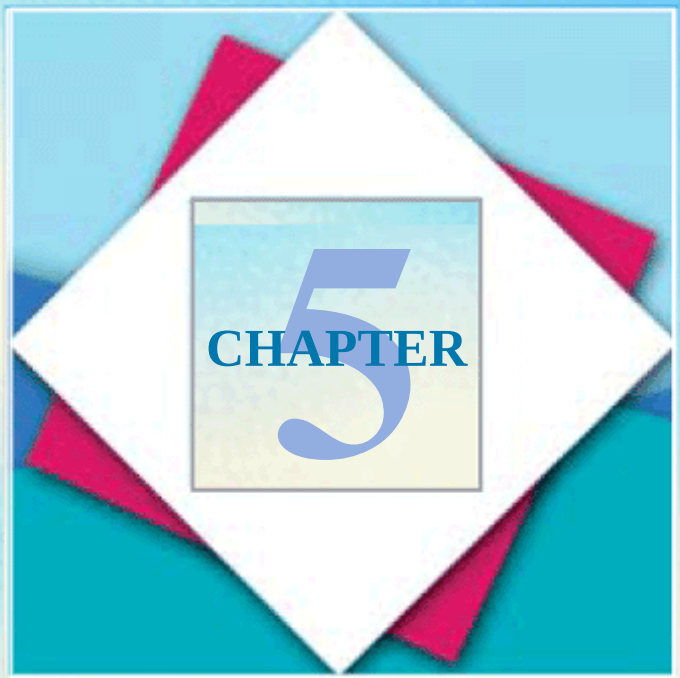
# MEASURING GDP AND ECONOMIC GROWTH



# Objectives

**After studying this chapter, you will able to**

- Define GDP and use the circular flow model to explain why GDP equals aggregate expenditure and aggregate income
- Explain the two ways of measuring GDP
- Explain how we measure real GDP and the GDP deflator
- Explain how we use real GDP to measure economic growth and describe the limitations of our measure

# An Economic Barometer

What exactly is GDP

How do we use it to tell us whether our economy is in a recession or how rapidly our economy is expanding?

How do we take the effects of inflation out of GDP to compare economic well-being over time

And how to we compare economic well-being across counties?

# Gross Domestic Product

## GDP Defined

**GDP** or **gross domestic product**, is the market value of all final goods and services produced in a country in a given time period.

This definition has four parts:

- Market value
- Final goods and services
- Produced within a country
- In a given time period

# Gross Domestic Product

**Market value**

GDP is a market value—goods and services are valued at their market prices.

To add apples and oranges, computers and popcorn, we add the market values so we have a total value of output in dollars.

# Gross Domestic Product

**Final goods and services**

GDP is the value of the *final goods and services* produced.

A **final good** (or service), is an item bought by its final user during a specified time period.

A final good contrasts with an intermediate good, which is an item that is produced by one firm, bought by another firm, and used as a component of a final good or service.

Excluding intermediate goods and services avoids double counting.

# Gross Domestic Product

**Produced within a country**

GDP measures production within a country—domestic production.

**In a given time period**

GDP measures production during a specific time period, normally a year or a quarter of a year.

# Gross Domestic Product

## GDP and the Circular Flow of Expenditure and Income

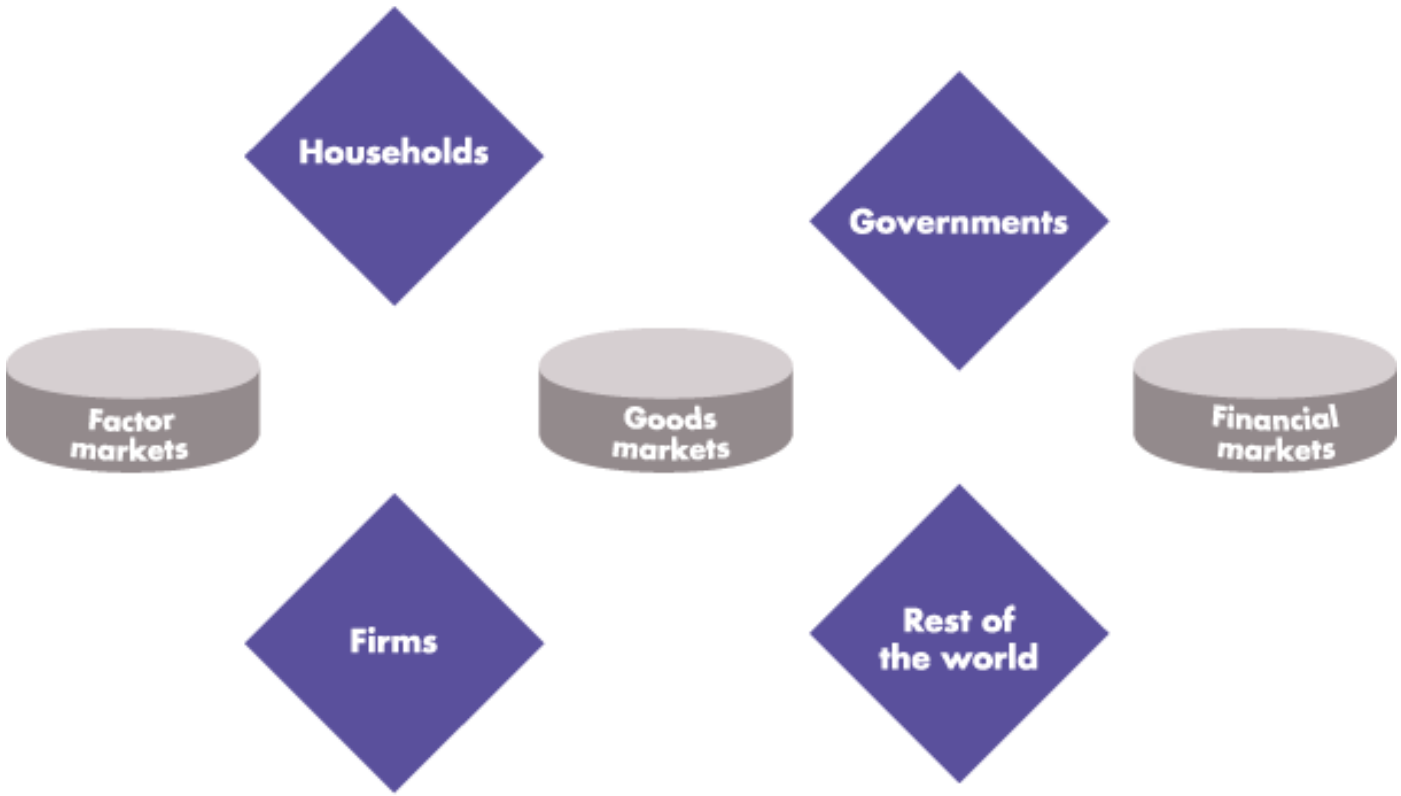
GDP measures the value of production, which also equals total expenditure on final goods and total income.

The equality of income and output shows the link between productivity and living standards.

The circular flow diagram in Figure 5.1 illustrates the equality of income, expenditure, and the value of production.

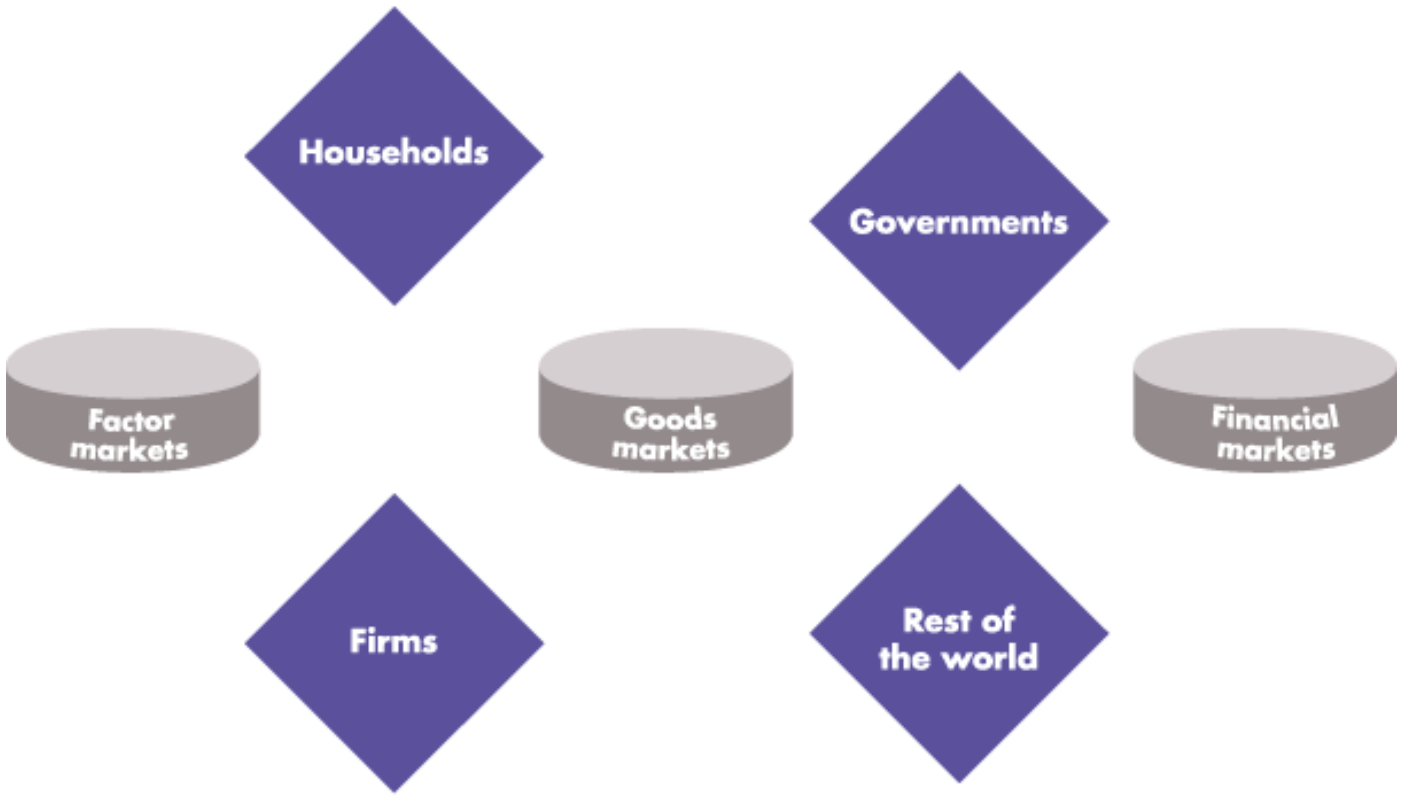
# Gross Domestic Product

The circular flow diagram shows the transactions among households, firms, governments, and the rest of the world



