CHAPTER 2

The Data of Macroeconomics

MACROECONOMICS SIXTH EDITION

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PowerPoint® Slides by Ron Cronovich

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

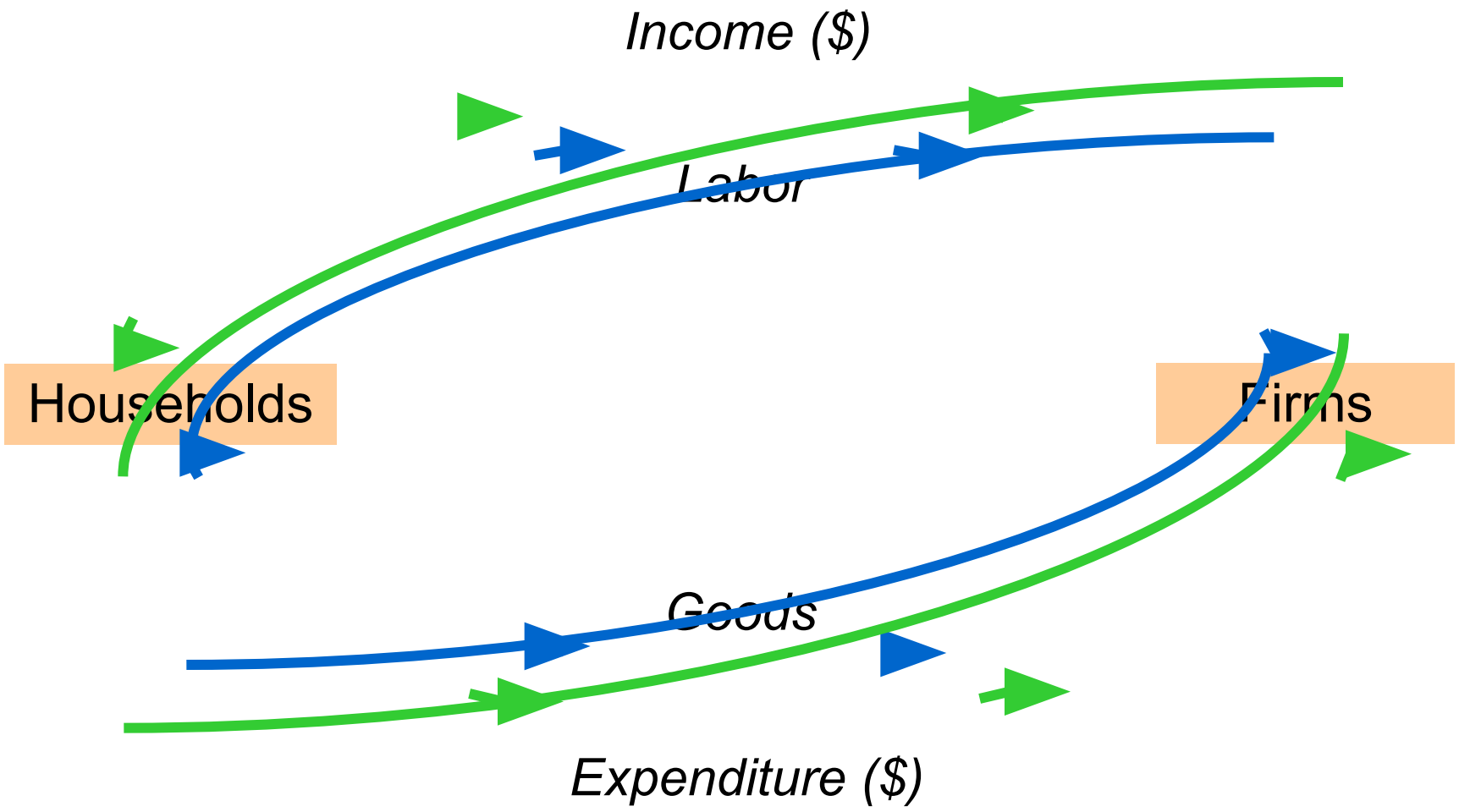
Gross Domestic Product: Expenditure and Income

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 spent by a buyer becomes income to the seller.

