PARKIN BADE

MACROECONOMICS

CANADA IN THE GLOBAL ENVIRONMENT TENTH EDITION

4 MONITORING THE VALUE OF PRODUCTION: GDP

After studying this chapter, you will be able to:

- Define GDP and explain why GDP equals aggregate expenditure and aggregate income
- Explain how the Statistics Canada measures GDP and real GDP
- Describe how real GDP is used and explain its limitations as a measure of economic well-being

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 the value of intermediate goods and services avoids counting the same value more than once.

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

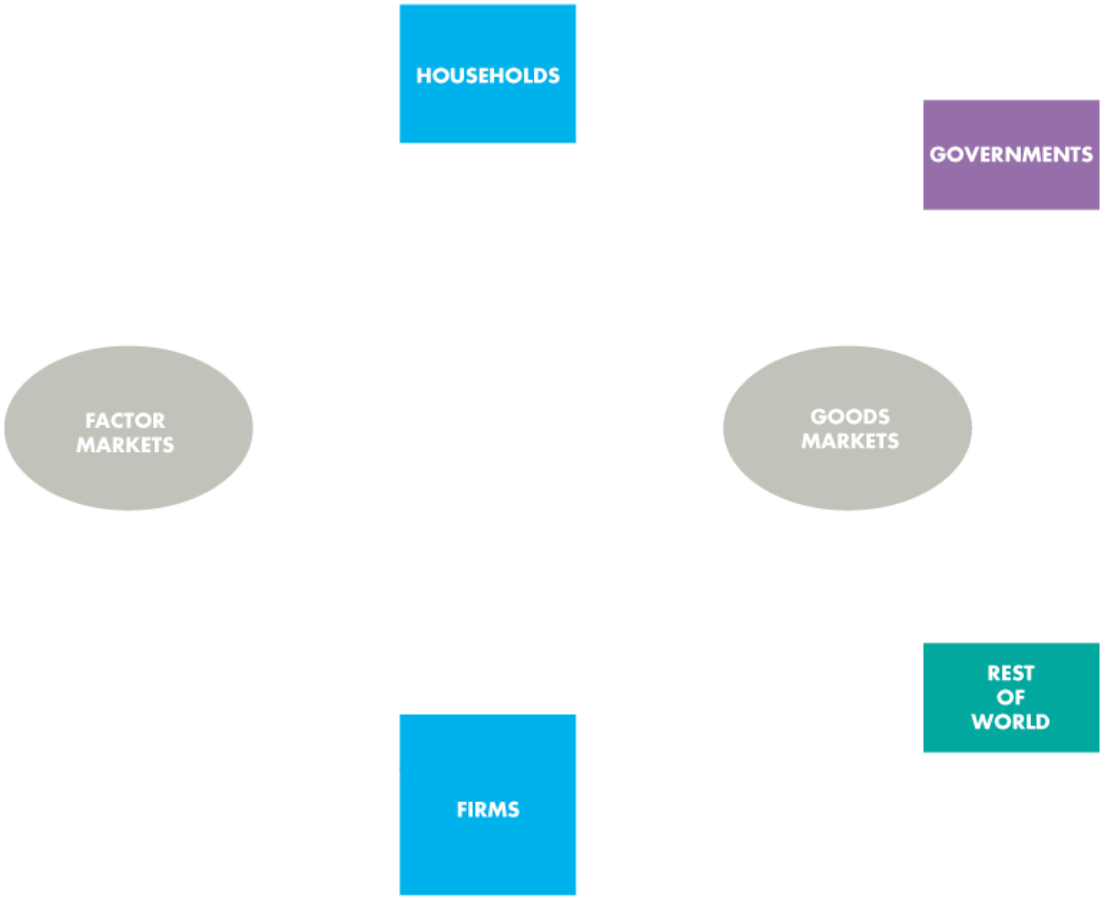
GDP measures the value of production, which also equals total expenditure on final goods and total income.

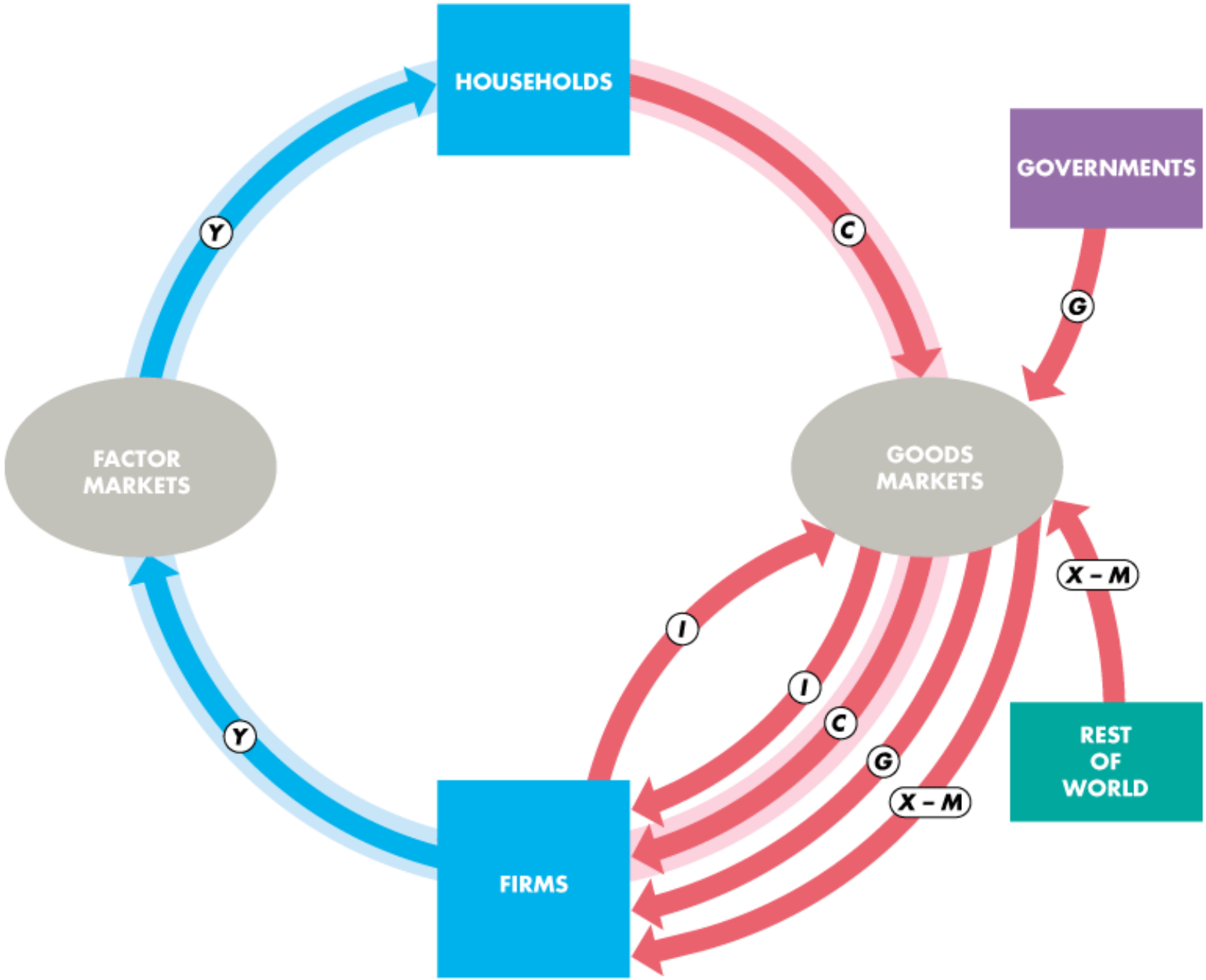
The equality of income and value of production shows the link between productivity and living standards.

The circular flow diagram in Figure 4.1 illustrates the equality of income and expenditure.

Gross Domestic Product

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





Gross Domestic Product

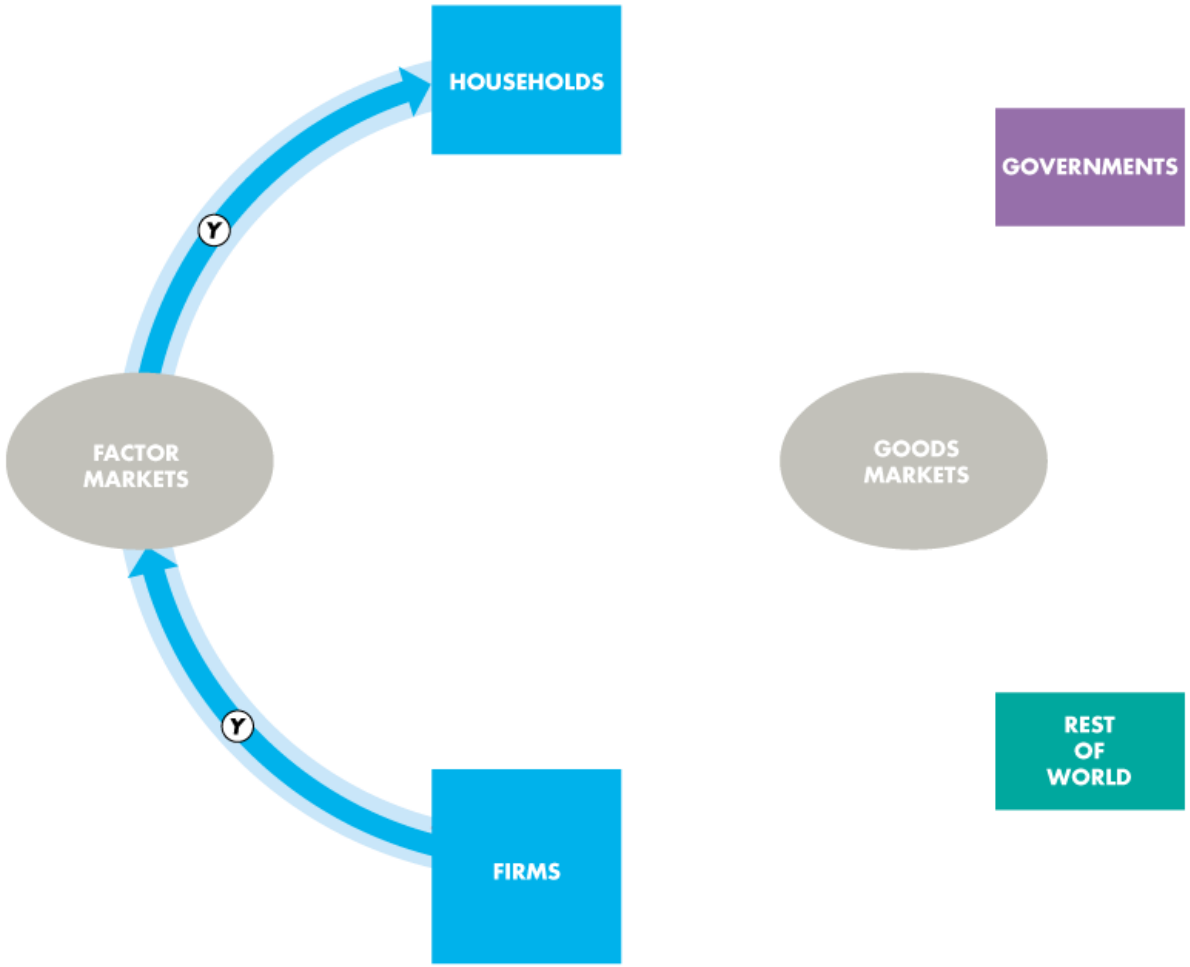
Households and Firms

Households sell and firms buy the services of labour, capital, and land in factor markets.

For these factor services, firms pay income to households: wages for labour services, interest for the use of capital, and rent for the use of land. A fourth factor of production, entrepreneurship, receives profit.

In the figure, the blue flow, Y, shows total income paid by firms to households.

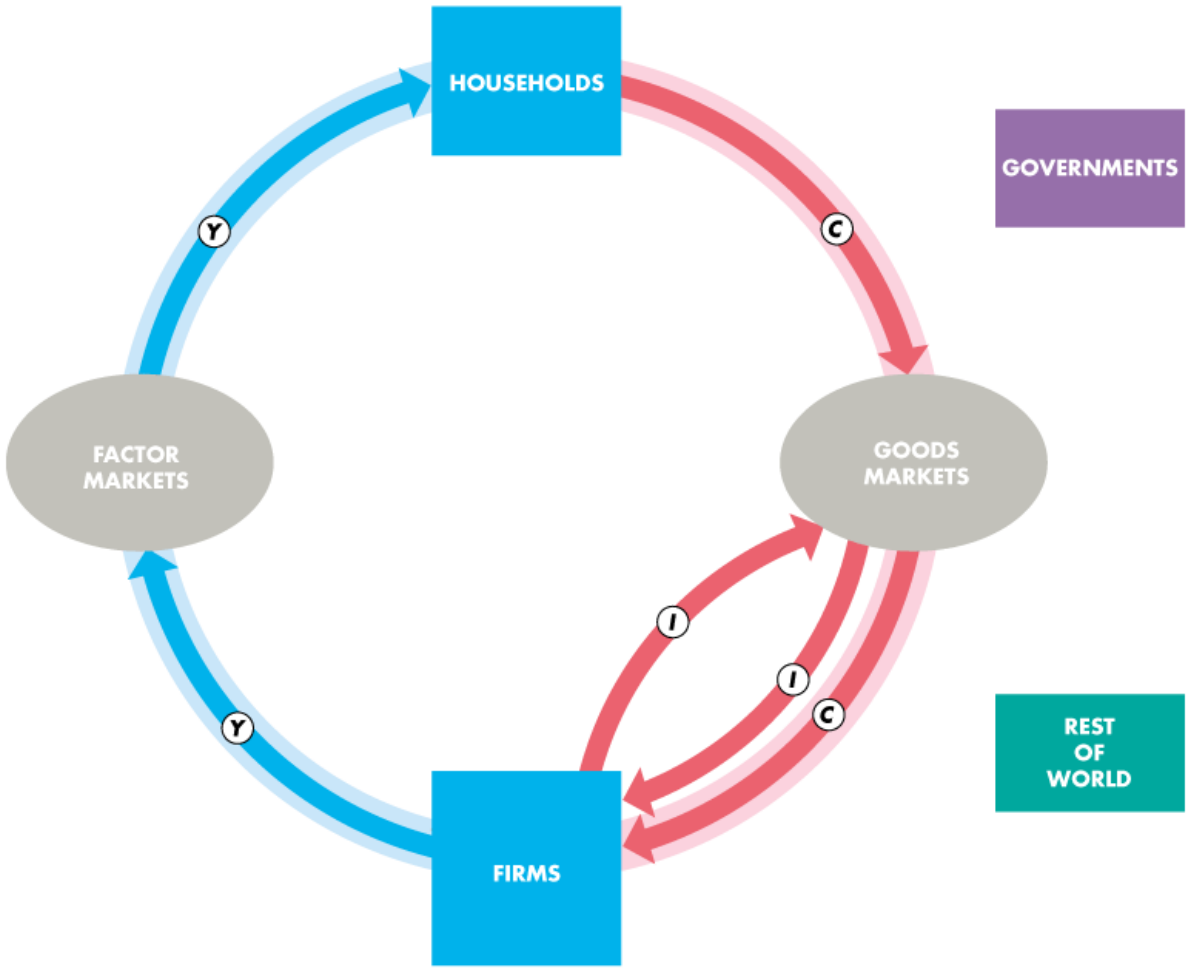
Gross Domestic Product



Gross Domestic Product

Firms sell and households buy consumer goods and services in the goods market.
Consumption expenditure is the total payment for consumer goods and services, shown by the red flow labelled C .
Firms buy and sell new capital equipment in the goods market and put unsold output into inventory.
The purchase of new plant, equipment, and buildings and the additions to inventories are investment, shown by the red flow labelled I.

