

Lecture 2 Imputation, CPI and Other Useful concepts

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Imputation(kizoku keisan)

- Some economic activities do not have sales. But they are important for the economy.
- Service provided by police
- Service provided by firefighter
- Self-consumed agricultural product.
- Owner occupied housing
- Note that some activities are excluded from imputation.

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Real vs. nominal GDP

- GDP is the value of all final goods and services produced.
- **nominal GDP** measures these values using current prices.
- **real GDP** measure these values using the prices of a base year.

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NOW YOU TRY:

Real & Nominal GDP

	2006		2007		2008	
	P	Q	P	Q	P	Q
good A	\$30	900	\$31	1,000	\$36	1,050
good B	\$100	192	\$102	200	\$100	205

- Compute nominal GDP in each year.
- Compute real GDP in each year using 2006 as the base year.

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NOW YOU TRY:

Answers

nominal GDP *multiply Ps & Qs from same year*

2006: $\$46,200 = \$30 \times 900 + \$100 \times 192$

2007: $\$51,400$

2008: $\$58,300$

real GDP *multiply each year's Qs by 2006 Ps*

2006: $\$46,200$

2007: $\$50,000$

2008: $\$52,000 = \$30 \times 1050 + \$100 \times 205$

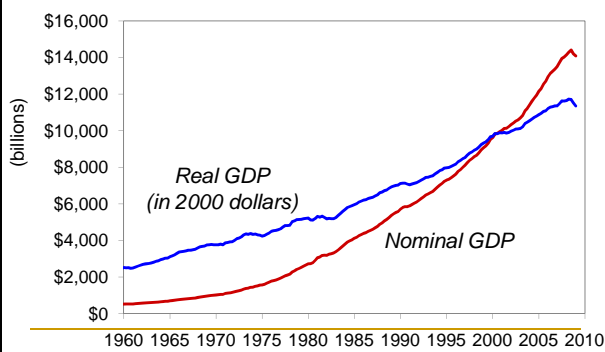
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Real GDP controls for inflation

- Changes in nominal GDP can be due to:
 - changes in prices.
 - changes in quantities of output produced.
- Changes in real GDP can only be due to changes in quantities, because real GDP is constructed using constant base-year prices.

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U.S. Nominal and Real GDP, 1960-2009



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GDP Deflator

- **Inflation rate**: the percentage increase in the overall level of prices
- One measure of the price level: **GDP deflator**

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

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NOW YOU TRY:

GDP deflator and inflation rate

	Nom. GDP	Real GDP	GDP deflator	Inflation rate
2006	\$46,200	\$46,200		<i>n.a.</i>
2007	51,400	50,000		
2008	58,300	52,000		

- Use your previous answers to compute the GDP deflator in each year.
- Use GDP deflator to compute the inflation rate from 2006 to 2007, and from 2007 to 2008.

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NOW YOU TRY:

Answers

	Nominal GDP	Real GDP	GDP deflator	Inflation rate
2006	\$46,200	\$46,200	100.0	<i>n.a.</i>
2007	51,400	50,000	102.8	2.8%
2008	58,300	52,000	112.1	9.1%

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Understanding the GDP deflator

Example with 3 goods

For good $i = 1, 2, 3$

P_{it} = the market price of good i in month t

Q_{it} = the quantity of good i produced in month t

$NGDP_t$ = Nominal GDP in month t

$RGDP_t$ = Real GDP in month t

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Understanding the GDP deflator

$$\text{GDP deflator}_t = \frac{NGDP_t}{RGDP_t} = \frac{P_{1t}Q_{1t} + P_{2t}Q_{2t} + P_{3t}Q_{3t}}{RGDP_t}$$

$$= \left(\frac{Q_{1t}}{RGDP_t} \right) P_{1t} + \left(\frac{Q_{2t}}{RGDP_t} \right) P_{2t} + \left(\frac{Q_{3t}}{RGDP_t} \right) P_{3t}$$

The GDP deflator is a weighted average of prices.

The weight on each price reflects that good's relative importance in GDP.

Note that the weights change over time.

