

Economic Growth

CHAPTER 9

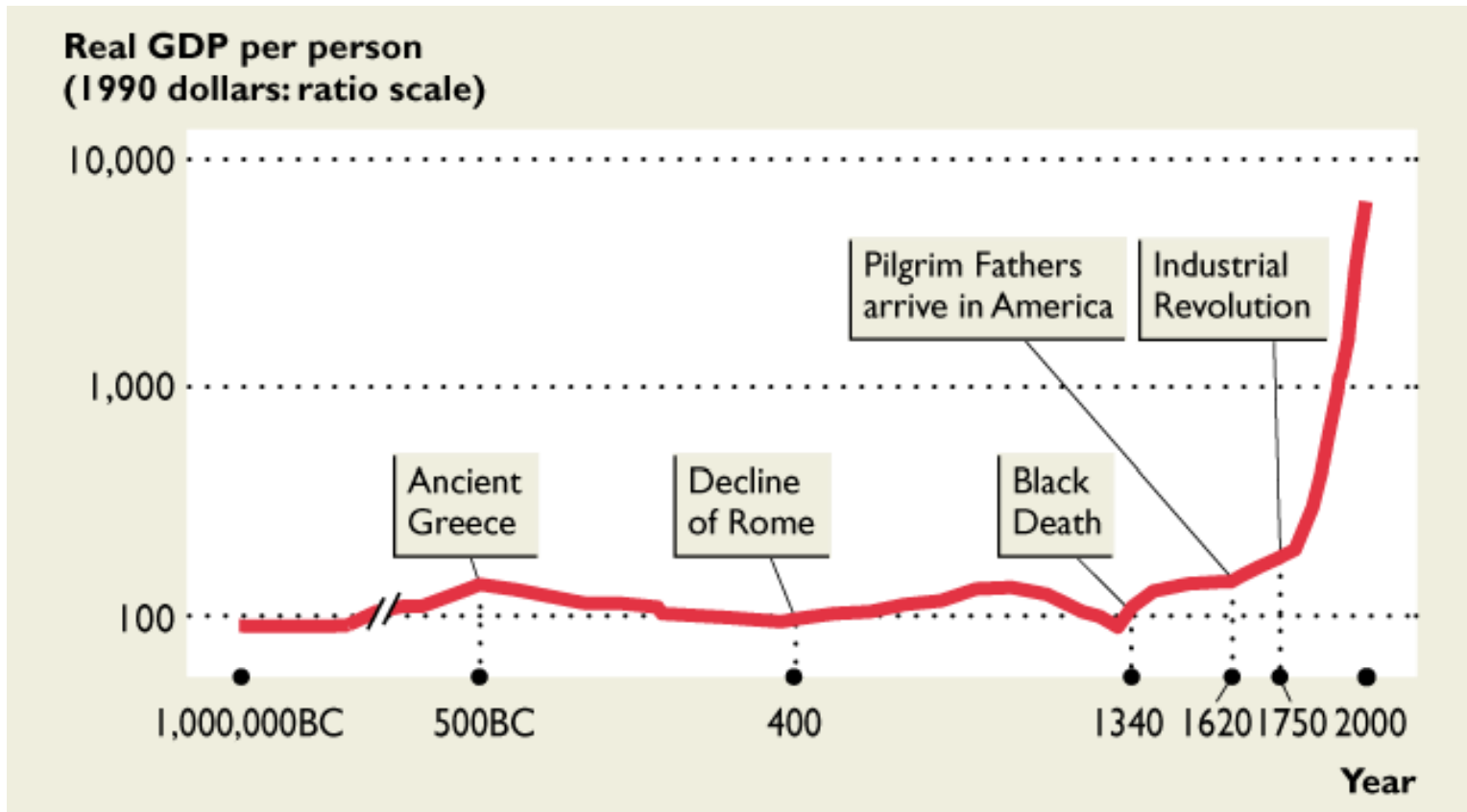


Fact: enormous differences between poor and rich

Country	GDP per Capita (PPP \$)	Year
Zimbabwe	\$200	2008
Congo	300	2009
Burundi	300	2009
Liberia	500	2009
U.S.A.	46,400	2009
Singapore	50,300	2009
Norway	59,300	2009
Luxemburg	77,600	2009

History of Growth

This figure shows the estimates of 1 million years of real GDP per person (in 2000 U.S. dollars) .



Persistent Gaps or Convergence?

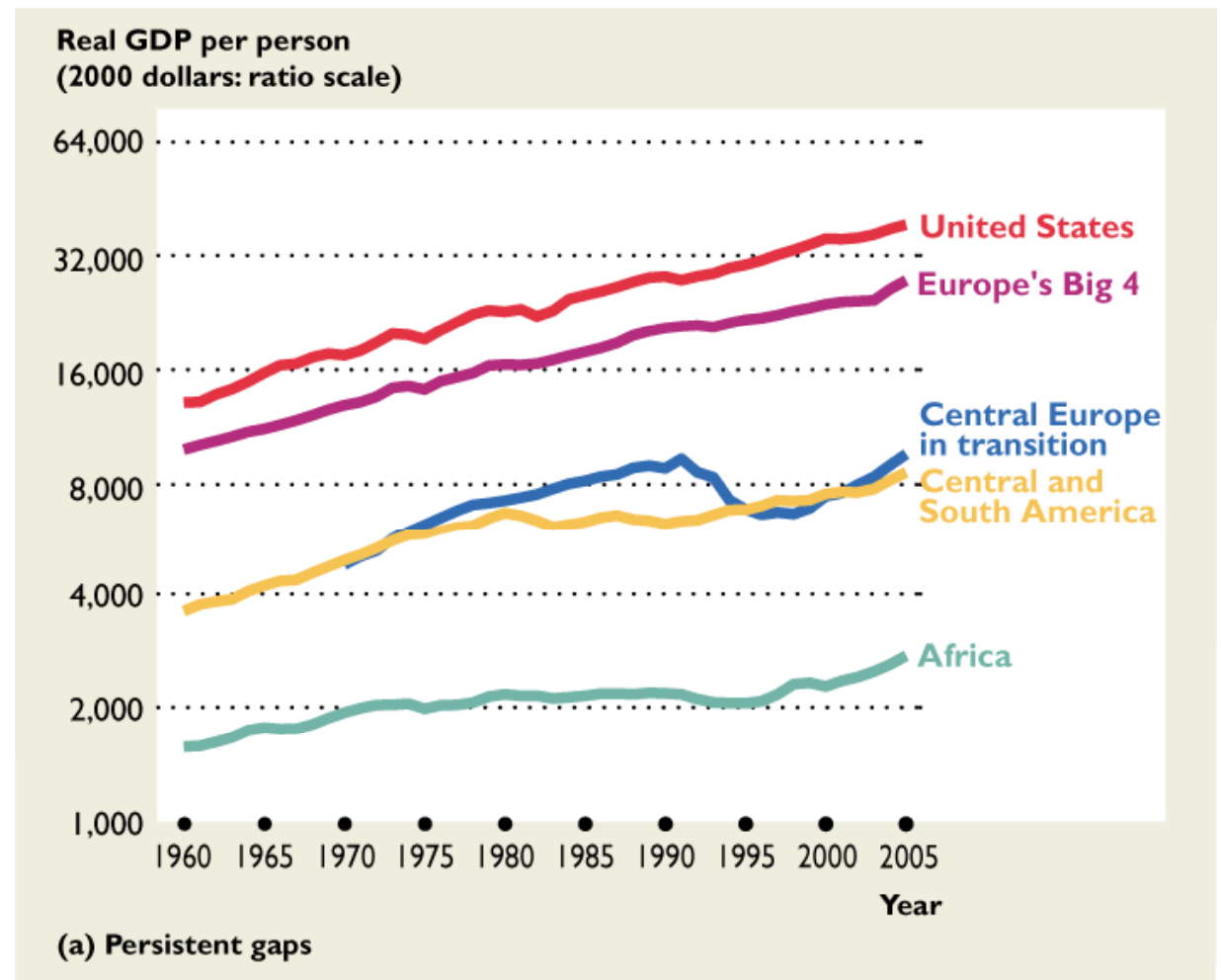
This figure shows persistent gaps in the growth rates of real GDP per person between...

