



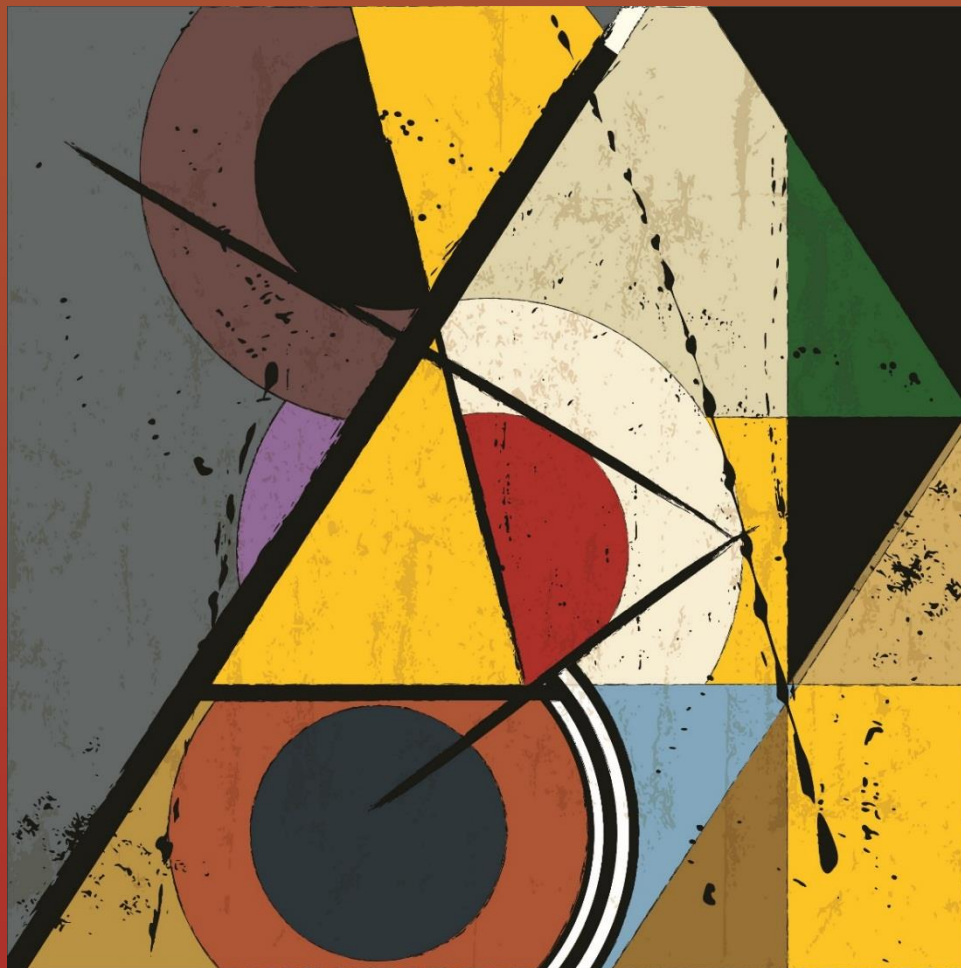
## The Data of Macroeconomics

Modified by  
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Presentation Slides

# Macroeconomics

*N. Gregory Mankiw*



# IN THIS CHAPTER, YOU WILL LEARN:



... the meaning and measurement of the most important macroeconomic statistics:

- gross domestic product (GDP)
- the consumer price index (CPI)
- the unemployment rate