The Circular Flow



Value added

definition:

A firm's **value added** is
the value of its output
minus
the value of the intermediate goods
the firm used to produce that output.

Exercise: (Problem 2, p. 40)

- 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 & compare
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
- investment
- government spending
- net exports

Consumption (C)

definition: The value of all goods and services bought by households. Includes:

- ***durable goods***
  last a long time
  ex: cars, home appliances
- ***nondurable goods***
  last a short time
  ex: food, clothing
- ***services***
  work done for consumers
  ex: dry cleaning, air travel.

U.S. consumption, 2005

	$ billions	*% of GDP*
Consumption	$8,745.7	70.0%
Durables	1,026.5	8.2
Nondurables	2,564.4	20.5
Services	5,154.9	41.3

Investment (I)

Definition 1: Spending on [the factor of production] capital.

Definition 2: Spending on goods bought for future use

Includes:

- ***business fixed investment***
  Spending on plant and equipment that firms will use to produce other goods & services.
- ***residential fixed investment***
  Spending on housing units by consumers and landlords.
- ***inventory investment***
  The change in the value of all firms' inventories.

U.S. investment, 2005

	$ billions	*% of GDP*
Investment	$2,105.0	16.9%
Business fixed	1,329.8	10.6
Residential	756.3	6.1
Inventory	18.9	0.2

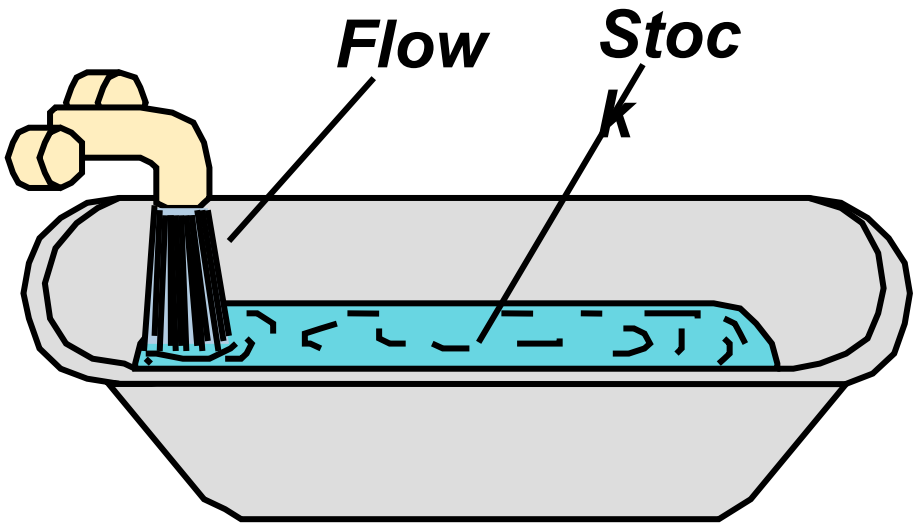
Investment vs. Capital

Note: Investment is spending on new capital.

Example *(assumes no depreciation)*:

- 1/1/2006:
  economy has $500b worth of capital
- during 2006:
  investment = $60b
- 1/1/2007:
  economy will have $560b worth of capital

Stocks vs. Flows



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

E.g.,
"The U.S. capital stock was $26 trillion on January 1, 2006."

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

E.g., "U.S. investment was $2.5 trillion during 2006."

Stocks vs. Flows - examples

stock	*flow*
a person's wealth	a person's annual saving
# of people with college degrees	# of new college graduates this year
the govt debt	the govt budget deficit

Now you try:

Stock or flow?

