MACROECONOMICS

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THE DATA OF MACROECONOMICS

CHAPTER 2

MODIFIED FOR ECON 2204

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

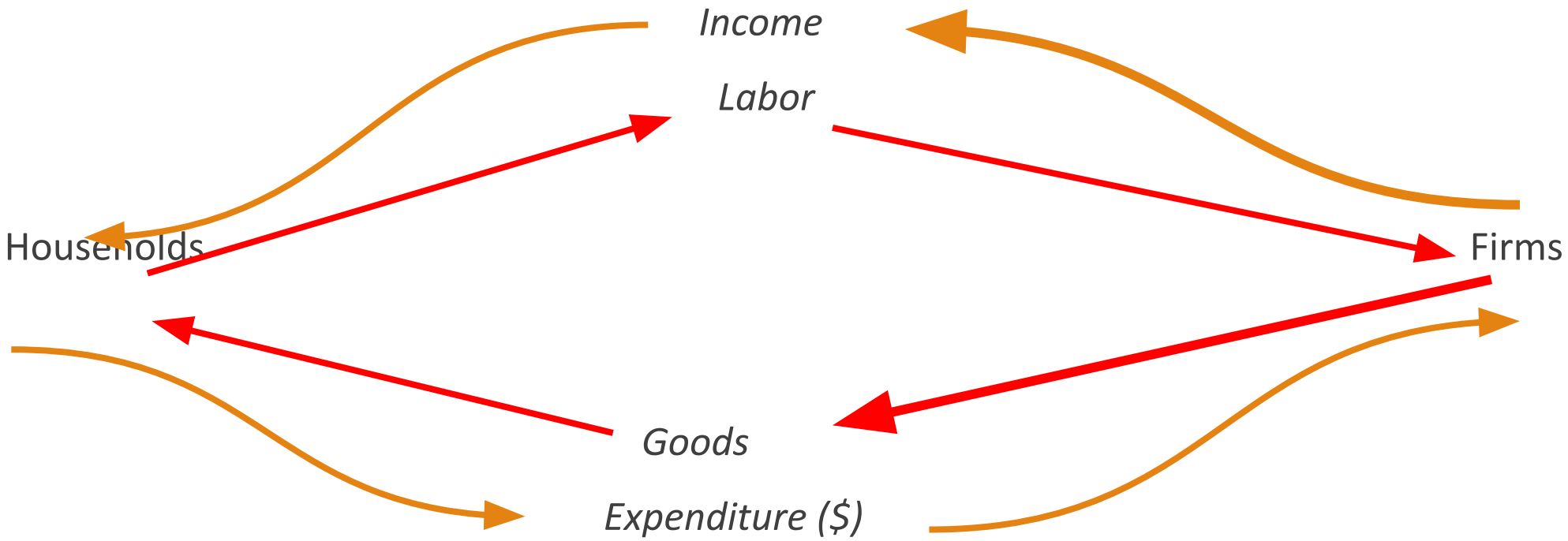
Two definitions:

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



Value added

Value added:

The value of output

minus

the value of the intermediate goods

used to produce that output

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 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. Includes:

Durable goods

last a long time.

E.g., cars, home appliances

Nondurable goods

last a short time.

E.g., food, clothing

Services

are intangible items purchased by consumers.

E.g., dry cleaning, air travel

U.S. Consumption, 2014

	$ billions	*% of GDP*
Consumption	12,002	68.2
Durables	1,320	7.5
Nondurables	2,691	15.3
Services	7,990	45.4

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, 2014

	$ billions	*% of GDP*
Investment	2,905	16.5
Business fixed	2,244	12.8
Residential	566	3.2
Inventory	94	0.5

Investment vs. capital

Note: Investment is spending on new capital.