Gross Domestic Product



Gross Domestic Product

Governments

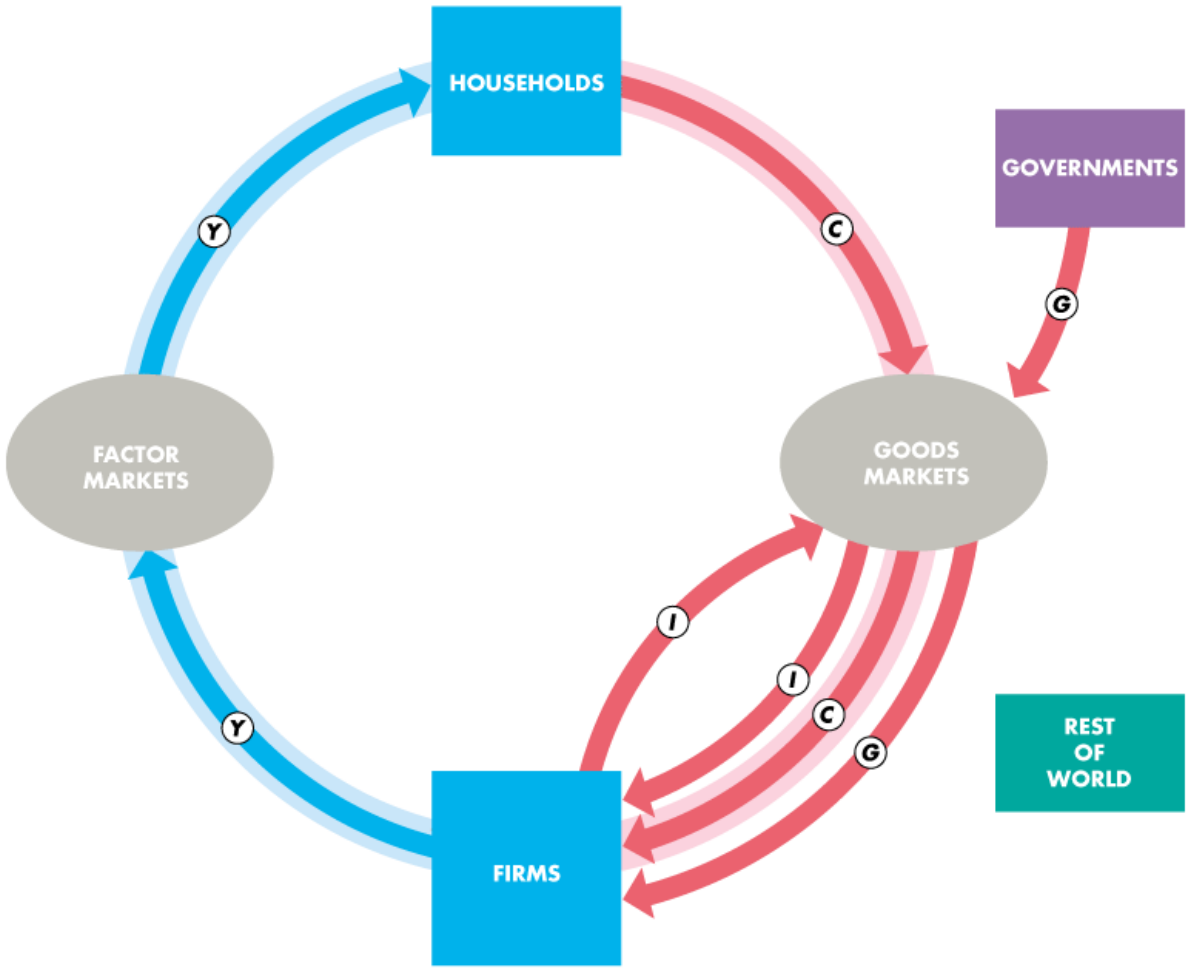
Governments buy goods and services from firms and their expenditure on goods and services is called government expenditure.

Government expenditure is shown as the red flow G.

Governments finance their expenditure with taxes and pay financial transfers to households, such as unemployment benefits, and pay subsidies to firms.

These financial transfers are not part of the circular flow of expenditure and income.

Gross Domestic Product



Gross Domestic Product

Rest of the World

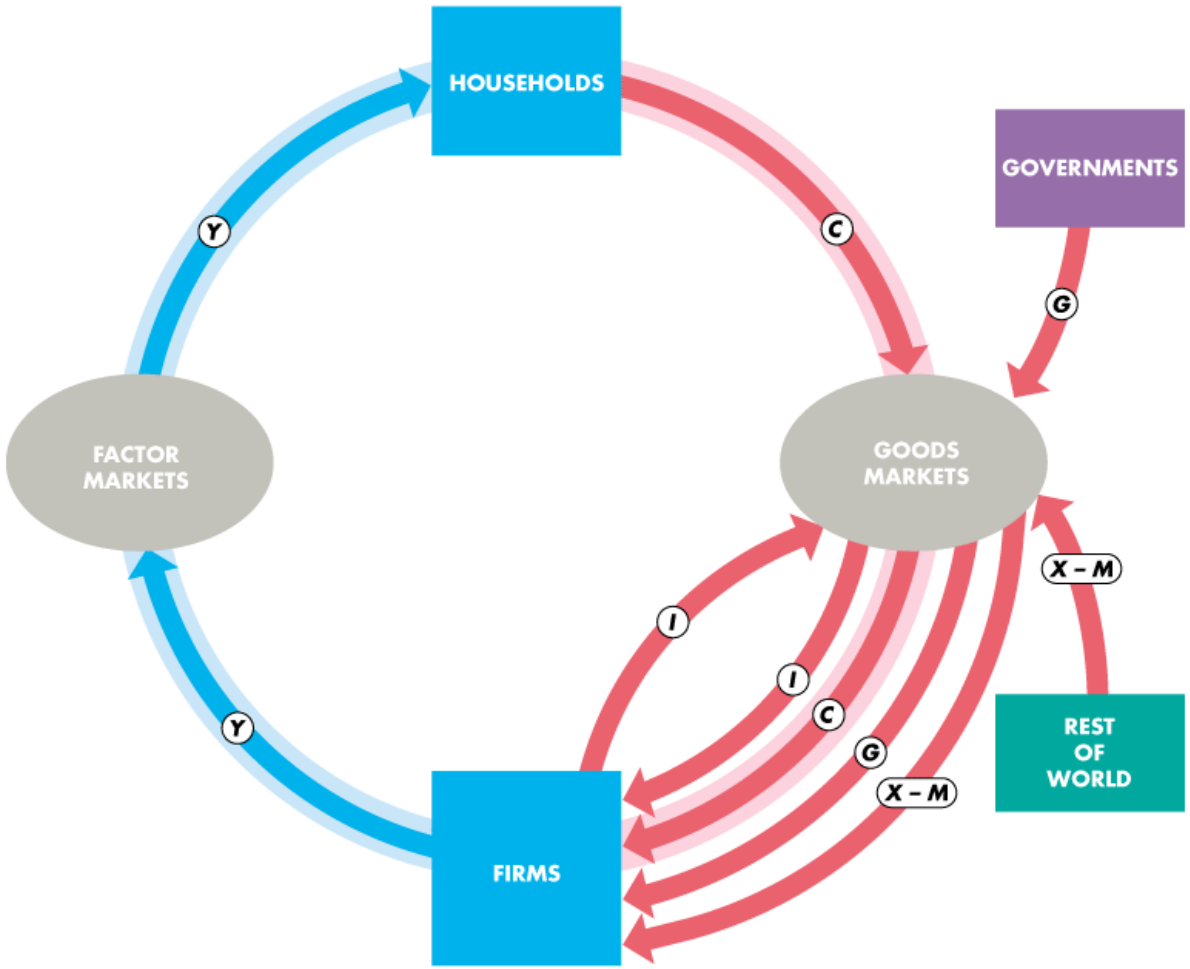
Firms in Canada sell goods and services to the rest of the world—exports—and buy goods and services from the rest of the world—imports.

The value of exports (X) minus the value of imports (M) is called net exports, the red flow X – M.

If net exports are positive, the net flow of goods and services is from Canadian firms to the rest of the world.

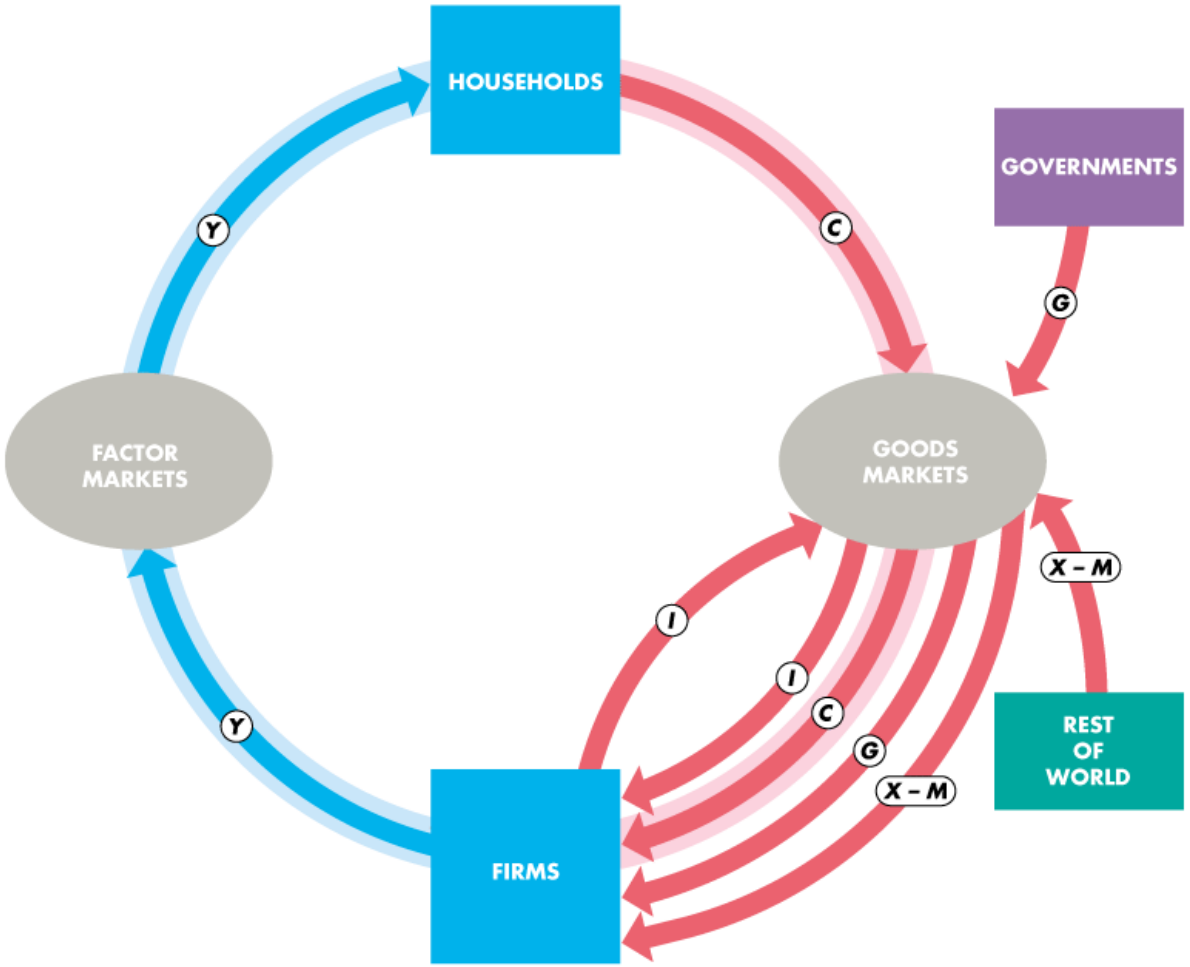
If net exports are negative, the net flow of goods and services is from the rest of the world to Canadian firms.

