



Soochow University International Programs

2021 SCUIP Winter Session I
ECON202



Lecture 3: Measuring the Cost of Living

ECON202: Macroeconomics
Soochow University



Prerequisites

- These are some of the things you need to know to understand today's lecture:
 - GDP, nominal and real

The Cost of Living

- We need all sorts of things to live.
- These things are typically not free.
- How are we to measure the cost of living the way we actually live?

The Cost of Living (Cont'd)

- Question: Why do we need to know the cost of living?
- Answer: To see whether our incomes are keeping up with the cost of living.

GDP Deflator

- It measures the changes in prices for **all** of the **final** goods and services **domestically** produced in an economy.

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

- Its growth rate is a measure of the rate of **inflation**.

GDP Deflator and Inflation Rate

	Apples		Oranges		
	Price (\$)	Quantity	Price (\$)	Quantity	
2015	50	10	20	50	$\text{Growth Rate} = \frac{\text{New value} - \text{Old value}}{\text{Old value}} \times 100$
2016	100	20	30	100	
2017	150	20	50	200	
	Nominal GDP			\$	GDP Deflator
2015	$(\$50 \times 10) + (\$20 \times 50) =$			1500	$100 \times 1500 / 1500 = 100$
2016	$(\$100 \times 20) + (\$30 \times 100) =$			5000	$100 \times 5000 / 3000 = 167$
2017	$(\$150 \times 20) + (\$50 \times 200) =$			13000	$100 \times 13000 / 5000 = 260$
	Real GDP (Base year 2015)			2015 \$	Inflation (%)
2015	$(\$50 \times 10) + (\$20 \times 50) =$			1500	
2016	$(\$50 \times 20) + (\$20 \times 100) =$			3000	$100 \times (167 - 100) / 100 = 67$
2017	$(\$50 \times 20) + (\$20 \times 200) =$			5000	$100 \times (260 - 167) / 167 = 55.69$

GDP Deflator (Cont'd)

- The GDP deflator tells us how the overall level of prices in a particular year compare to the overall level of prices in the base year.
- Why call it a **deflator**?
- Nominal GDP changes from one year to the next partly because of inflation.
- Real GDP, on the other hand, changes because of changes in production alone.
- The GDP deflator can convert Nominal GDP to Real GDP by **deflating** the effect of inflation in Nominal GDP.

Converting Nominal GDP to Real GDP

- We just saw that

$$\text{GDP Deflator}_{YYYY} = \frac{\text{Nominal GDP}_{YYYY}}{\text{Real GDP}_{YYYY}} \times 100$$

- Therefore,

$$\text{Real GDP}_{yyyy} = \frac{\text{Nominal GDP}_{yyyy}}{\text{GDP Deflator}_{yyyy}} \times 100$$

- Therefore, if you know the Nominal GDP and the GDP Deflator, you can calculate the Real GDP

The Cost of Living (Cont'd)

- We saw that the GDP deflator gives us one number that represents the overall level of the prices of **all domestically** produced **final** goods and services.
- But not all final goods are bought by consumers.
- We now need one number that represents the overall level of the prices of **all goods that a typical consumer buys**.
- This is the **Consumer Price Index (CPI)**.