Africa,

Central and South America,

Central Europe in transition,

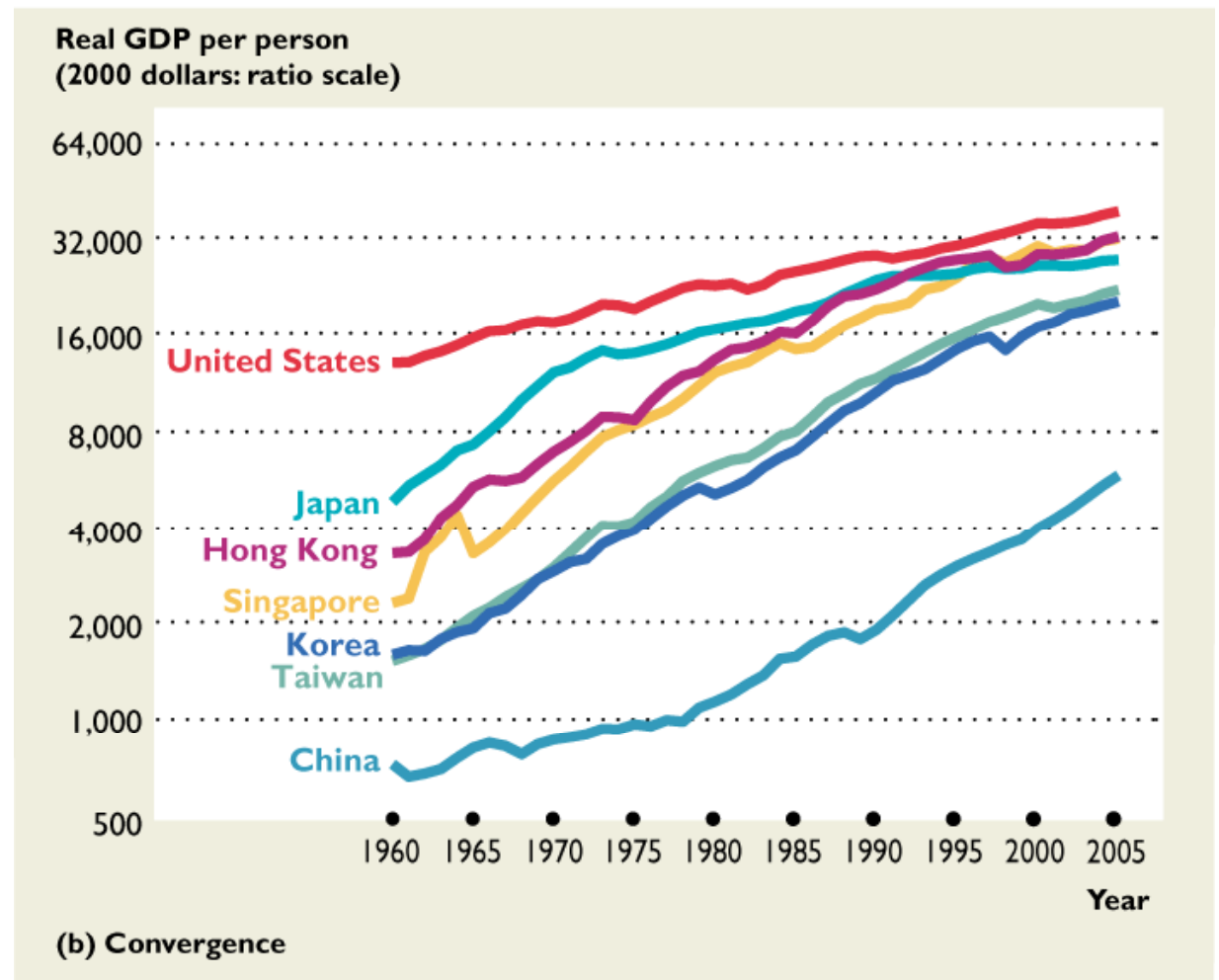
and the rich industrial economies.



Persistent Gaps or Convergence?

This figure tells a different story.

It shows how the economies of East Asia have converged on the United States.



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1** Define and calculate the economic growth rate, and explain the implications of sustained growth.
- 2** Identify the main the sources of economic growth.
- 3** Review the theories of economic growth that explain why growth rates vary over time and across countries.
- 4** Describe the policies that might speed economic growth.

9.1 THE BASICS OF ECONOMIC GROWTH

Economic growth is a sustained expansion of production possibilities measured as the increase in real GDP over a given period.

■ Calculating Growth Rates

Economic growth rate is the rate of change of real GDP expressed as a percentage per year.

9.1 THE BASICS OF ECONOMIC GROWTH

To calculate this growth rate, we use the formula:

$$\text{Growth of real GDP} = \frac{\text{Real GDP in current year} - \text{Real GDP in previous year}}{\text{Real GDP in previous year}} \times 100$$

For example, if real GDP in the current year is \$8.4 trillion and if real GDP in the previous year was \$8.0 trillion, then the growth rate of real GDP is

$$\text{Growth of real GDP} = \frac{\$8.4 \text{ trillion} - \$8.0 \text{ trillion}}{\$8.0 \text{ trillion}} \times 100 = 5 \text{ percent.}$$

9.1 THE BASICS OF ECONOMIC GROWTH

The standard of living depends on real GDP per person.