Example *(assumes no depreciation)*:

1/1/2016:

Economy has $10 trillion worth of capital

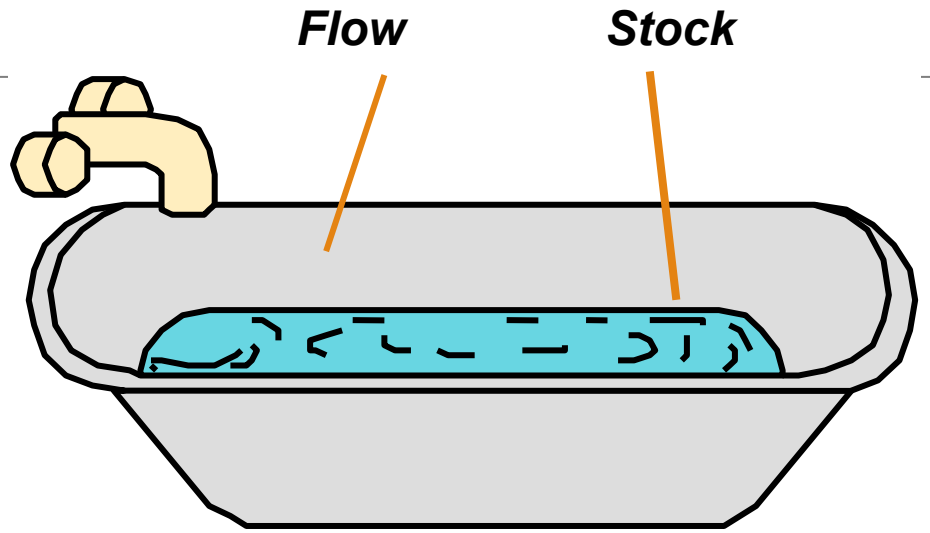
During 2016:

Investment = $2 trillion

1/1/2017:

Economy will have $12 trillion 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 $10 trillion on January 1, 2016."

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

E.g., "U.S. investment was $2 trillion during 2016."

Stocks vs. Flows: Examples

Stock	*Flow*
a person's wealth	a person's annual savings
# 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 time you spend studying

The size of your MP3/iTunes 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, 2014

	$ billions	% of GDP
Govt spending	3,209	18.2
- Federal	1,241	7.1
Nondefense	457	2.6
Defense	784	4.5
- State & local	1,968	11.2

Net exports (NX)

NX = exports – imports

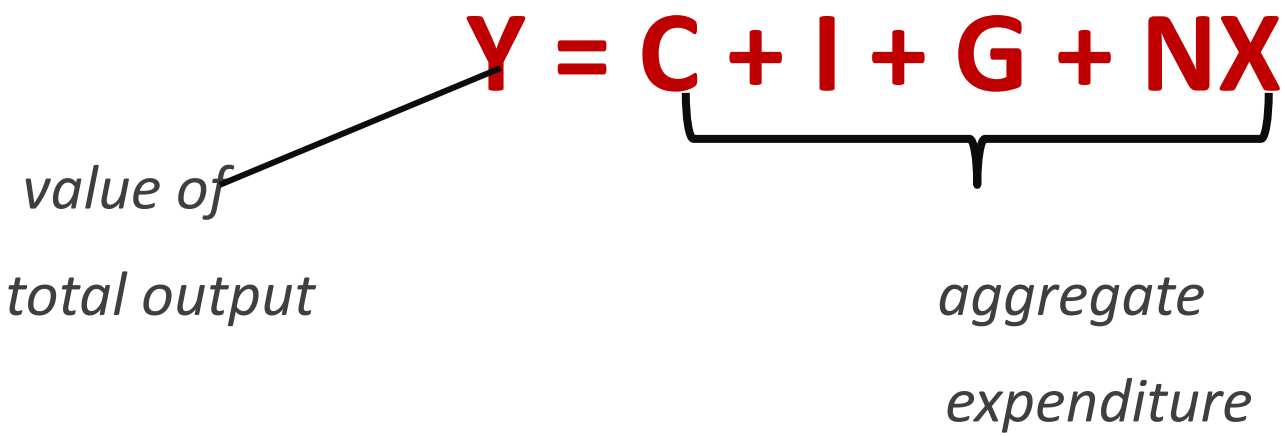
Exports: the value of goods and services sold to other countries

Imports: the value of goods and services purchased from other countries

Hence, NX equals net spending from abroad on our goods and services

U.S. Net Exports, 2014

	$ billions	% of GDP
Net Exports of Goods and Services	- 517	- 2.9
Exports	2,367	13.4
Goods	1,645	9.3
Services	721	4.1
Imports	2,883	16.4
Goods	2,394	13.6
Services	489	2.8


Y = C + I + G + NX
value of
total output
aggregate
expenditure

NOW YOU TRY
An expenditure-output puzzle?