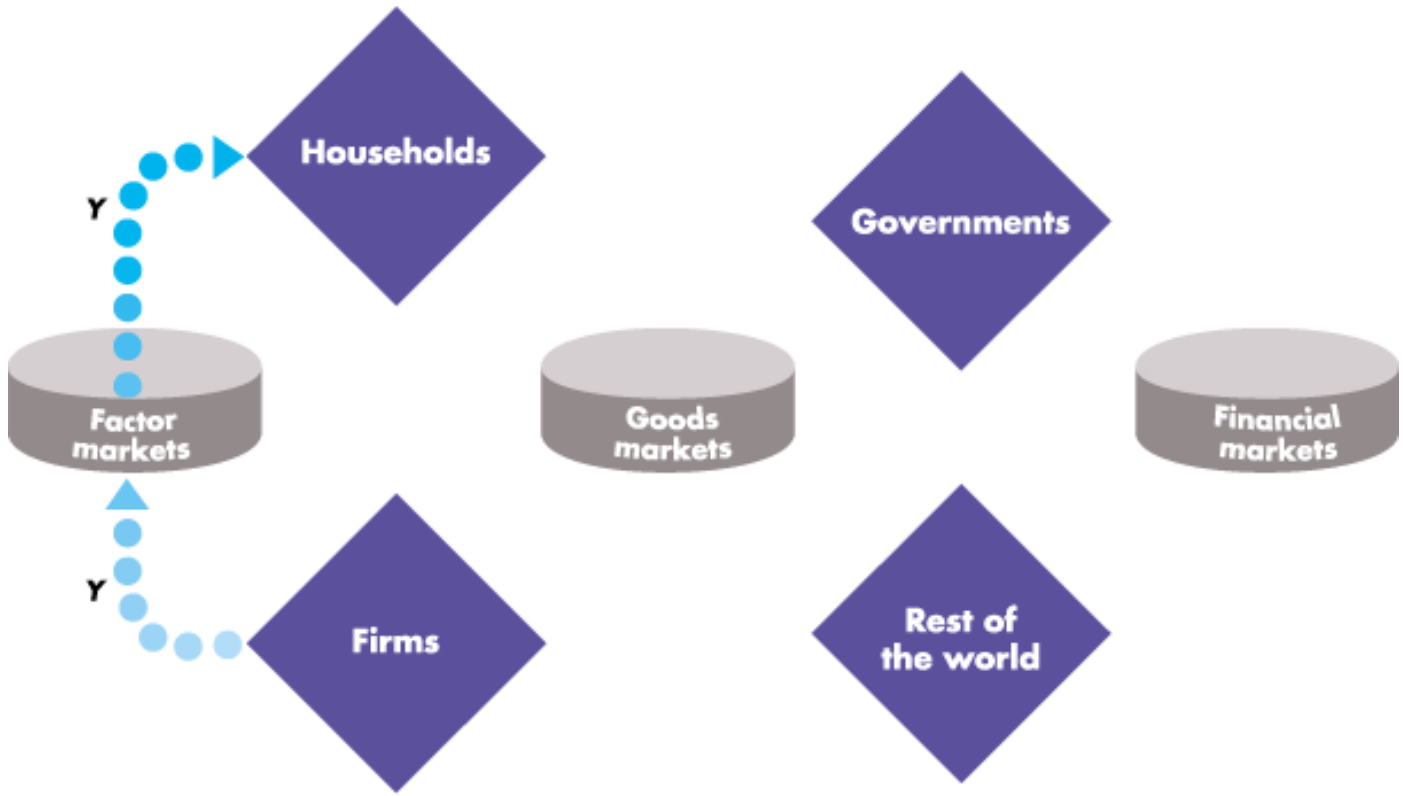
# Gross Domestic Product

These transactions take place in factor markets, goods markets, and financial markets.



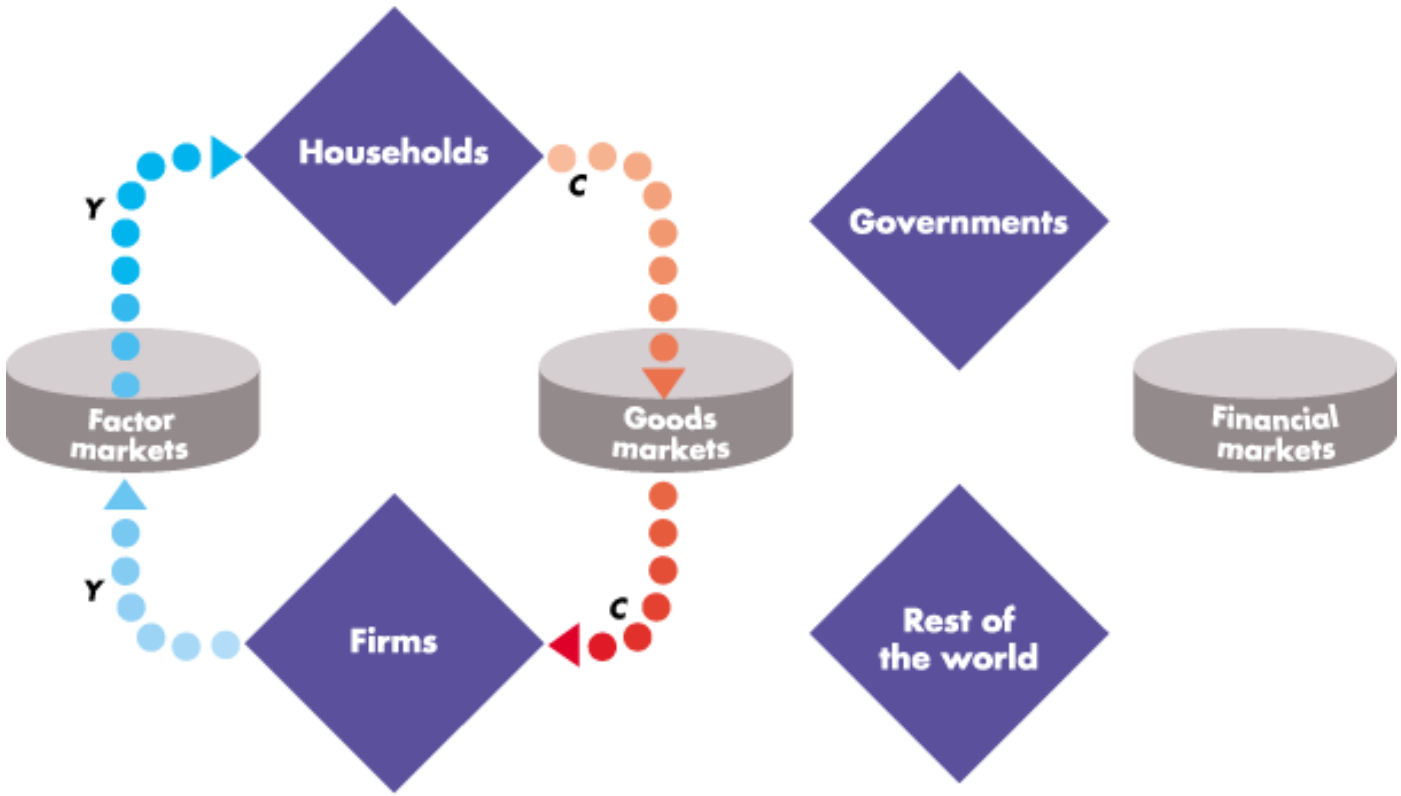
# Gross Domestic Product

Firms hire factors of production from households. The blue flow, *Y*, shows total income paid by firms to households.