Real GDP per person is real GDP divided by the population. (**Real GDP per capita**)

The contribution of real GDP growth to the change in the standard of living depends on the growth rate of real GDP per person.

9.1 THE BASICS OF ECONOMIC GROWTH

Year	2000	2001	Growth Rate
Real GDP	\$8.0 trillion	\$8.4 trillion	$\frac{8.4 - 8}{8} = 0.05 = 5\%$
Population	200 million	202 million	$\frac{202 - 200}{200} = 0.01 = 1\%$
Real GDP/person	\$40,000	41,584	$\frac{41,584 - 40,000}{40,000} = 0.0396 = 3.96\%$

9.1 THE BASICS OF ECONOMIC GROWTH

■ Growth rate of a variable Y

$$growth(Y) = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$

■ Approximate growth rate of a ratio

$$growth\left(\frac{Y}{X}\right) \approx growth(Y) - growth(X)$$

■ Approximate growth rate of a product

$$growth(Y \cdot X) \approx growth(Y) + growth(X)$$

9.1 THE BASICS OF ECONOMIC GROWTH

■ The Magic of Sustained Growth

Sustained growth of real GDP per person can transform a poor society into a wealthy one. The reason is that economic growth is like compound interest.

Rule of 70 is the number of years it takes for the level of any variable to double is approximately 70 divided by the annual percentage growth rate of the variable.

9.1 THE BASICS OF ECONOMIC GROWTH

Table 9.1 Growth Rates

Growth rate (% per year)	Years for level to double	Example
2	35	U.S. real GDP per person
7	10	China real GDP per person

9.2 THE SOURCES OF ECONOMIC GROWTH

To understand what determines the growth rate of real GDP, we must understand what determines the growth rates of the factors of production and rate of increase in their productivity.

All the influences on real GDP growth can be divided into those that increase

- Aggregate hours
- Labor productivity

9.2 THE SOURCES OF ECONOMIC GROWTH

For example, suppose that the total real GDP (Y) can be modeled as follows:

$$Y = A\sqrt{K}\sqrt{L}$$

A – productivity level (technology + human capital)

K – physical capital and land

L – labor (aggregate hours)

We see that the sources of growth of Y are:

(i) Growth in L , (ii) growth in K , (iii) growth in A .

9.2 THE SOURCES OF ECONOMIC GROWTH

■ Aggregate Hours

Over time, aggregate hours increase. This growth in aggregate hours comes from growth in the labor force rather than from growth in average hours per worker.

While the participation rate has increased over the past few decades, it has an upper limit, and most of the growth of aggregate hours comes from population growth.

So population growth is the only source of growth in aggregate labor hours that can be sustained over long periods.

9.2 THE SOURCES OF ECONOMIC GROWTH

Population growth brings economic growth, but it does not bring growth in real **GDP per person** unless labor becomes more productive.

■ Labor Productivity

Labor productivity is the quantity of real GDP produced by one hour of labor.

It is calculated by using the formula:

$$\text{Labor productivity} = \frac{\text{Real GDP}}{\text{Aggregate hours}}$$

9.2 THE SOURCES OF ECONOMIC GROWTH

Example: suppose $A = 10$, $K = 16$, $L = 100$.

The total output is $Y = 10\sqrt{16}\sqrt{100} = 400$, and output per hour is $Y / L = 400 / 100 = 4$.

Now suppose $A = 10$, $K = 16$, $L = 121$.

The total output is $Y = 10\sqrt{16}\sqrt{121} = 440$, and output per hour is $Y / L = 440 / 121 = 3.64$

Total real GDP increased, but output per hour has declined. The reason is **diminishing returns to labor**.

Conclusion: growth in standard of living cannot be generated by growth in population alone.

9.2 THE SOURCES OF ECONOMIC GROWTH

When labor productivity grows, real GDP per person grows, so the growth in labor productivity is the basis of rising living standards.

The growth of labor productivity depends on three things:

- Saving and investment in physical capital
- Expansion of human capital
- Discovery of new technologies

9.2 THE SOURCES OF ECONOMIC GROWTH

Saving and Investment in Physical Capital

Saving and investment in physical capital increase the amount of capital per worker and increase labor productivity.

Expansion of Human Capital

Human capital—the accumulated skill and knowledge of people—comes from two sources:

- Education and training
- Job experience

9.2 THE SOURCES OF ECONOMIC GROWTH

Discovery of New Technologies

To reap the benefits of technological change, capital must increase.

Some of the most powerful and far-reaching technologies are embodied in human capital.

For example, language, writing, and mathematics.

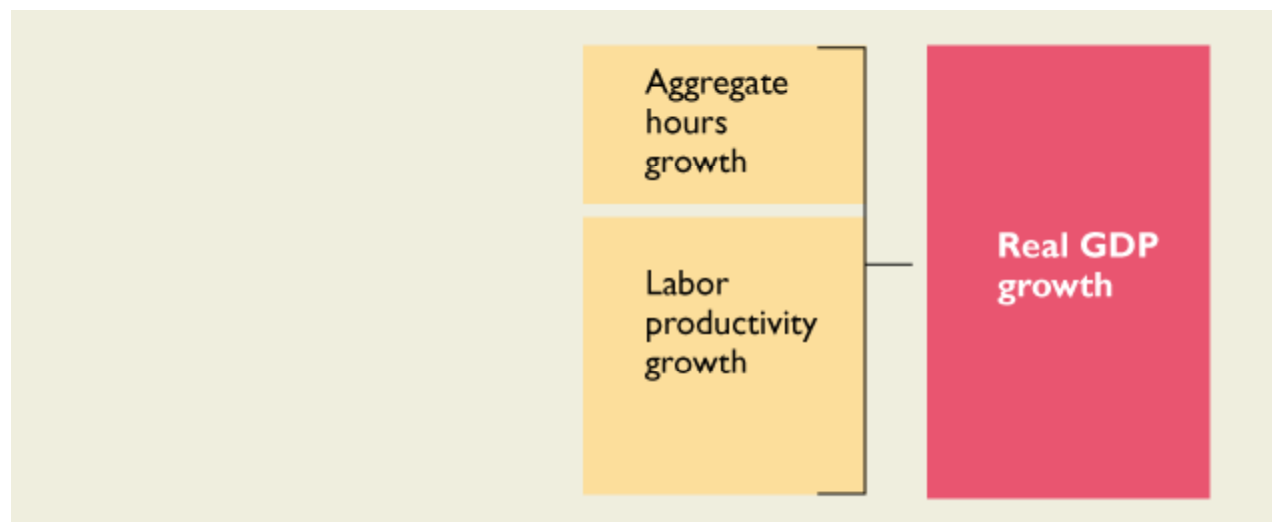
But most technologies are embodied in physical capital.