Suppose a firm:

produces $10 million worth of final goods

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 and services

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 minus factor payments to abroad

Examples of factor payments: wages, profits, rent, interest & dividends on assets

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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	1,858,740	-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

Other Measures of Income

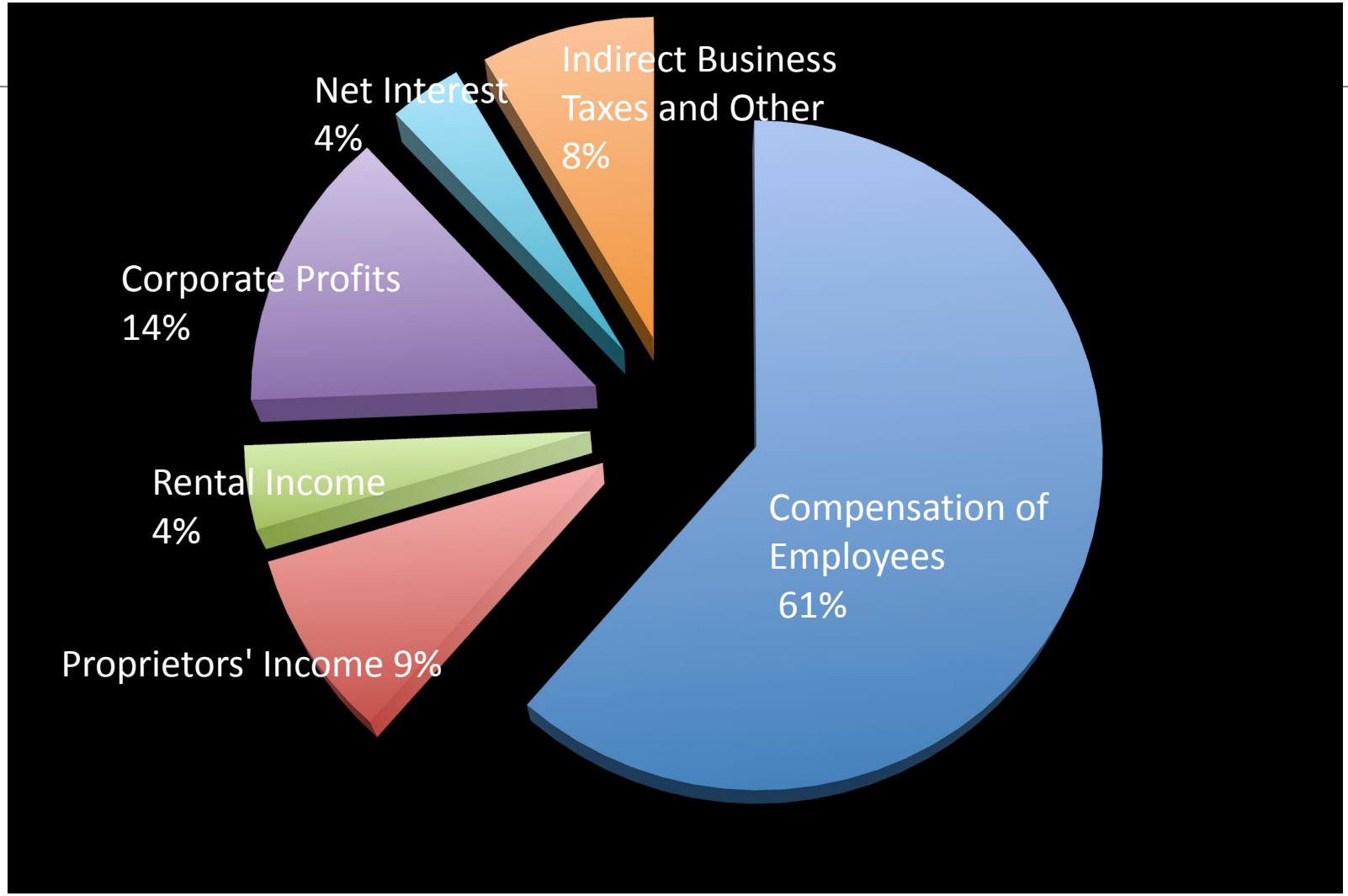
Net National Product = GNP – Depreciation

National Income = NNP – Statistical Discrepancy

National Income = Compensation of Employees + Proprietors' Income + Rental Income + Corporate Profits + Net Interest + Indirect Business Taxes

Note: Supplement 2-5 describes recent change in definition of National Income to include Indirect Business Taxes.