Gross Domestic Product



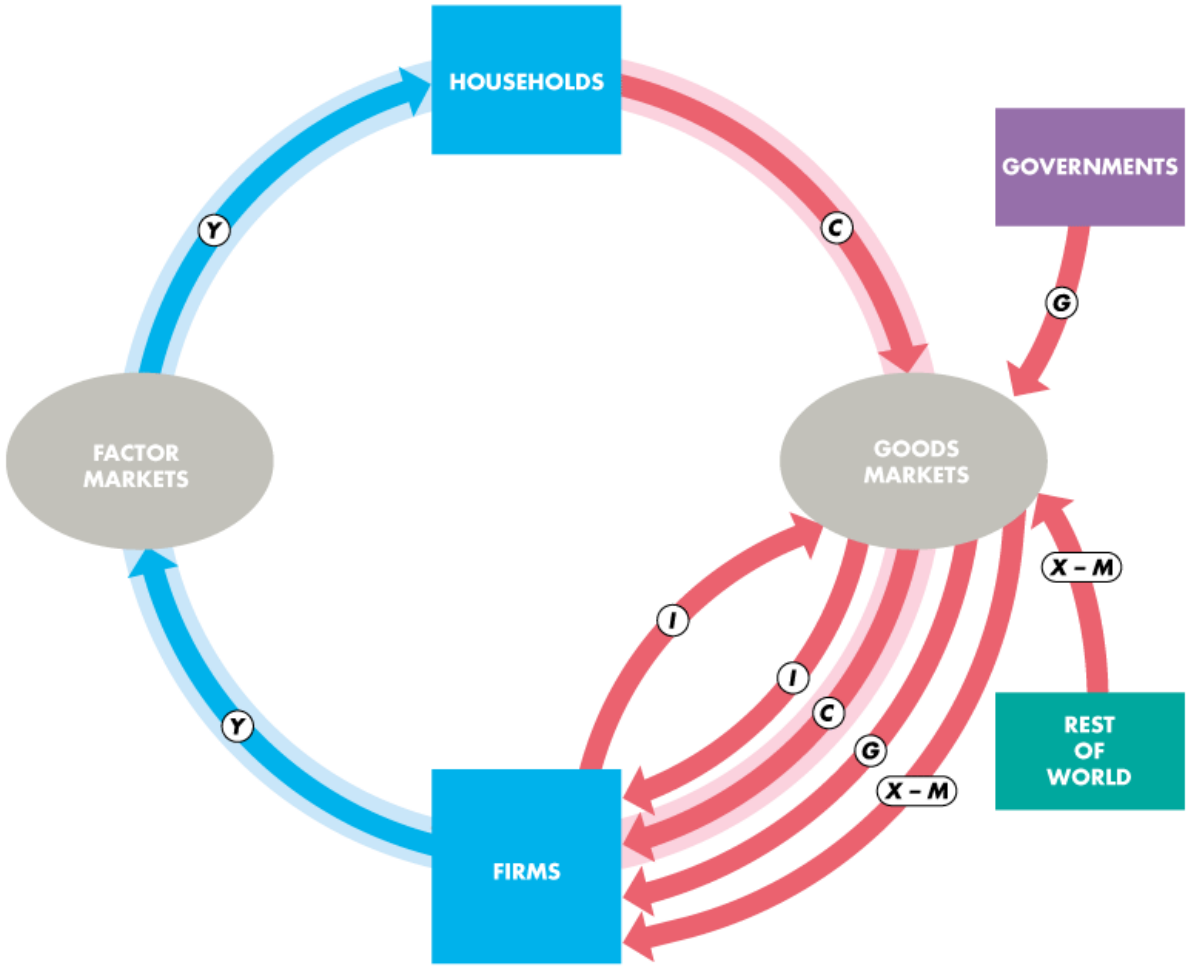
Gross Domestic Product

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



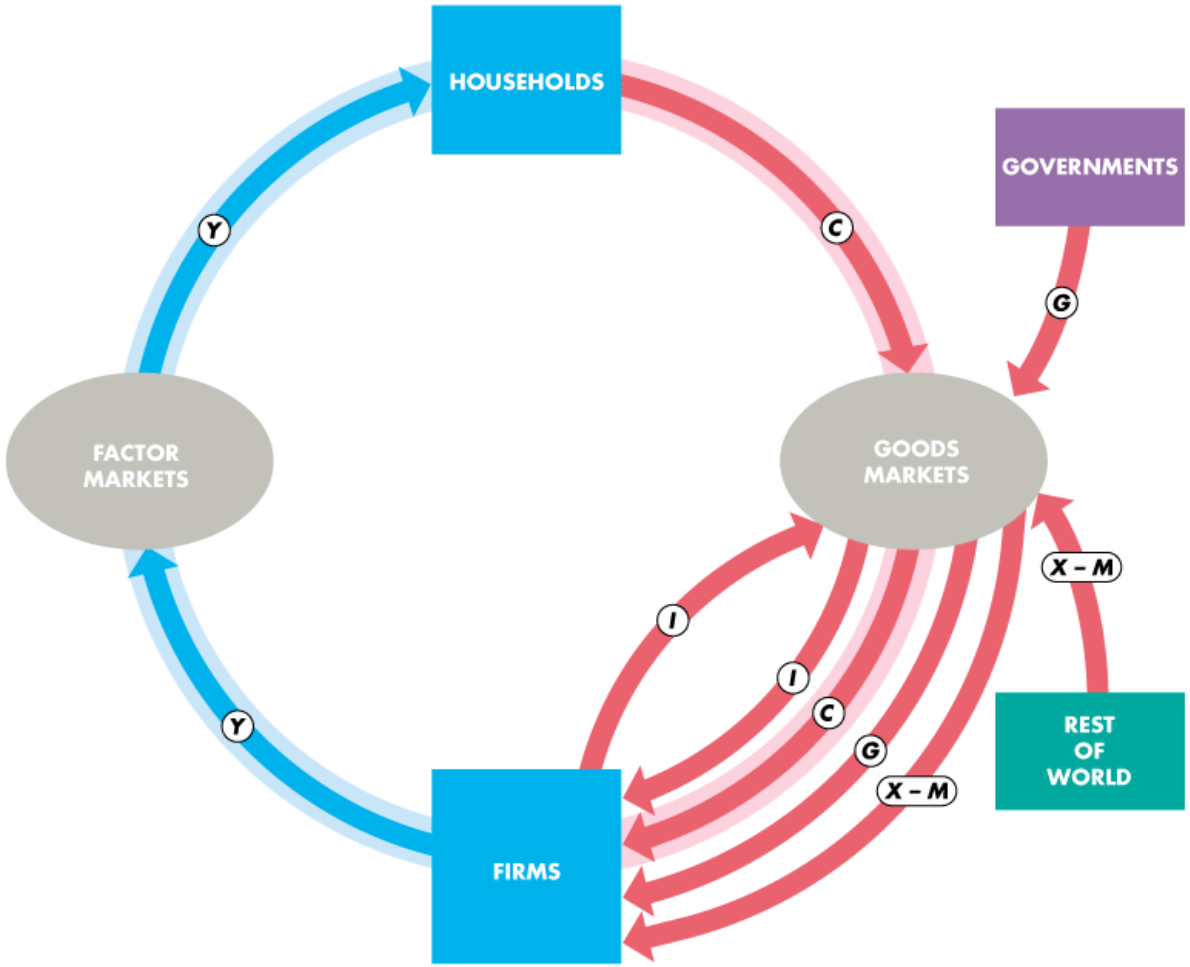
Gross Domestic Product

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 shows two ways of measuring GDP.

GDP Equals Expenditure Equals Income

Total expenditure on final goods and services equals GDP.

$$GDP = C + I + G + X - M.$$

Aggregate income equals the total amount paid for the use of factors of production: 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

Why Is Domestic Product "Gross"?

"Gross" means before deducting the depreciation of capital

.

The opposite of gross is net.

"Net" means after deducting the depreciation of capital.

Gross Domestic Product

Depreciation is the decrease in the value of a firm's capital that results from wear and tear and obsolescence.
Gross investment is the total amount spent on purchases of new capital and on replacing depreciated capital.
Net investment is the increase in the value of the firm's capital.

Net investment = Gross investment ? Depreciation.

Gross Domestic Product

Gross investment is one of the expenditures included in the expenditure approach to measuring GDP.
So total product is a gross measure.
Gross profit, which is a firm's profit before subtracting depreciation, is one of the incomes included in the income approach to measuring GDP.
So total product is a gross measure.

Measuring Canadian GDP

The Bureau of Economic Analysis uses two approaches to measure GDP:

- The expenditure approach
- The income approach

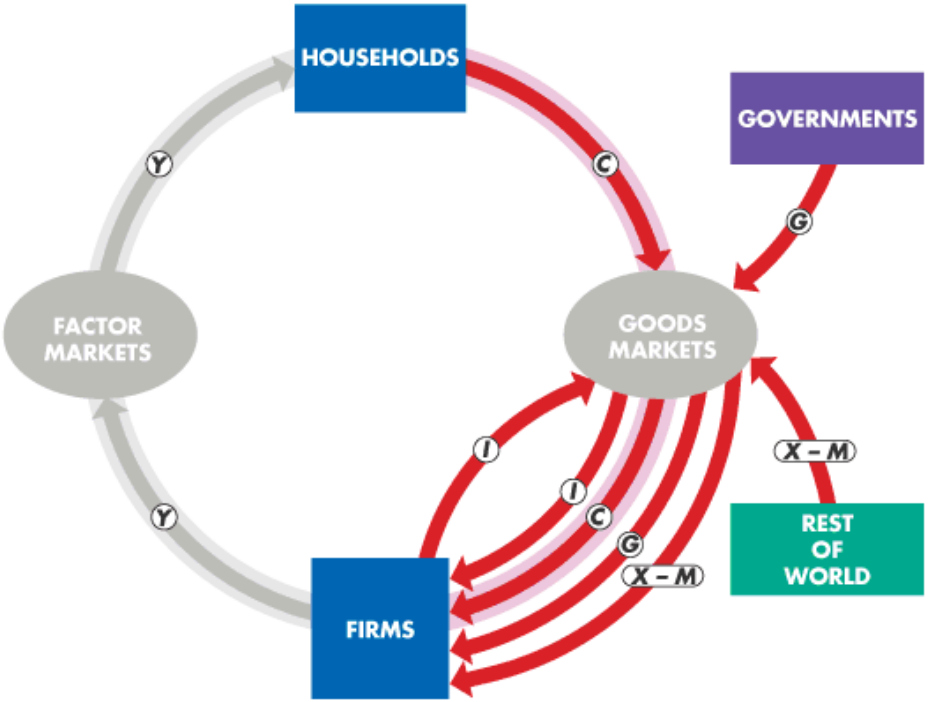
Measuring Canadian GDP

The Expenditure Approach

The expenditure approach measures GDP as the sum of the red flow: consumption expenditure, investment, government expenditure on goods and services, and net exports.

GDP = C + I + G + (X ? M)

Table 4.1 on the next slideshows the expenditure approach with 2016 data.



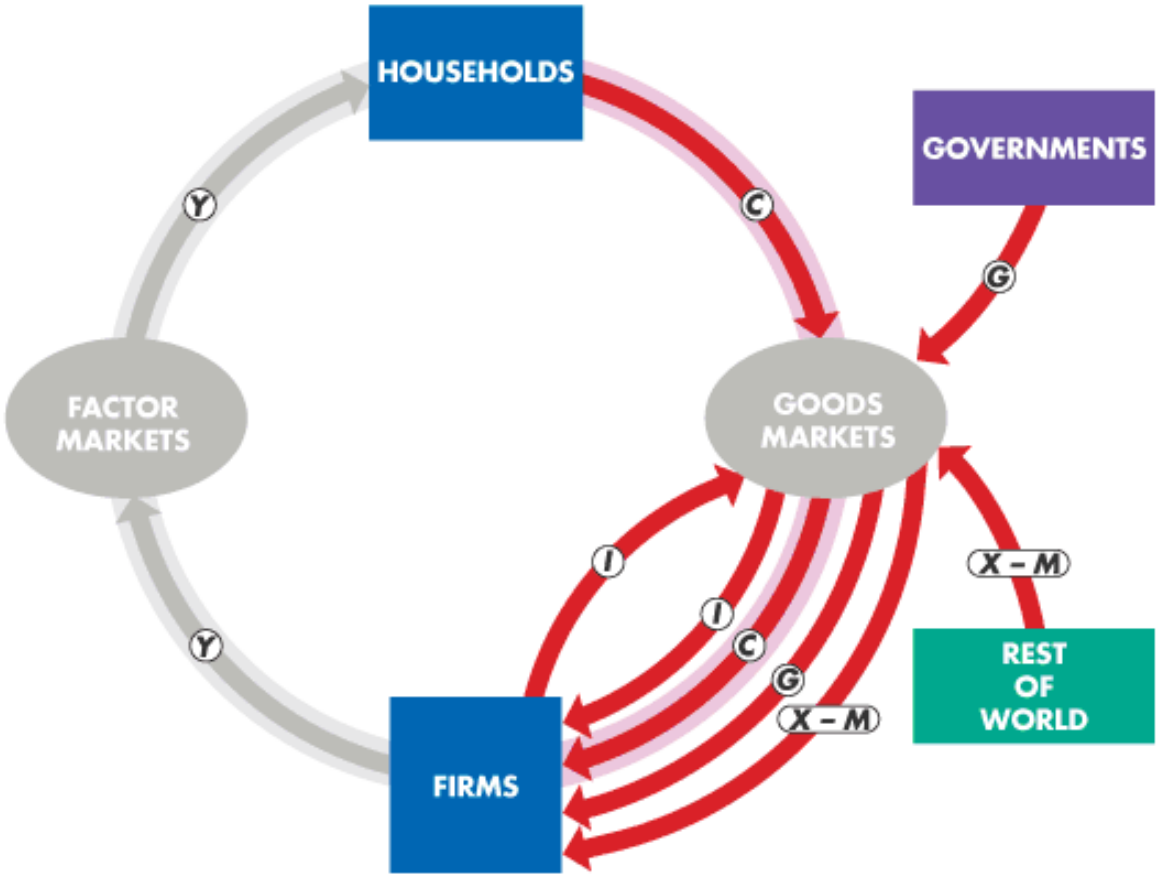


TABLE 4.1 GDP: The Expenditure Approach

Item	Symbol	Amount in 2016 (billions of dollars)	Percentage of GDP
Consumption expenditure	C	1,183	58.3
Investment	I	384	19.0
Government expenditure on goods and services	G	509	25.1
Net exports of goods and services	$X - M$	− 48	− 2.4
Gross domestic product	***Y***	**2,028**	**100.0**