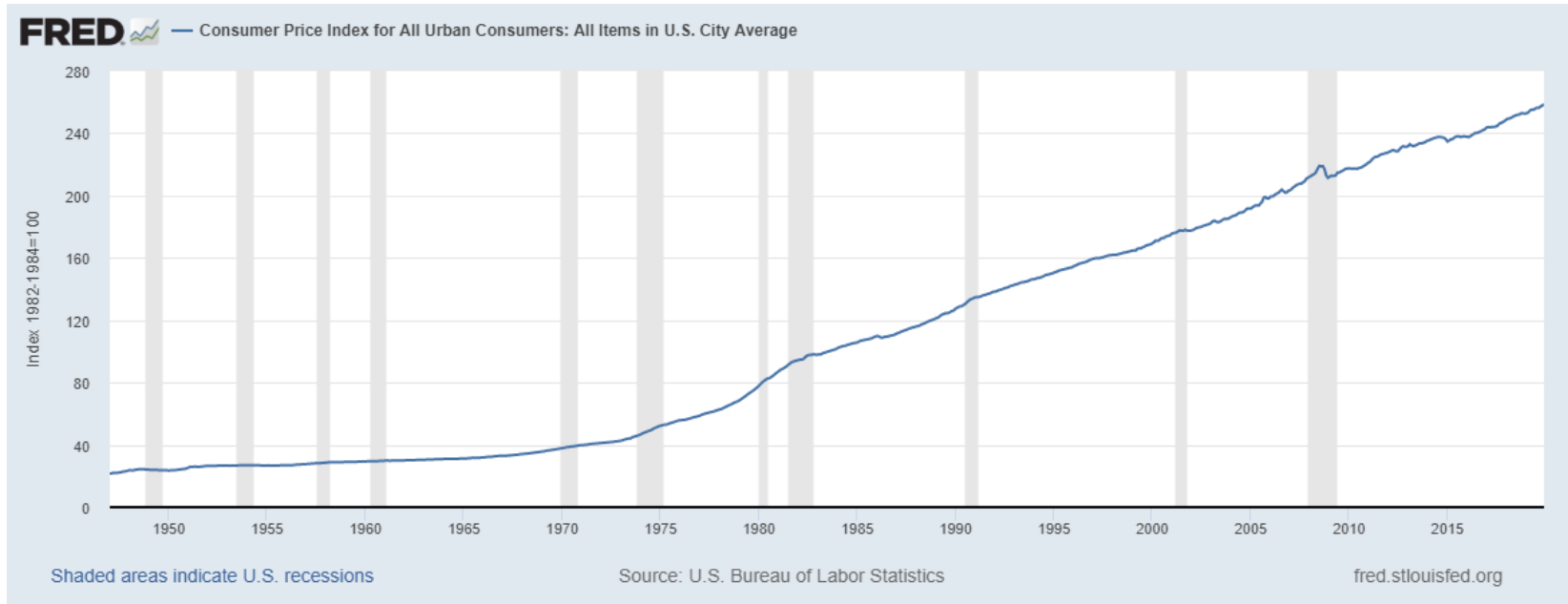


The Consumer Price Index

- The **Consumer Price Index (CPI)** is a measure of the overall cost of the goods and services bought by a typical consumer.
 - When the CPI rise, the typical family has to spend more dollars to maintain the same standard of living.
 - The Bureau of Labor Statistics (BLS) reports the CPI each month:
<https://www.bls.gov/news.release/cpi.toc.htm>
 - It is used to monitor changes in the cost of living over time.



The Consumer Price Index (Cont'd)



How the CPI is Calculated?

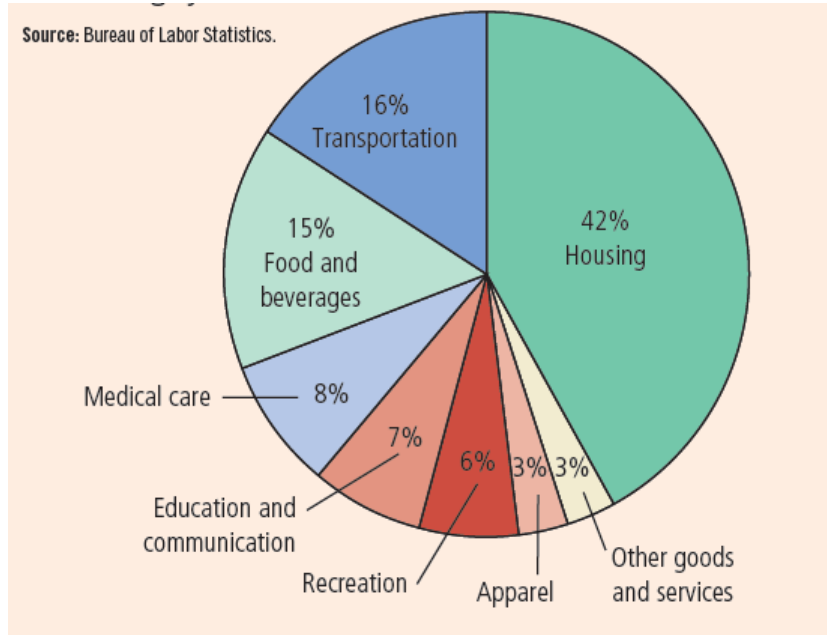
- **Fix the basket:** figure out what is in the “basket” of goods that the typical consumer buys.
- **Find the prices** paid by the typical consumer for the goods in the “basket”.
- **Compute the basket’s cost**
- **Choose a base year and compute the CPI** for all years.
- **Compute the inflation rates** for all years.