Components of National Income, 2014



Other Measures of Income

Personal Income = National Income - Indirect Business Taxes - Corporate Profits - Social Insurance Contributions - Net Interest + Dividends + Government Transfers to Individuals + Personal Interest Income

Disposable Personal Income = Personal Income - Personal Tax and Nontax Payments

Disposable Personal Income is what households and noncorporate businesses have to spend (or save).

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.

Solve the problem ????

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

1) Compute nominal GDP in each year.
2) Compute real GDP in each year using 2006 as the base year

Solution

Nominal GDP is $P_s \times Q_s$ *the same year*

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

2007: $51,400

2008: $58,300

Real GDP is 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:

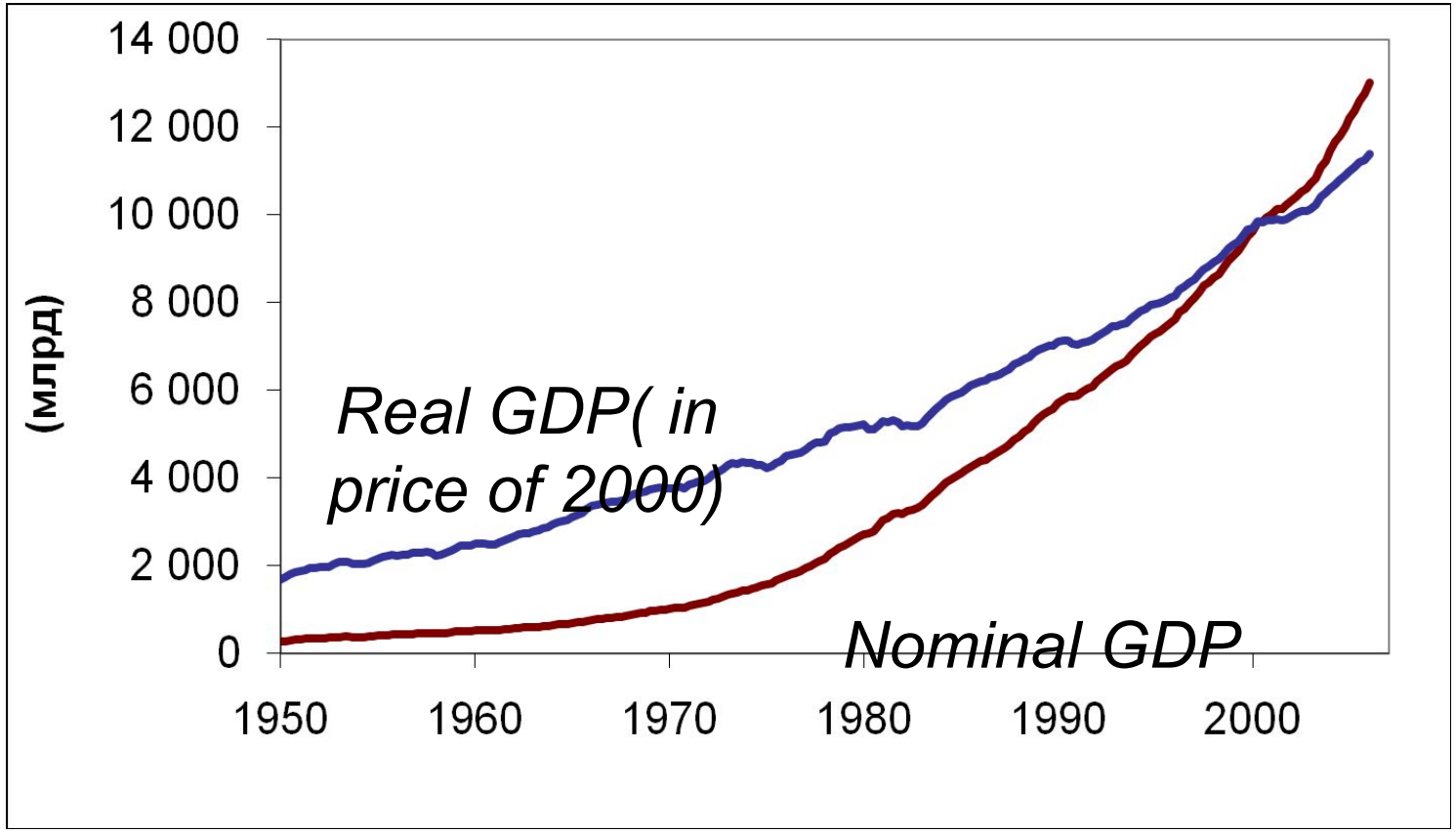
✔ changes in prices

✔changes in quantities of output produced

Changes in real GDP can only be due to changes in quantities.