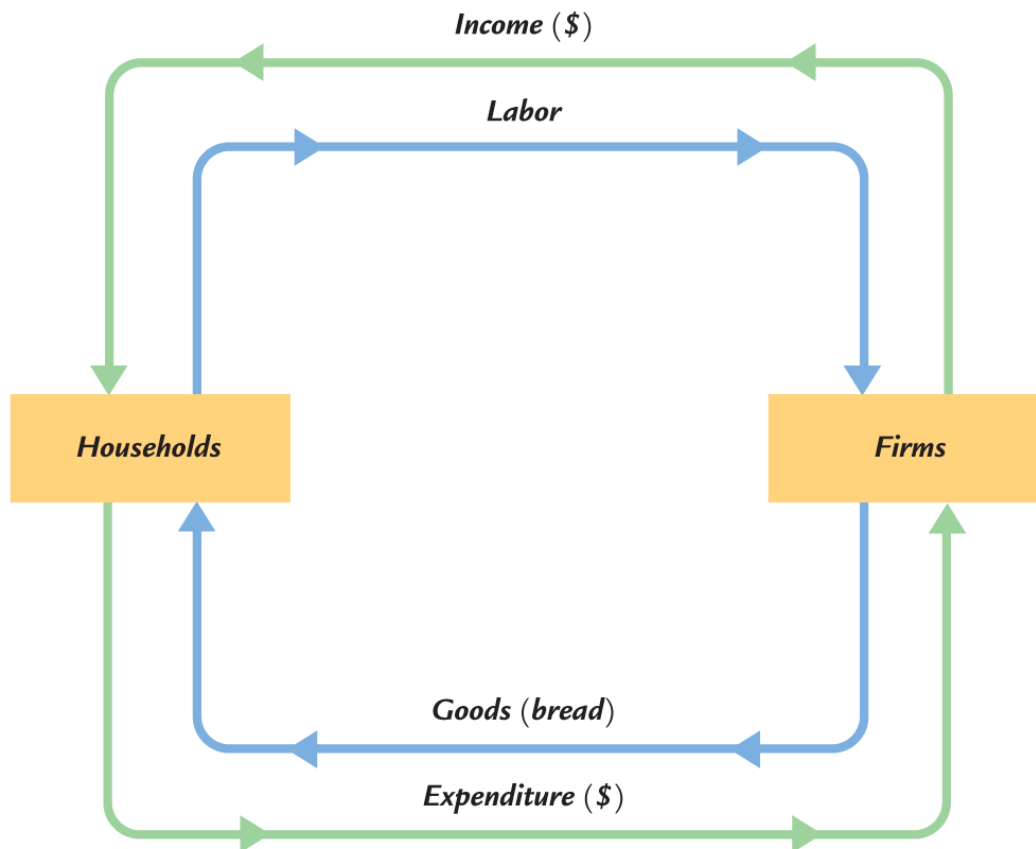
# Gross domestic product: Expenditure and income

Two definitions:

- Total expenditure on domestically produced final goods and services.
- Total income earned by domestically located factors of production.

*Expenditure equals income because every dollar a buyer spends becomes income to the seller.*

# The circular flow



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## Value added

**Value added** is the value of output minus the value of the intermediate goods used to produce that output

Note: Intermediate goods are produced from raw materials by one firm and then sold to another firm for final processing

Eg. Meat- cattle rancher

## NOW YOU TRY

### Identifying value added

- A farmer grows a bushel of wheat and sells it to a miller for \$1.00.
- The miller turns the wheat into flour and sells it to a baker for \$3.00.
- The baker uses the flour to make a loaf of bread and sells it to an engineer for \$6.00.
- The engineer eats the bread.

*Compute the value added at each stage of production and GDP.*

## Final goods, value added, and GDP

- GDP = value of final goods produced  
= sum of value added at all stages of production
- The value of the final goods already includes the value of the intermediate goods, so including intermediate *and* final goods in GDP would be double counting.

# The expenditure components of GDP

- consumption, **C**
- investment, **I**
- government spending, **G**
- net exports, **NX**

An important identity:

$$Y = C + I + G + NX$$

*value of  
total output*

*aggregate  
expenditure*



# Consumption (C)

**Definition:** The value of all goods and services bought by households, including:

- ***Durable goods***  
last a long time.  
Examples: cars, home appliances
- ***Nondurable goods***  
last a short time.  
Examples: food, clothing
- ***Services***  
are intangible items purchased by consumers.  
Examples: dry cleaning,  
air travel

## U.S. consumption, 2016

	Total (billions of dollars)	Per Person (dollars)
<b>Gross Domestic product</b>	18,624	57,638
<b>Consumption</b>	12,821	39,677
Nondurable goods	2,710	8,388
Durable goods	1,411	4,367
Services	8,699	26,922

# Investment (I)

- Spending on capital, a physical asset used in future production
- Includes:
  - **Business fixed investment**—Spending on plant and equipment
  - **Residential fixed investment**—Spending by consumers and landlords on housing units
  - **Inventory investment**—The change in the value of all firms' inventories

## U.S. investment, 2016

	Total (billions of dollars)	Per Person (dollars)
<b>Gross Domestic product</b>	18,624	57,638
<b>Consumption</b>	3,057	9,461
Nonresidential fixed investment	2,316	7,168
Residential fixed investment	706	2,185
Inventory investment	35	109

## Government Spending ( $G$ )

- $G$  includes all government spending on goods and services.
- $G$  excludes transfer payments (e.g., unemployment insurance payments) because they do not represent spending on goods and services.