How the CPI is Calculate? (Cont'd)

- **Fix the basket:** determine what “basket” of goods the typical consumer buys.
 - The Bureau of Labor Statistics (BLS) identifies a market basket of goods and services the typical consumer buys.
 - The BLS conducts monthly consumer surveys to set the weights for the prices of those goods and services.



The Typical Basket of Goods and Services



This figure shows how the typical consumer divides spending among various categories of goods and services. The Bureau of Labor Statistics calls each percentage the “relative importance” of the category.

How the CPI is Calculated? (Cont'd)

- **Find the prices:** Find the prices of each of the goods and services in the typical consumer's basket at each point in time.
 - These prices are the prices paid by the typical consumer.



How the CPI is Calculated? (Cont'd)

- **Compute the basket's cost:** Use the data on prices to calculate the cost of the typical consumer's basket in different years.



How the CPI is Calculated? (Cont'd)

- Choose a *Base Year* and Compute the CPI:
 - Designate a particular year as the base year, making it the benchmark against which other years are compared.
 - Compute the CPI for a given year as follows:
 - 1) divide the cost of the typical consumer's basket in the given year by its cost in the base year
 - 2) multiply the result by 100



How the CPI is Calculated? (Cont'd)

- **Compute the inflation rate:** The inflation rate for a given year is the percentage increase in the CPI from the preceding period.

$$\text{Inflation Rate in Year 2} = \frac{\text{CPI in Year 2} - \text{CPI in Year 1}}{\text{CPI in Year 1}} \times 100$$

How the CPI is Calculated? (Cont'd)

Step 1: Survey Consumers to Determine a Fixed Basket of Goods

Basket = 4 hot dogs, 2 hamburgers

Step 2: Find the Price of Each Good in Each Year

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

Step 3: Compute the Cost of the Basket of Goods in Each Year

2016	$(\$1 \text{ per hot dog} \times 4 \text{ hot dogs}) + (\$2 \text{ per hamburger} \times 2 \text{ hamburgers}) = \8 per basket
2017	$(\$2 \text{ per hot dog} \times 4 \text{ hot dogs}) + (\$3 \text{ per hamburger} \times 2 \text{ hamburgers}) = \14 per basket
2018	$(\$3 \text{ per hot dog} \times 4 \text{ hot dogs}) + (\$4 \text{ per hamburger} \times 2 \text{ hamburgers}) = \20 per basket

How the CPI is Calculated? Another Example

- Base year is 2002.
- Basket of goods in 2002 costs \$1,200.
- The same basket in 2004 costs \$1,236.
- $\text{CPI for 2004} = (\$1,236 / \$1,200) \times 100 = 103$
- Prices increased 3 percent between 2002 and 2004.

Problems in Measuring the Cost of Living

- The CPI is an accurate measure of the selected goods that make up the typical bundle, but it is not a perfect measure of the cost of living.



Problems in Measuring the Cost of Living (Cont'd)

- Substitution bias
- Introduction of new goods
- Unmeasured quality changes

Substitution Bias

- The basket does not change to reflect consumer reaction to changes in relative prices.
 - Consumers substitute toward goods that have become relatively less expensive.
 - The index overstates the increase in cost of living by not considering consumer substitution.

Substitution Bias in CPI

- Suppose Red Apples and Green Apples are the only two commodities and are identical except for color.
- Suppose the typical consumer's basket has, for many years, contained 10 of each type.
- Suppose the prices in 2015 (the base year) were \$2 per apple for both types. So, the cost of the consumer's basket was \$40 in 2015.
- Suppose the prices in 2016 are \$4 for a Red Apple and \$2 for a Green Apple. So the cost of the consumer's basket is \$60 in 2016.
- Therefore, the CPI for 2016 is $(60/40) \times 100 = 150$, indicating a 50% increase in the cost of living.
- But has the cost of living really increased?

Substitution Bias in CPI (Cont'd)

- No. The consumer can switch to zero Red Apples and 20 Green Apples and enjoy the same satisfaction as always without any increase in cost.
- Therefore, the CPI exaggerates the true cost of living.



Introduction of New Goods

- The basket does not reflect the change in purchasing power brought on by the introduction of new products.
 - New products result in greater variety, which in turn makes each dollar more valuable.
 - Consumers need fewer dollars to maintain any given standard of living.

Unmeasured Quality Changes

- If the quality of a good rises from one year to the next, the value of a dollar rises, even if the price of the good stays the same.
 - If the quality of a good falls from one year to the next, the value of a dollar falls, even if the price of the good stays the same.
 - The BLS tries to adjust the price for constant quality, but such differences are hard to measure.