**One way to calculate real GDP is by using constant base-year prices.

U.S. Nominal and Real GDP, 1950-2006



GDP deflator

Inflation rate: the percentage increase in the overall level of prices.

One measure of the price level: **GDP deflator**

Definition:

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

Practice problem, part 2

	Nom. GDP	Real GDP	GDP deflator	inflation rate
2002	$46,200	$46,200		*n.a.*
2003	51,400	50,000		
2004	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 2002 to 2003, and from 2003 to 2004.

Answers to practice problem, part 2

	Nom. GDP	Real GDP	GDP deflator	Inflation rate
2002	$46,200	$46,200	100.0	*n.a.*
2003	51,400	50,000	102.8	2.8%
2004	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

$$\text{GDP deflator} = 100 \times \frac{\text{NGDP}_t}{\text{RGDP}_t} = 100 \times \frac{P_{1t}Q_{1t} + P_{2t}Q_{2t} + P_{3t}Q_{3t}}{\text{RGDP}_t}$$

$$= 100 \times \left[\left(\frac{Q_{1t}}{\text{RGDP}_t} \right) P_{1t} + \left(\frac{Q_{2t}}{\text{RGDP}_t} \right) P_{2t} + \left(\frac{Q_{3t}}{\text{RGDP}_t} \right) P_{3t} \right]$$

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.

Working with percentage changes

USEFUL TRICK #1 For any variables ***X*** and ***Y***,

the percentage change in ($X \times Y$)

≈ the percentage change in ***X***

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

EX: If your hourly wage rises 5%

and you work 7% more hours,

then your wage income rises approximately 12%.

Working with percentage changes

USEFUL TRICK #2

the percentage change in (X/Y)

$\approx$ the percentage change in X

$-$ the 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.

This makes chain-weighted GDP more accurate than constant-price GDP.

But the two measures are highly correlated, and constant-price real GDP is easier to compute…

…so we’ll usually use constant-price real GDP.

Consumer Price Index (CPI)

A measure of the overall level of prices

Published by the **Bureau of Labor Statistics** (**BLS**)

Used to

- track changes in the typical household's cost of living
- adjust many contracts for inflation (*i.e.*,"COLAs")
- allow comparisons of dollar figures from different years

How the BLS constructs the CPI

1. Surveys consumers to determine composition of the typical consumer's "basket" of goods.
2. Every month, collects 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*

The basket contains 20 pizzas and 10 compact discs.

prices:

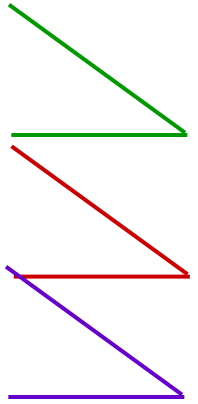
	pizza	CDs
2002	$10	$15
2003	$11	$15
2004	$12	$16
2005	$13	$15