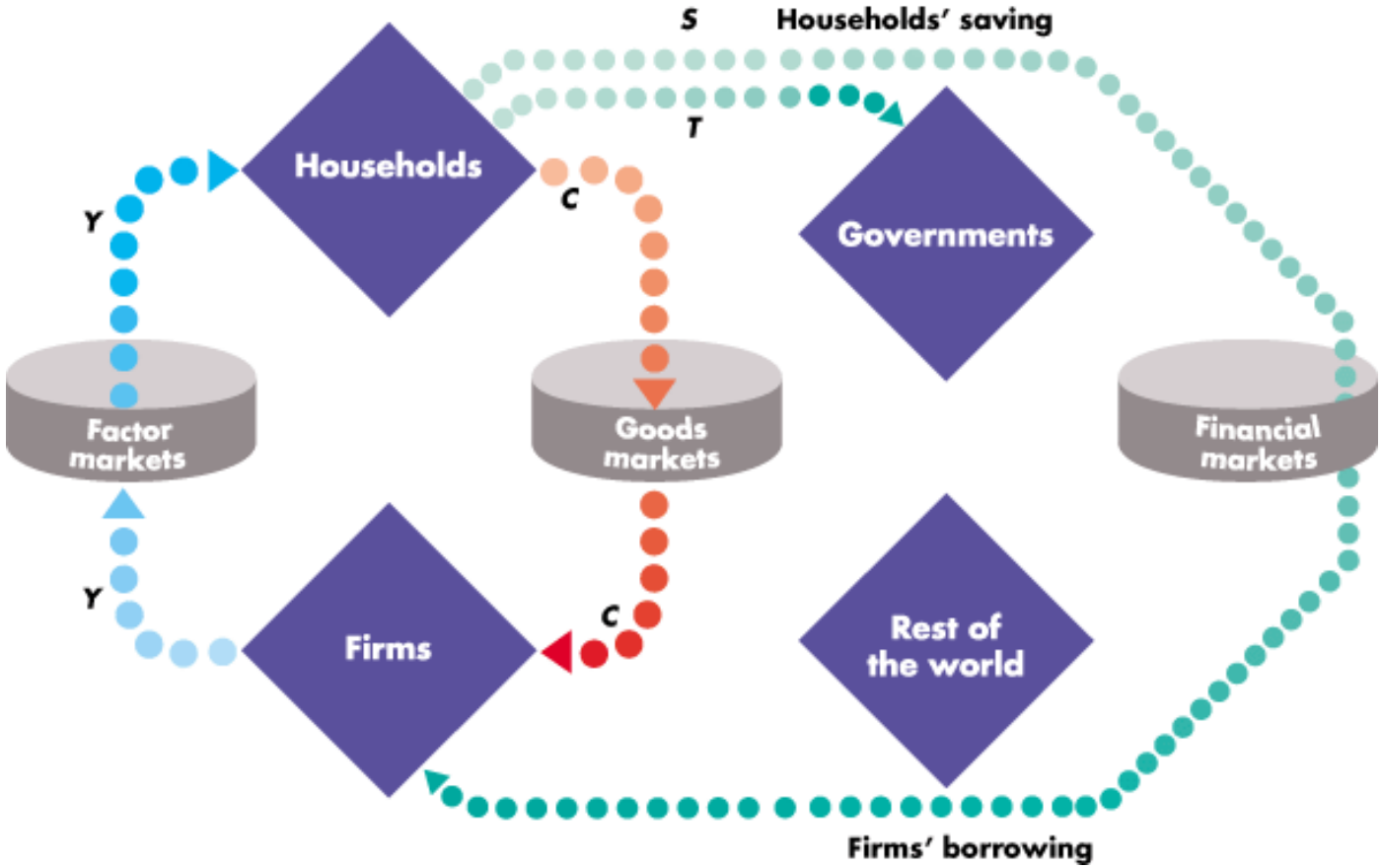
# Gross Domestic Product

Households buy consumer goods and services. The red flow, *C*, shows consumption expenditures.



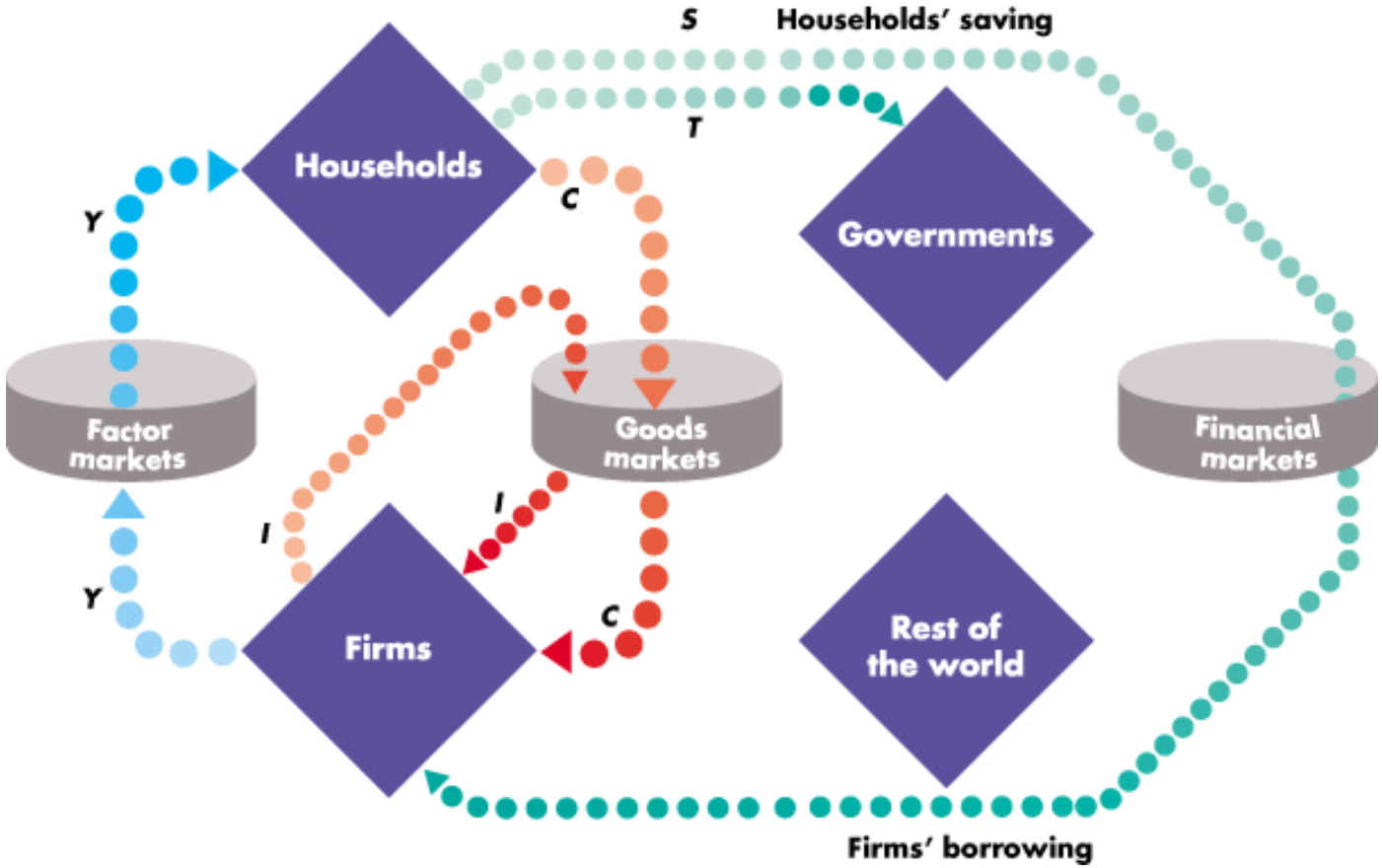
# Gross Domestic Product

Households save, *S*, and pay taxes, *T*. Firms borrow some of what households save to finance their investment.



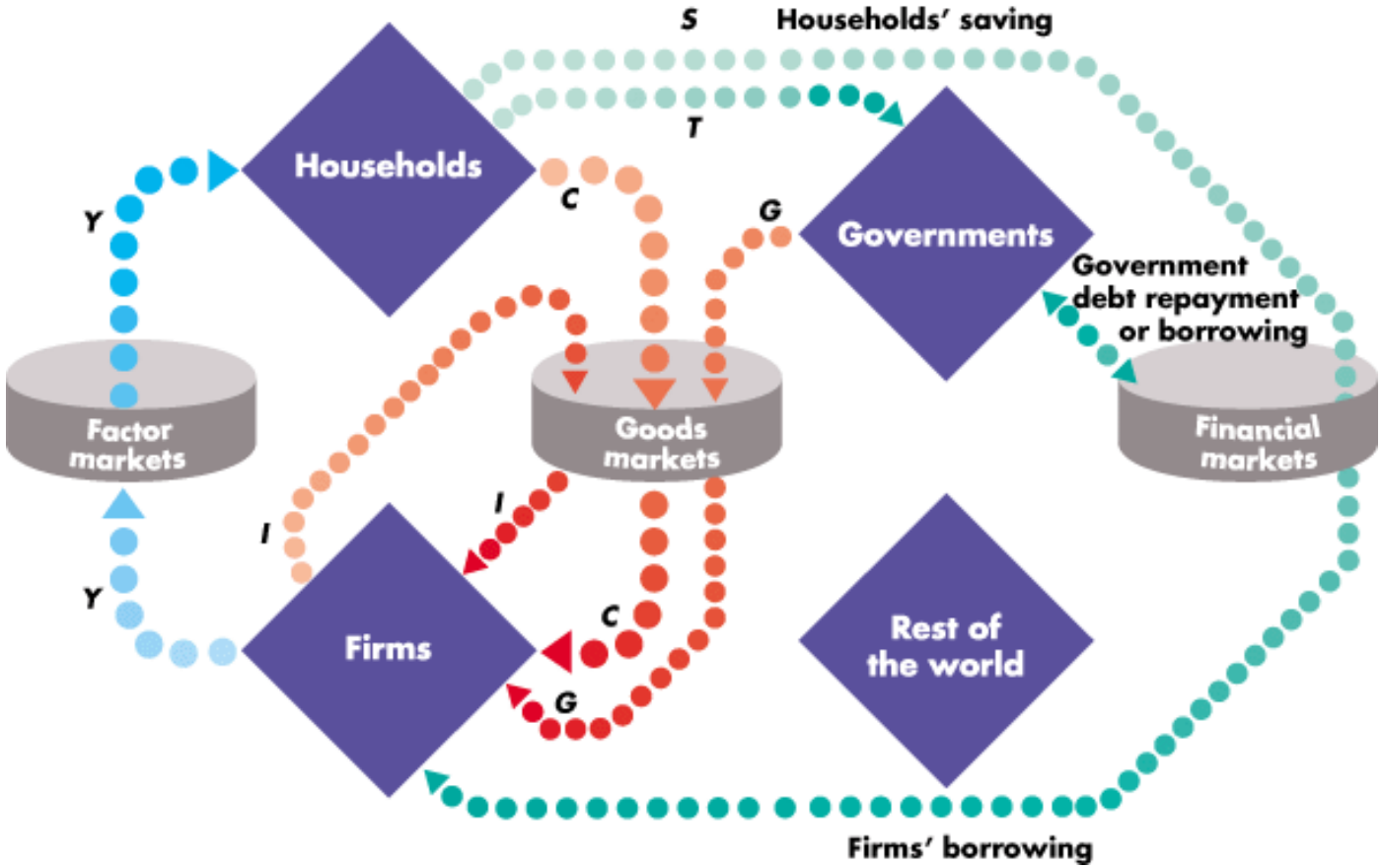
# Gross Domestic Product

Firms buy capital goods from other firms. The red flow *I* represents this investment expenditure by firms.