## Net Exports ( $NX$ )

- $NX$  = exports – imports
  - **Exports:** the value of g&s (goods and services) sold to other countries
  - **Imports:** the value of g&s purchased from other countries
- Hence,  $NX$  equals net spending from abroad on our g&s.

## U.S. net exports, 2016

	Total (billions of dollars)	Per Person (dollars)
<b>Gross Domestic product</b>	18,624	57,638
<b>Net Exports</b>	-521	-1,613
Exports	2,215	6,854
Imports	2,736	8,647

## NOW YOU TRY

### An expenditure-output puzzle?

Suppose a firm:

- produces \$10 million worth of final goods
- sells only \$9 million worth
- Does this violate the ***expenditure = output*** identity?



## Why output = expenditure

- Unsold output goes into inventory and is counted as “inventory investment” . . . whether or not the inventory buildup was intentional.
- In effect, we are assuming that firms purchase their unsold output.

## Stocks vs. flows

A **stock** is a quantity measured **at a point in time**.

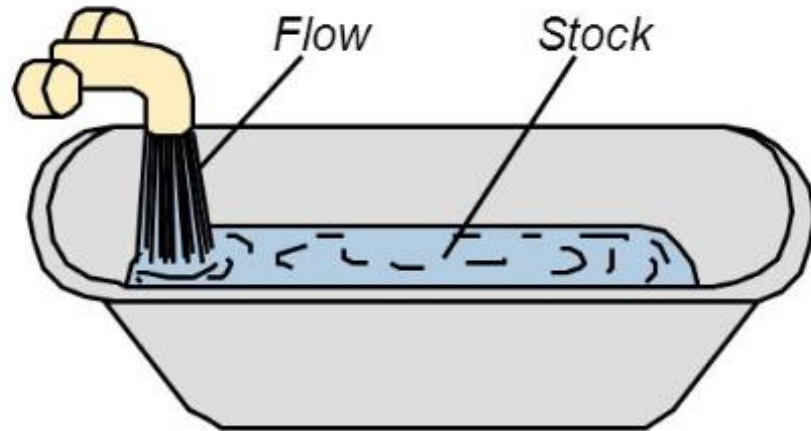
Example: “The U.S. capital stock was \$10 trillion on January 1, 2016.”

A **flow** is a quantity measured **per unit of time**.

Example: “U.S. investment was \$2 trillion during 2016.”

# Stocks vs. flows: examples

## ■ Stocks vs. Flows



More examples:

<i><b>stock</b></i>	<i><b>flow</b></i>
a person's wealth	a person's saving
# of people with college degrees	# of new college graduates
the govt. debt	the govt. budget deficit

## NOW YOU TRY

### Stock or flow?

- The balance on your credit card statement
- How much time you spend studying
- The size of your MP3/iTunes collection
- The inflation rate
- The unemployment rate

## An important and versatile concept

We have now seen that GDP measures:

- total income
- total output
- total expenditure
- the sum of value added at all stages in the production of final goods

# GNP vs. GDP

- **Gross national product (GNP):**  
Total income earned by the nation's factors of production, regardless of where located.
- **Gross domestic product (GDP):**  
Total income earned by domestically located factors of production, regardless of nationality.
- $\text{GNP} - \text{GDP} = \text{factor payments from abroad} - \text{factor payments to abroad}$
- Examples of factor payments: wages, profits, rent, interest and dividends on assets
- Note: **factor payments** are simply payments to the factors of production, such as the wages earned by labor.

## NOW YOU TRY

### Discussion question

In your country,  
which would you  
want to be bigger:  
GDP or GNP?  
Why?