- the balance on your credit card statement
- how much you study economics outside of class
- the size of your compact disc collection
- the inflation rate
- the unemployment rate

Government spending (G)

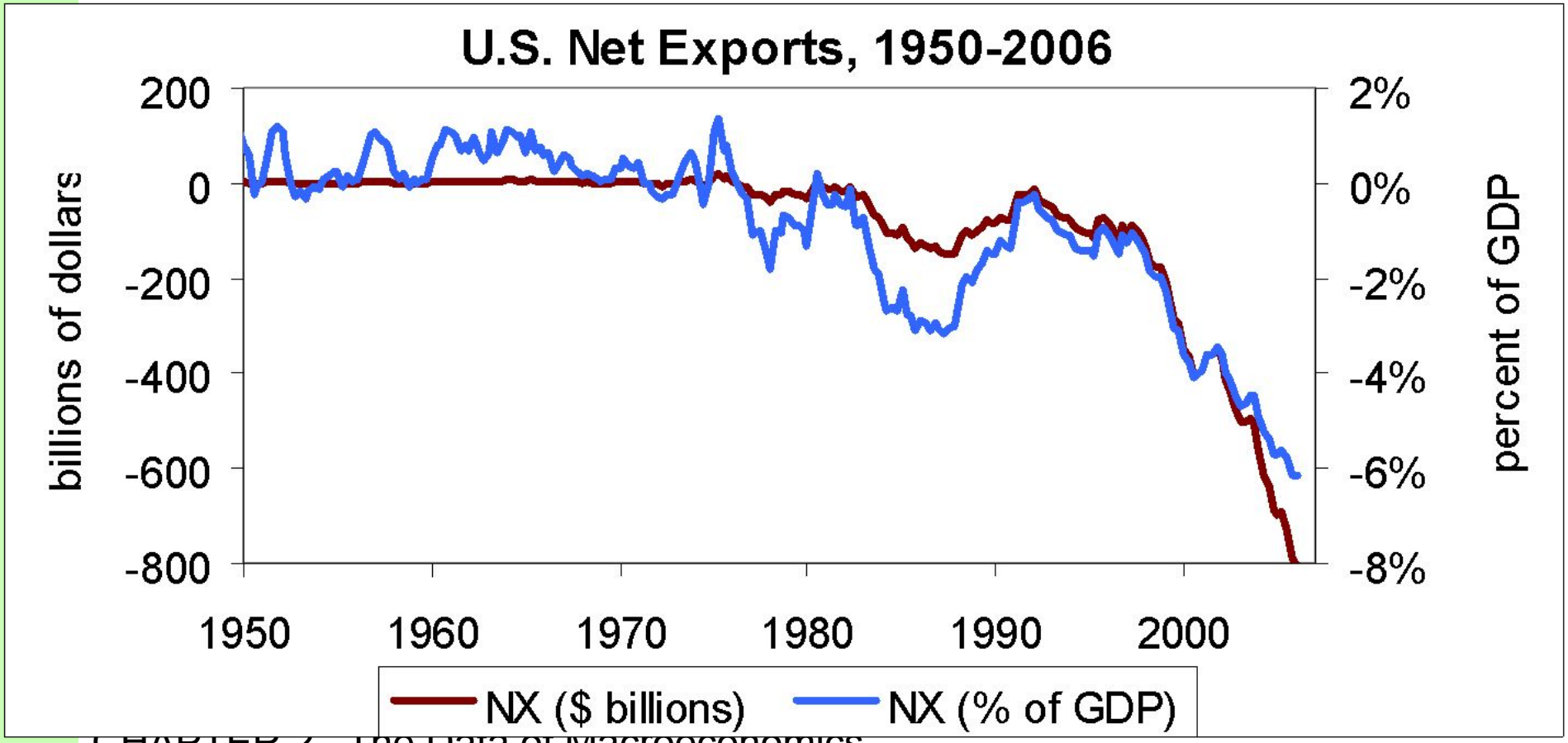
- **G** includes all government spending on goods and services..
- **G** excludes transfer payments (e.g., unemployment insurance payments), because they do not represent spending on goods and services.

U.S. government spending, 2005

	$ billions	% of GDP
Govt spending	$2,362.9	18.9%
Federal	877.7	7.0
Non-defense	290.6	2.3
Defense	587.1	4.7
State & local	1,485.2	11.9

Net exports: NX = EX – IM

def: The value of total exports (**EX**) minus the value of total imports (**IM**).



An important identity

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

value of total output

aggregate expenditure

A question for you:

Suppose a firm

- produces $10 million worth of final goods
- but only sells $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.