For each year, compute

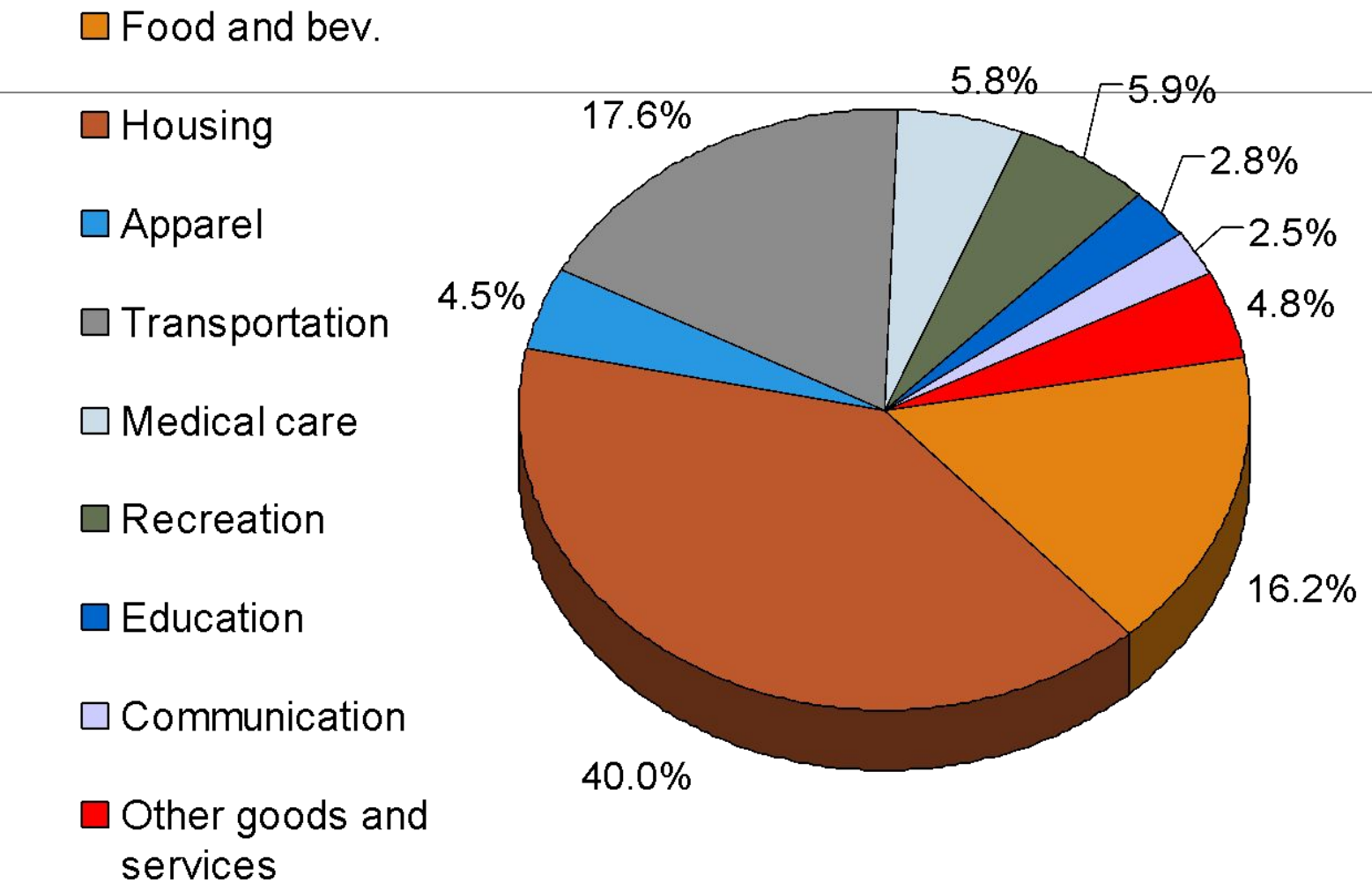
- the cost of the basket
- the CPI (use 2002 as the base year)
- the inflation rate from the preceding year

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

$$\text{CPI in month } t = 100 \times \frac{E_t}{E_b} = 100 \times \frac{P_{1t}C_1 + P_{2t}C_2 + P_{3t}C_3}{E_b}$$

$$= 100 \times \left[\left(\frac{C_1}{E_b} \right) P_{1t} + \left(\frac{C_2}{E_b} \right) P_{2t} + \left(\frac{C_3}{E_b} \right) P_{3t} \right]$$

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 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.

Discussion topic:

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 taxes and Social Security taxes, how does the CPI's bias affect you?