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Two arithmetic tricks for working with percentage changes

1. For any variables X and Y ,
percentage change in $(X \times Y)$
 \approx percentage change in X
 $+ \text{percentage change in } Y$

EX: If your hourly wage rises 5% and you work 7% more hours, then your wage income rises approximately 12%.

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Two arithmetic tricks for working with percentage changes

2. percentage change in (X/Y)
 \approx percentage change in X
 $- \text{percentage change in } Y$

EX: GDP deflator = $100 \times \text{NGDP}/\text{RGDP}$.

If NGDP rises 9% and RGDP rises 4%, then the inflation rate is approximately 5%.

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Consumer Price Index (CPI)

- A measure of the overall level of prices
- Published by the Bureau of Labor Statistics (BLS)
- Uses:
 - tracks changes in the typical household's cost of living
 - adjusts many contracts for inflation ("COLAs")
 - allows comparisons of dollar amounts over time

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How the government constructs the CPI

1. Survey consumers to determine composition of the typical consumer's "basket" of goods
2. Every month, collect data on prices of all items in the basket; compute cost of basket
3. CPI in any month equals

$$100 \times \frac{\text{Cost of basket in that month}}{\text{Cost of basket in base period}}$$

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NOW YOU TRY:
Compute the CPI

Basket: 20 pizzas, 10 compact discs

prices:	pizza	CDs
2002	\$10	\$15
2003	\$11	\$15
2004	\$12	\$16
2005	\$13	\$15

- For each year, compute
- the cost of the basket
 - the CPI (use 2002 as the base year)
 - the inflation rate from the preceding year

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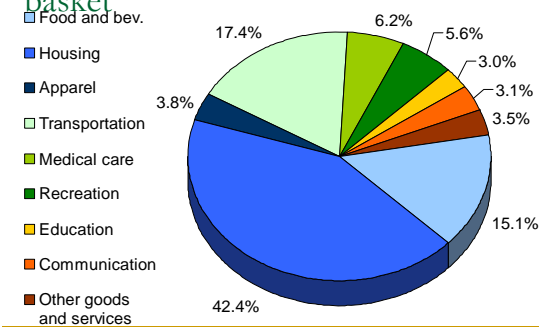
NOW YOU TRY:
Answers to CPI exercise

	Cost of basket	CPI	Inflation rate
2002	\$350	100.0	<i>n.a.</i>
2003	370	105.7	5.7%
2004	400	114.3	8.1%
2005	410	117.1	2.5%

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The composition of the CPI's

"basket"



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Understanding the CPI

Example with 3 goods

For good $i = 1, 2, 3$

C_i = the amount of good i in the CPI's basket

P_{it} = the price of good i in month t

E_t = the cost of the CPI basket in month t

E_b = the cost of the basket in the base period

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Understanding the CPI

$$\begin{aligned}\text{CPI in month } t &= \frac{E_t}{E_b} = \frac{P_{1t}C_1 + P_{2t}C_2 + P_{3t}C_3}{E_b} \\ &= \left(\frac{C_1}{E_b}\right) P_{1t} + \left(\frac{C_2}{E_b}\right) P_{2t} + \left(\frac{C_3}{E_b}\right) P_{3t}\end{aligned}$$

The CPI is a weighted average of prices.

The weight on each price reflects that good's relative importance in the CPI's basket.

Note that the weights remain fixed over time.

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Why the CPI may overstate inflation

- **Substitution bias:**
The CPI uses fixed weights, so it cannot reflect consumers' ability to substitute toward goods whose relative prices have fallen.
- **Introduction of new goods:**
The introduction of new goods makes consumers better off and, in effect, increases the real value of the dollar. But it does not reduce the CPI, because the CPI uses fixed weights.
- **Unmeasured changes in quality:**
Quality improvements increase the value of the dollar, but are often not fully measured.

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The size of the CPI's bias

- In 1995, a Senate-appointed panel of experts estimated that the CPI overstates inflation by about 1.1% per year.
- So the BLS made adjustments to reduce the bias.
- Now, the CPI's bias is probably under 1% per year.

