to hear what you know about inflation.

- What comes to your mind when you hear the word “inflation”?
- Who benefits and who gets hurt when there is high inflation? Low inflation?
- What if we had deflation or very high inflation? What would you do?
- Coca-Cola used to cost five cents. Was that a lot or not? How can we know?
- An average annual baseball player salary in 1950 was just over \$13k? Do you think it was a lot?
- We typically think that a 10% return on investment is “good”. What if inflation is very high? Is it still good?
- When you save and invest, what do you care about: having a higher amount of dollars or being able to buy as much as possible in the future? Which should you care about: nominal or real interest rate?

Using student answers to questions, suggestions, and ideas, create a discussion using follow-up questions.

Write down a few big ideas and the general outline for the class.

- CPI is used to measure the overall level of prices in the economy.
- CPI shows the cost of a basket of goods and services relative to the cost of basket in the base year.
- CPI is not perfect. It does not take into account: substitution, introduction of new goods, unmeasurable changes in goods and services.
- CPI typically overstates the inflation.
- Both CPI and GDP deflator measure the overall level of prices in the economy. However, they differ.
- CPI focuses on G&S that typical consumers buy, GDP deflator focuses on G&S that are produced in the country.
- To compare dollar figures from different point in time, we need to make adjustment for inflation.
- Real interest rate shows an increase in the purchasing power while nominal – shows an increase in the dollar amount.

Why are we learning this?

We are learning this because of the following.

- Inflation affects us all. The price of rent, food and other goods and services we buy every day, on average, increases over time.
- It is important to recognize the difference between increase in price due to some good specific factors and due to inflation. Inflation does not mean that the prices of all goods in the economy are rising. Inflation means that prices *on average* are rising. In fact, the prices of many electronic goods have fallen over time.
- To understand trends, you need to be able to compare dollar amounts over time. It can only be done by understanding inflation.
- To understand how does a contract or benefit yearly inflation adjustment affect the recipient.

- To recognize nominal from real interest rates and understand how saving, investing, and wealth accumulation is affected by inflation.

What is our goal for the class?

The purpose of this class is to demonstrate:

- what is inflation and deflation,
- how inflation is measured (5 steps),
- the issues with measuring inflation,
- to understand the difference between different measures of inflation,
- to learn to compare dollar values from different points in time,
- to understand the difference between and compute nominal and real interest rates.

Content

5 Steps in Computing the Consumer Price Index (CPI)

Consumer price index (CPI) is a measure of the overall cost of the goods and services bought by a typical consumer.

Bureau of Labor Statistics computes CPI as follows:

1. The Bureau of Labor Statistics uses surveys to determine a representative bundle of goods and services purchased by a typical consumer. For example: 4 hot dogs and 2 hamburgers.
2. Prices for each of the goods and services in the basket must be determined for each time period.

Year	Price of Hot Dogs	Price of Hamburgers
2016	\$1	\$2
2017	\$2	\$3
2018	\$3	\$4

3. By keeping the basket the same, only prices are being allowed to change. This allows us to isolate the effects of price changes over time.

Year	Price of Hot Dogs	Price of Hamburgers	Cost of Basket (CoB)
2016	\$1	\$2	\$8
2017	\$2	\$3	\$14
2018	\$3	\$4	\$20

4. Choose a base year and compute the Consumer Price Index. For example, base year is 2016.

Formula for computing CPI:

$$CPI = \left(\frac{\text{Price of basket in current year}}{\text{Price of basket in base year}} \right) \times 100$$

$$CPI \text{ for } 2016 = (\$8)/(\$8) \times 100 = 100$$

$$CPI \text{ for } 2017 = (\$14)/(\$8) \times 100 = 175$$

$$CPI \text{ for } 2018 = (\$20)/(\$8) \times 100 = 250$$

Year	Price of Hot Dogs	Price of Hamburgers	Cost of Basket (CoB)	CPI
2016	\$1	\$2	\$8	100
2017	\$2	\$3	\$14	175
2018	\$3	\$4	\$20	250

5. Compute the inflation rate.

Inflation rate is the percentage change in the price index from the preceding period.