Is the government giving your grandmother too big 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

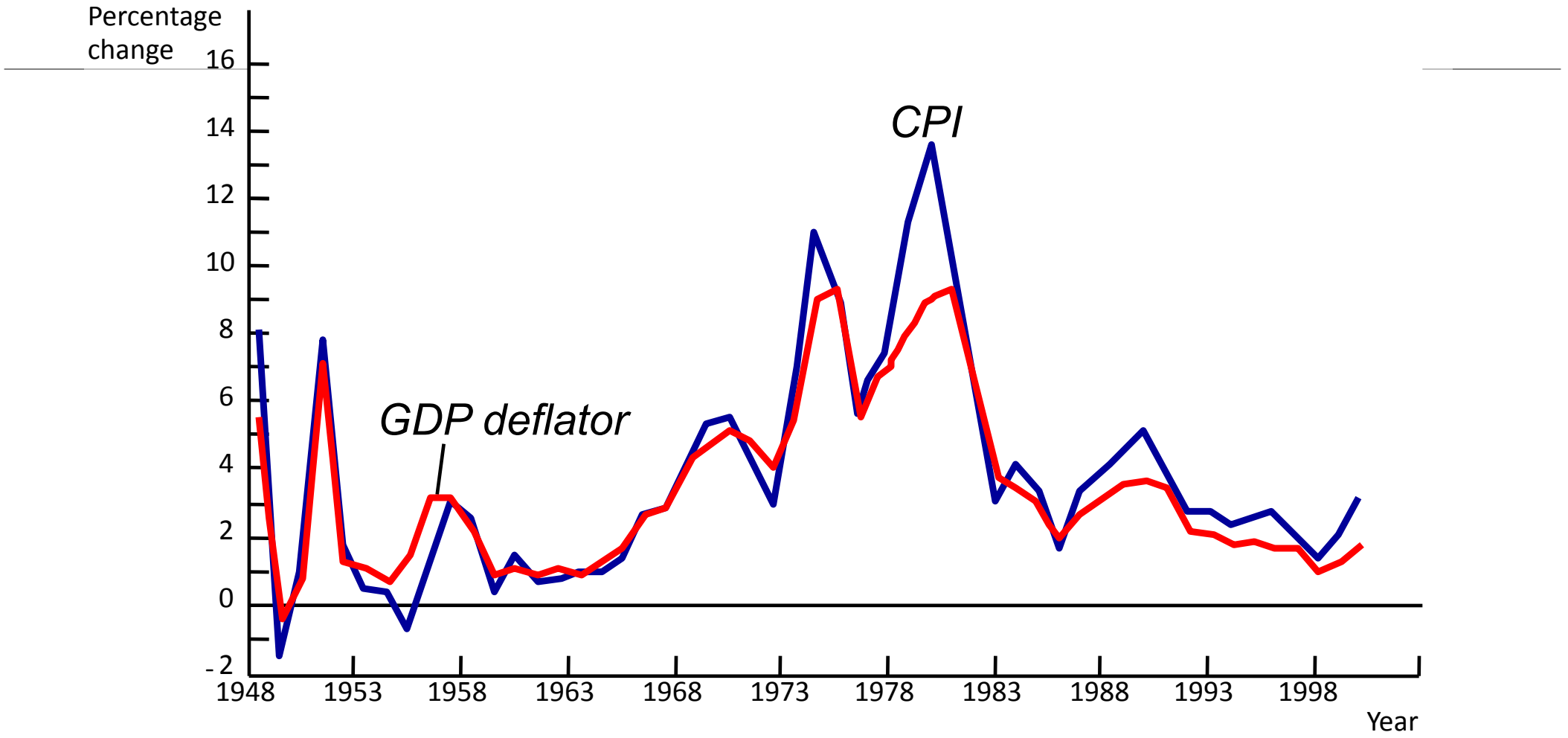
prices of imported consumer goods

- included in CPI
- excluded from GDP deflator

the basket of goods

- CPI: fixed
- GDP deflator: changes every year

Two measures of inflation



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, May 2003

Number employed	=	137.5 million
Number unemployed	=	9.0 million
Adult population	=	220.8 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*** = 137.5, ***U*** = 9.0, ***POP*** = 220.8