9.2 THE SOURCES OF ECONOMIC GROWTH

■ Sources of Growth: A Summary

Figure 9.1 shows the sources of economic growth.

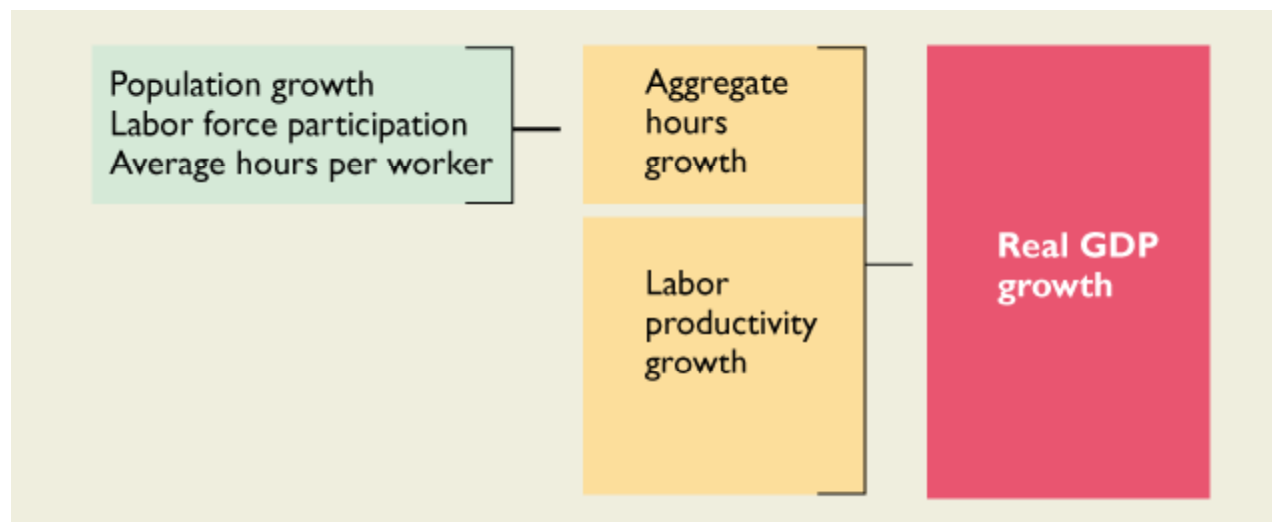
Real GDP growth depends on aggregate labor hours growth and on labor productivity growth.



9.2 THE SOURCES OF ECONOMIC GROWTH

Aggregate hours growth depends on

- Population growth
- The labor force participation rate
- Average hours per worker

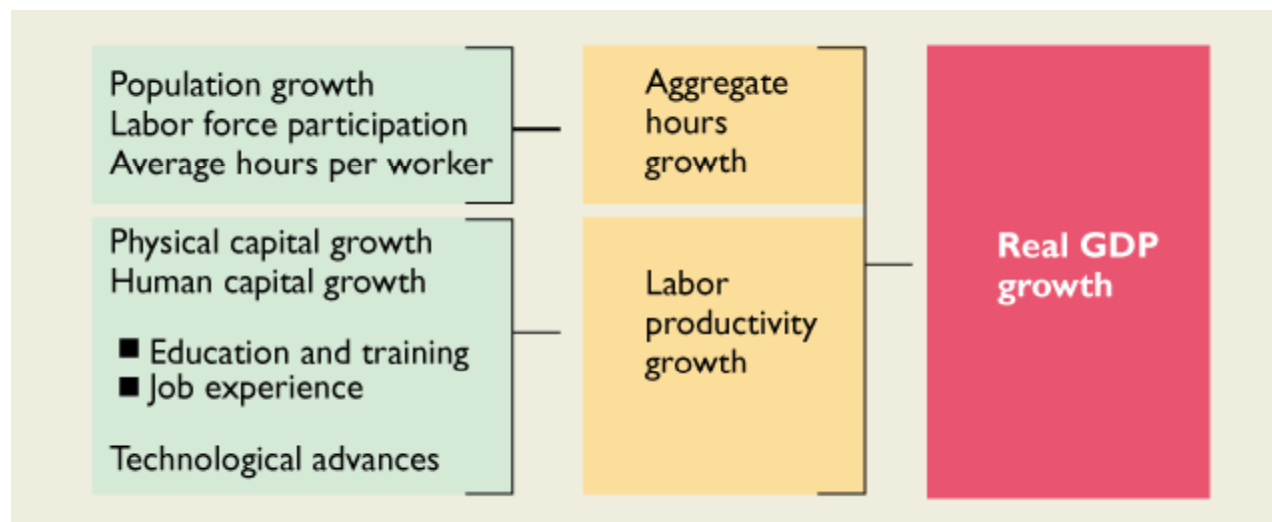


9.2 THE SOURCES OF ECONOMIC GROWTH



Labor productivity growth depends on

- Physical capital growth
- Human capital growth
- Technological advances



9.3 THEORIES OF ECONOMIC GROWTH

The three growth theories that we study are:

- Classical growth theory
- Neoclassical growth theory
- New growth theory

9.3 THEORIES OF ECONOMIC GROWTH

■ Classical Growth Theory

Classical growth theory is the theory that the clash between an exploding population and limited resources will eventually bring economic growth to an end.

Malthusian theory is another name for classical growth theory—named for Thomas Robert Malthus.

9.3 THEORIES OF ECONOMIC GROWTH

The Basic Idea

Advances in technology and the accumulation of capital bring increased productivity and increased real GDP per person.

Classical growth theory says that the increase in real GDP per person will be temporary because prosperity will induce a population explosion.

The population explosion will decrease real GDP per person.

9.3 THEORIES OF ECONOMIC GROWTH

Classical Theory of Population Growth

When the classical economists were developing their ideas about population growth, an unprecedented population explosion was under way.

To explain the high rate of population growth, the classical economists used the idea of a subsistence real income (real GDP per person).

In classical theory, when real income exceeds the subsistence real income, the population grows.

9.3 THEORIES OF ECONOMIC GROWTH

The increasing population decreases the amount of capital per hour of labor, so eventually labor productivity and real GDP per person decrease.