Problems in Measuring the Cost of Living (Cont'd)

- The substitution bias, introduction of new goods, and unmeasured quality changes cause the CPI to overstate the true cost of living.
 - The issue is important because many government programs use the CPI to adjust for changes in the overall level of prices.
 - The CPI overstates inflation by about 1 percentage point per year.



Correcting Economic Variables for the Effects of Inflation

- The Consumer Price Index is used to correct for the effects of inflation when comparing dollar figures from different eras.
 - See the BLS's inflation calculator



Quick Quiz

- CPI in 1914 = 10
- CPI in 2012 = 230
- Henry Ford paid his workers \$5 a day in 1914.
- Question: How much is that in 2012 dollars?
- Answer: \$115
 - CPI rose by a multiple of 23 ($=230/10$) from 1914 to 2012.
 - So, the 2012 equivalent of the 1914 salary would have to be 23 times the 1914 salary = $23 \times \$5 = \115

General Rule of Correcting for Inflation

- If you know a dollar amount in year a , what is the equivalent dollar amount – in purchasing power – in year b ?
- $\text{Year } b \text{ amount} = \text{Year } a \text{ amount} \times \frac{\text{CPI in Year } b}{\text{CPI in Year } a}$

FYI: Mr. Index Goes to Hollywood

Film	Year of Release	Total Domestic Gross (in millions of 2004 dollars)
1. <i>Gone with the Wind</i>	1939	\$1,254
2. <i>Star Wars</i>	1977	1,084
3. <i>The Sound of Music</i>	1965	870
4. <i>E.T.: The Extra-Terrestrial</i>	1982	861
5. <i>The Ten Commandments</i>	1956	801
6. <i>Titanic</i>	1997	789
7. <i>Jaws</i>	1975	783
8. <i>Doctor Zhivago</i>	1965	740
9. <i>The Jungle Book</i>	1967	662
10. <i>Snow White and the Seven Dwarfs</i>	1937	650

Indexation

- When some dollar amount is automatically corrected for inflation by law or contract, the amount is said to be **indexed** for inflation.

Real and Nominal Interest Rates

- Interest represents a payment in the future for a receipt of money in the past.



Real and Nominal Interest Rates (Cont'd)

- The **nominal interest rate** is the interest rate usually mentioned in borrowing or lending contracts.
 - It is **not** corrected for inflation.
 - It is the interest rate that a bank pays.
- The **real interest rate** is the interest rate that is corrected for the effects of inflation.



Real and Nominal Interest Rates (Cont'd)

- Suppose you borrowed \$1,000 for one year.
- Suppose the nominal interest rate was 15%.
- Suppose that, during the year, inflation was 10%.

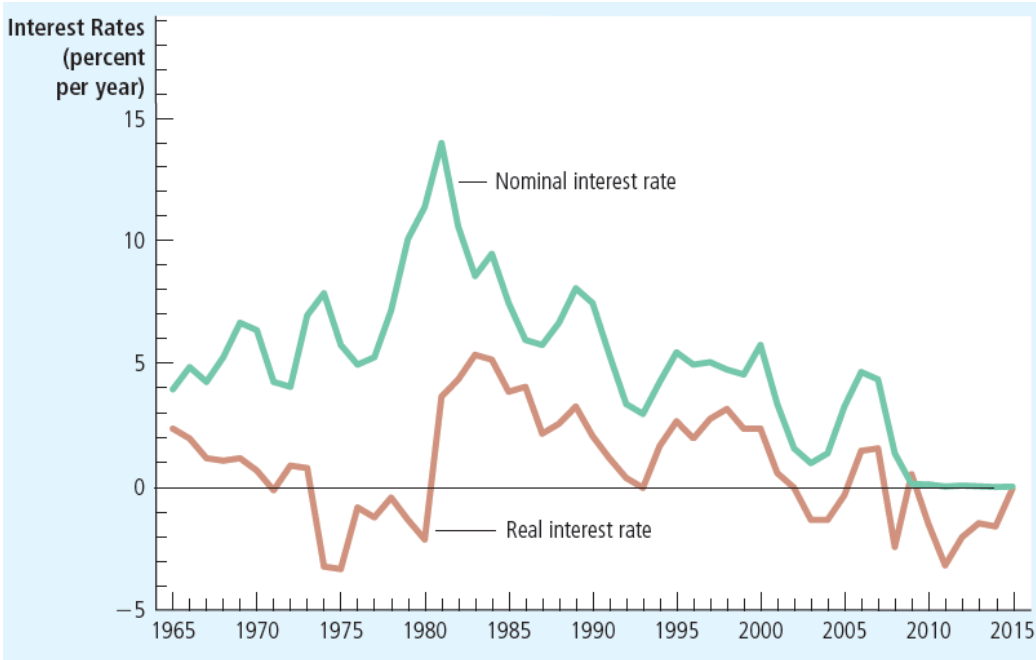
$$\begin{aligned} \text{Real interest rate} &= \text{Nominal interest rate} - \text{Inflation} \\ &= 15\% - 10\% = 5\% \end{aligned}$$