Inflation is computed using the percentage change formula.

$$\text{Inflation rate in year 2} = \frac{\text{CPI in year 2} - \text{CPI in year 1}}{\text{CPI in year 1}} \times 100$$

Inflation Rate for 2017 = $(175 - 100)/100 \times 100 = 75\%$.

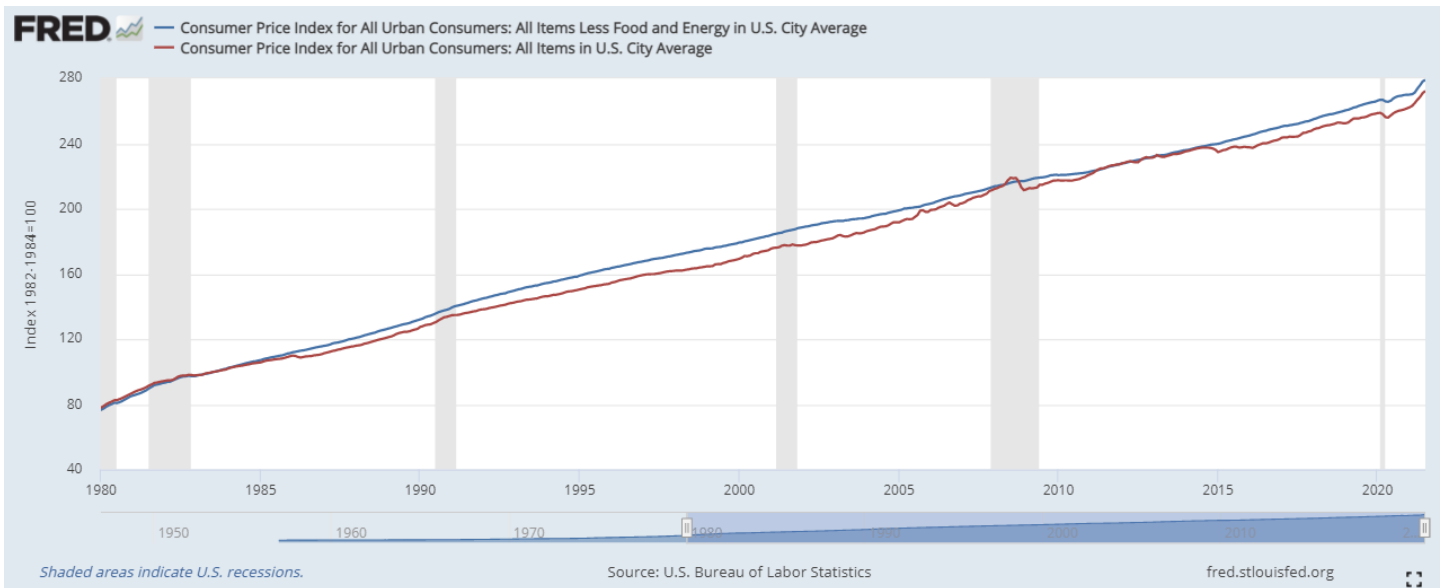
Inflation Rate for 2018 = $(250 - 175)/175 \times 100 = 43\%$.

Year	Price of Hot Dogs	Price of Hamburgers	Cost of Basket (CoB)	CPI	Inflation
2016	\$1	\$2	\$8	100	-
2017	\$2	\$3	\$14	175	75%
2018	\$3	\$4	\$20	250	43%

Core CPI

Some groups of products and services have much more variability than others. Prices of food and energy are among those that are some of the least stable.

Core CPI is a measure of the overall cost of consumer goods and services excluding food and energy. The core CPI better reflects ongoing inflation trends.