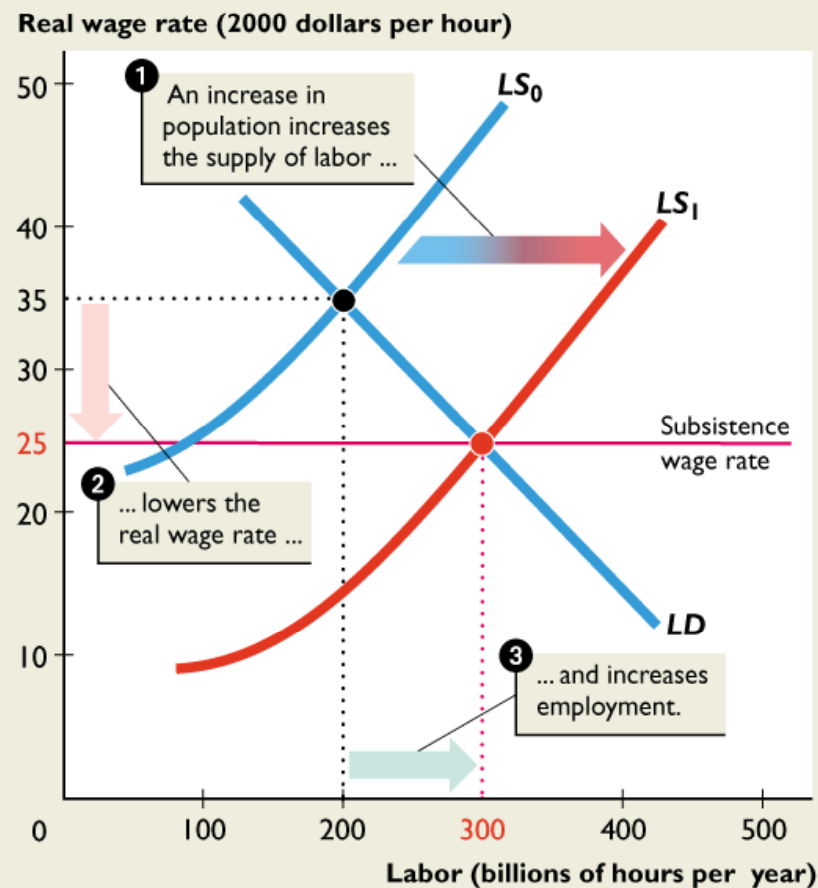
So no matter how much technological change occurs, real income (real GDP per person) is always pushed back toward the subsistence level.

This dismal implication led to economics being called “the dismal science.”

9.3 THEORIES OF ECONOMIC GROWTH

Figure 9.2 shows that with the wage rate above the subsistence wage, the population increases .

1. The supply of labor increases.
2. The wage rate falls.
3. Employment increases.



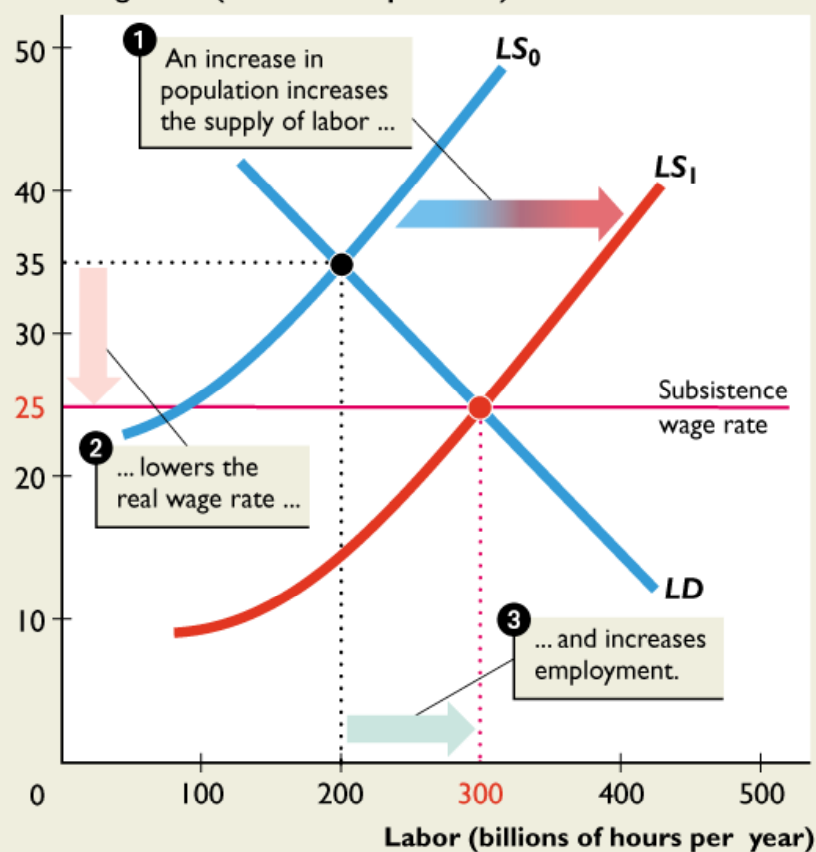
(a) The labor market

9.3 THEORIES OF ECONOMIC GROWTH



The population and the supply of labor keep increasing until the wage rate equals the subsistence wage rate.

Real wage rate (2000 dollars per hour)