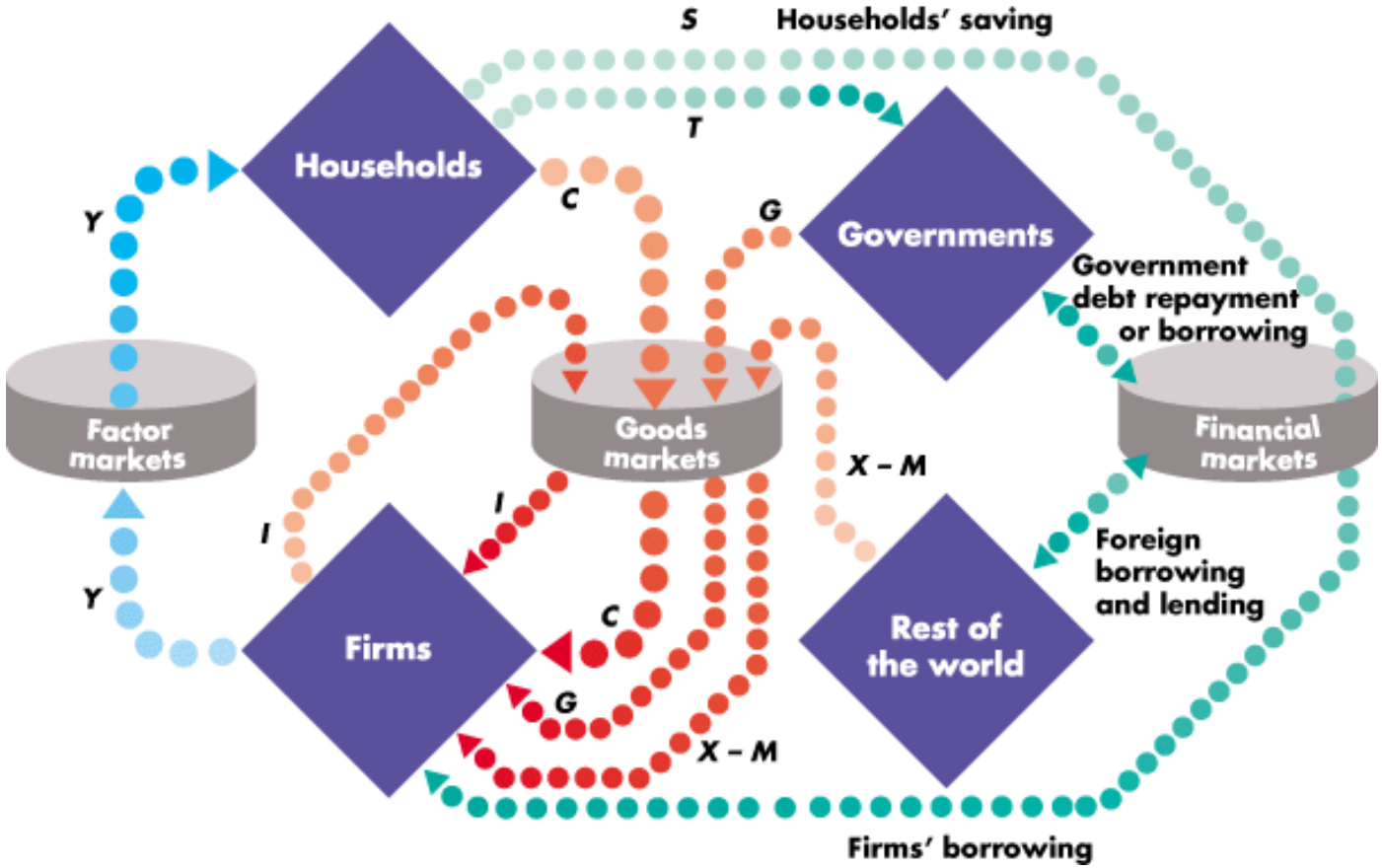
# Gross Domestic Product

Governments buy goods and services, *G*, and borrow or repay debt if spending exceeds or is less than taxes



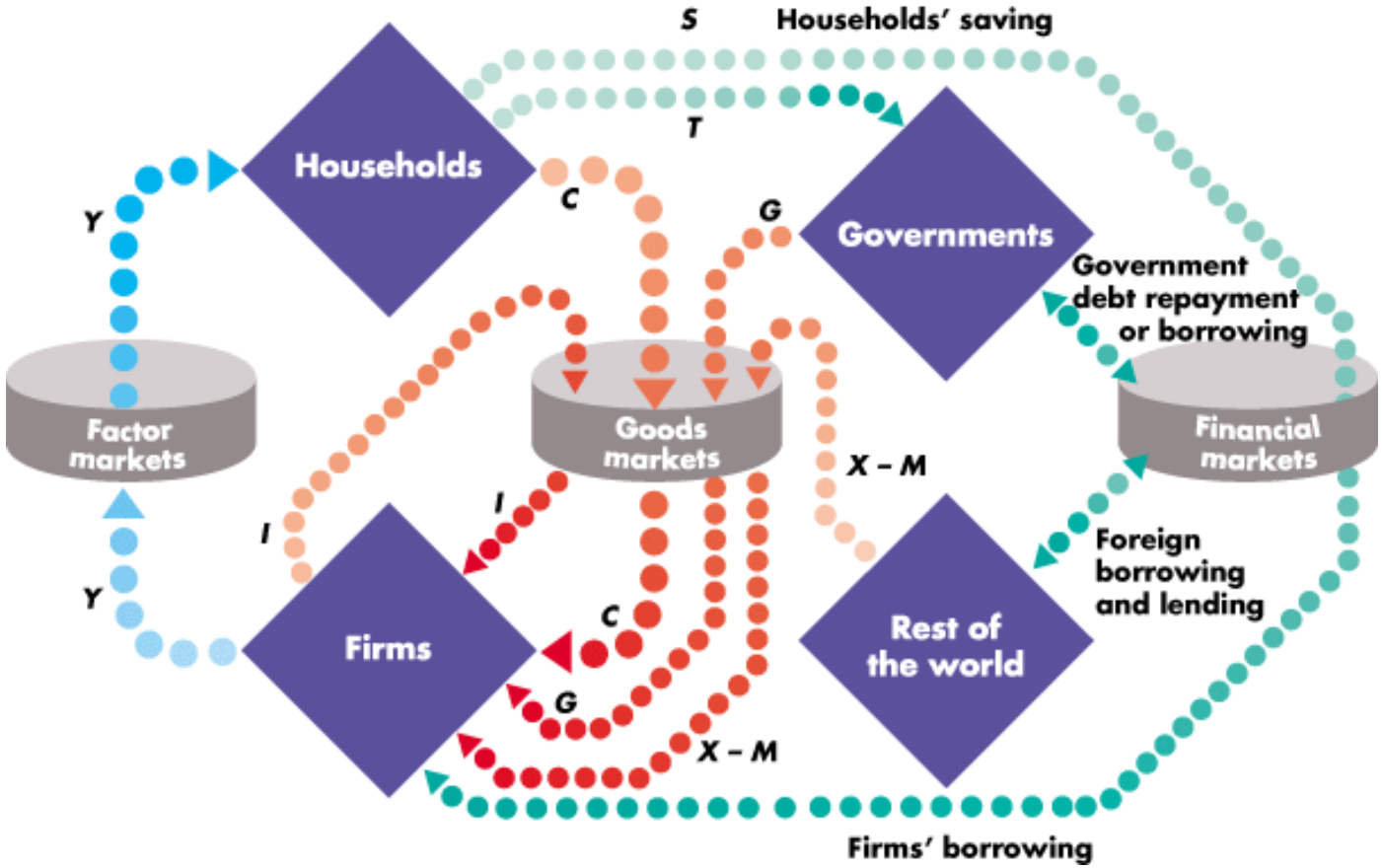
# Gross Domestic Product

The rest of the world buys goods and services from us, *X* and sells us goods and services, *M*—net exports are *X* - *M*