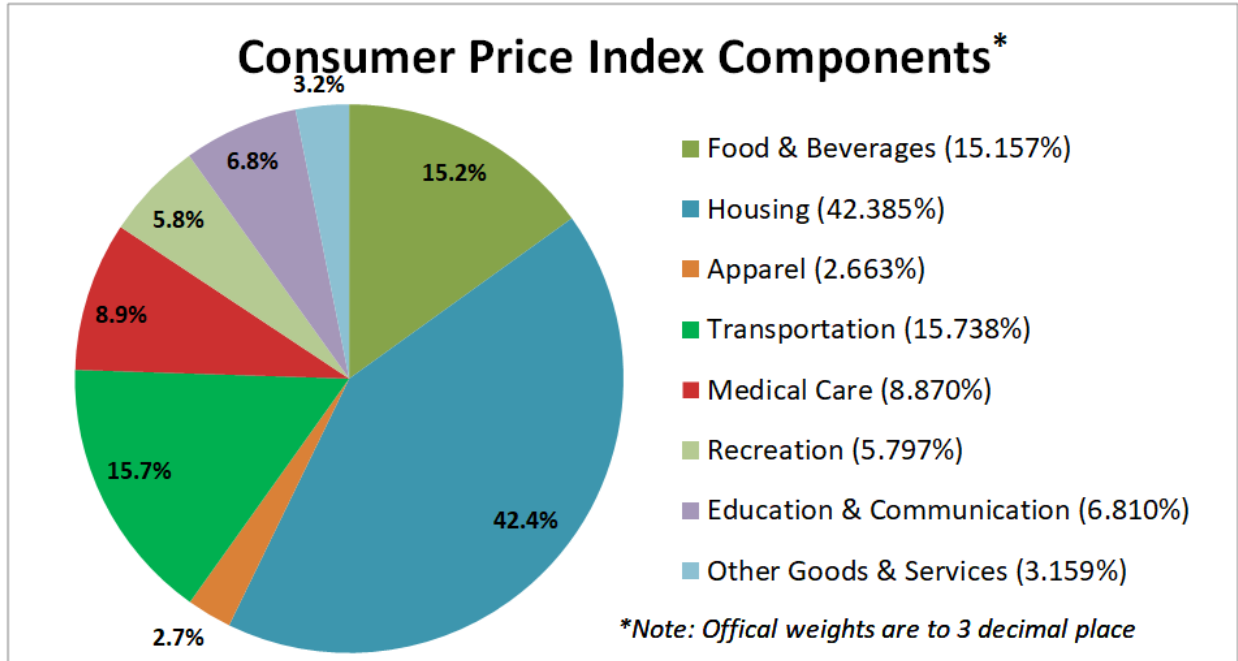


Producer Price Index (PPI)

Producer price index (PPI) is a measure of the cost of a basket of goods and services bought by firms.

Before there are any changes in prices typical consumers pay (measured by CPI), we may expect to see higher prices that firms face. Because firms eventually pass on higher costs to consumers in the form of higher prices on products, the producer price index is believed to be useful in predicting changes in the CPI.

Make-Up of CPI's Basket



Source: BLS; The most recent annual reweighting was in December 2020

CPI vs GDP Deflator

The GDP deflator reflects the prices of all goods produced domestically, while the CPI reflects the prices of all goods bought by consumers.

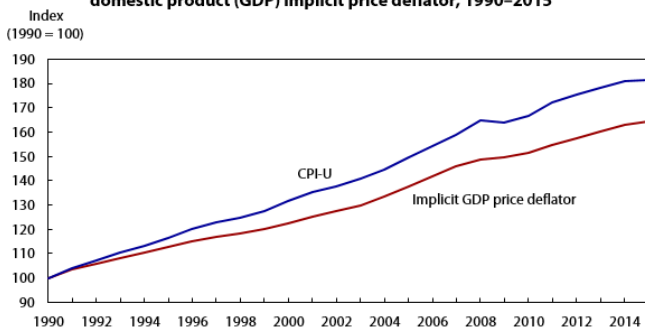
The CPI compares the prices of a fixed basket of goods over time, while the GDP deflator compares the prices of the goods currently produced to the prices of the goods produced in the base year. This means that the group of goods and services used to compute the GDP deflator changes automatically over time as output changes.

Change in prices of foreign products such as French wine or Greek olive oil will affect inflation measured by the CPI but not GDP deflator. On the other hand, when the price of products such as John Deere industrial tractor or industrial Caterpillar machinery increase, CPI is unchanged but GDP deflator is affected.