(a) The labor market

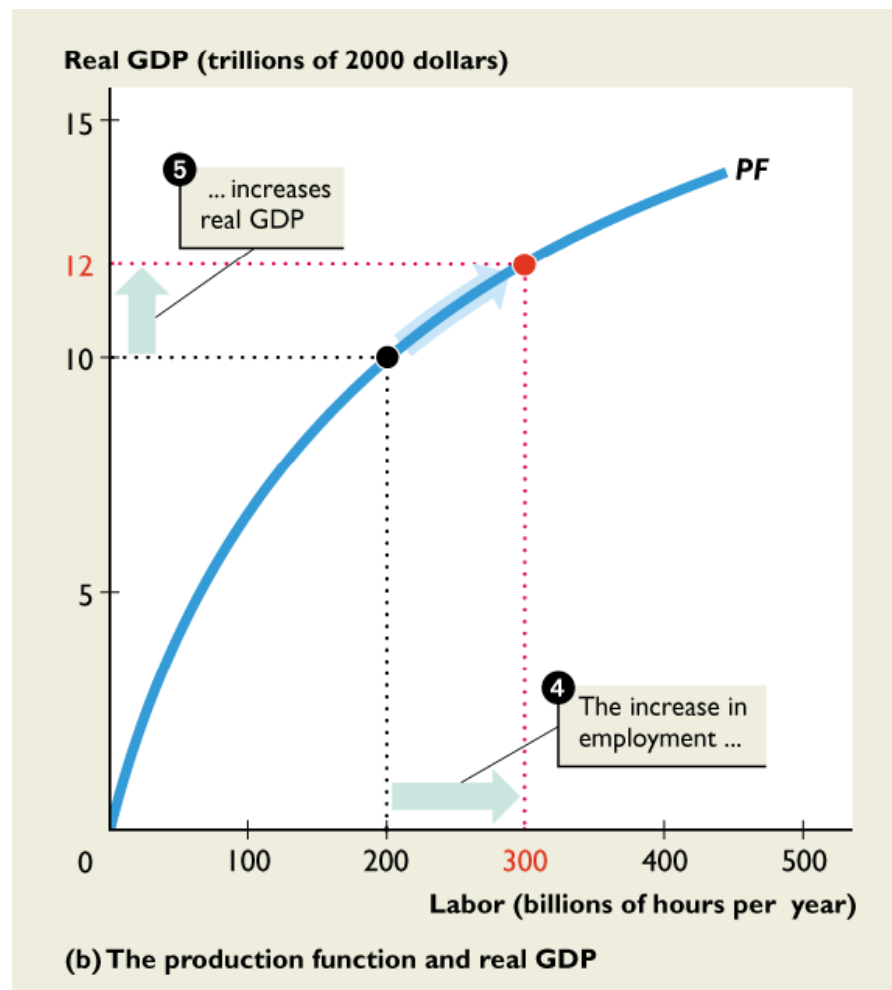
9.3 THEORIES OF ECONOMIC GROWTH



4. The increase in employment ...

5. Increases real GDP.

The increase in population increases employment and real GDP and lowers the wage rate and real GDP per hour of work.



9.3 THEORIES OF ECONOMIC GROWTH

Real GDP per hour of work decreases because of diminishing returns.

Diminishing returns are the tendency for each additional hour of labor employed to produce a successively smaller additional amount of output.

So if the real wage rate exceeds the subsistence real wage rate, according to the classical theory, population growth brings a fall in the real wage rate and a fall in real GDP per hour of work.

9.3 THEORIES OF ECONOMIC GROWTH

■ Neoclassical Growth Theory

Neoclassical growth theory is the theory that real GDP per person will increase as long as technology keeps advancing.

Neoclassical growth theory predicts that

- Real GDP growth rate will equal the population growth rate plus labor productivity growth.
- Real GDP per person will increase as long as technology keeps advancing—economic growth will persist.

9.3 THEORIES OF ECONOMIC GROWTH

Population Growth

Two opposing economic forces influence population growth.

As incomes increase, the birth rate decreases and the death rate decreases.

These opposing forces are offsetting, so the rate of population growth is independent of the rate of economic growth.

The historical population trends contradict the views of the classical economists.

9.3 THEORIES OF ECONOMIC GROWTH

Technological Change

In the neoclassical theory, the rate of technological change influences the rate of economic growth, but economic growth does not influence the pace of technological change.

Technological change results from chance.

- When we get lucky, we have rapid technological change.
- When we have bad luck, the pace of technological advance slows

9.3 THEORIES OF ECONOMIC GROWTH

The Basic Idea

Technological advances bring profit opportunities.

Businesses expand and new businesses are created to exploit the new technologies.

Investment and saving increase, so capital per hour of labor increases.

The economy enjoys increased prosperity and growth.

9.3 THEORIES OF ECONOMIC GROWTH

But will the prosperity last? And will the growth last?

Neoclassical growth theory says that the prosperity will last but the growth will not unless technology keeps advancing.

The prosperity persists because no population explosion occurs to lower real GDP per person.

9.3 THEORIES OF ECONOMIC GROWTH

But growth stops if technology stops advancing because capital accumulation brings diminishing returns, which slow the growth rate of real GDP and reduces saving and investment.

Eventually, the growth rate of capital slows to that of the population and real GDP per person stops growing.

A Problem with Neoclassical Growth Theory

The theory does not explain what determines technological change.

9.3 THEORIES OF ECONOMIC GROWTH

■ New Growth Theory

New growth theory

The theory that our unlimited wants will lead us to ever greater productivity and perpetual economic growth.

According to new growth theory, real GDP per person grows because of the choices people make in the pursuit of profit.

9.3 THEORIES OF ECONOMIC GROWTH

Choices and Innovation

The new theory of economic growth emphasizes three facts about market economies:

- Human capital grows because of choices.
- Discoveries result from choices.
- Discoveries bring profit, and competition destroys profit.

9.3 THEORIES OF ECONOMIC GROWTH

Human Capital Expansion and Choices

People decide how long to remain in school, what to study, and how hard to study.

Discoveries and Choices

The pace at which new discoveries are made—and at which technology advances—is not determined by chance.

The pace at which new discoveries are made depends on how many people are looking for a new technology and how intensively they are looking.

9.3 THEORIES OF ECONOMIC GROWTH

Discoveries and Profits

The forces of competition squeeze profits, so to increase profit, people constantly seek either lower cost methods of production or new and better products for which people are willing to pay a higher price.

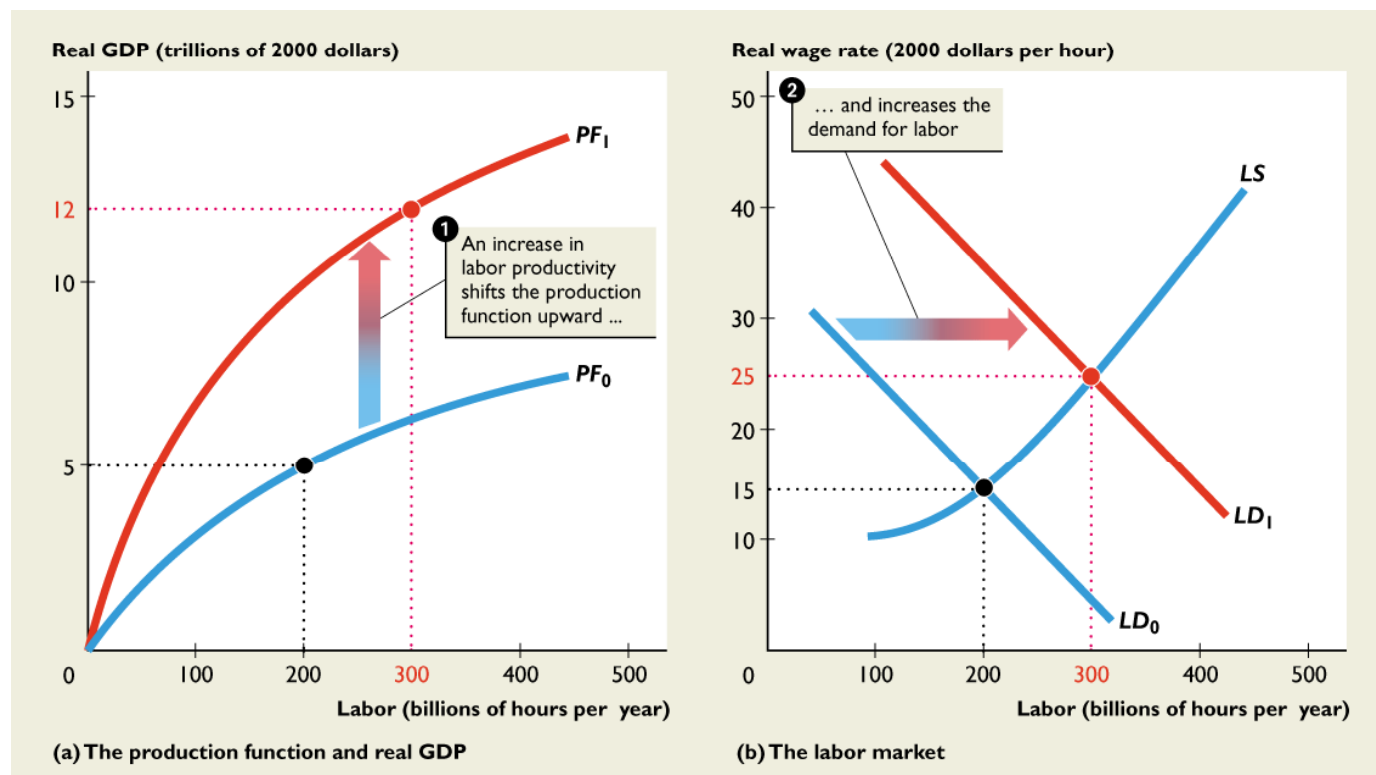
Two other facts play a key role in the new growth theory:

- Many people can use discoveries at the same time.
- Physical activities can be replicated.

9.3 THEORIES OF ECONOMIC GROWTH

Figure 9.3 shows the effect of an increase in labor productivity.

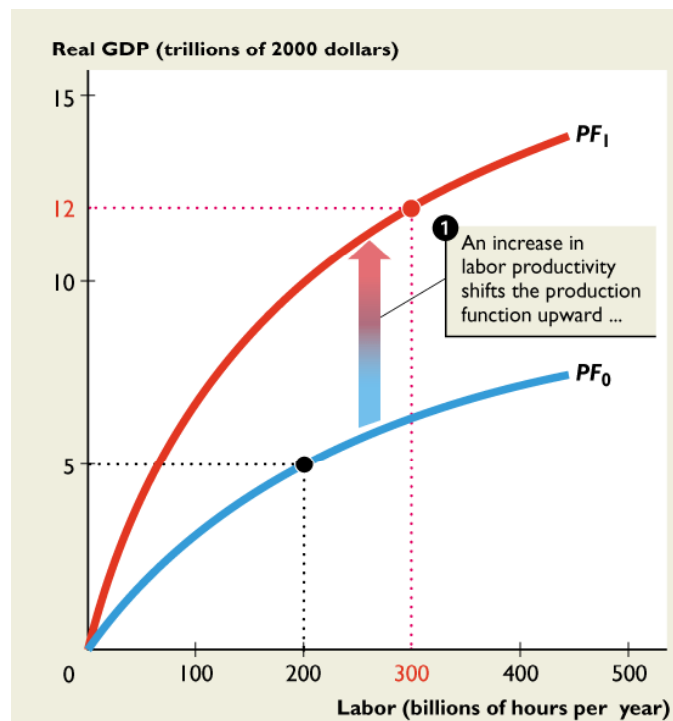
1. Production function shifts upward and
2. The demand for labor increases.



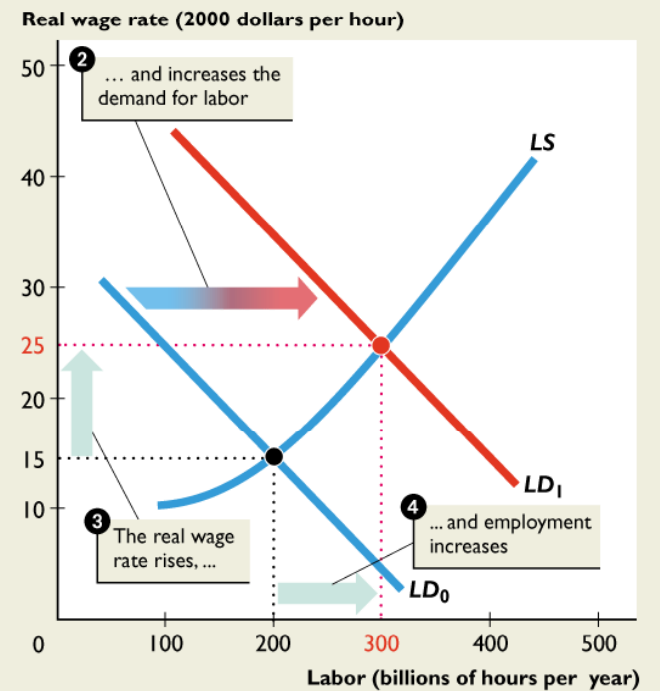
9.3 THEORIES OF ECONOMIC GROWTH

3. The real wage rate rises and

4. The quantity of labor employed increases.



(a) The production function and real GDP

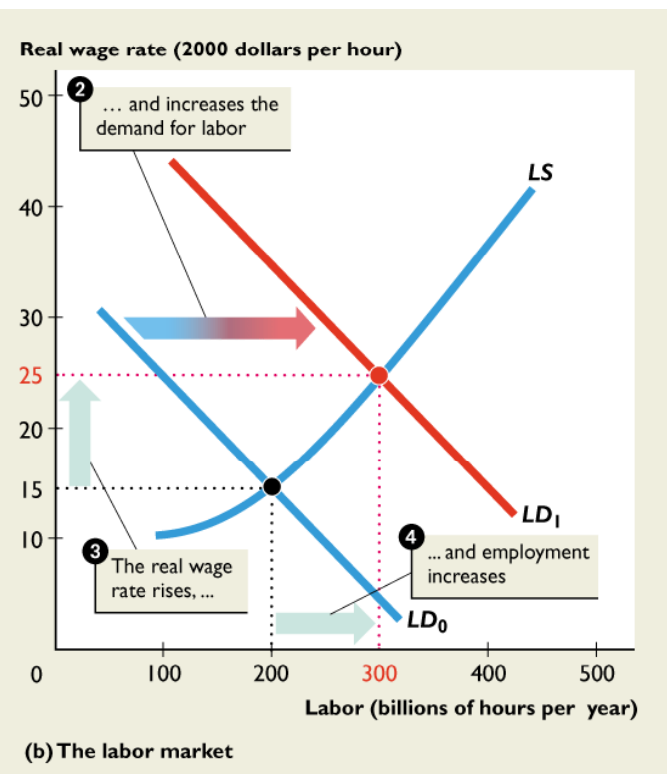
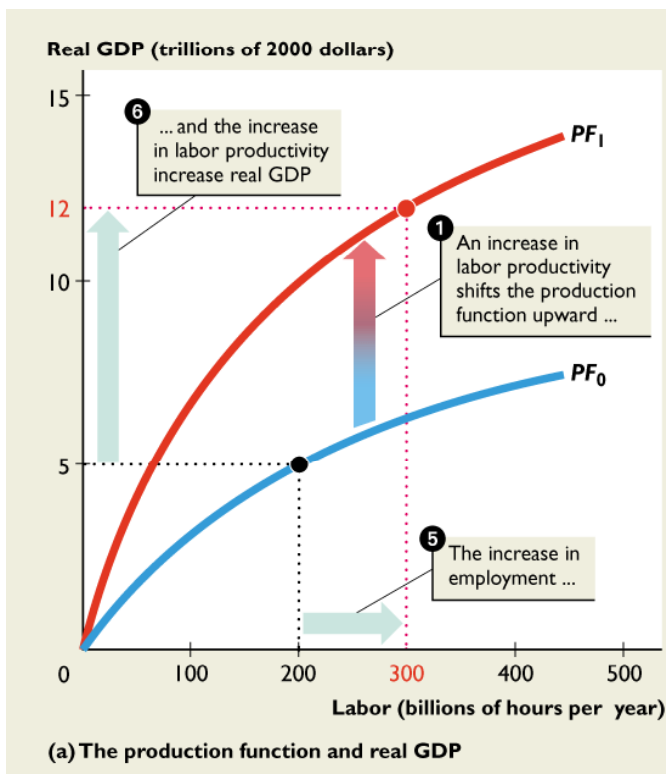