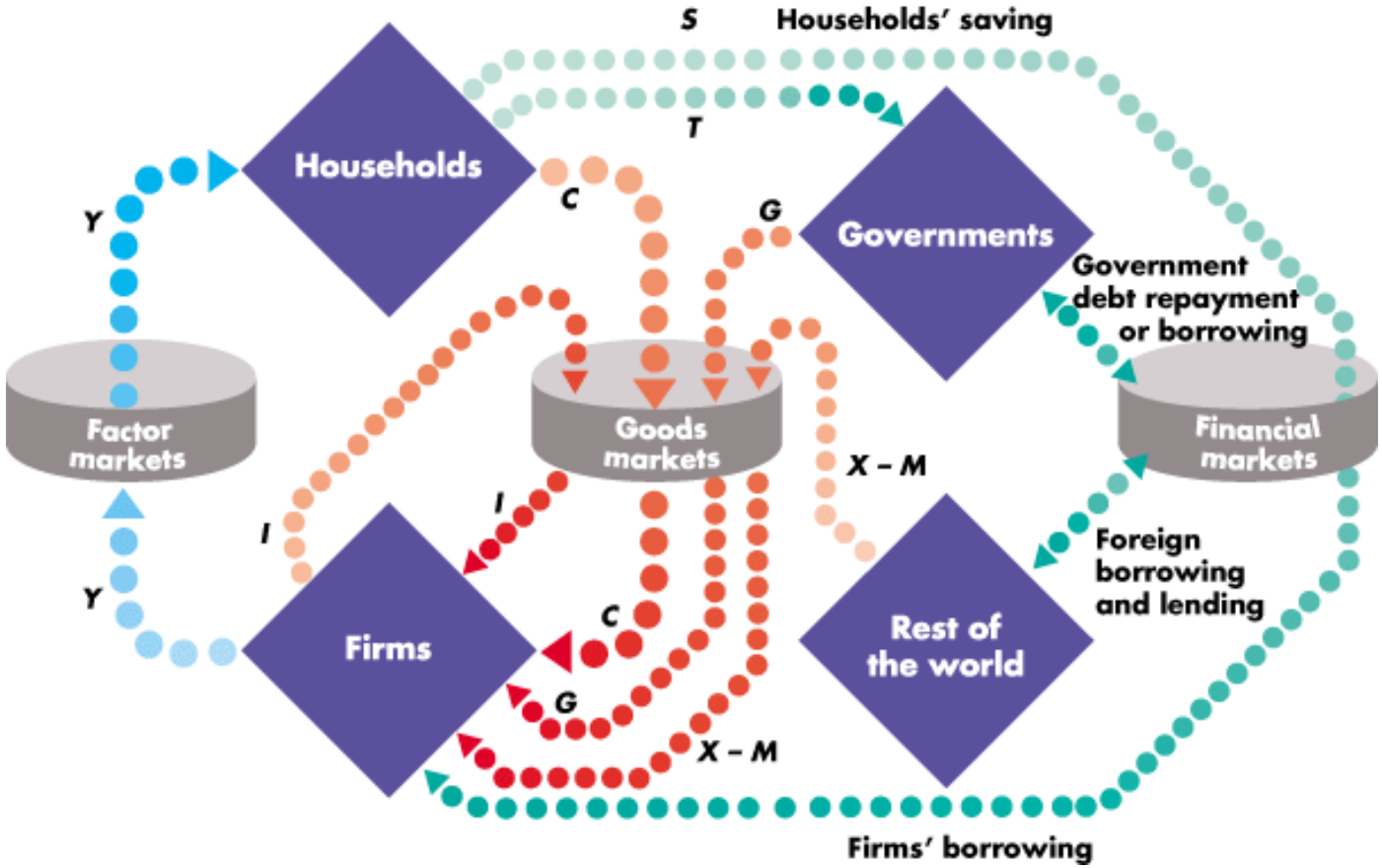
# Gross Domestic Product

And the rest of the world borrows from us or lends to us depending on whether net exports are positive or negative.



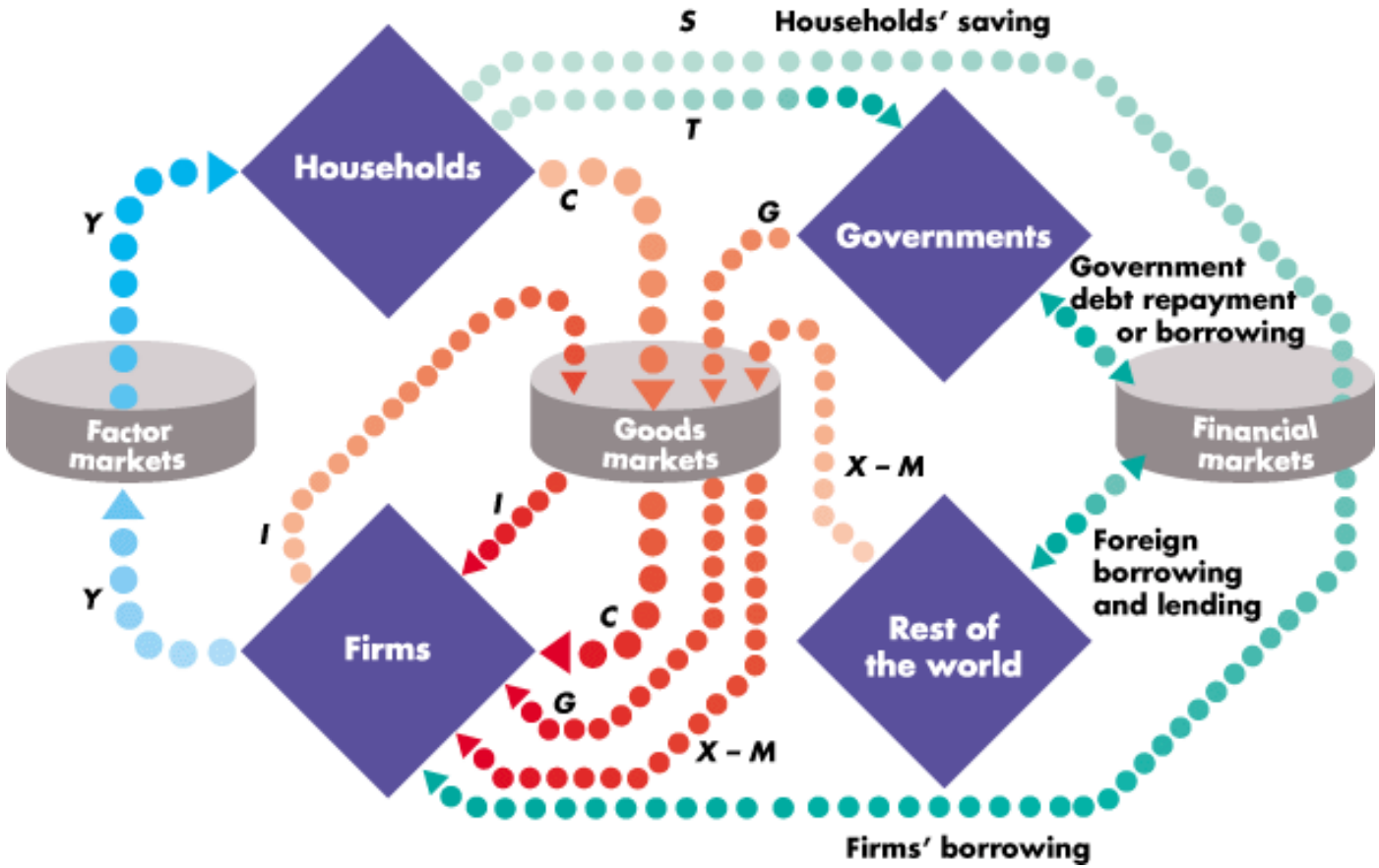
# Gross Domestic Product

The blue and red flows are the circular flow of expenditure and income. The green flows are borrowing and lending.



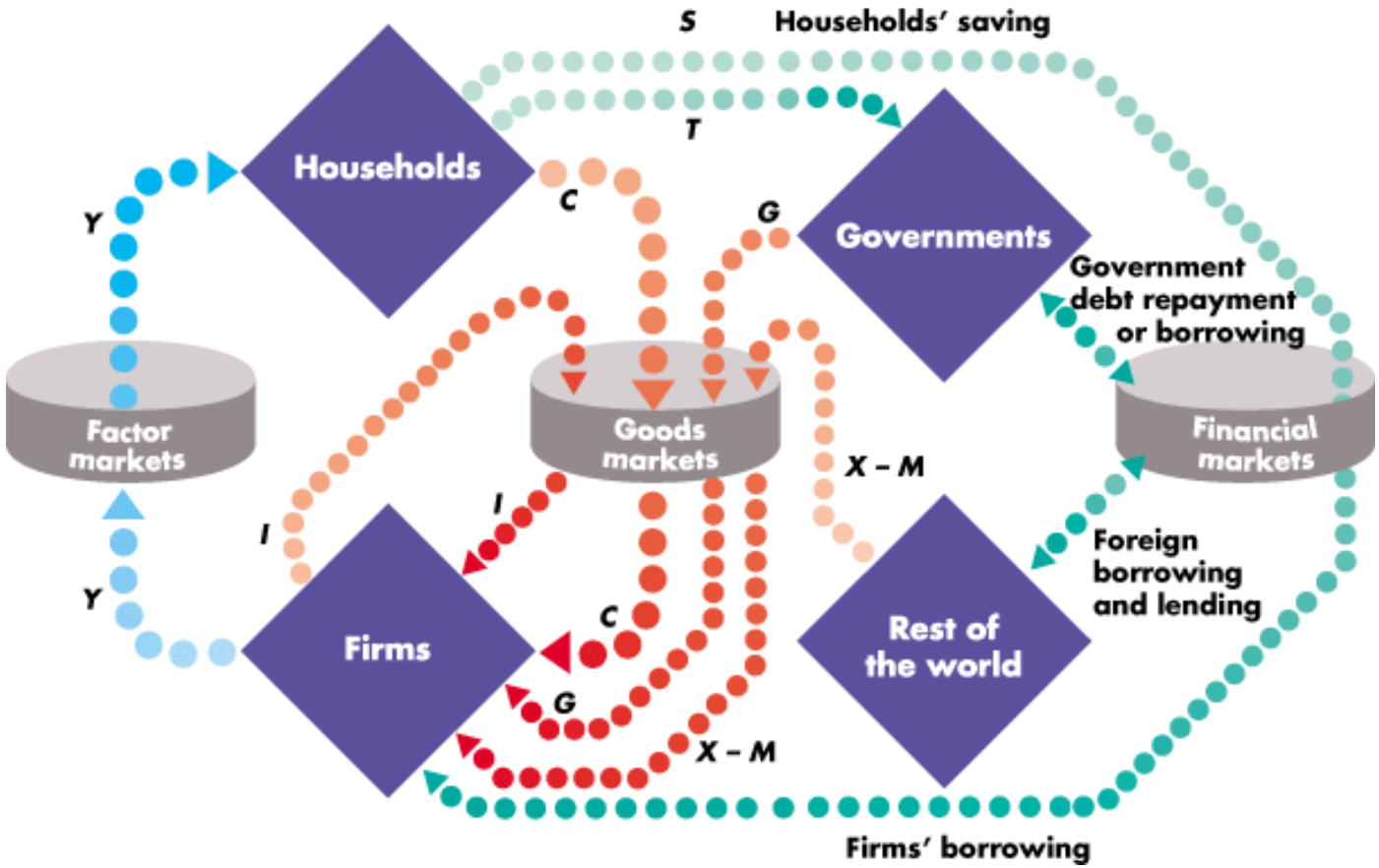
# Gross Domestic Product

The sum of the red flows equals the blue flow.