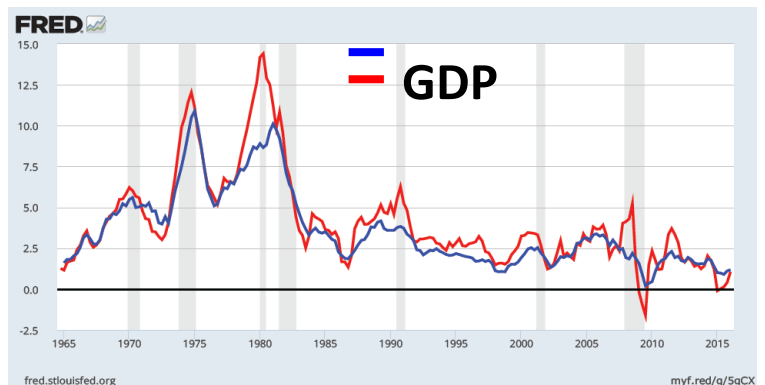
CPI basket = only consumer products included, can be made-abroad.

GDP = only domestically produced goods included.

Figure 1. Consumer Price Index for All Urban Consumers (CPI-U) and gross domestic product (GDP) implicit price deflator, 1990–2015



Source: U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis.



Correcting Economic Variables for the Effects of Inflation

Dollar figures over time are not directly meaningfully comparable. 5 dollars many years ago were able to buy much more than 5 dollars today. In other words, those \$5 many years ago would be the same as having much more today. How much more? To answer this question, we use the following formula:

$$\text{Value in Year 2 dollars} = \text{Value in Year 1 dollars} \times \left(\frac{\text{Price level in Year 2}}{\text{Price level in Year 1}} \right)$$

For example: Babe Ruth's 1931 salary of \$80,000 in 2015 dollars was:

Salary in 2015 dollars = Salary in 1931 dollars \times (CPI in 2015 / CPI in 1931)

Salary in 2015 dollars = \$80,000 \times (237/15.2)

Salary in 2015 dollars = \$1,247,368

Of course, we can also consider how much a current salary of say \$70,000 would have been in 1931. To do so we use the same formula.

$$\text{Value in Year 1 dollars} = \text{Value in Year 2 dollars} * \left(\frac{\text{Price level in Year 1}}{\text{Price level in Year 2}} \right)$$

Salary (of \$70k in 2015) in 1931 dollars = Salary in 1931 dollars \times (CPI in 2015 / CPI in 1931)

Salary in 1931 dollars = \$70,000 \times (15.2/237)