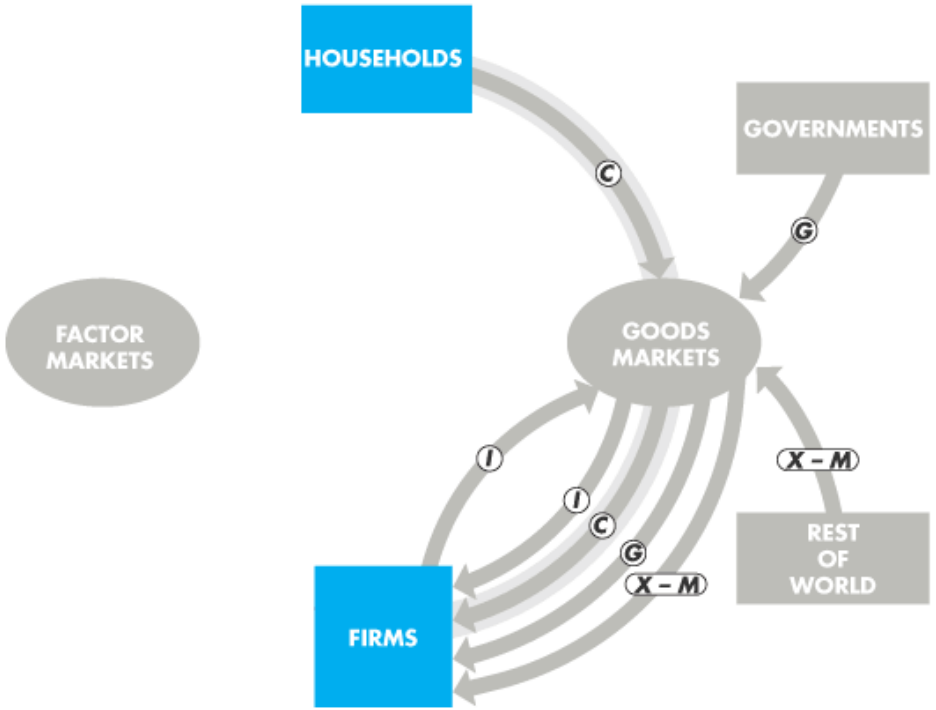
Measuring Canadian GDP

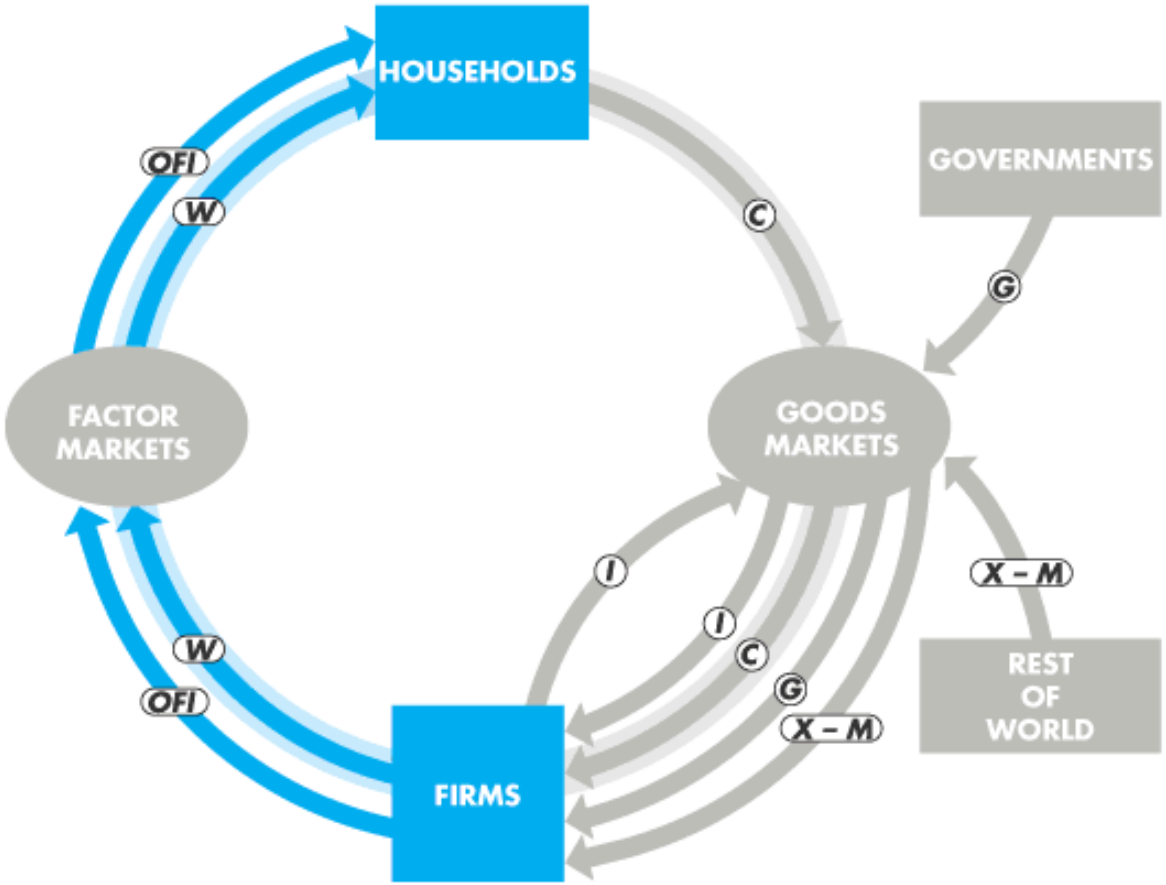
The Income Approach

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

Two broad categories are

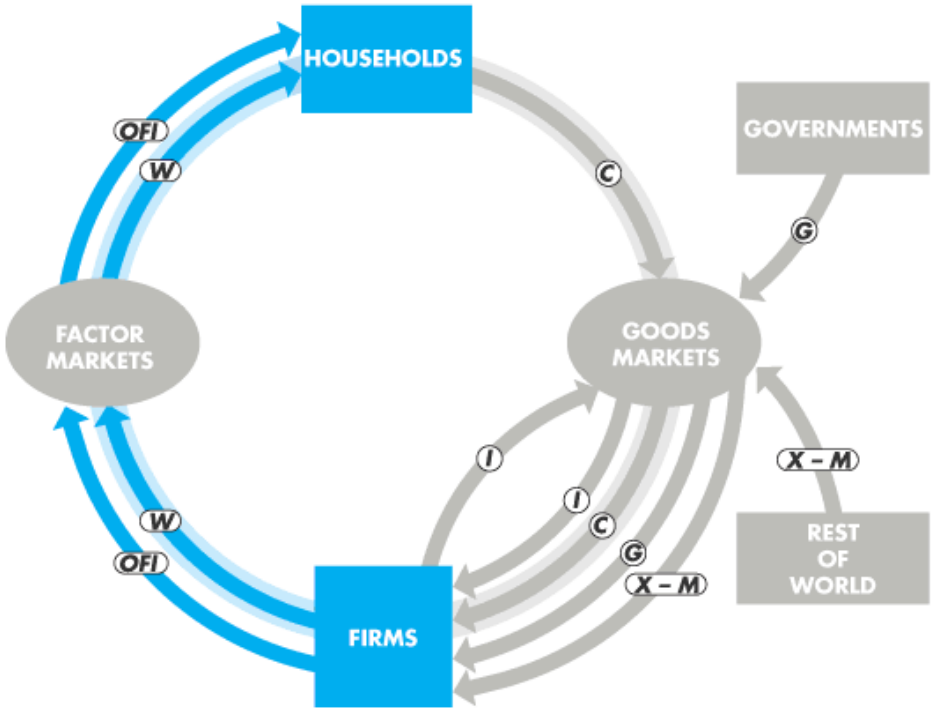
1. Wages, salaries, and other labour income
2. Other factor incomes





Measuring Canadian GDP

The payment for labour services is the sum of net wages plus benefits such as pension contributions and is shown by the blue flow W. Other factor incomes include a mixture of interest, rent, and profit and include some labour income from self-employment. They are included in the blue flow OFI.



Measuring Canadian GDP

The sum of all factor incomes is net domestic income at factor cost.
Two adjustments must be made to get GDP:
1. Indirect taxes less subsidies are added to get from factor cost to market prices.
2. Depreciation is added to get from net domestic income to gross domestic income.

Table 4.2 on the next slide shows the income approach with data for 2016.

TABLE 4.2 GDP: The Income Approach

Item	Amount in 2016 (billions of dollars)	Percentage of GDP
Wages, salaries, and supplementary labour income	1,051	51.8
Other factor incomes	399	19.7
Net domestic income at factor cost	1,450	71.5
Indirect taxes *less* subsidies	227	11.2
Net domestic income at market prices	1,677	82.7
Depreciation	351	17.3
GDP (income approach)	**2,028**	**100.0**
Statistical discrepancy	0	0.0
GDP (expenditure approach)	**2,028**	**100.0**

Source of data: Statistics Canada, CANSIM Table 380-0063.

Measuring Canadian GDP

Nominal GDP and Real GDP

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

Currently, the reference base year is 2007 and we describe real GDP as measured in 2007 dollars.

Nominal GDP is the value of goods and services produced during a given year valued at the prices that prevailed in that same year.

Nominal GDP is just a more precise name for GDP.

Measuring Canadian GDP

Calculating Real GDP

Table 4.3(a) shows the quantities produced and the prices in 2007 (the base year).

Nominal GDP in 2007 is $100 million.

Because 2007 is the base year, real GDP and nominal GDP both are $100 million.

TABLE 20.3 Calculating Nominal GDP and Real GDP

	Item	Quantity (millions)	Price (dollars)	Expenditure (millions of dollars)
(a) In 2007				
C	T-shirts	10	5	50
I	Computer chips	3	10	30
G	Security services	1	20	20
Y	Real GDP in 2007			100

TABLE 4.3 Calculating Nominal GDP and Real GDP

	Item	Quantity (millions)	Price (dollars)	Expenditure (millions of dollars)
(a) In 2007				
C	T-shirts	10	5	50
I	Computer chips	3	10	30
G	Security services	1	20	20
Y	Real GDP in 2007			100
(b) In 2016				
C	T-shirts	4	5	20
I	Computer chips	2	20	40
G	Security services	6	40	240
Y	Nominal GDP in 2016			300
(c) Quantities of 2016 valued at prices of 2007				
C	T-shirts	4	5	20
I	Computer chips	2	10	20
G	Security services	6	20	120
Y	Real GDP in 2016			160

Measuring Canadian GDP

Table 4.3(b) shows the quantities produced and the prices in 2016.
Nominal GDP in 2016 is $300 million.
Nominal GDP in 2016 is three times its value in 2007
.

TABLE 20.3 Calculating Nominal GDP and Real GDP

	Item	Quantity (millions)	Price (dollars)	Expenditure (millions of dollars)
(a) In 2007				
C	T-shirts	10	5	50
I	Computer chips	3	10	30
G	Security services	1	20	20
Y	Real GDP in 2007			100
(b) In 2014				
C	T-shirts	4	5	20
I	Computer chips	2	20	40
G	Security services	6	40	240
Y	Nominal GDP in 2014			300

Pearson

Measuring Canadian GDP

In Table 4.3(c), we calculate real GDP in 2016.
The quantities are those of 2016, as in part (b).
The prices are those in the base year (2007) as in part (a).
The sum of these expenditures is real GDP in 2016, which is $160 million.

TABLE 20.3 Calculating Nominal GDP and Real GDP

	Item	Quantity (millions)	Price (dollars)	Expenditure (millions of dollars)
(a) In 2007				
C	T-shirts	10	5	50
I	Computer chips	3	10	30
G	Security services	1	20	20
Y	Real GDP in 2007			100
(b) In 2014				
C	T-shirts	4	5	20
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Y	Real GDP in 2014			160

The Uses and Limitations of Real GDP

Economists use estimates of real GDP for two main purposes:

- To compare the standard of living over time
- To compare the standard of living across countries

The Uses and Limitations of Real GDP

The Standard of Living Over Time

Real GDP per person is real GDP divided by the population.

Real GDP per person tells us the value of goods and services that the average person can enjoy.

By using real GDP, we remove any influence that rising prices and a rising cost of living might have had on our comparison.

The Uses and Limitations of Real GDP

Long-Term Trend

A handy way of comparing real GDP per person over time is to express it as a ratio of some reference year.
For example, in 1969, real GDP per person was $19,000 and in 2010, it was $38,000.
So real GDP per person in 2010 was double its 1969 level —that is, $38,000 ÷ $19,000 = 2.

The Uses and Limitations of Real GDP

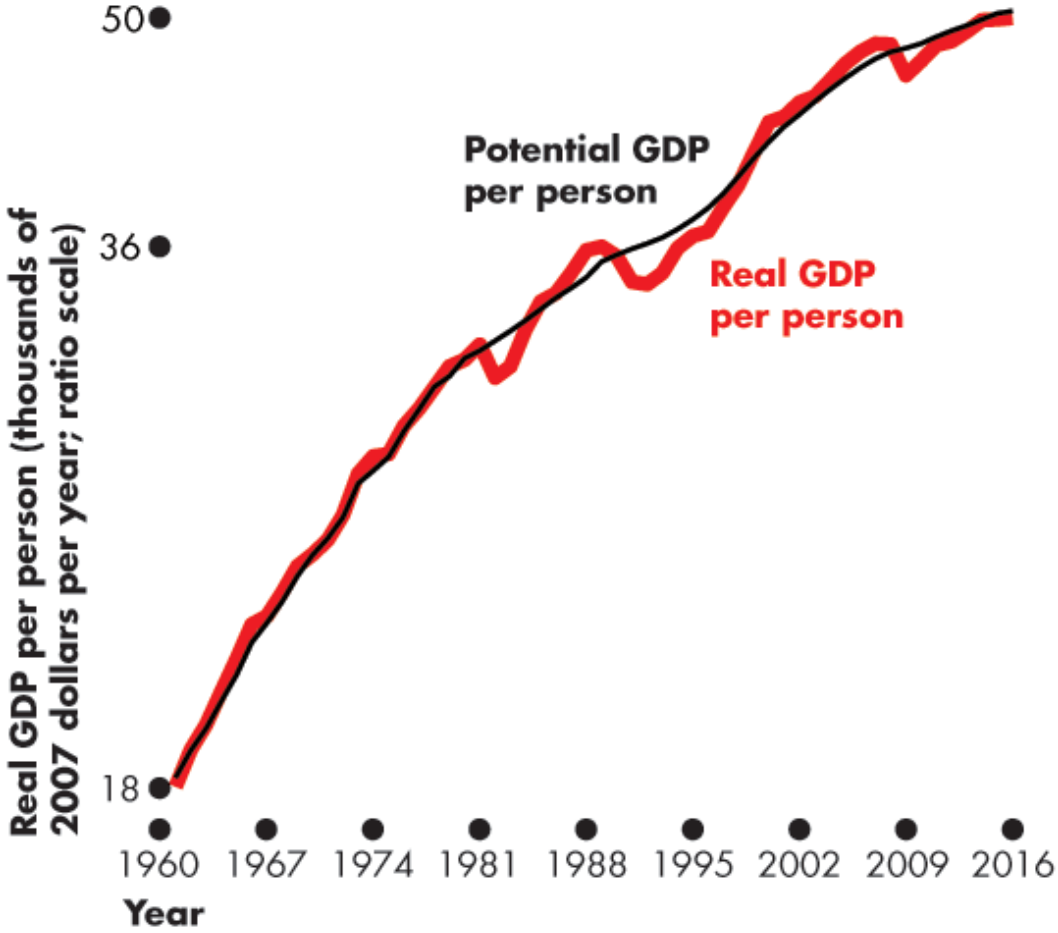
Two features of our expanding living standard are