## GNP vs. GDP in select countries, 2012

Country	GNP	GDP	GNP – GDP (% of GDP)
Bangladesh	127,672	116,355	9.7
Japan	6,150,132	5,961,066	3.2
China	8,184,963	8,227,103	-0.5
United States	16,514,500	16,244,600	1.7
India	1,837,279	1,8585,740	-1.2
Canada	1,821,424	1,779,635	2.3
Greece	250,167	248,939	0.5
Iraq	216,453	215,838	0.3
Ireland	171,996	210,636	-18.3

*GNP and GDP in millions of current U.S. dollars.*



## 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** measures these values using the prices of a base year.

## NOW YOU TRY

### Real and nominal GDP

	<b>2015:</b> <i>P</i>	<b>2015:</b> <i>Q</i>	<b>2016:</b> <i>P</i>	<b>2016:</b> <i>Q</i>	<b>2017:</b> <i>P</i>	<b>2017:</b> <i>Q</i>
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 2015 as the base year.

## NOW YOU TRY

### Real and nominal GDP, answers

Nominal GDP *multiply Ps and Qs from same year*

$$2015: \$46,200 = \$30 \times 900 + \$100 \times 192$$

$$2016: \$51,400$$

$$2017: \$58,300$$

Real GDP *multiply each year's Qs by 2015 Ps*

$$2015: \$46,200$$

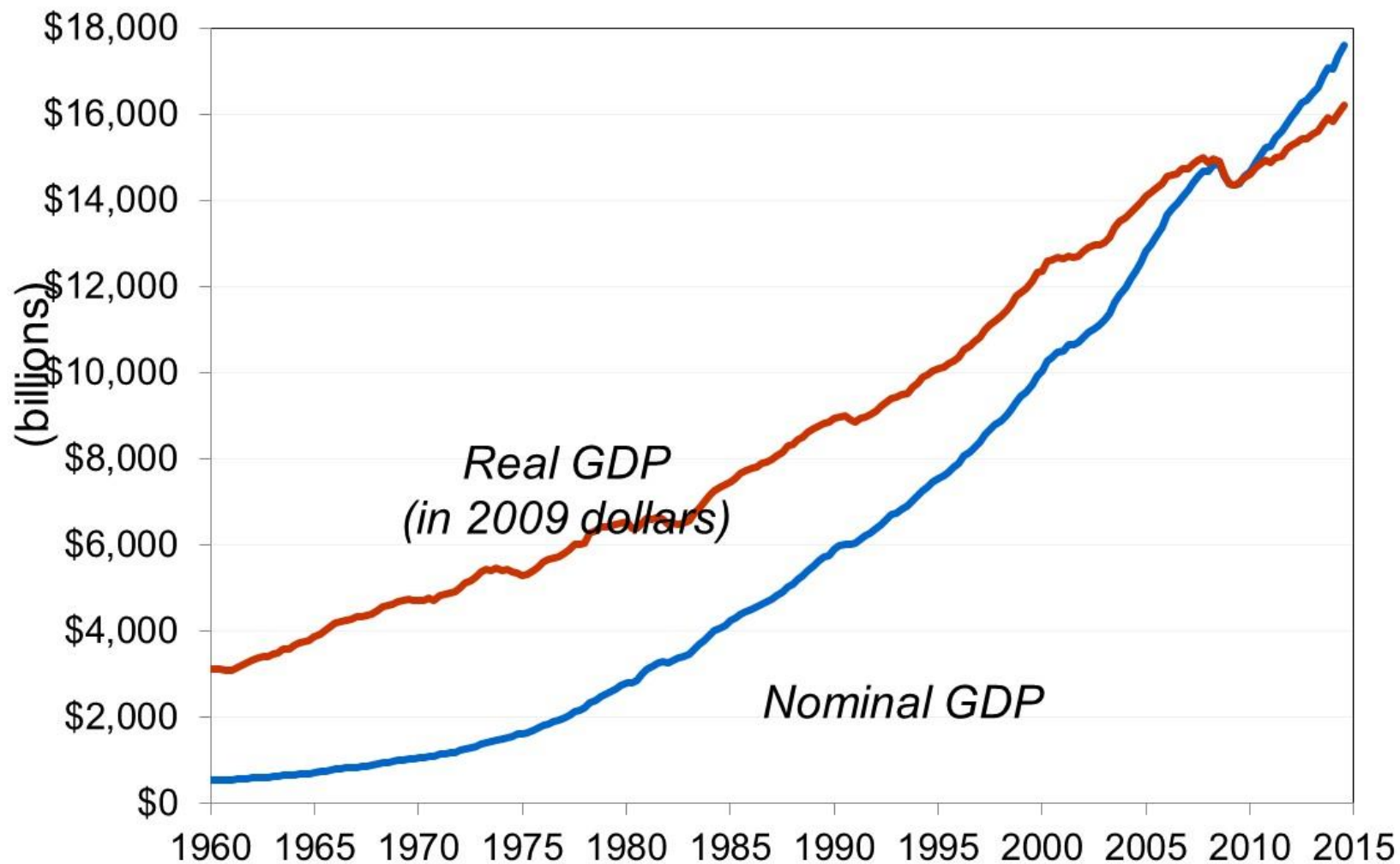
$$2016: \$50,000$$

$$2017: \$52,000 = \$30 \times 1050 + \$100 \times 205$$

## 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.

# U.S. nominal and real GDP, 1960–2014



# GDP deflator

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

Definition:

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

## NOW YOU TRY

### GDP deflator and the inflation rate

	Nominal GDP	Real GDP	GDP deflator	Inflation rate
2015	\$46,200	\$46,200		n.a.
2016	51,400	50,000		
2017	58,300	52,000		



- Use your previous answers to compute the GDP deflator in each year.
- Use the GDP deflator to compute the inflation rate from 2015 to 2016 and from 2016 to 2017.

## NOW YOU TRY

### GDP deflator and the inflation rate, answers

	Nominal GDP	Real GDP	GDP deflator	Inflation rate
2015	\$46,200	\$46,200	100.0	n.a.
2016	51,400	50,000	102.8	2.8%
2017	58,300	52,000	112.1	9.0%



$$2016 \text{ Inflation Rate} = \frac{(2016 \text{ GDP deflator} - 2015 \text{ GDP deflator})}{2015 \text{ GDP deflator}} \times 100$$



## Chain-weighted real GDP

- Over time, relative prices change, so the base year should be updated periodically.
- In essence, **chain-weighted real GDP** updates the base year every year, so it is more accurate than constant-price GDP.
- Your textbook usually uses constant-price real GDP because:
  - the two measures are highly correlated
  - constant-price real GDP is easier to compute

# Consumer price index (CPI)

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

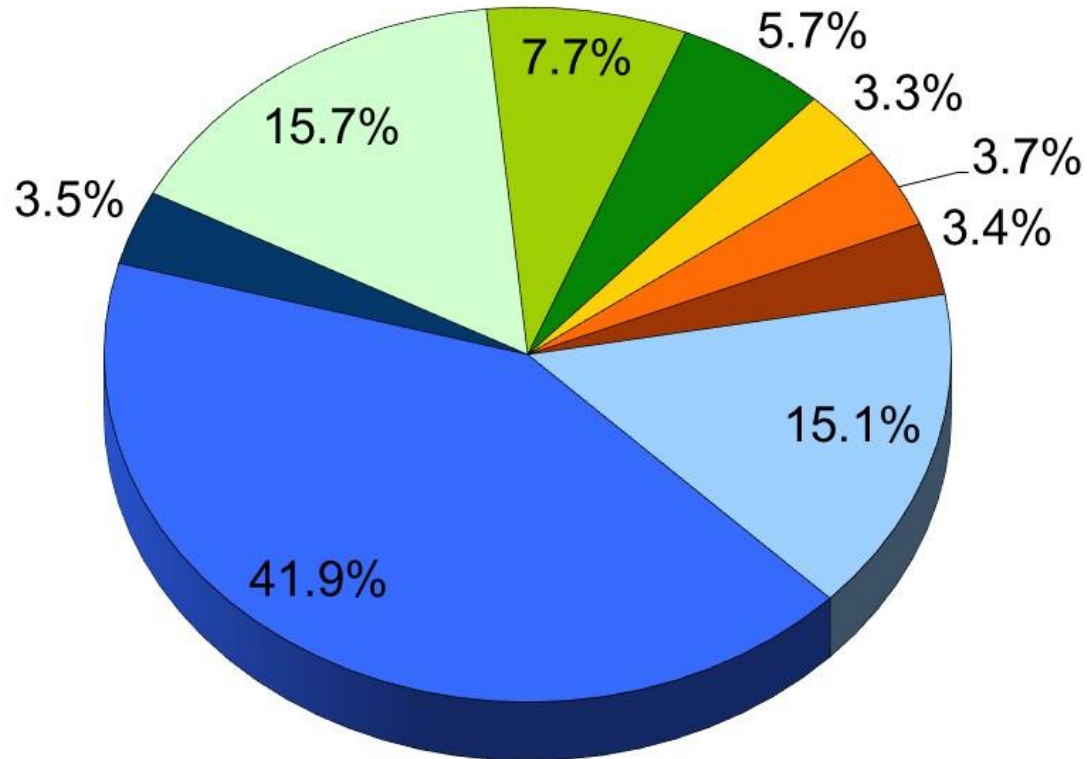
## How the BLS constructs the CPI

1. It surveys consumers to determine the composition of the typical consumer's "basket" of goods
2. Every month, it collects data on the prices of all items in the basket and computes the cost of the basket
3. CPI in any month equals