GDP: 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.

  (GNP – GDP) = (factor payments from abroad)
  – (factor payments to abroad)

Discussion question:

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

Why?

(GNP – GDP) as a percentage of GDP

selected countries, 2002

U.S.A.	1.0%
Angola	-13.6
Brazil	-4.0
Canada	-1.9
Hong Kong	2.2
Kazakhstan	-4.2
Kuwait	9.5
Mexico	-1.9
Philippines	6.7
U.K.	1.6

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.

Practice problem, part 1

	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.

Answers to practice problem, part 1

nominal GDP *multiply Ps & Qs from same year*

2006: $46,200 = $30 × 900 + $100 × 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 × 1050 + $100 × 205

Real GDP controls for inflation

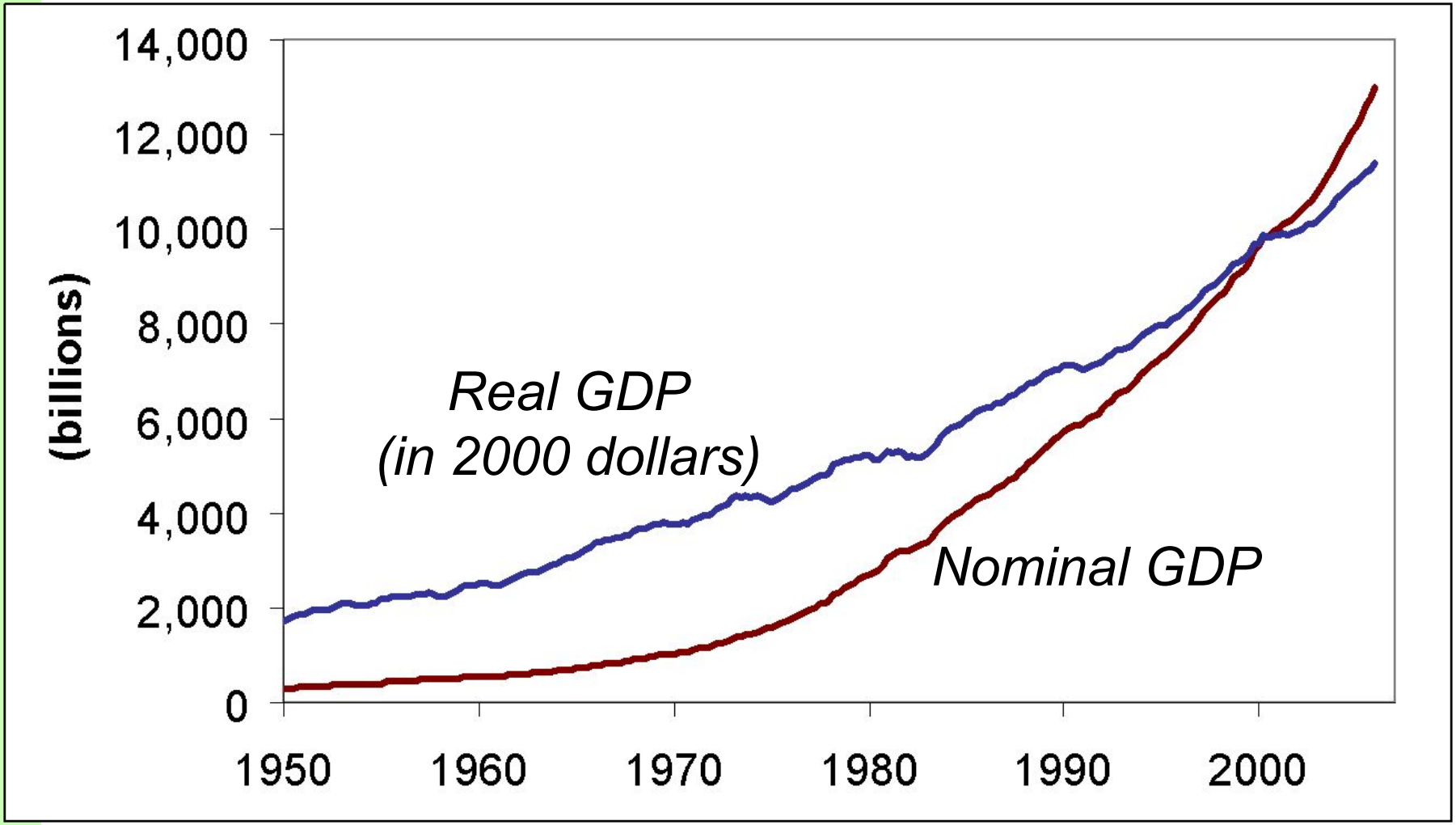
Changes in nominal GDP can be due to:

- 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, 1950–2006



GDP Deflator

- The **inflation rate** is the percentage increase in the overall level of prices.
- One measure of the price level is the **GDP deflator**, defined as

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

Practice problem, part 2

	Nom. GDP	Real GDP	GDP deflator	Inflation rate
2006	$46,200	$46,200		*n.a.*
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.

Answers to practice problem, part 2

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

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

Understanding the GDP deflator

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

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

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.

Two arithmetic tricks for working with percentage changes

1. For any variables ***X*** and ***Y***,

percentage change in (***X*** × ***Y***)

≈ percentage change in ***X***

\+ percentage change in ***Y***

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

Two arithmetic tricks for working with percentage changes

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

EX: GDP deflator = 100 × NGDP/RGDP.

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

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:
  - tracks changes in the typical household's cost of living
  - adjusts many contracts for inflation ("COLAs")
  - allows comparisons of dollar amounts over time

How the BLS 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

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

Exercise: *Compute the CPI*

Basket contains 20 pizzas and 10 compact discs.

prices:

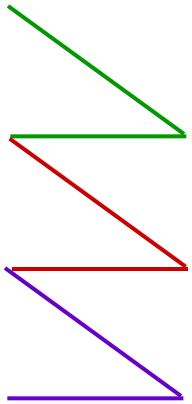
	pizza	CDs
2002	$10	$15
2003	$11	$15
2004	$12	$16
2005	$13	$15