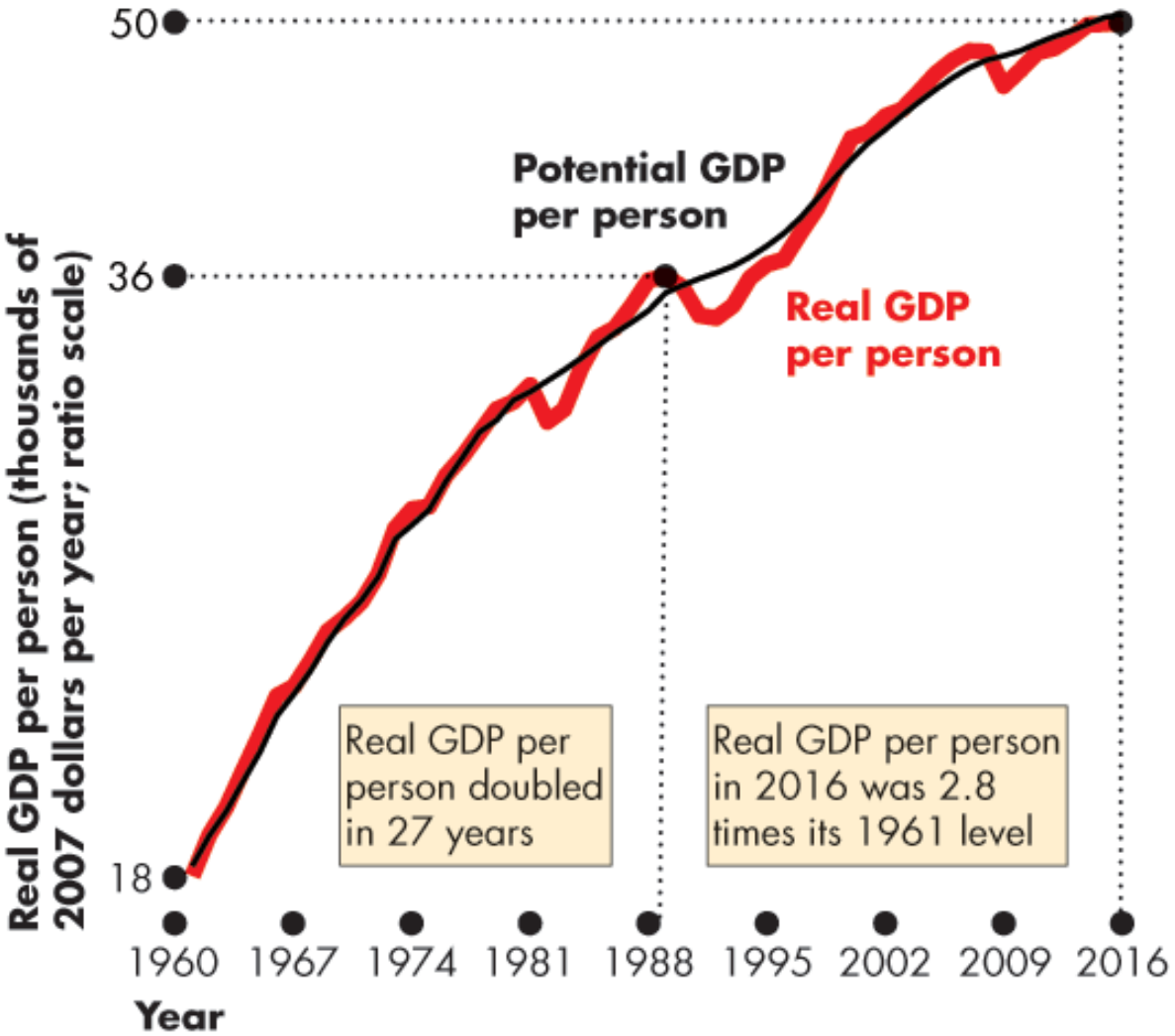
- The growth of potential GDP per person
- Fluctuations of real GDP around potential GDP

The value of real GDP when all the economy's labour, capital, land, and entrepreneurial ability are fully employed is called potential GDP.

The Uses and Limitations of Real GDP

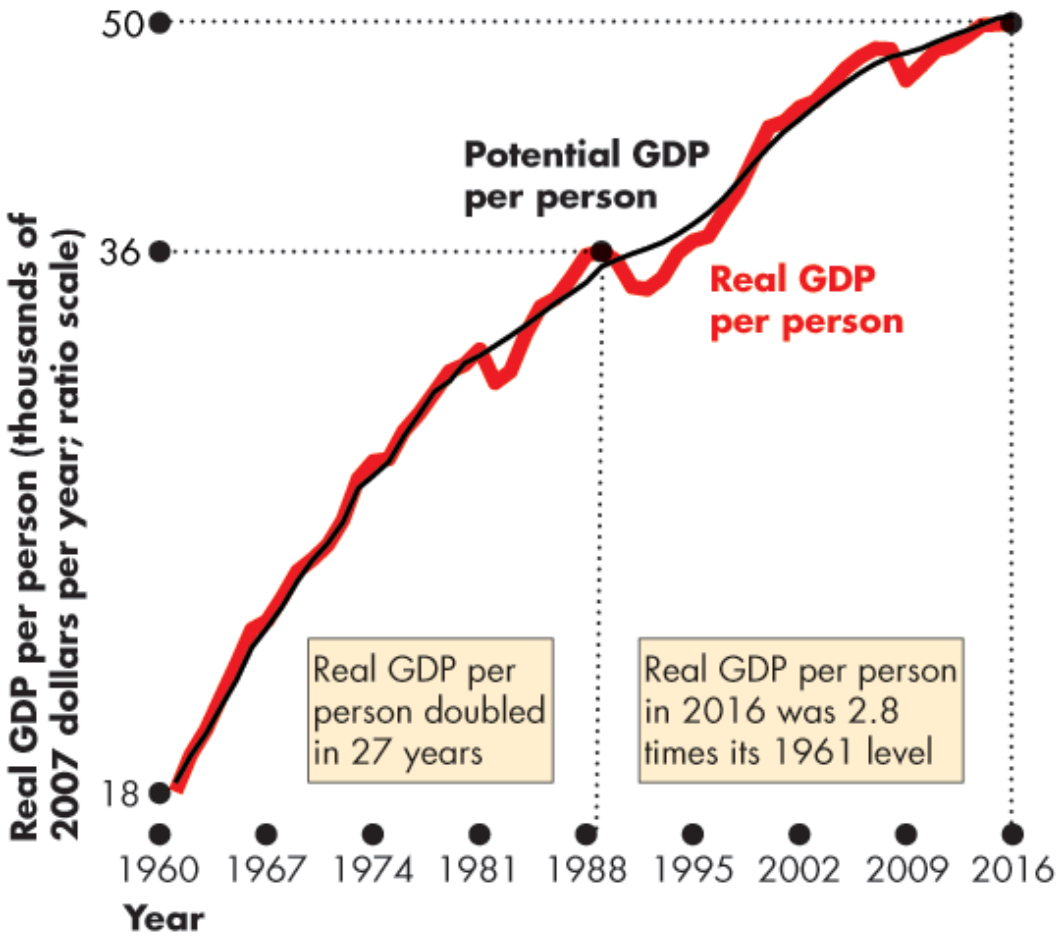
Figure 4.2 shows Canadian real GDP per person.
Potential GDP grows at a steady pace because the quantities of the factors of production and their productivity grow at a steady pace.
Real GDP fluctuates around potential GDP.





The Uses and Limitations of Real GDP

Real GDP per person in Canada:
Doubled between 1961 and 1988 ...
and in 2016 was 2.6 times its 1961 value.



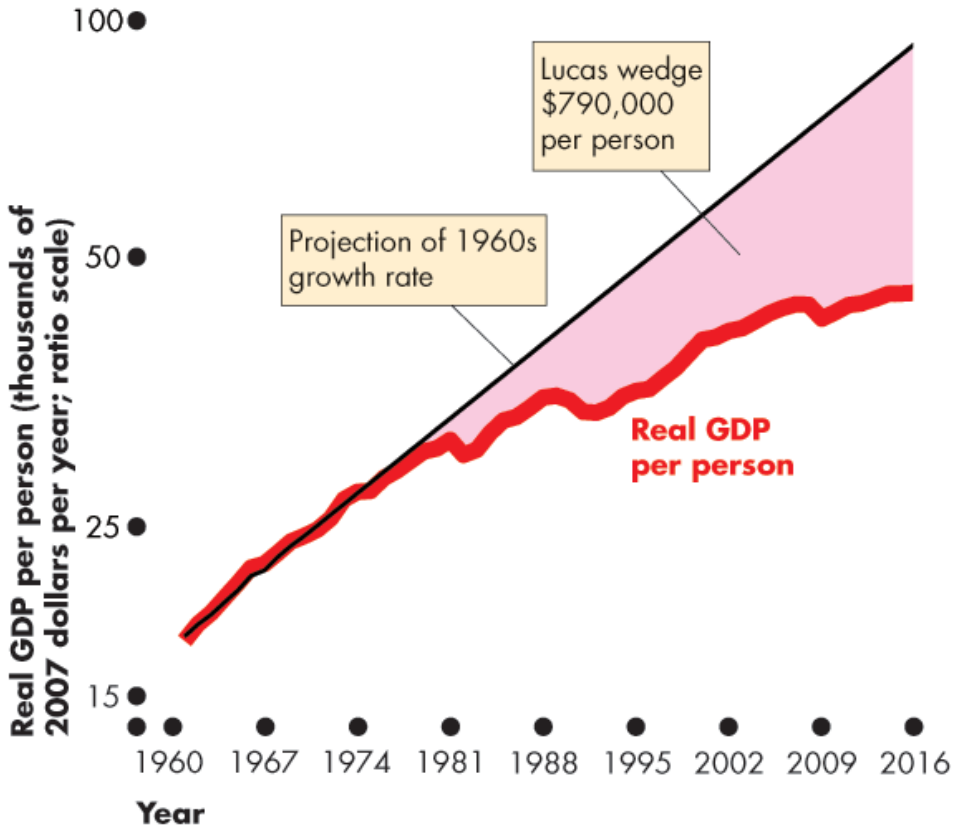
The Uses and Limitations of Real GDP

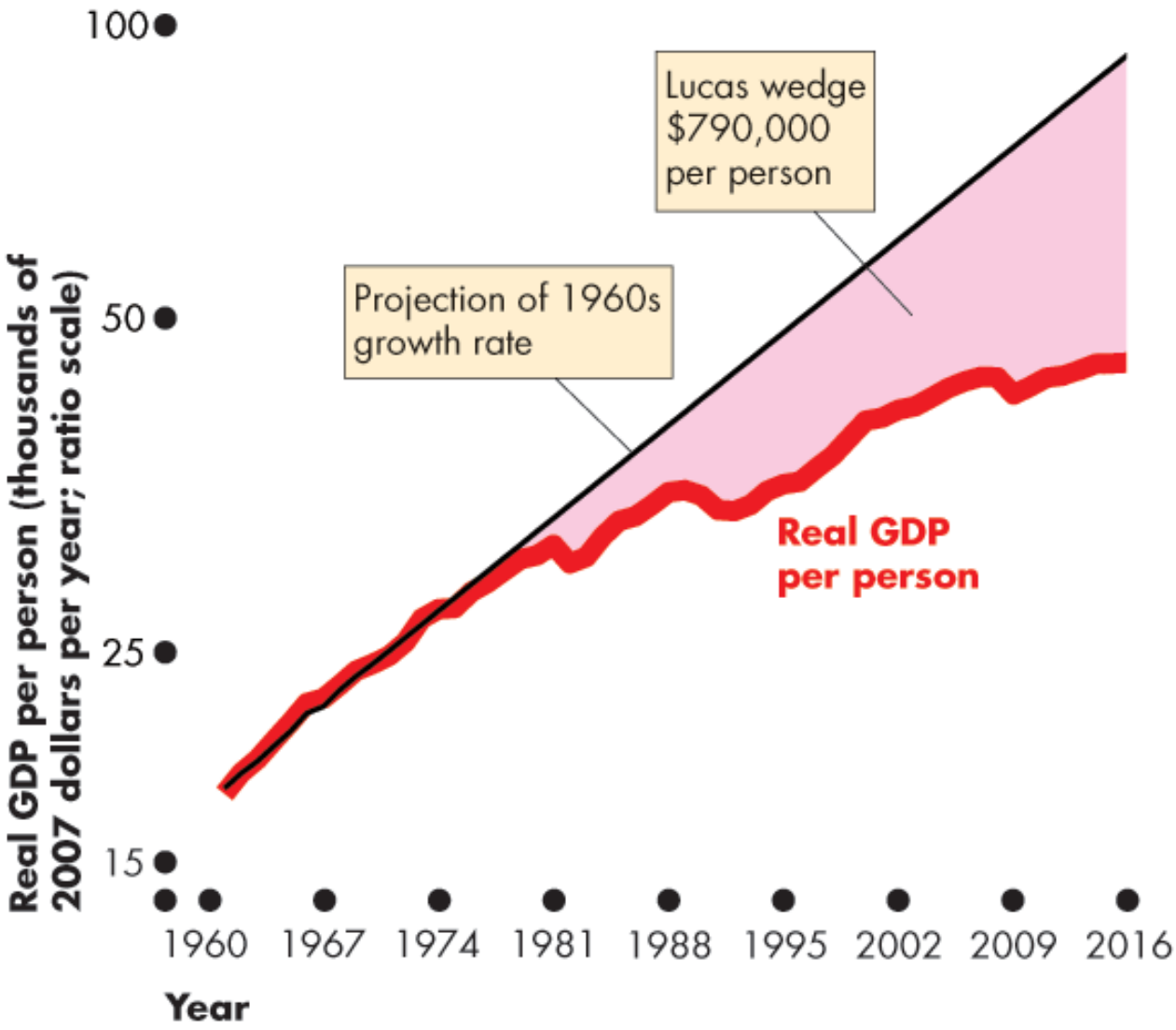
Productivity Growth Slowdown

The growth rate of real GDP per person slowed after 1970.
How costly was that slowdown?
The answer is provided by a number that we'll call the Lucas wedge.
Lucas wedge is the dollar value of the accumulated gap between what real GDP per person would have been if the 1960s growth rate had persisted and what real GDP per person turned out to be.

The Uses and Limitations of Real GDP

Figure 4.3 illustrates the Lucas wedge.
The red line is actual real GDP per person.
The thin black line is the trend that real GDP per person would have followed if the 1960s growth rate of potential GDP had persisted.
The shaded area is the Lucas wedge.





The Uses and Limitations of Real GDP

Real GDP Fluctuations— The Business Cycle

A business cycle is a periodic but irregular up-and-down movement of total production and other measures of economic activity.