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

# The composition of the CPI's "basket"

- Food and bev.
- Housing
- Apparel
- Transportation
- Medical care
- Recreation
- Education
- Communication
- Other goods and services



# NOW YOU TRY

## Compute the CPI

### Basket:

20 pizzas and  
10 compact discs

### Prices:

	Pizza	CDs
2015	\$10	\$15
2016	\$11	\$15
2017	\$12	\$16
2018	\$13	\$15


For each year, compute:

- the cost of the basket
- the CPI (using 2015 as the base year)
- the inflation rate from the preceding year

## NOW YOU TRY

Compute the CPI, answers

	Cost of basket	CPI	Inflation rate
2015	\$350	100.0	n.a.
2016	370	105.7	5.7%
2017	400	114.3	8.1%
2018	410	117.1	2.5%



## Why the CPI may overstate inflation

- **Substitution bias:**

The CPI uses fixed weights (a fixed basket of goods), 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.

## 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:

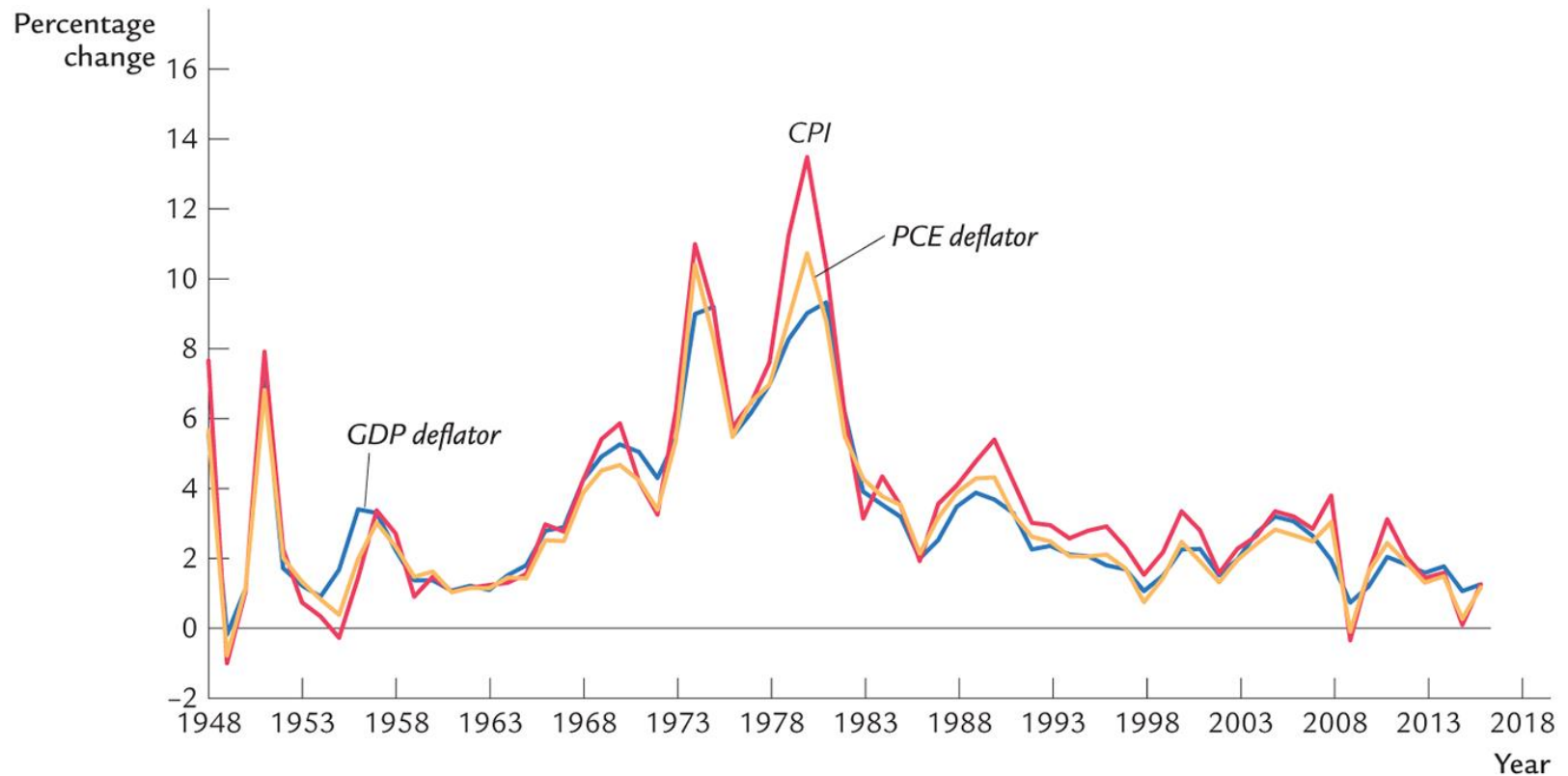
- CPI: fixed
- GDP deflator: changes every year