labor force

L = ***E*** +***U*** = 137.5 + 9.0 = 146.5

not in labor force

NILF = ***POP*** – ***L*** = 220.8 – 146.5 = 74.3

unemployment rate

U/L = 9/146.5 = 0.061 or 6.1%

labor force participation rate

L/POP = 146.5/220.8 = 0.664 or 66.4%

Exercise: *Compute percentage changes in labor force statistics*

Suppose

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

Compute the percentage changes in

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

the unemployment rate: **–1%**

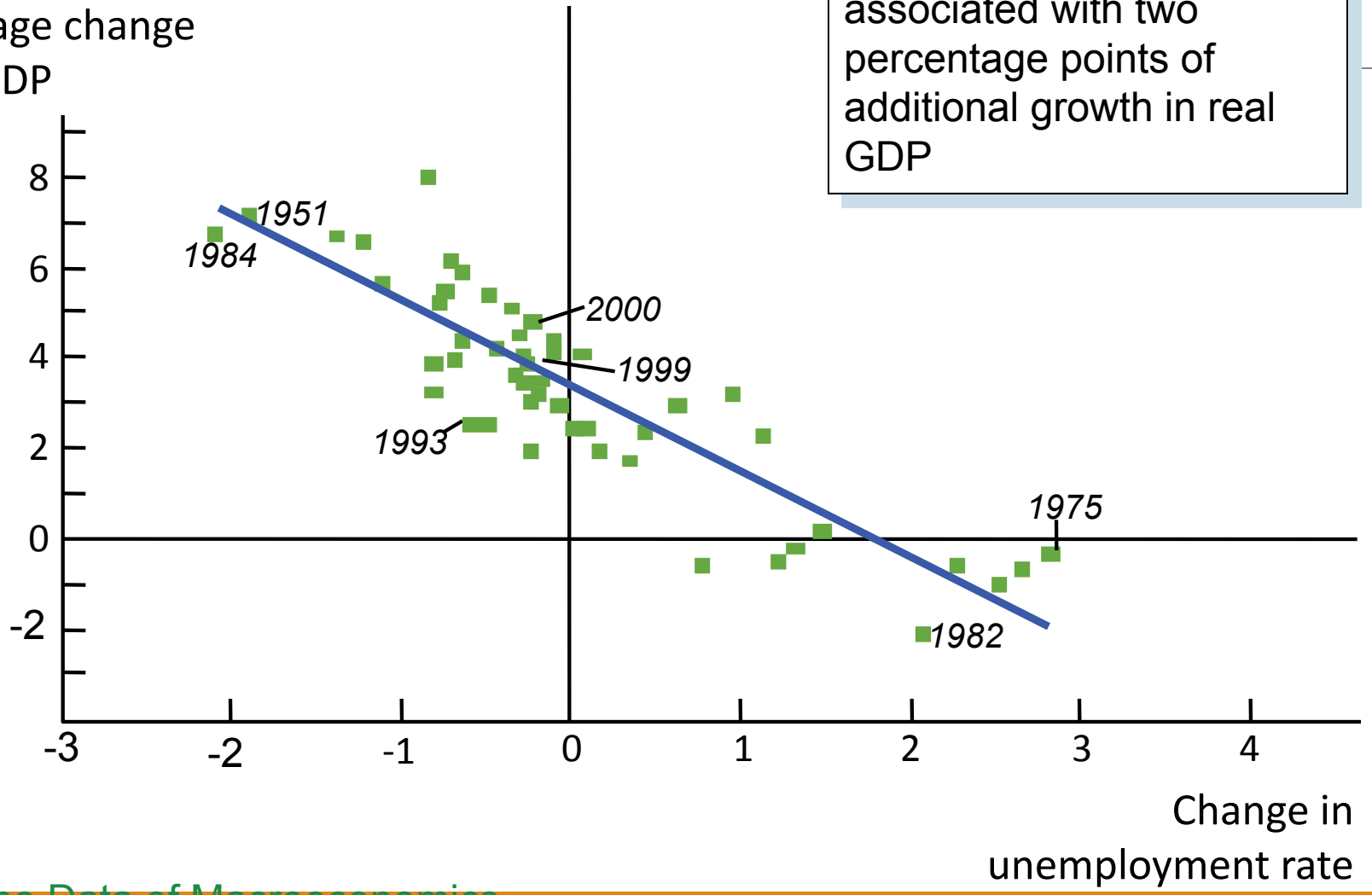
Okun's Law

Employed workers help produce GDP, while unemployed workers do not.
So one would expect
a negative relationship between unemployment and real GDP.

This relationship is clear in the data…

Okun's Law

Okun's Law states that a one-percent decrease in unemployment is associated with two percentage points of additional growth in real GDP



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
   - 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.

   When unemployment rises, the growth rate of real GDP falls.