Every cycle has two phases:

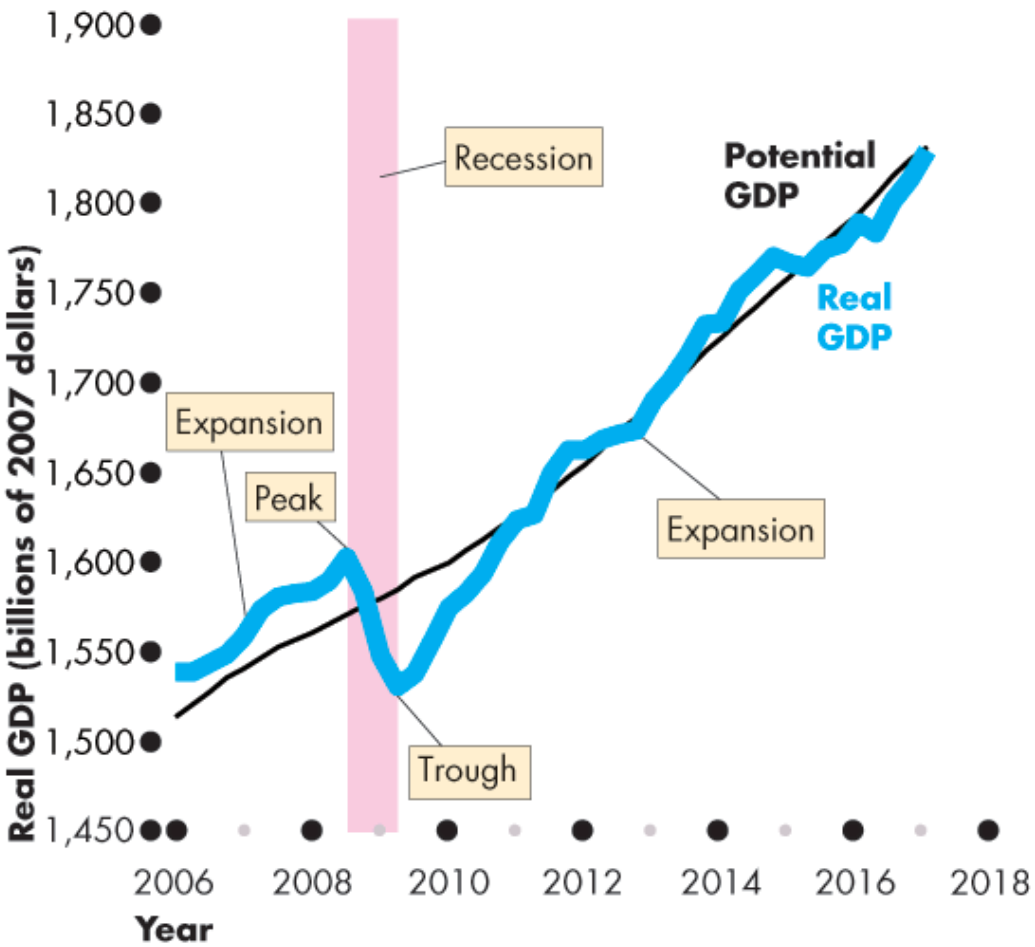
1. Expansion
2. Recession

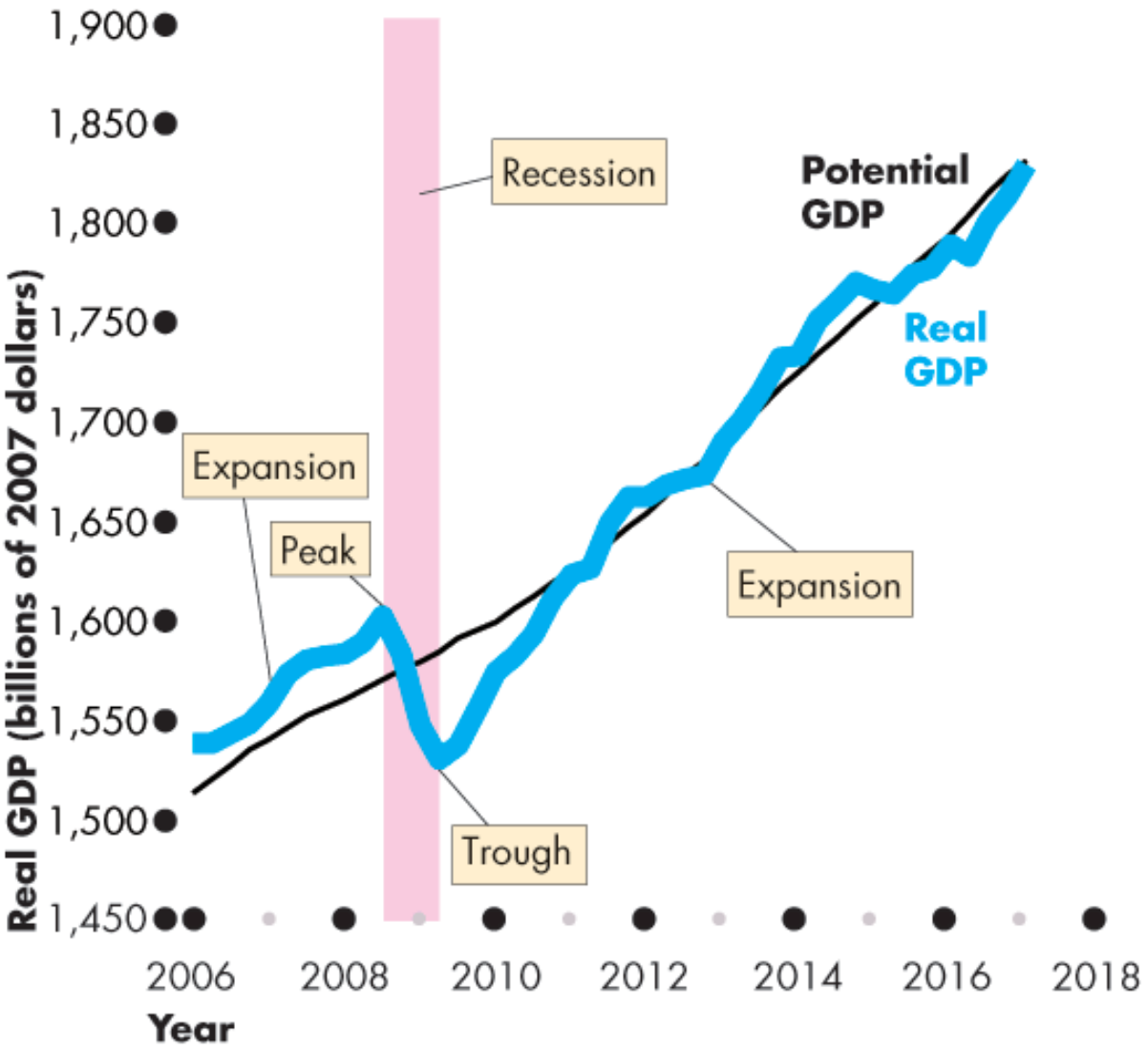
and two turning points:

1. Peak
2. Trough

The Uses and Limitations of Real GDP

Figure 4.4 illustrates the business cycle.
An expansion is a period during which real GDP increases—from a trough to a peak.
Recession is a period during which real GDP decreases—its growth rate is negative for at least two successive quarters.





The Uses and Limitations of Real GDP

The Standard of Living Across Countries

Two problems arise in using real GDP to compare living standards across countries:

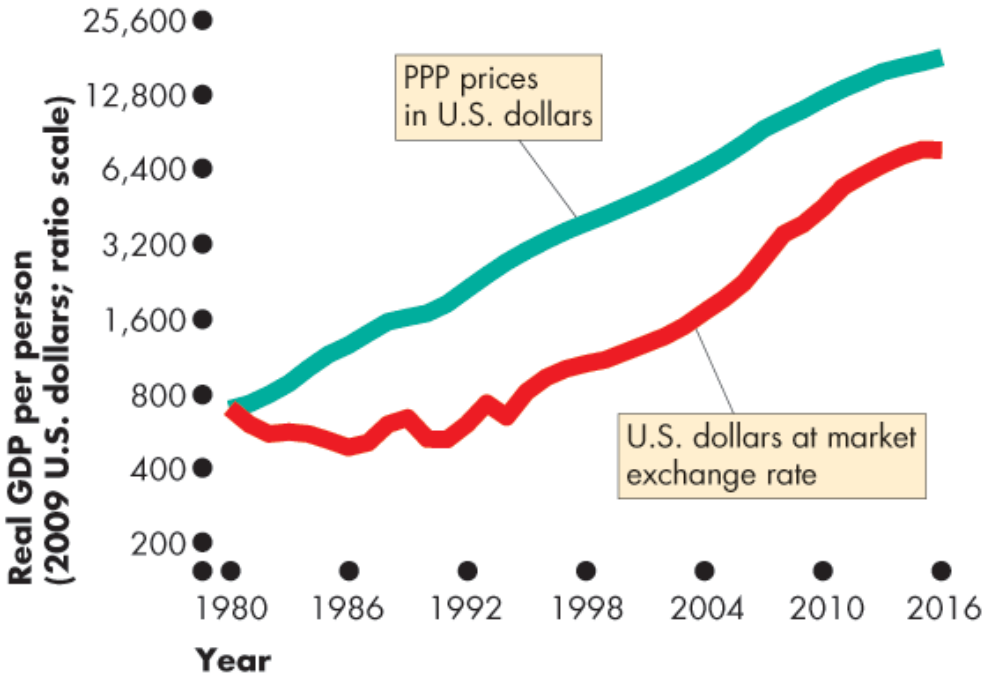
1. The real GDP of one country must be converted into the same currency units as the real GDP of the other country.
2. The goods and services in both countries must be valued at the same prices.

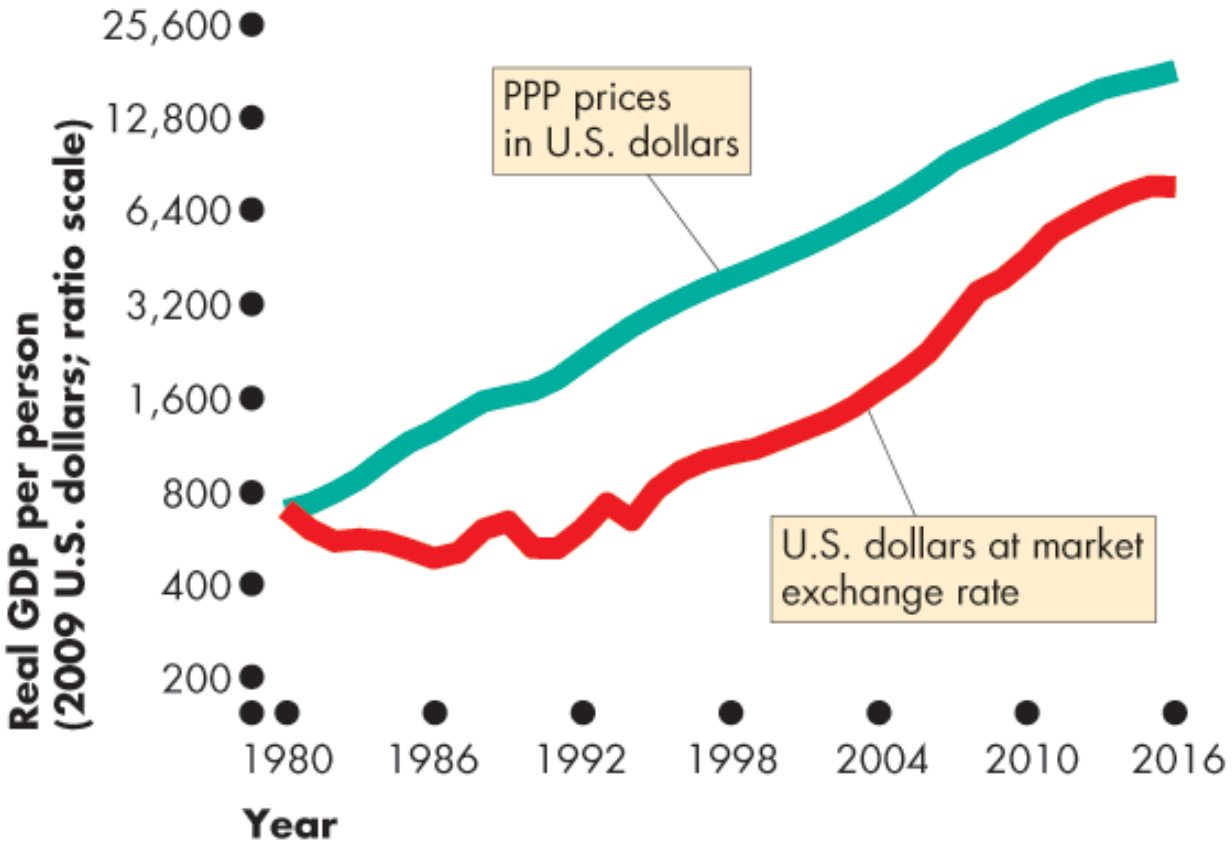
The Uses and Limitations of Real GDP

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.
The United States and China provide a striking example. For example, using the market exchange rate to value China's GDP in U.S. dollars leads to an estimate that in 2016, GDP per person in the United States was 6.3 times GDP per person in China.

The Uses and Limitations of Real GDP

Figure 4.5 illustrates the problem.
Using the market exchange rate and domestic prices makes China look like a poor developing country.
But when GDP is valued at purchasing power parity prices, U.S. income per person is only 3.8 times that in China.





The Uses and Limitations of Real GDP

Limitations of Real GDP

Real GDP measures the value of goods and services that are bought in markets.

Some of the factors that influence the standard of living and that are not part of GDP are

- Household production
- Underground economic activity
- Health and life expectancy
- Leisure time
- Environmental quality
- Political freedom and social justice

The Uses and Limitations of Real GDP

The Bottom Line

Do we get the wrong message about the level and growth of economic well-being and the standard of living by looking at the growth of real GDP?

The influences that are omitted from real GDP are probably large.

It is possible to construct broader measures that combine the many influences that contribute to human happiness.

Despite all the alternatives, real GDP per person remains the most widely used indicator of economic well-being.

Mathematical Note: Chained-Dollar Real GDP

Statistics Canada uses a measure of real GDP called chained-dollar real GDP.

Three steps are needed to calculate this measure:

- Value production in the prices of adjacent years
- Find the average of two percentage changes
- Link (chain) to the reference year

Mathematical Note: Chained-Dollar Real GDP

Value Production in Prices of Adjacent Years

Part (a) shows the quantities and prices in 2015.
Part (b) shows the quantities and prices in 2016.
Part (c) the quantities of 2016 valued at 2015 prices.
Part (d) the quantities of 2015 valued at prices of 2016.

TABLE 1 Real GDP Calculation Step 1: Value Production in Adjacent Years at Prices of Both Years

	Item	Quantity (millions)	Price (dollars)	Expenditure (millions of dollars)
(a) In 2015				
C	T-shirts	3	5	15
I	Computer chips	3	10	30
G	Security services	5	20	100
Y	Nominal GDP in 2015			**145**
(b) In 2016				
C	T-shirts	4	5	20
I	Computer chips	2	20	40
G	Security services	6	40	240
Y	Nominal GDP in 2016			**300**
(c) Quantities of 2016 valued at prices of 2015				
C	T-shirts	4	5	20
I	Computer chips	2	10	20
G	Security services	6	20	120
Y	2016 production at 2015 prices			**160**
(d) Quantities of 2015 valued at prices of 2016				
C	T-shirts	3	5	15
I	Computer chips	3	20	60
G	Security services	5	40	200
Y	2015 production at 2016 prices			**275**

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Mathematical Note: Chained-Dollar Real GDP

Parts (a) and (c) value the quantities of both years at 2015 prices.
That is, valuing the goods and services at 2015 prices, real GDP increased from $145 million to $160 million.