# The PCE deflator

- Another measure of the price level: personal consumption expenditures (PCE) deflator, **the ratio of nominal to real consumer spending**
- How the PCE is like the CPI:
  - only includes consumer spending
  - includes imported consumer goods
- How the PCE is like the GDP deflator:
  - the “basket” changes over time
- The Federal Reserve prefers PCE.

# The GDP deflator, CPI, and PCE deflator



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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

# Important labor-force concepts

- **Labor force** is the sum of employed and unemployed

**Labor force = # of Employed + # of Unemployed**

- **Unemployment rate** is the percentage of the labor force that is unemployed

$$\text{Unemployment rate} = \frac{\text{\textit{\# of Unemployed}}}{\text{\textit{Labor Force}}} * 100$$

# Important labor-force concepts

- **Labor-force participation rate** fraction of the adult population that “participates” in the labor force—that is, is working or looking for work

$$\text{Labor-Force participation rate} = \frac{\text{Labor Force}}{\text{Adult Population}} * 100$$

## NOW YOU TRY

### Computing labor statistics

#### **U.S. adult population by group, June 2017**

Number employed = 153.2 million

Number unemployed = 7.0 million

Adult population = 255.0 million

Calculate

- the labor force
- the unemployment rate
- the labor force participation rate

## NOW YOU TRY

### Computing labor statistics, answers

Data: ***E*** = 153.2, ***U*** = 7.0, ***POP*** = 255.0

Labor force

$$L = E + U = 153.2 + 7.0 = \underline{160.2}$$

Unemployment rate

$$U/L \times 100\% = (7.0/160.2) \times 100\% = \underline{4.4\%}$$

Labor force participation rate

$$L/POP \times 100\% = (160.2/255.0) \times 100\% = \underline{62.8\%}$$

## Two helpful facts for working with percentage changes, part 1

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

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



## Two helpful facts for working with percentage changes, part 2

**2. Percentage change in  $(X/Y)$**   
 **$\approx$  percentage change in  $X$**   
 **$-$  percentage change in  $Y$**

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

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

## NOW YOU TRY

### Computing percentage changes

Suppose

- population increases by 1%
- labor force increases by 3%
- number of unemployed persons increases by 2%

Compute the percentage changes in the labor- force participation and unemployment rates.

## NOW YOU TRY

### Computing percentage changes, answers

$$\text{LFPR} = L/\text{POP}$$

L increases 3%, POP increases 1%,  
so LFPR increases  $3\% - 1\% = 2\%$ .