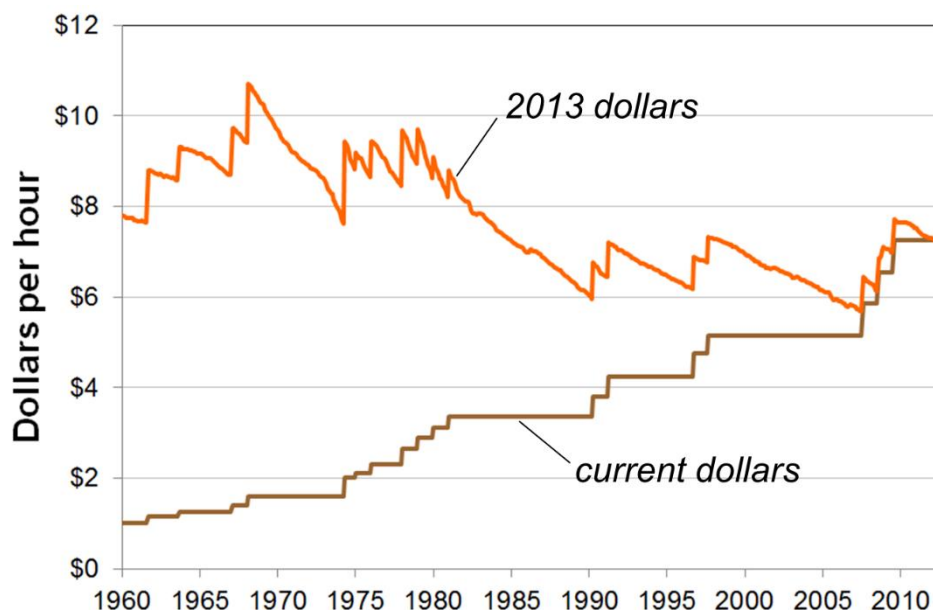
Salary in 1931 dollars = \$4,489.45

Now you can compare your first pay with how much your parents made in their first job, or how much your parents' first car cost vs how much you paid or expect to pay for your first car.

These adjustments are not always done. When biggest salaries or sales, or other records are announced, they are often not adjusted for inflation. For example, reports of box office success are often made in terms of the dollar values of ticket sales. These ticket sales are then compared with ticket sales of movies in the past. However, no corrections for changes in the value of a dollar are made. With every year, more and more movies will beat old records just due to inflation, not because of the popularity of some of these movies.

Minimum Wage

Minimum wage, for example, is determined by laws. They do not change every year even though prices, on average, are rising. This means that a person working on a minimum wage for multiple years is becoming worse off every year. Once the minimum wage is increased, workers get a boost but over time it declines unless additional increases are passed.



Comparing Tuition Increases Across US Colleges and Universities

It is no surprise to anyone that college tuition has increased significantly over the last few decades. However, which type of institutions saw a highest percentage increase. Use the dollar figures in table below, and convert the 1990 costs into 2015 dollars. Then, compute the percentage change using only 2015 dollars.

Tuition and Fees at U.S. Colleges and Universities		
	1990	2015
Private non-profit 4-year	\$9,340	\$32,405
Public 4-year	\$1,908	\$9,410
Public 2-year	\$906	\$3,435
CPI	130.7	237.7

	1990	2015	% change
CPI	130.7	237.7	81.9%
Private non-profit 4-year (current \$)	\$9,340	\$32,405	
Private non-profit 4-year (in 2015 \$)	\$16,986	\$32,405	90.8%
Public 4-year (current \$)	\$1,908	\$9,410	
Public 4-year (in 2015 \$)	\$3,470	\$9,410	171.2%
Public 2-year (current \$)	\$906	\$3,435	
Public 2-year (in 2015 \$)	\$1,648	\$3,435	108.4%

Indexation

Indexation is the automatic correction of a dollar amount for the effects of inflation by law or contract. Many government transfer programs use indexation for the benefits. The government also indexes the tax brackets used for federal income tax. There are uses of indexation in the private sector as well. Many labor contracts include cost-of-living allowances (COLAs).

If you earn the same pay for two years in a row with positive inflation, it means you are earning less! This is because while you get paid the same, the prices, on average, are increasing, and thus cannot afford to buy as much as before, or cannot save as much as before.

Real Interest Rate

Nominal interest rate is the interest rate that measures the change in dollar amounts. This is what you always see on your credit card statements, investment accounts, student debt contracts, bank loans, mortgages and other. However, without knowing inflation, this number can be meaningless.

Real interest rate takes into account inflation. Real interest rate is the interest rate corrected for inflation. It shows how the purchasing power of your investment grows. In other words, it tells how much more you can buy after every year of investing.

We can use a very simple formula to measure the real interest rate:

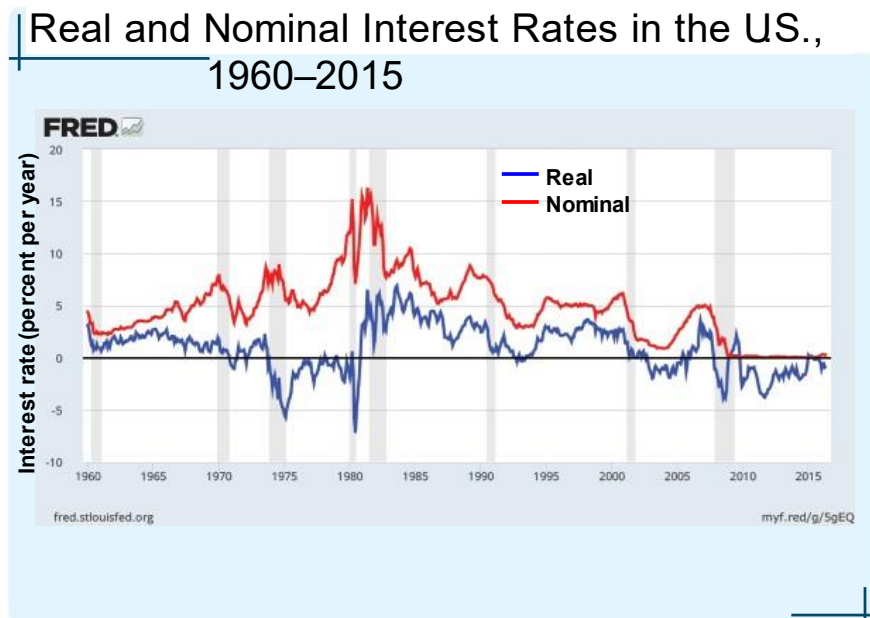
$$\text{real interest rate} = \text{nominal interest rate} - \text{inflation rate}$$

Imagine your goal is to save enough to put a down payment on a house. Today, you would need \$100,000 which you don't have. Instead, what you have, say \$50k you invest and get a 7% yearly return on your investment. As it turns, this amount will grow fairly quickly. After 1 year, you will have \$54.5k, after another \$59.405k... interest will accrue additional interest. You will find that you will have \$100k after just over 8 years. However, will \$100k, be enough for a down payment of a comparable house? Probably not! Even though, after 8 years you will have 2 times more dollars than what you started with, it will likely not be enough. Say inflation, over that period was 3% per year. This means that the real interest rate is only 9-3=6%. Your purchasing power grows only 6%. After 8 years, you will only be able to buy 60% more, not double as you need for your down payment.

	Amount	Increase in Dollar Amount	Increase in purchasing power
	\$ 50,000.00	1	1
Year 1	\$ 54,500.00	1.09	1.06
Year 2	\$ 59,405.00	1.1881	1.1236
Year 3	\$ 64,751.45	1.295029	1.191016
Year 4	\$ 70,579.08	1.41158161	1.26247696
Year 5	\$ 76,931.20	1.538623955	1.338225578
Year 6	\$ 83,855.01	1.677100111	1.418519112
Year 7	\$ 91,401.96	1.828039121	1.503630259
Year 8	\$ 99,628.13	1.992562642	1.593848075
Year 9	\$ 108,594.66	2.171893279	1.689478959
Year 10	\$ 118,368.18	2.367363675	1.790847697
Return	9%		
Inflation	3%		

This example shows that we should always consider the real interest rate and consider the growth of our purchasing power, not the dollar amount. In order to do so, we need to keep track of inflation in the economy.

Since inflation is almost always positive, nominal interest rate is almost always higher than the real interest rate. The difference between the nominal and the real interest rates is the inflation.



Conclusion

Quick Quiz to Check Student Understanding

- Question 1: The CPI gives greater weights to goods that consumers purchase more of.
 - o **A: True**
 - o B: False

Question 2: Other prices the same, an increase in the price of French wine would increase

- o A: both the GDP deflator and the CPI.
 - o B: the GDP deflator but not the CPI.
 - o **C: the CPI but not the GDP deflator.**
 - o D: neither the GDP deflator nor the CPI.
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- Question 3: In 1991 a median home cost \$122,000 and CPI = 137. In 2016, the median home cost \$219,400 and CPI = 237.7. In real terms
 - o A: Houses were more expensive in 1991.
 - o **B: Houses were more expensive in 2016.**
 - o C: Houses were the same in both years.
 - o D: Not enough information to answer.