# Gross Domestic Product

That is: $Y = C + I + G + X - M$



# Gross Domestic Product

The circular flow demonstrates how GDP can be measured in two ways.

**Aggregate expenditure**

Total expenditure on final goods and services, equals the value of output of final goods and services, which is GDP.

$$\text{Total expenditure} = C + I + G + (X - M).$$

# Gross Domestic Product

**Aggregate income**

Aggregate income earned from production of final goods, $Y$, equals the total paid out for the use of resources, wages, interest, rent, and profit.

Firms pay out all their receipts from the sale of final goods, so income equals expenditure,

$$Y = C + I + G + (X - M).$$

# Gross Domestic Product

## Financial Flows

Financial markets finance deficits and investment.

Household saving $S$ is income minus net taxes and consumption expenditure, and flows to the financial markets;

$$Y = C + S + T,$$

income equals the uses of income.

# Gross Domestic Product

If government purchases exceed net taxes, the deficit ($G - T$) is borrowed from the financial markets (if $T$ exceeds $G$, the government surplus flows to the markets).

If imports exceed exports, the deficit with the rest of the world ($M - X$) is borrowing from the rest of the world.

# Gross Domestic Product

## How Investment Is Financed

Investment is financed from three sources:

- Private saving, $S$
- Government budget surplus, $(T - G)$
- Borrowing from the rest of the world $(M - X)$.

# Gross Domestic Product

We can see these three sources of investment finance by using the fact that aggregate expenditure equals aggregate income.

Start with

$$Y = C + S + T = C + I + G + (X - M).$$

Then rearrange to obtain

$$I = S + (T - G) + (M - X)$$

Private saving $S$ plus government saving $(T - G)$ is called **national saving**.

# Gross Domestic Product

## Gross and Net Domestic Product

"Gross" means before accounting for the depreciation of capital. The opposite of gross is net.

To understand this distinction, we need to distinguish between flows and stocks in macroeconomics.

A **flow** is a quantity per unit of time; a **stock** is the quantity that exists at a point in time.

# Gross Domestic Product

**Wealth**, the value of all the things that people own, is a stock. *Saving* is the *flow* that changes the *stock of wealth*.

*Capital*, the plant, equipment, and inventories of raw and semi-finished materials that are used to produce other goods and services is a stock.

*Investment* is the *flow* that changes the *stock of capital*.

**Depreciation** is the decrease in the capital stock that results from wear and tear, and obsolescence.

**Capital consumption** is another name for depreciation.

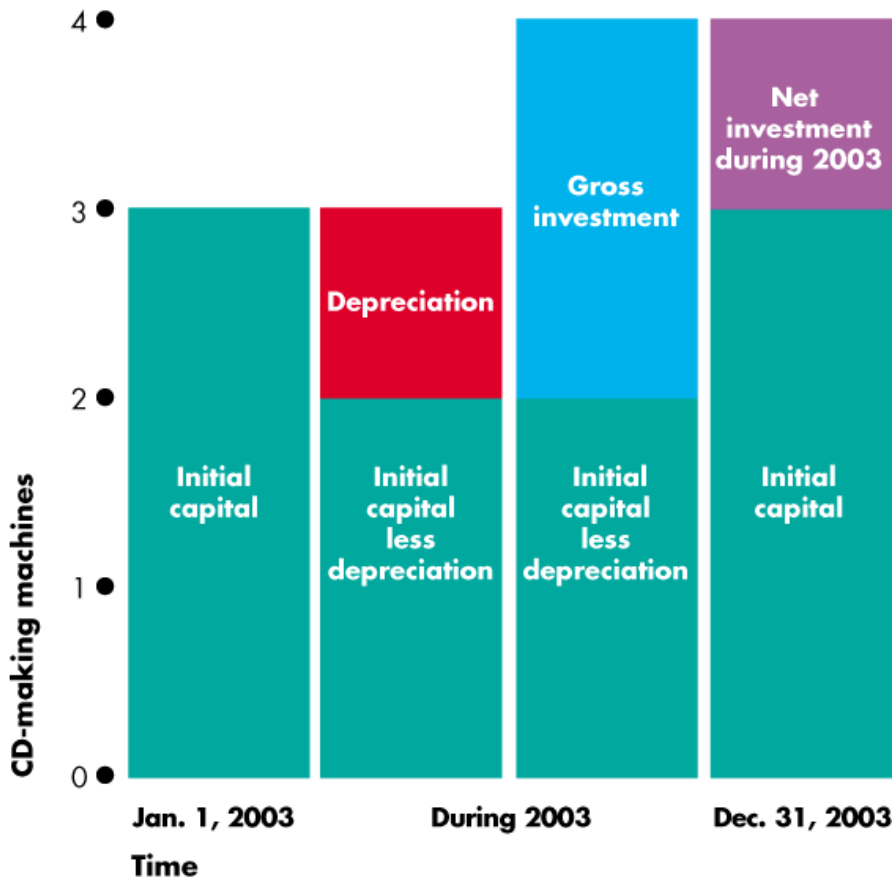
# Gross Domestic Product

**Gross investment** is the total amount spent on purchases of new capital and on replacing depreciated capital.

**Net investment** is the change in the stock of capital and equals gross investment minus depreciation.

# Gross Domestic Product

Figure 5.2 illustrates the relationships among capital, gross investment, depreciation, and net investment.



# Gross Domestic Product

Gross profits, and GDP, include depreciation.

Similarly, gross investment includes that amount of purchases of new capital goods that replace depreciation

Net profits, net domestic product, and net investment subtract depreciation from the gross concepts.

Investment plays a central role in the economy. Increases in capital are one source of growth in potential real GDP; fluctuations in investment are one source of fluctuations in real GDP.

# Measuring U.S. GDP

The Bureau of Economic Analysis uses two approaches to measure GDP

- The expenditure approach
- The income approach

# Measuring U.S. GDP

## The Expenditure Approach

The *expenditure approach* measures GDP as the sum of consumption expenditure, investment, government purchases of goods and services, and net exports.

Table 5.1 in the textbook shows the expenditure approach with data for 2003.

# Measuring U.S. GDP

## The Income Approach

The *income approach* measures GDP by summing the incomes that firms pay households for the factors of production they hire.

# Measuring U.S. GDP

The *National Income and Product Accounts* divide incomes into five categories

- Compensation of employees
- Net interest
- Rental income
- Corporate profits.
- Proprietors' income.

The sum of these five income components is *net domestic income at factor cost*.

# Measuring U.S. GDP

Two adjustments must be made to get GDP

- Indirect taxes minus subsidies are added to get from *factor cost* to *market prices*.
- Depreciation (or capital consumption) is added to get from *net* domestic product to *gross* domestic product.

Table 5.2 in the textbook shows the income approach with data for 2003.

# Real GDP and the Price Level

**Real GDP** is the value of final goods and services produced in a given year when valued at constant prices.

## Calculating Real GDP

The first step in calculating real GDP is to calculate **nominal GDP**, which is the value of goods and services produced during a given year valued at the prices that prevailed in that same year.

# Real GDP and the Price Level

The table provides data for 2002 and 2003.

In 2002, nominal GDP is:

Expenditure on balls $100

Expenditure on bats $100

Nominal GDP $200

| Item | Quantity | Price |
|---|---|---|
| **2002** | | |
| Balls | 100 | $1.00 |
| Bats | 20 | $5.00 |
| **2003** | | |
| Balls | 160 | $0.50 |
| Bats | 22 | $22.50 |

# Real GDP and the Price Level

In 2003, nominal GDP is:

Expenditure on balls $80

Expenditure on bats $495

Nominal GDP $575

| Item | Quantity | Price |
|---|---|---|
| **2002** | | |
| Balls | 100 | $1.00 |
| Bats | 20 | $5.00 |
| **2003** | | |
| Balls | 160 | $0.50 |
| Bats | 22 | $22.50 |

# Real GDP and the Price Level

The old method of calculating real GDP was to value each year's output at the prices of a base year—the *base year prices method*.

Suppose 2002 is the base year and 2003 is the current year.

| Item | Quantity | Price |
|---|---|---|
| **2002** | | |
| Balls | 100 | $1.00 |
| Bats | 20 | $5.00 |
| **2003** | | |
| Balls | 160 | $0.50 |
| Bats | 22 | $22.50 |

# Real GDP and the Price Level

Expenditure on balls in 2003 valued at 2002 prices is $160.

Expenditure on bats in 2003 valued at 2002 prices is $110.