$$\text{U rate} = U/L$$

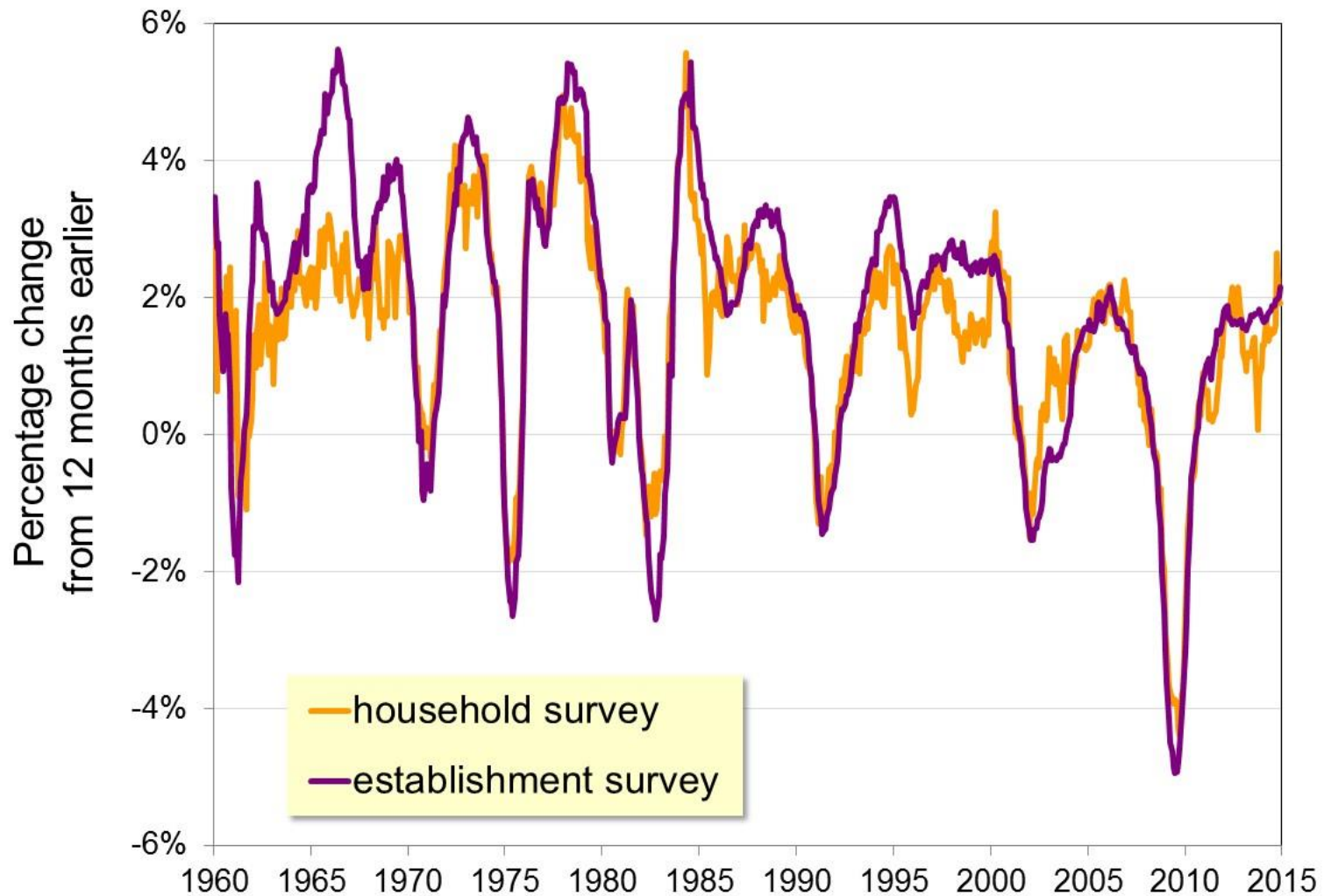
U increases 2%, L increases 3%,  
so U-rate increases  $2\% - 3\% = -1\%$ .

*Note: The changes in LFPR and U-rate are shown as a percentage of their initial values, not in percentage points!*

## The establishment survey

- The BLS obtains a second measure of employment by surveying businesses, asking how many workers are on their payrolls.
- Neither measure is perfect, and they occasionally diverge due to:
  - treatment of self-employed persons
  - new firms not counted in establishment survey
  - technical issues involving population inferences from sample data

# The measures of employment growth



# CHAPTER SUMMARY, PART 1

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- Gross domestic product (GDP) measures both total income and total expenditure on the economy's output of goods and services.
- Nominal GDP values output at current prices; real GDP values output at constant prices. Changes in output affect both measures, but changes in prices affect only nominal GDP.
- GDP is the sum of consumption, investment, government purchases, and net exports.

# CHAPTER SUMMARY

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- The overall level of prices can be measured by either:
  - the consumer price index (CPI), the price of a fixed basket of goods purchased by the typical consumer, or
  - the GDP deflator, the ratio of nominal to real GDP.
- The unemployment rate is the fraction of the labor force that is not employed.