TABLE 1 Real GDP Calculation Step 1: Value Production in Adjacent Years at Prices of Both Years

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Y	2016 production at 2015 prices			**160**

Mathematical Note: Chained-Dollar Real GDP

Parts (b) and (d) value the quantities in both years at 2016 prices.
That is, valuing the goods and services at 2016 prices, real GDP increased from $275 million in 2015 to $300 million in 2016.

TABLE 1 Real GDP Calculation Step 1: Value Production in Adjacent Years at Prices of Both Years

	Item	Quantity (millions)	Price (dollars)	Expenditure (millions of dollars)
(b) In 2016				
C	T-shirts	4	5	20
I	Computer chips	2	20	40
G	Security services	6	40	240
Y	Nominal GDP in 2016			**300**
(d) Quantities of 2015 valued at prices of 2016				
C	T-shirts	3	5	15
I	Computer chips	3	20	60
G	Security services	5	40	200
Y	2015 production at 2016 prices			**275**

Mathematical Note: Chained-Dollar Real GDP

Find the Average of Two Percentage Changes

In part (a), at 2015 prices, production increased by 10 .3 percent.

In part (b) at 2016 prices, production increased by 9. 1 percent.

The average increase in production is 9.7 percent.

TABLE 2 Real GDP Calculation Step 2: Find Average of Two Percentage Changes

Value of Production	Millions of dollars
(a) At 2015 prices	
Nominal GDP in 2015	145
2016 production at 2015 prices	160
Percentage change in production at 2015 prices	10.3
(b) At 2016 prices	
2015 production at 2016 prices	275
Nominal GDP in 2016	300
Percentage change in production at 2016 prices	9.1
(c) Average percentage change in 2016	**9.7**

TABLE 2 Real GDP Calculation Step 2: Find Average of Two Percentage Changes

Value of Production	Millions of dollars
(a) At 2015 prices	
Nominal GDP in 2015	145
2016 production at 2015 prices	160
Percentage change in production at 2015 prices	10.3
(b) At 2016 prices	
2015 production at 2016 prices	275
Nominal GDP in 2016	300
Percentage change in production at 2016 prices	9.1
(c) Average percentage change in 2016	**9.7**

Mathematical Note: Chained-Dollar Real GDP

Link (Chain) to the Base Year

To find real GDP in 2016 in base-year prices (2007), we need to know the

1. Real GDP in 2007
2. Average growth rate each year from 2007 to 2016.

Mathematical Note: Chained-Dollar Real GDP

Starting with real GDP in 2007 of $110 million and the growth rate each year, real GDP in each year since 2007 is calculated as follows:
Real GDP in 2008 is 7 percent higher than the $110 million in 2007, which is $118 million.
The figure illustrates the linking back to the base year.

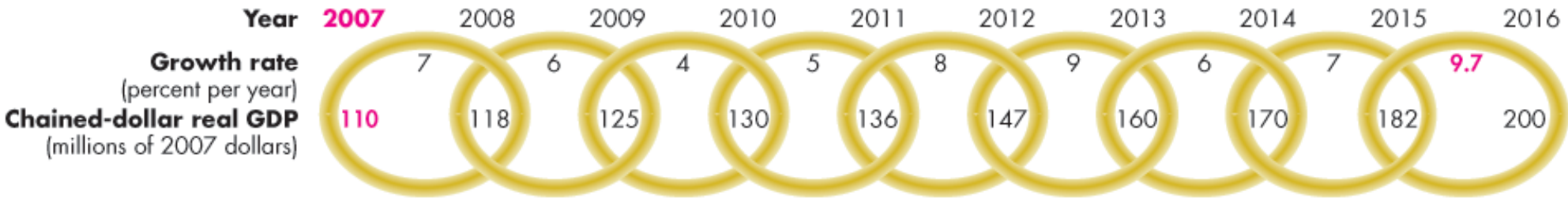

Figure 1 Real GDP Calculation Step 3: Repeat Growth Rate Calculations and Chain Link

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APPENDIX

Graphs in Macroeconomics

After studying this appendix, you will be able to:

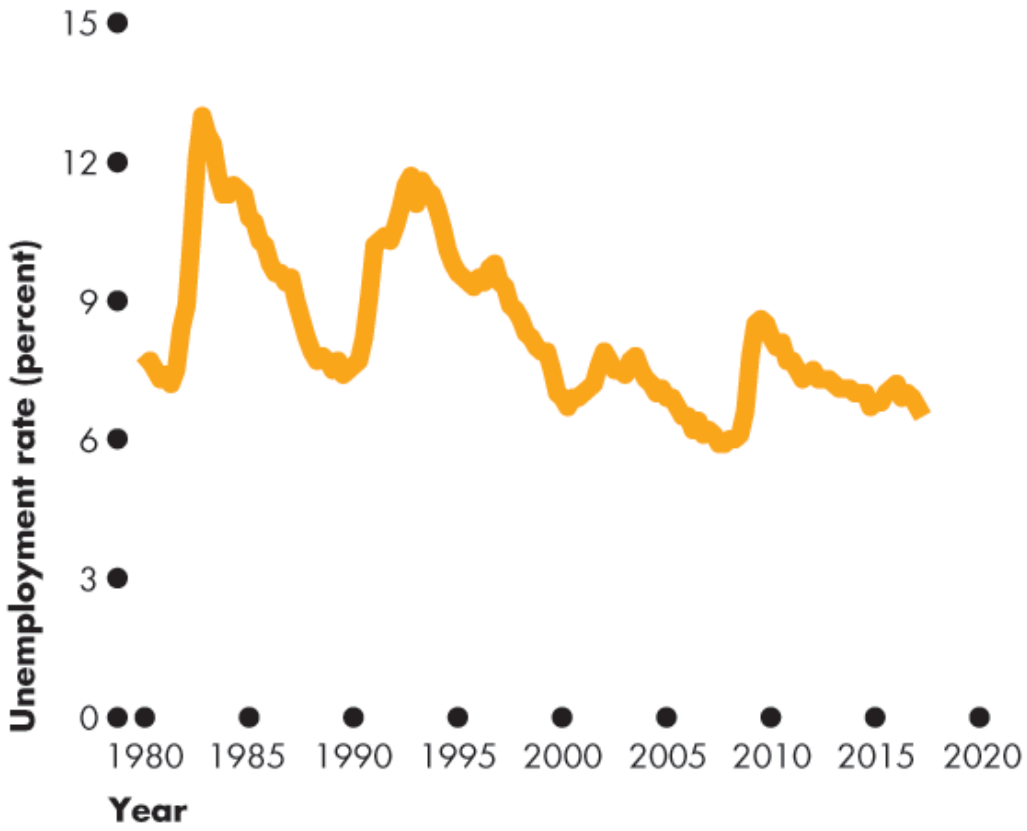
- Make and interpret a time-series graph
- Make and interpret a graph that uses a ratio scale

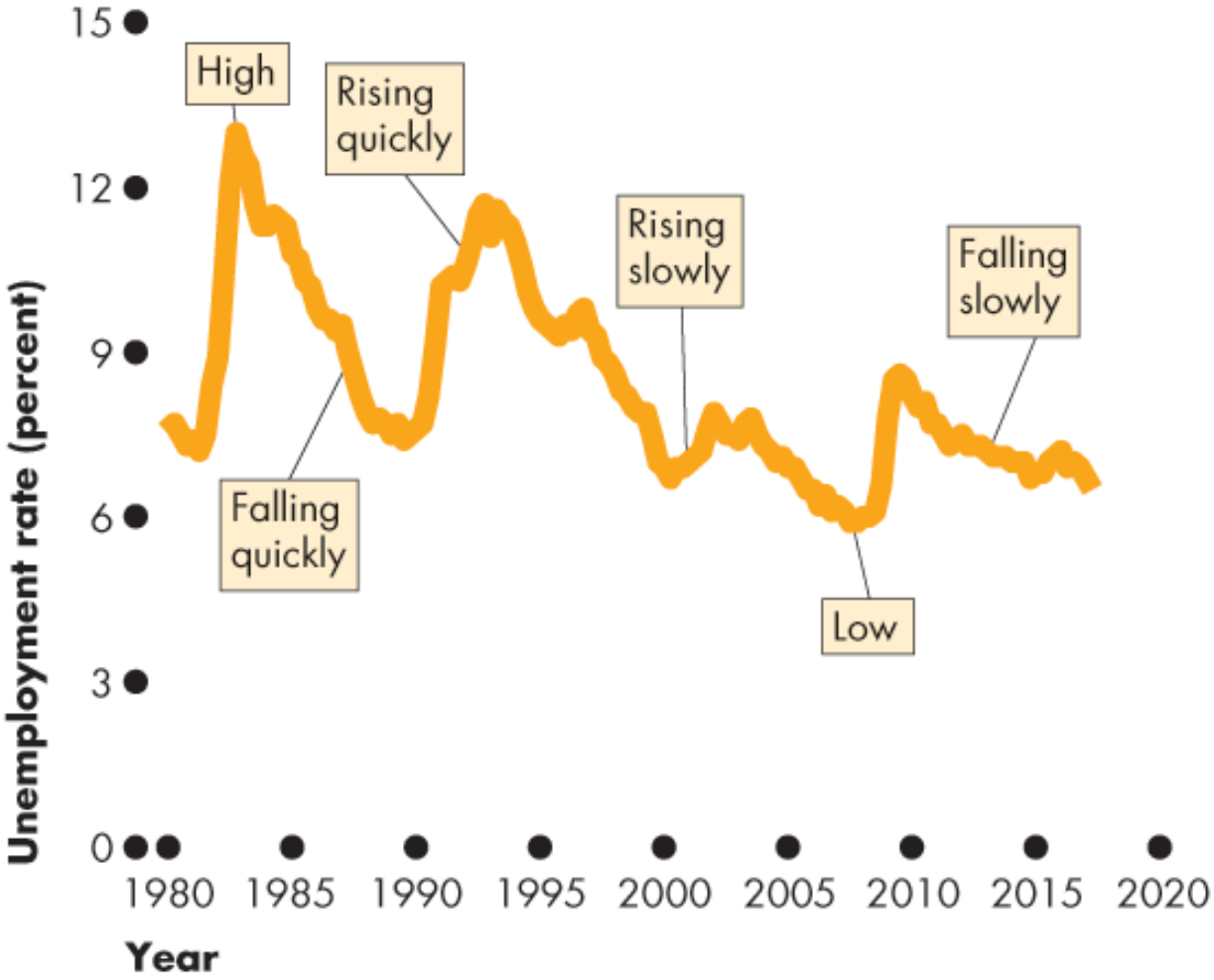
The Time-Series Graph

Making a Time-Series Graph

A time-series graph measures

- Time on the x-axis and
- The variable in which we are interested on the y-axis.



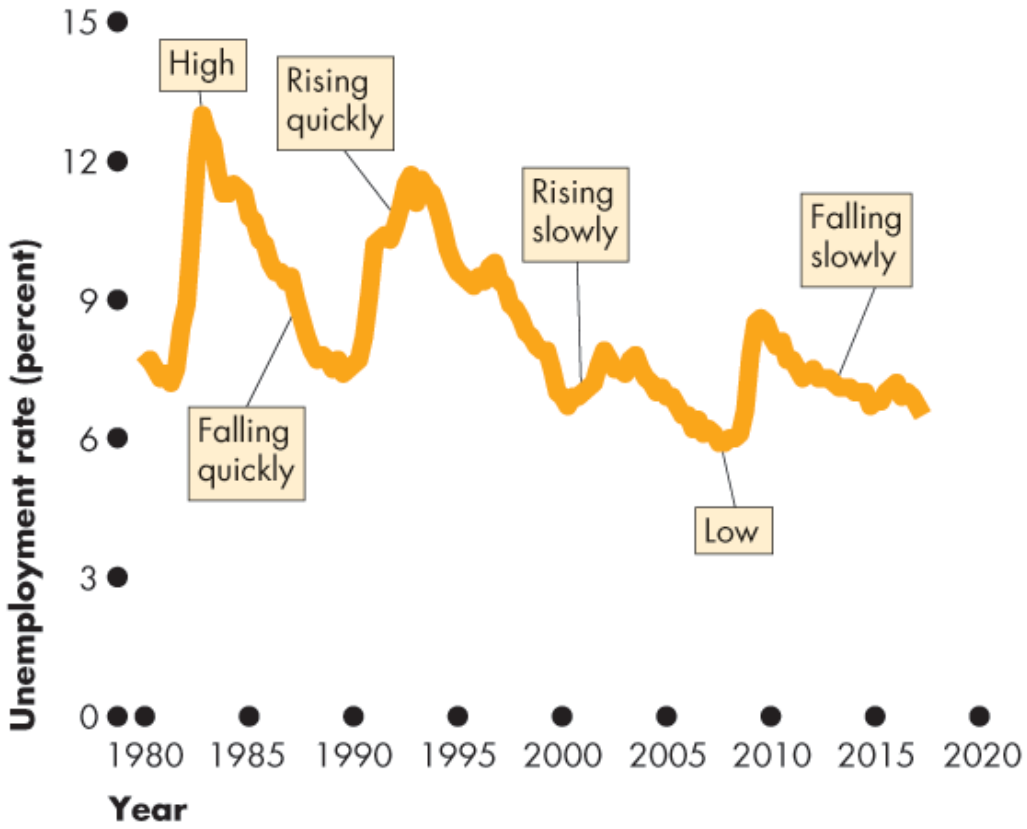


The Time-Series Graph

Reading a Time-Series Graph

A time-series graph shows the

- Level of the variable
- Change in the variable
- The speed of change in the variable