Real GDP in 2003 (base-year prices method) is $270.

| Item | Quantity | Price |
|---|---|---|
| **2002** | | |
| Balls | 100 | $1.00 |
| Bats | 20 | $5.00 |
| **2003** | | |
| Balls | 160 | $0.50 |
| Bats | 22 | $22.50 |

# Real GDP and the Price Level

The new method of calculating real GDP, which is called the **chain-weighted output index** method, uses the prices of two adjacent years to calculate the real GDP growth rate.

This calculation has four steps described on the next slide.

# Real GDP and the Price Level

Step 1: Value last year's production and this year's production at *last year's prices* and then calculate the growth rate of this number from last year to this year.

Step 2: Value last year's production and this year's production at *this year's prices* and then calculate the growth rate of this number from last year to this year.

Step 3: Calculate the average of the two growth rates. This average growth rate is the growth rate of real GDP from last year to this year.

Step 4: Repeat steps 1, 2, and 3 for each pair of adjacent years to link real GDP back to the base year's prices.

# Real GDP and the Price Level

We've done step 1.

2002 production at 2002 prices (GDP in 2002) is $200.

2003 production at 2002 prices is $270.

The 2003 growth rate in 2002 prices is 35 percent.

| Item | Quantity | Price |
|---|---|---|
| **2002** | | |
| Balls | 100 | $1.00 |
| Bats | 20 | $5.00 |
| **2003** | | |
| Balls | 160 | $0.50 |
| Bats | 22 | $22.50 |

# Real GDP and the Price Level

Step 2.

2002 production at 2003 prices is $500.

2003 production at 2003 prices (GDP in 2003) is $575.

The 2003 growth rate in 2003 prices is 15 percent.

| Item | Quantity | Price |
|---|---|---|
| **2002** | | |
| Balls | 100 | $1.00 |
| Bats | 20 | $5.00 |
| **2003** | | |
| Balls | 160 | $0.50 |
| Bats | 22 | $22.50 |

# Real GDP and the Price Level

Step 3.

The 2003 growth rate in 2002 prices is 35 percent.

The 2003 growth rate in 2003 prices is 15 percent.

The average of these two growth rates is 25 percent.

Real GDP in 2003 with 2002 as the base year is $250.

| Item | Quantity | Price |
|---|---|---|
| **2002** | | |
| Balls | 100 | $1.00 |
| Bats | 20 | $5.00 |
| **2003** | | |
| Balls | 160 | $0.50 |
| Bats | 22 | $22.50 |

# Real GDP and the Price Level

Step 4.

Because we're calculating real GDP in 2003 at 2002 prices, step 4 is completed!

Real GDP in 2002 is $200

Real GDP in 2003 is $250

| Item | Quantity | Price |
|---|---|---|
| **2002** | | |
| Balls | 100 | $1.00 |
| Bats | 20 | $5.00 |
| **2003** | | |
| Balls | 160 | $0.50 |
| Bats | 22 | $22.50 |

# Real GDP and the Price Level

## Calculating the Price Level

The average level of prices is called the **price level**.

One measure of the price level is the **GDP deflator**, which is an average of the prices of the goods in GDP in the current year expressed as a percentage of the base year prices.

The GDP deflator is calculated in the table on the next slide (and in Table 5.7 in the textbook).

# Real GDP and the Price Level

Nominal GDP and real GDP are calculated in the way that you've just seen.

GDP Deflator = (Nominal GDP/Real GDP) $\times$ 100.

In 2002, the GDP deflator is (\$200/\$200) $\times$ 100 = 100.

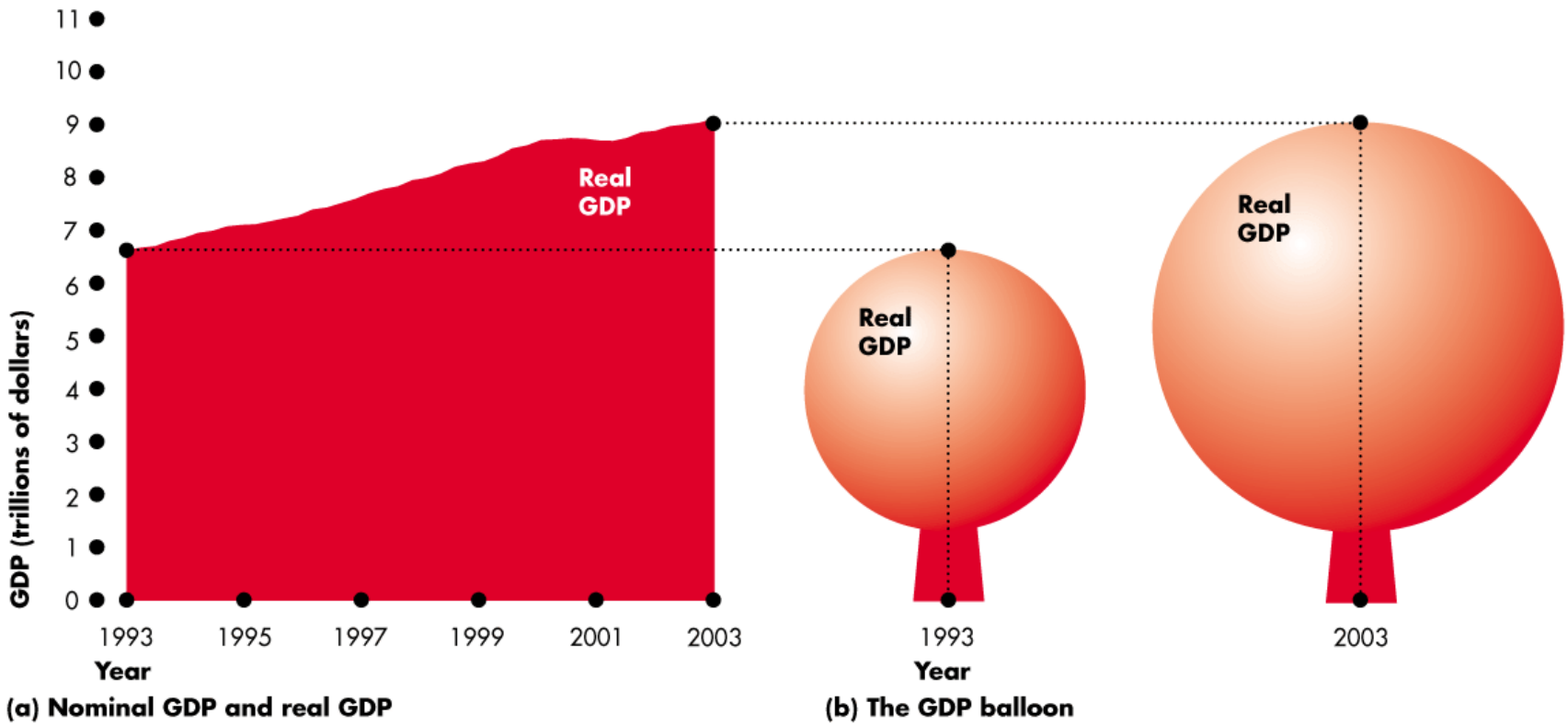
In 2003, the GDP deflator is (\$575/\$250) $\times$ 100 = 230.

| Year | Nominal GDP | Real GDP | GDP deflator |
|---|---|---|---|
| 2002 | \$200 | \$200 | 100 |
| 2003 | \$575 | \$250 | 230 |

# Real GDP and the Price Level

## Deflating the GDP Balloon

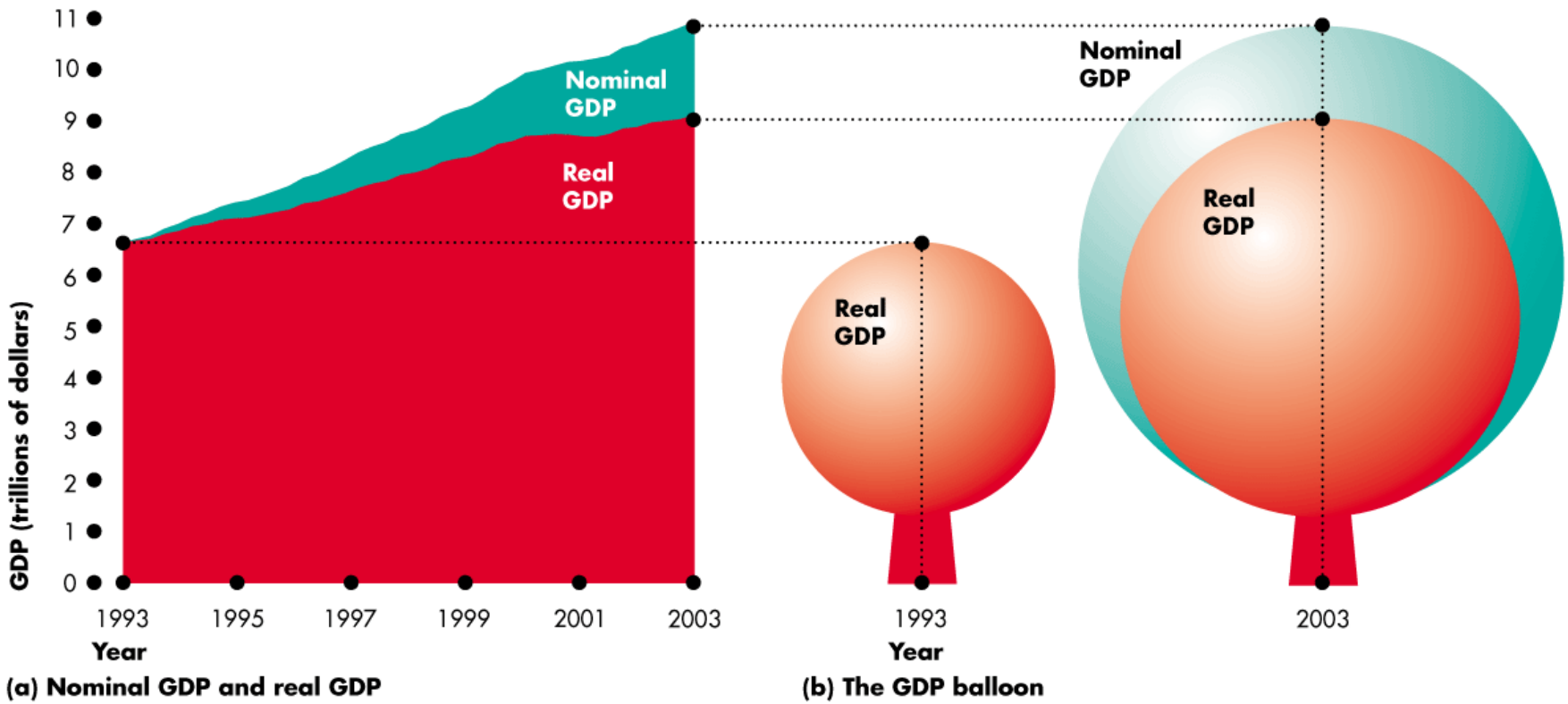
Nominal GDP increases because production—real GDP–increases.