Real and Nominal Interest Rates (Cont'd)

- You loan \$100 to a friend at the **nominal interest rate of 15%**.
 - A year later, you will get back **\$115**.
- Inflation turns out to be 10% during the loan period.
 - In particular, let's say the price of gold increased 10%.
 - Had you instead bought gold with your \$100, a year later you could have sold it for \$110.
- So, by lending \$100 to your friend, you actually earned **\$5**, over and above inflation.
 - So, your **real interest rate was 5%**.



Real and Nominal Interest Rates (Cont'd)



Notice that nominal and real interest rates often do not move together.

GDP Deflator vs. CPI

- Economists and policymakers monitor both the GDP deflator and the consumer price index to gauge how quickly prices are rising.
- There are, however, three important differences between the indexes.

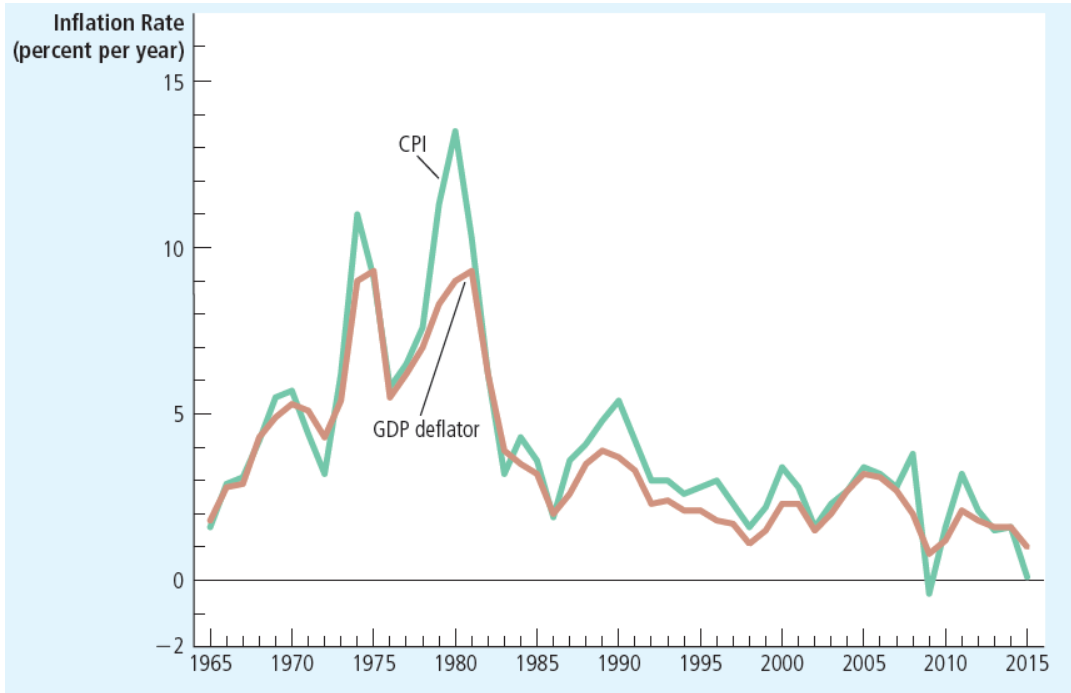
GDP Deflator vs. CPI (Cont'd)

- Prices of non-consumer goods and services:
 - included in GDP deflator (if produced domestically)
 - excluded from CPI
- Prices of imported consumer goods and services:
 - included in CPI
 - excluded from GDP deflator
- The basket of goods and services:
 - CPI: fixed
 - GDP deflator: changes every year

GDP Deflator vs. CPI (Cont'd)

- The BLS calculates other prices indexes:
 - The index for different regions within the country.
 - The **producer price index**, which measures the cost of a basket of goods and services bought by firms rather than consumers.

Two Measures of Inflation



Notice that the two measures of inflation generally move together.



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