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The Time-Series Graph

Ratio Scale Reveals Trend

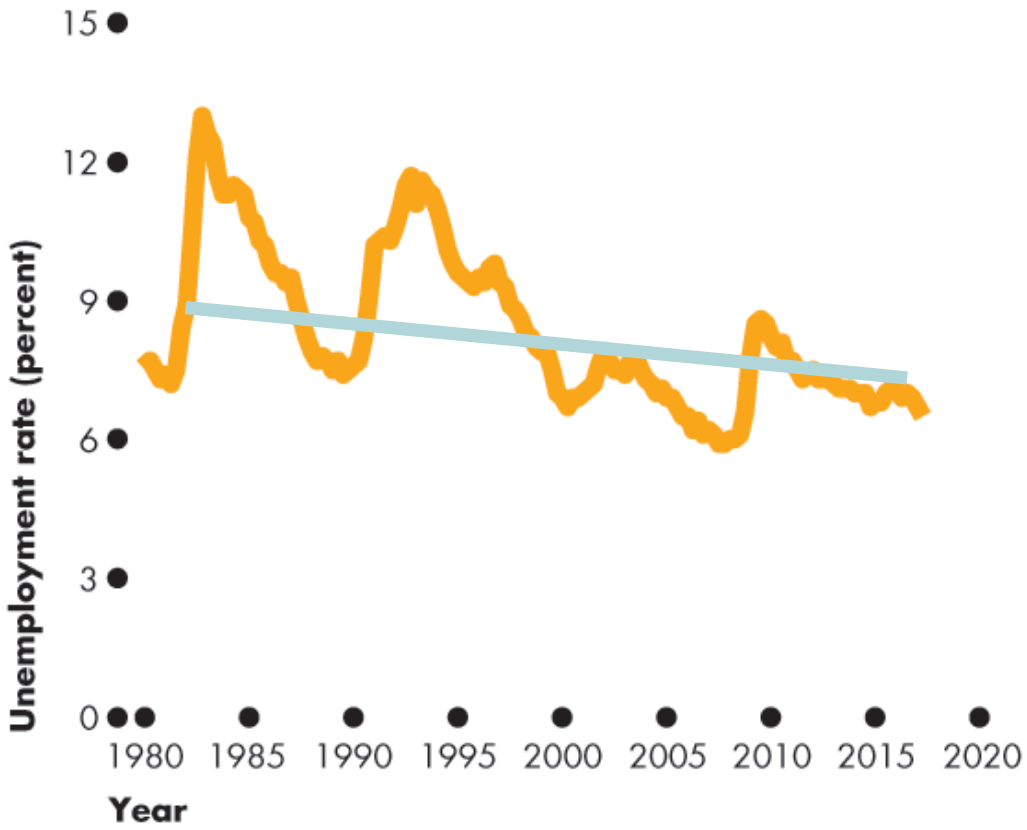
A time-series graph also reveals whether a variable has a

- Cycle—a tendency for a variable to alternate between upward and downward movements
- Trend—a tendency for a variable to move in one general direction

The Time-Series Graph

This time-series graph has

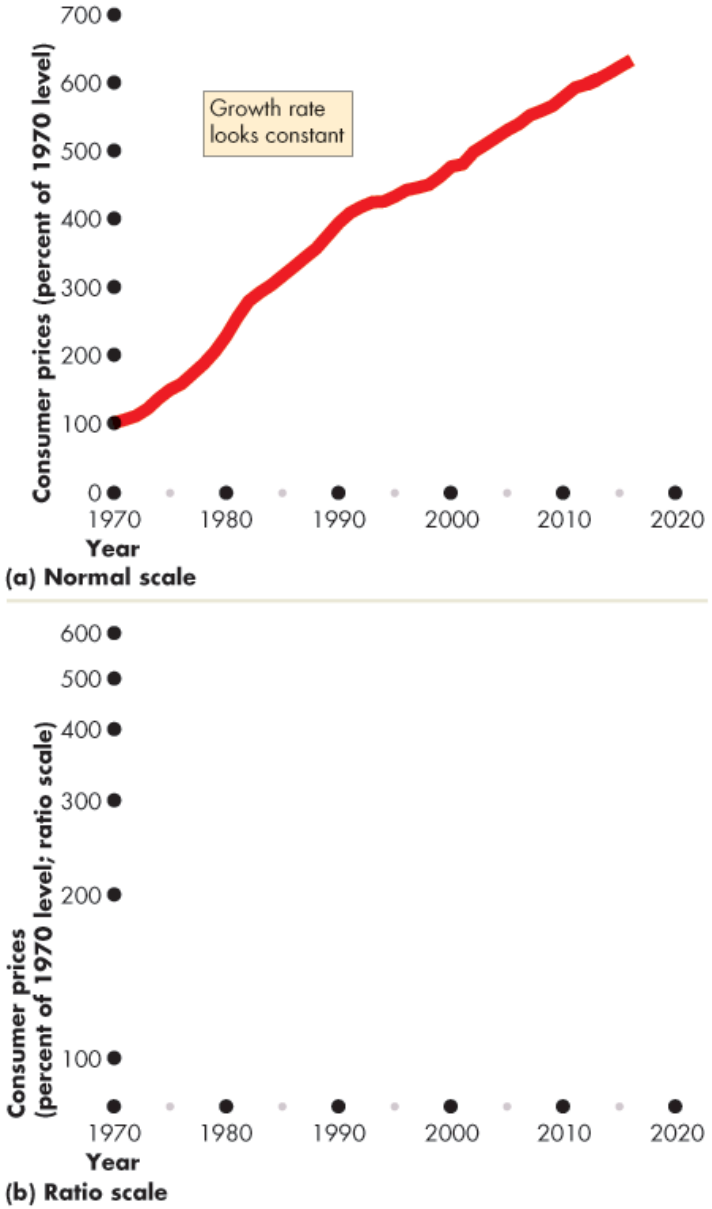
- A cycle
- No trend

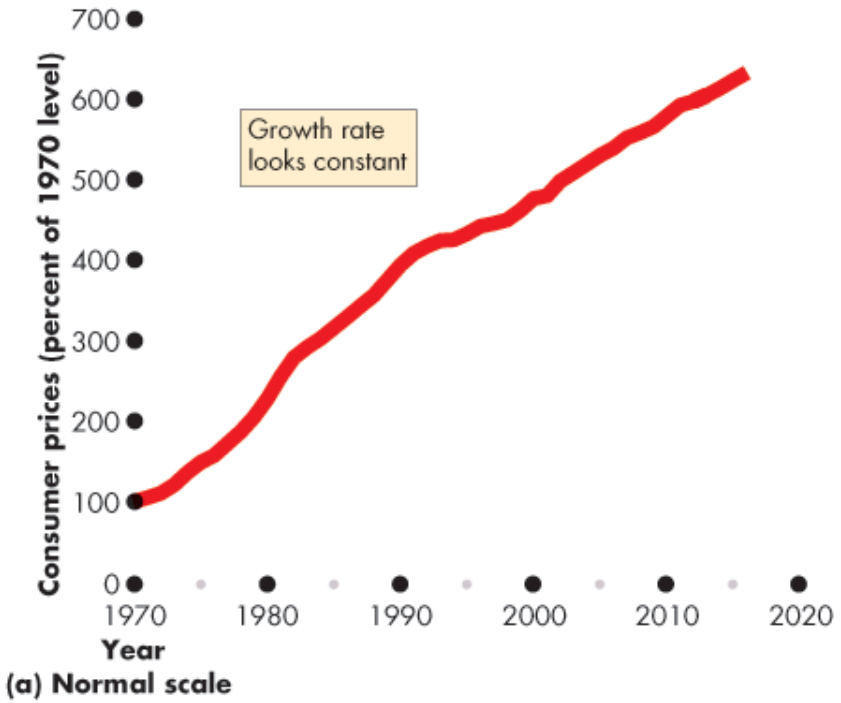


The Time-Series Graph

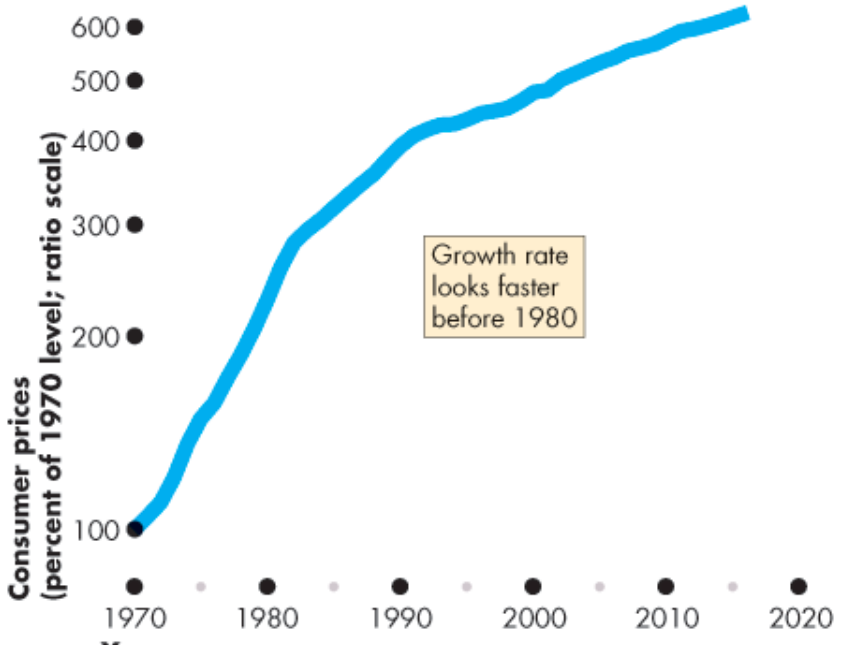
A Time-Series with a Trend

Figure A21.2(a) shows the average prices paid by consumers since 1970.
In 1970, the price is set at 100.
The price in other years is measured as a percentage of the 1970 level.
Prices look as if they increased at a constant rate.





(a) Normal scale



(b) Ratio scale

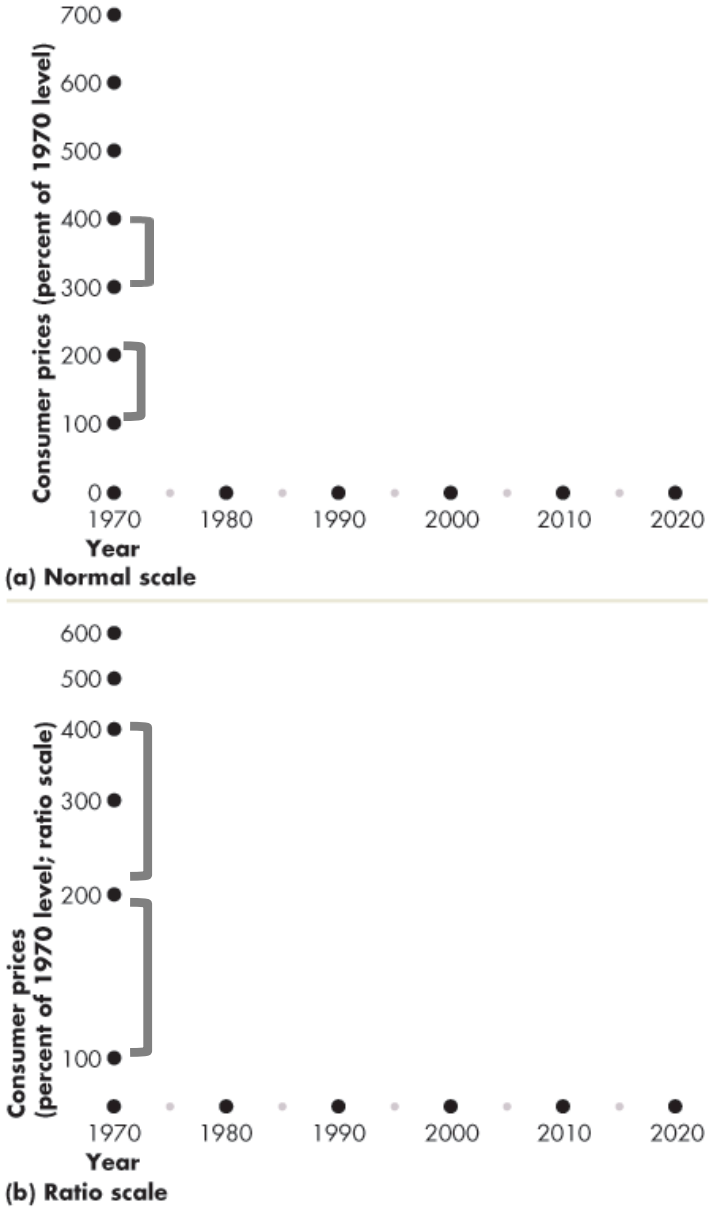
The Time-Series Graph

Using a Ratio Scale

On the y-axis of a normal graph, the gap between 100 and 200 is the same as that between 300 and 400.

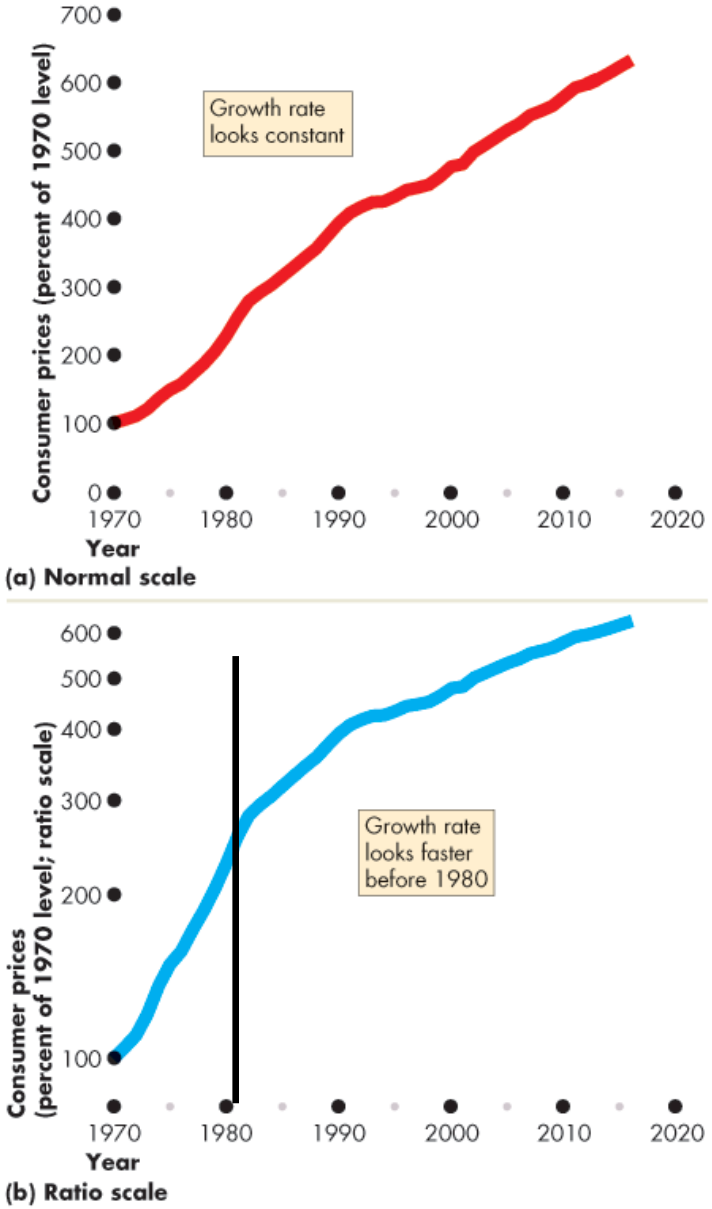
On a graph with a ratio scale the gap between 100 and 200 is same as that between 200 and 400.

The ratio of 200 to 100 equals the ratio of 400 to 200 —a constant ratio gap.



The Time-Series Graph

Graphing data on a ratio scale reveals the trend.
The steeper the line, the faster is the growth rate of prices.
Prices rose rapidly in the 1970s and more slowly in the 1980s, 1990s, and 2000s.



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