# Real GDP and the Price Level

## Deflating the GDP Balloon

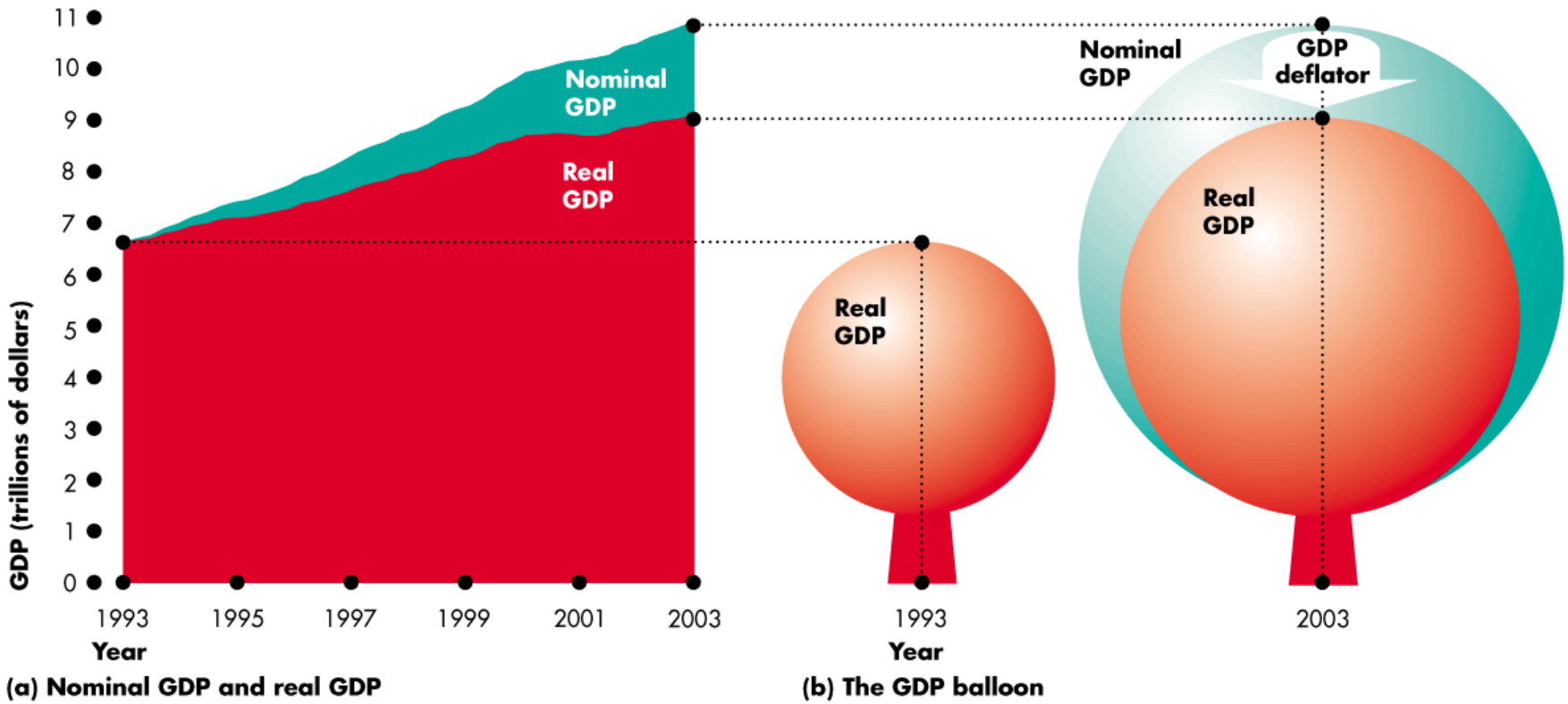
Nominal GDP also increases because prices rise.



# Real GDP and the Price Level

## Deflating the GDP Balloon

We use the GDP deflator to let the air out of the nominal GDP balloon and reveal real GDP.



# Measuring Economic Growth

We use real GDP to calculate the economic growth rate.

The **economic growth rate** is the percentage change in the quantity of goods and services produced from one year to the next.

We measure economic growth so we can make:

- Economic welfare comparisons
- International welfare comparisons
- Business cycle forecasts

# Measuring Economic Growth

## Economic Welfare Comparisons

Economic welfare measures the nation's overall state of economic well-being.

Real GDP is not a perfect measure of economic welfare for seven reasons:

1. Quality improvements tend to be neglected in calculating real GDP so the inflation rate is overstated and real GDP understated.

2. Real GDP does not include household production, that is, productive activities done in and around the house by members of the household.

# Measuring Economic Growth

## Economic Welfare Comparisons

Economic welfare measures the nation's overall state of economic well-being.

Real GDP is not a perfect measure of economic welfare for seven reasons:

3. Real GDP, as measured, omits the underground economy, which is illegal economic activity or legal economic activity that goes unreported for tax avoidance reasons.

4. Health and life expectancy are not directly included in real GDP.

# Measuring Economic Growth

## Economic Welfare Comparisons

Economic welfare measures the nation's overall state of economic well-being.

Real GDP is not a perfect measure of economic welfare for seven reasons:

5. Leisure time, a valuable component of an individual's welfare, is not included in real GDP.

6. Environmental damage is not deducted from real GDP.

7. Political freedom and social justice are not included in real GDP.

# Measuring Economic Growth

## International Comparisons

Real GDP is used to compare economic welfare in one country with that in another.

Two special problems arise in making these comparisons.

Real GDP of one country must be converted into the same currency units as the real GDP of the other country, so an exchange rate must be used.

The same prices should be used to value the goods and services in the countries being compared, but often are not.

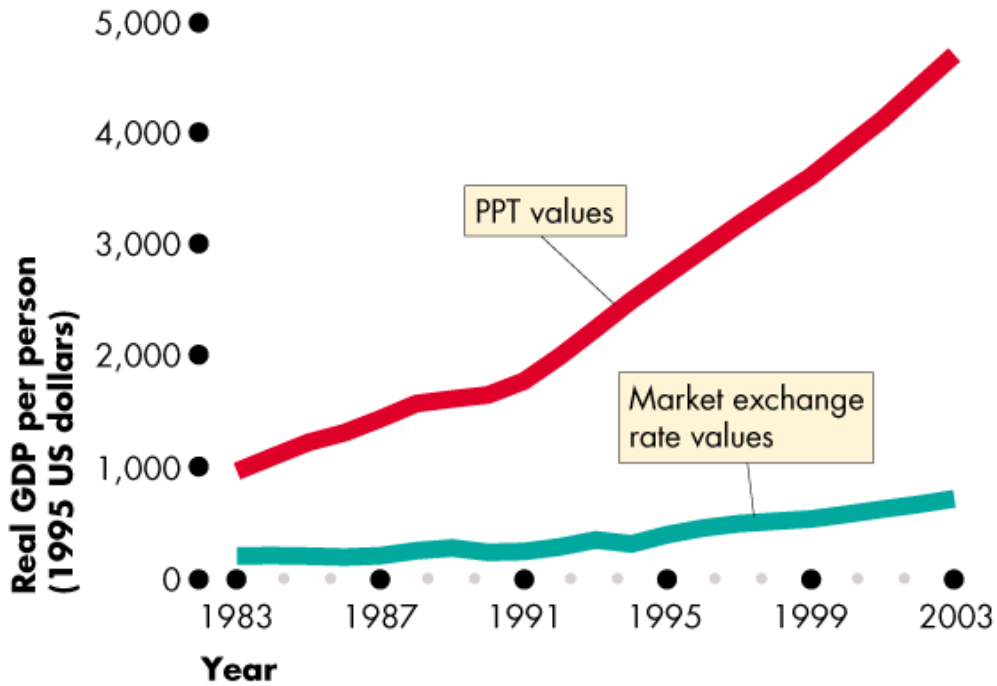
# Measuring Economic Growth

Using the exchange rate to compare GDP in one country with GDP in another country is problematic because prices of particular products in one country may be much less or much more than in the other country.

Using the exchange rate to value Chinese GDP in dollars leads to an estimate that U.S. real GDP per person was 69 times Chinese real GDP per person.

# Measuring Economic Growth

Using purchasing power parity prices leads to an estimate that per person GDP in the United States is (only) 12 times that in China—see Figure 5.4.



# Measuring Economic Growth

## Business Cycle Forecasts

Real GDP is used to measure business cycle fluctuations.

These fluctuations are probably accurately timed but the changes in real GDP probably overstate the changes in total production and people's welfare caused by business cycles.

# THE END