For each year, compute

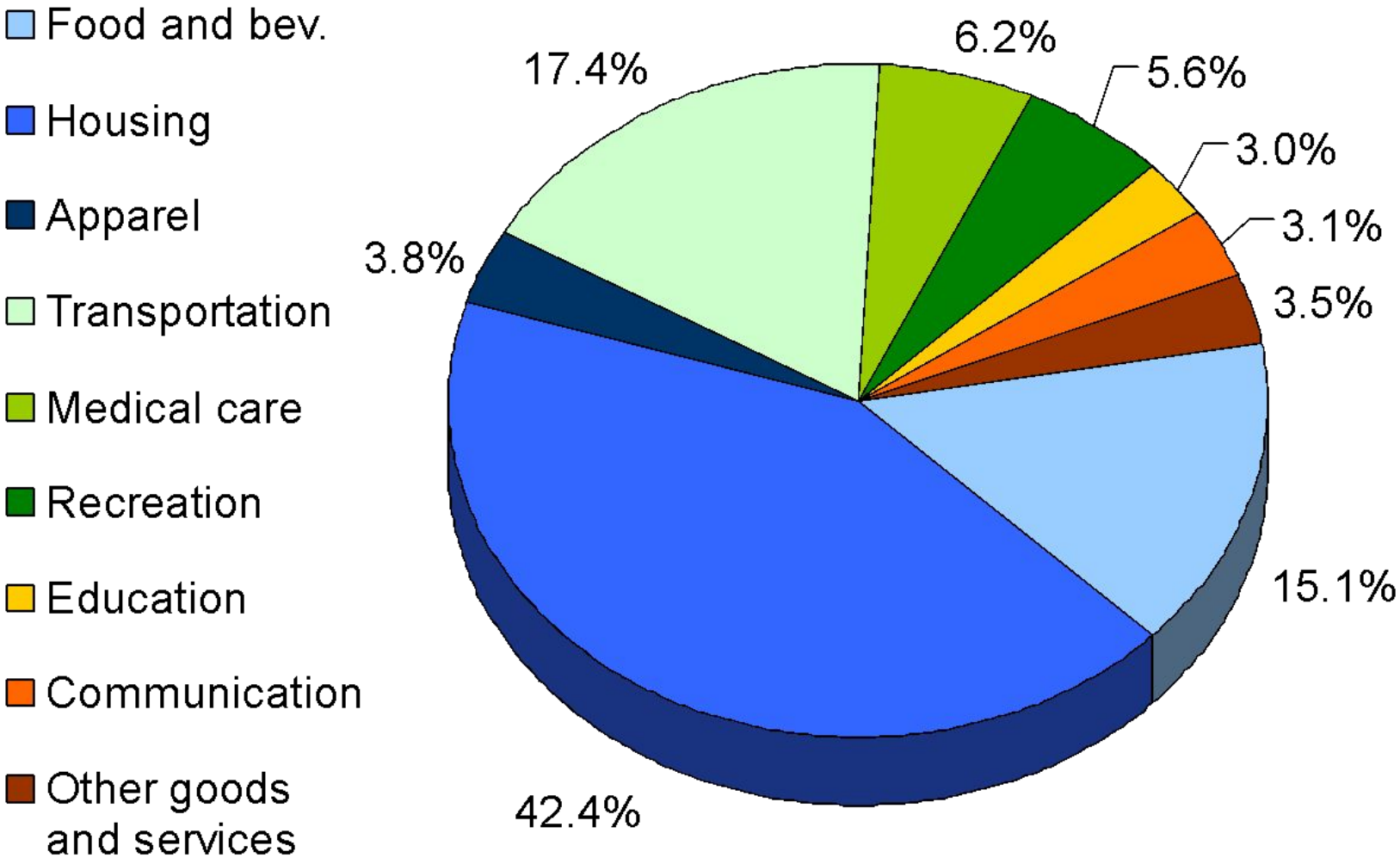
- the cost of the basket
- the CPI (use 2002 as the base year)
- the inflation rate from the preceding year

Answers:

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



The composition of the CPI's "basket"



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

Understanding the CPI

$$\text{CPI in month } t = \frac{E_t}{E_b} = \frac{P_{1t}C_1 + P_{2t}C_2 + P_{3t}C_3}{E_b}$$

$$= \left(\frac{C_1}{E_b}\right) P_{1t} + \left(\frac{C_2}{E_b}\right) P_{2t} + \left(\frac{C_3}{E_b}\right) P_{3t}$$

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.

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.

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.

Discussion questions:

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

CPI vs. GDP Deflator

prices of capital goods

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

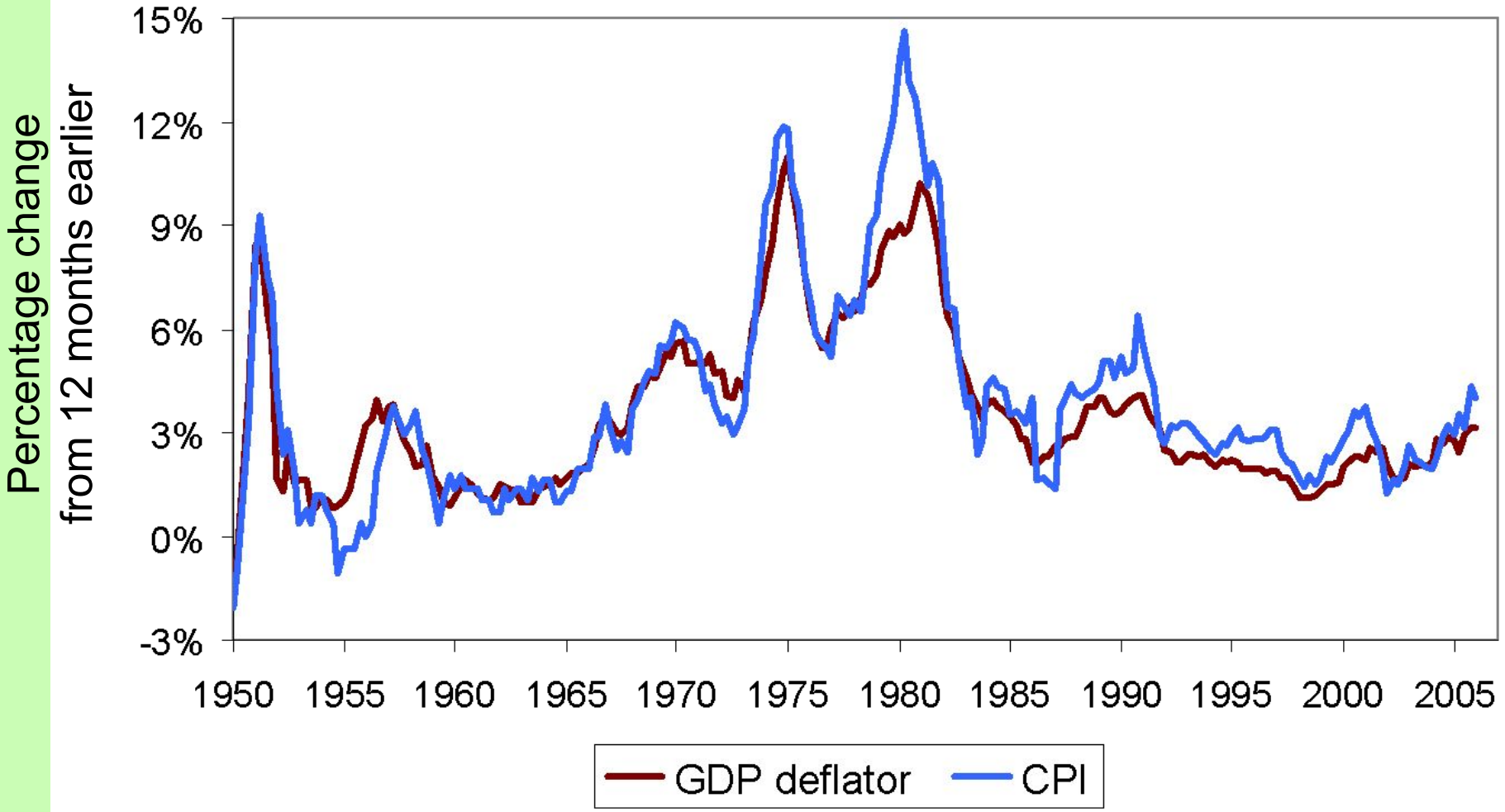
prices of imported consumer goods

- included in CPI
- excluded from GDP deflator

the basket of goods

- CPI: fixed
- GDP deflator: changes every year

Two measures of inflation in the U.S.



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

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

Exercise:
Compute labor force statistics

U.S. adult population by group, June 2006

Number employed = 144.4 million

Number unemployed = 7.0 million

Adult population = 228.8 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

Answers:

- data: ***E*** = 144.4, ***U*** = 7.0, ***POP*** = 228.8
- labor force
  L = ***E*** +***U*** = 144.4 + 7 = 151.4
- not in labor force
  NILF = ***POP*** – ***L*** = 228.8 – 151.4 = 77.4
- unemployment rate
  U/L x 100% = (7/151.4) x 100% = 4.6%
- labor force participation rate
  L/POP x 100% = (151.4/228.8) x 100% = 66.2%