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NOW YOU TRY:

Discussion Questions

1. If your grandmother receives Social Security, how is she affected by the CPI's bias?
2. Where does the government get the money to pay COLAs to Social Security recipients?
3. If you pay income and Social Security taxes, how does the CPI's bias affect you?
4. Is the government giving your grandmother too much of a COLA?
5. How does your grandmother's "basket" differ from the CPI's? Does this affect your answer to Q4?

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CPI vs. GDP Deflator

Prices of capital goods:

- included in GDP deflator (if produced domestically)
- excluded from CPI

Prices of imported consumer goods:

- included in CPI
- excluded from GDP deflator

The basket of goods:

- CPI: fixed
- GDP deflator: changes every year

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Real vs. Nominal GDP

- GDP is the value of all final goods and services produced.
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Real GDP controls for inflation

Changes in nominal GDP can be due to:

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Changes in real GDP can only be due to changes in quantities, because real GDP is constructed using constant base-year prices.

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Reasons why the CPI may overstate inflation

- **Substitution bias:** The CPI uses fixed weights, so it cannot reflect consumers' ability to substitute toward goods whose relative prices have fallen.
- **Introduction of new goods:** The introduction of new goods makes consumers better off and, in effect, increases the real value of the dollar. But it does not reduce the CPI, because the CPI uses fixed weights.
- **Unmeasured changes in quality:** Quality improvements increase the value of the dollar, but are often not fully measured.

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The CPI's bias

- The Boskin Panel's "best estimate":
The CPI overstates the true increase in the cost of living by 1.1% per year.
- Result: the BLS has refined the way it calculates the CPI to reduce the bias.
- It is now believed that the CPI's bias is slightly less than 1% per year.

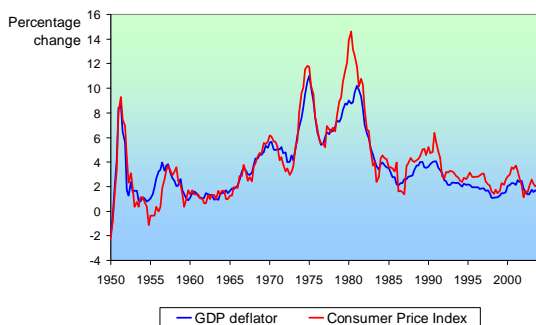
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CPI vs. GDP deflator

- prices of capital goods
 - included in GDP deflator (if produced domestically)
 - excluded from CPI
- prices of imported consumer goods
 - included in CPI
 - excluded from GDP deflator
- the basket of goods
 - CPI: fixed
 - GDP deflator: changes every year

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Two measures of inflation



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Categories of the population

- **employed**
working at a paid job
- **unemployed**
not employed but looking for a job
- **labor force**
the amount of labor available for producing goods and services; all employed plus unemployed persons
- **not in the labor force**
not employed, not looking for work.

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Two important labor force concepts

- **unemployment rate**
percentage of the labor force that is unemployed
- **labor force participation rate**
the fraction of the adult population that 'participates' in the labor force

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Exercise: *Compute labor force statistics*

U.S. adult population by group, May 2004

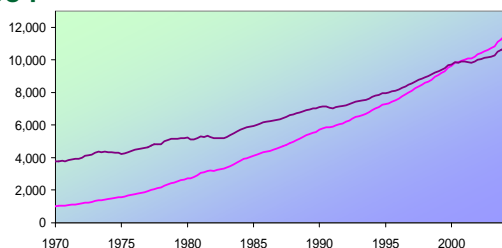
Number employed	=	138.8 million
Number unemployed	=	8.2 million
Adult population	=	223.0 million

Use the above data to calculate

- the labor force
- the number of people not in the labor force
- the labor force participation rate
- the unemployment rate

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U.S. Real & Nominal GDP, 1970-2004



— Nominal GDP (billions of dollars)
— Real GDP (billions of chained 2000 dollars)

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Categories of the population

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Answers:

- data: E = #employed people U = #unemployed, POP = population
- labor force
 $L = E + U$
- not in labor force
 $NILF = POP - L$
- unemployment rate
 U/L
- labor force participation rate
 L/POP

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Okun's Law

- When the negative shocks happens to the economy, some people becomes unemployed. So one would expect a negative relationship between unemployment and real GDP.
- This relationship is clear in the data in the time series data.

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