- Question 4: A friend tells you that he deposited money in a bank one year ago and it now purchases 2% more goods than it did a year ago. Which of the following is consistent with this claim?
 - o A: The nominal interest rate was 1% and the inflation rate was 1%
 - o B: The nominal interest rate was 3% and the inflation rate was 5%
 - o **C: The nominal interest rate was 6% and the inflation rate was 4%**
 - o D: The nominal interest rate was 7% and the inflation rate was 3.5%

- Question 5 (open-ended): Which is likely to have the larger effect on the CPI, a 2 percent increase in the price of food or a 3 percent increase in the price of diamond rings?

- Question 6 (open-ended): Jay and Joyce meet George, the banker, to work out the details of a mortgage. They all expect that inflation will be 2 percent over the term of the loan, and they agree on a nominal interest rate of 6 percent. As it turns out, the inflation rate is 5 percent over the term of the loan. What was the expected real interest rate? What was the actual real interest rate? Who benefited and who lost because of the unexpected inflation?

Main Points to Remember

- The consumer price index (CPI) shows the cost of a basket of goods and services relative to the cost of the same basket in the base year. The index is used to measure the overall level of prices in the economy. The percentage change in the CPI measures the inflation rate.
- The CPI is an imperfect measure of the cost of living for three reasons. First, it does not take into account consumers' ability to substitute toward goods that become relatively cheaper over time. Second, it does not take into account increases in the purchasing power of the dollar due to the introduction of new goods. Third, it

is distorted by unmeasured changes in the quality of goods and services. Because of these measurement problems, the CPI overstates true inflation.

- Like the CPI, the GDP deflator measures the overall level of prices in the economy. The two price indexes usually move together, but there are important differences. The GDP deflator differs from the CPI because it includes goods and services produced rather than goods and services consumed. As a result, imported goods affect the CPI but not the GDP deflator. In addition, while the CPI uses a fixed basket of goods, the GDP deflator automatically changes the group of goods and services over time as the composition of GDP changes.
- Dollar figures from different times do not represent a valid comparison of purchasing power. To compare a dollar figure from the past to a dollar figure today, the older figure should be inflated using a price index.
- Various laws and private contracts use price indexes to correct for the effects of inflation. The tax laws, however, are only partially indexed for inflation.
- A correction for inflation is especially important when looking at data on interest rates. The nominal interest rate is the interest rate usually reported; it is the rate at which the number of dollars in a savings account increases over time. By contrast, the real interest rate takes into account changes in the value of the dollar over time. The real interest rate equals the nominal interest rate minus the rate of inflation.

Let Students Give Input

- Ask students with what they found interesting.
- Have a discussion on student-interest topics.
- Prepare a bit more on those interests for the beginning of the next session.

Leave a few additional external sources to learn more.

Websites

- [CPI. Bureau of Labor Statistics](#)
- [Data on Inflation in the US. Fred Economic Data](#)
- [Data on Inflation Around the World. OECD](#)
- [Data on Inflation Around the World. World Bank](#)
- [Inflation: Prices on the Rise. Basics. International Monetary Fund \(IMF\)](#)
- [What is Inflation. Federal Reserve Bank of Cleveland](#)
- [The Great Inflation. Federal Reserve History](#)
- [Visualizing the History of U.S. Inflation Over 100 Years](#)
- [The Worst Hyperinflation Situations of All Time. CNBC](#)

Podcasts

- [Why the Price of Coke Didn't Change for 70 Years](#)
- [The Indicator: Inflation or Shrinkflation](#)
- [Planet Money: Inflation, Deflation](#)
- [Fed of St. Louis. The Economic Lowdown Podcast Series. Inflation](#)
- [The Great Inflation Debate](#)

YouTube Videos, News Clips, and Lessons Explaining Trade Concepts

- [What One Winemaker's Pricing Decisions Tell Us About Inflation. WSJ](#)
- [US Inflation: Highest Levels in Decades Hit Working Americans. Al Jazeera English](#)
- [Inflation and Bubbles and Tulips: Crash Course Economics #7](#)
- [Why Printing Trillions of Dollars May Not Cause Inflation](#)
- [Inflation: could covid-19 cause prices to rise? The Economist](#)
- [Zimbabwe Struggles with Hyperinflation. AP](#)
- [Surviving Hyperinflation in Venezuela](#)
- [History of Inflation. Bank of England](#)