Exercise: *Compute percentage changes in labor force statistics*

Suppose

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

Compute the percentage changes in

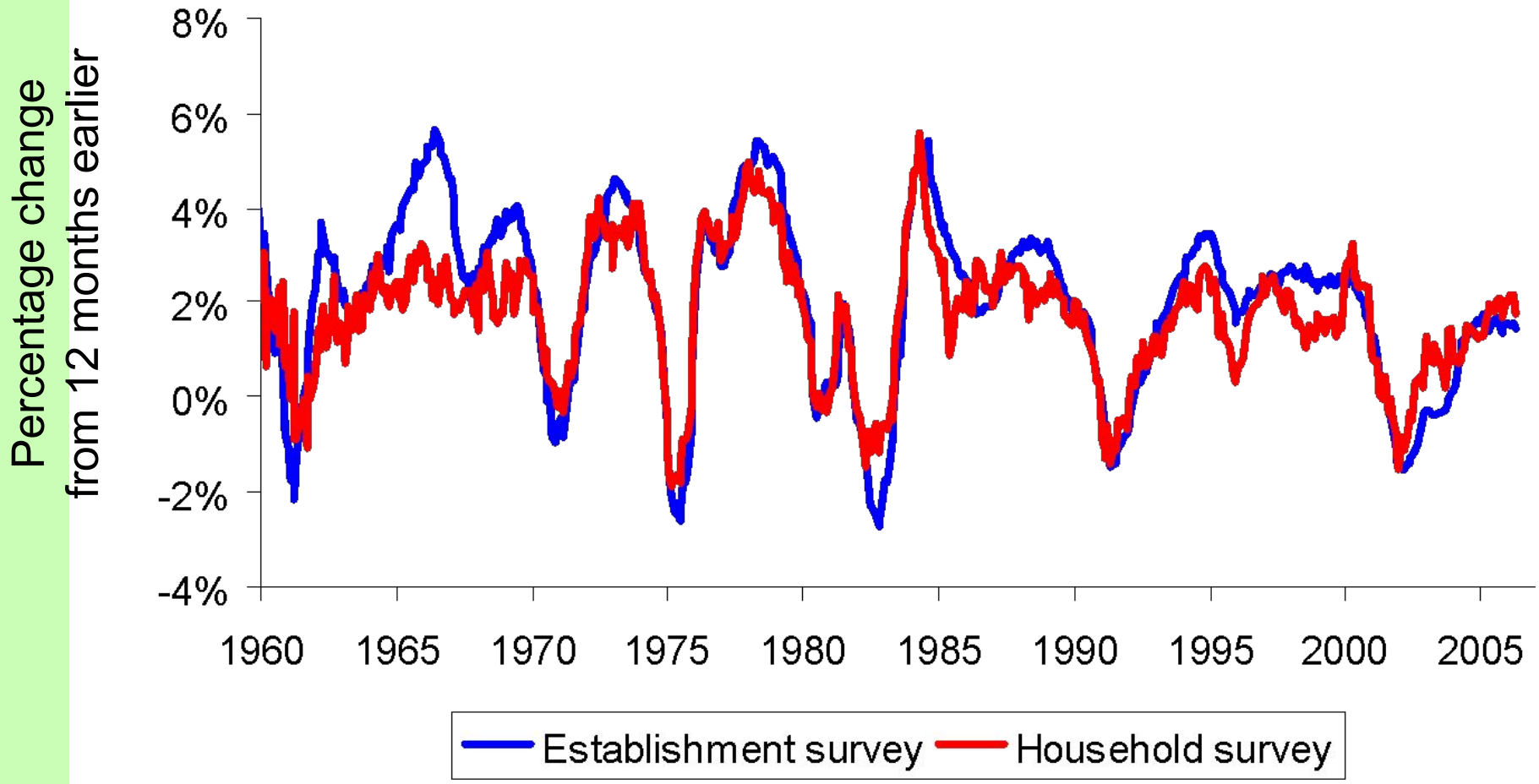
the labor force participation rate: **2% − 1%**

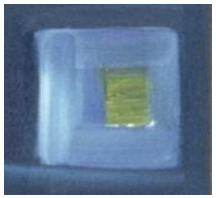
the unemployment rate:

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

Two measures of employment growth



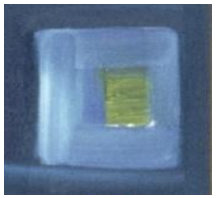


Chapter Summary

1. Gross Domestic Product (GDP) measures both total income and total expenditure on the economy's output of goods & services.

2. Nominal GDP values output at current prices; real GDP values output at constant prices. Changes in output affect both measures, but changes in prices only affect nominal GDP.

3. GDP is the sum of consumption, investment, government purchases, and net exports.



Chapter Summary

4. 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
5. The unemployment rate is the fraction of the labor force that is not employed.