(b) The labor market

9.3 THEORIES OF ECONOMIC GROWTH



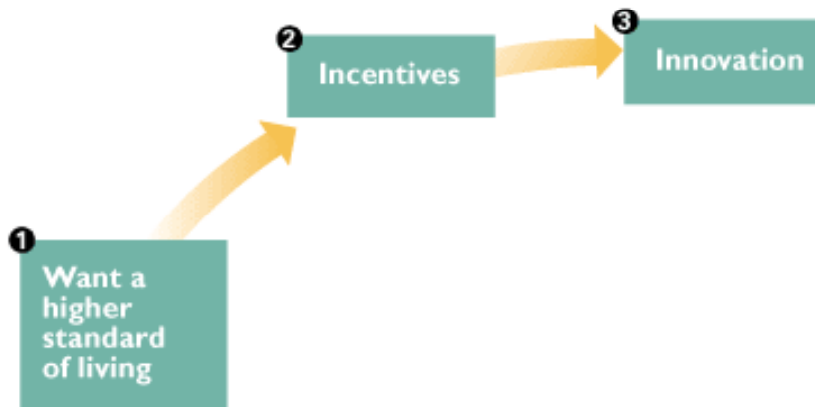
- 5. The increase in employment and
- 6. The increase in labor productivity increase real GDP.



9.3 THEORIES OF ECONOMIC GROWTH

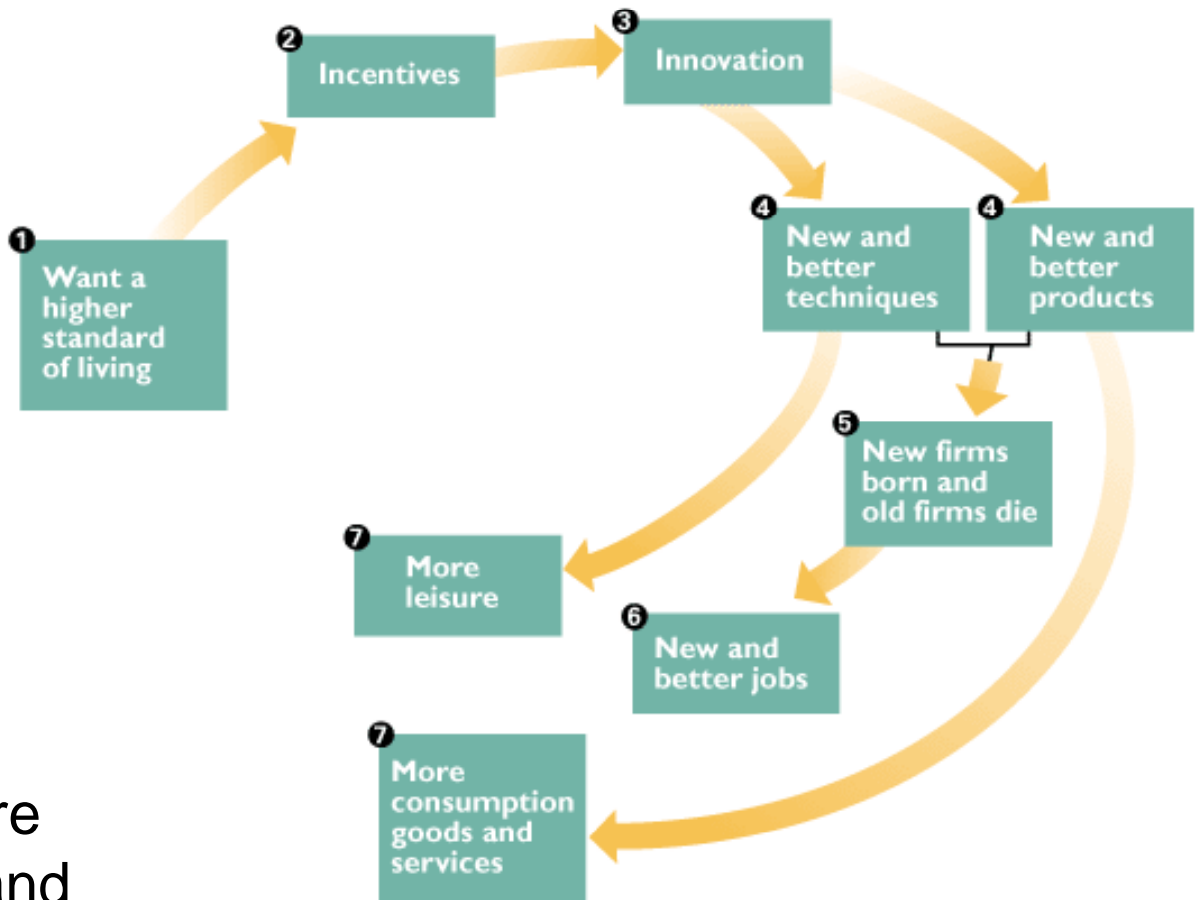
Figure 9.4 illustrates new growth theory in terms of a perpetual motion machine.

1. People want a higher standard of living and are spurred by...
2. Profit incentives to make the...
3. Innovations that lead to...



9.3 THEORIES OF ECONOMIC GROWTH

4. New and better techniques and new and better products, which in turn lead to...
5. The birth of new firms and the death of some old firms,
6. New and better jobs, and...
7. More leisure and more consumption goods and services.



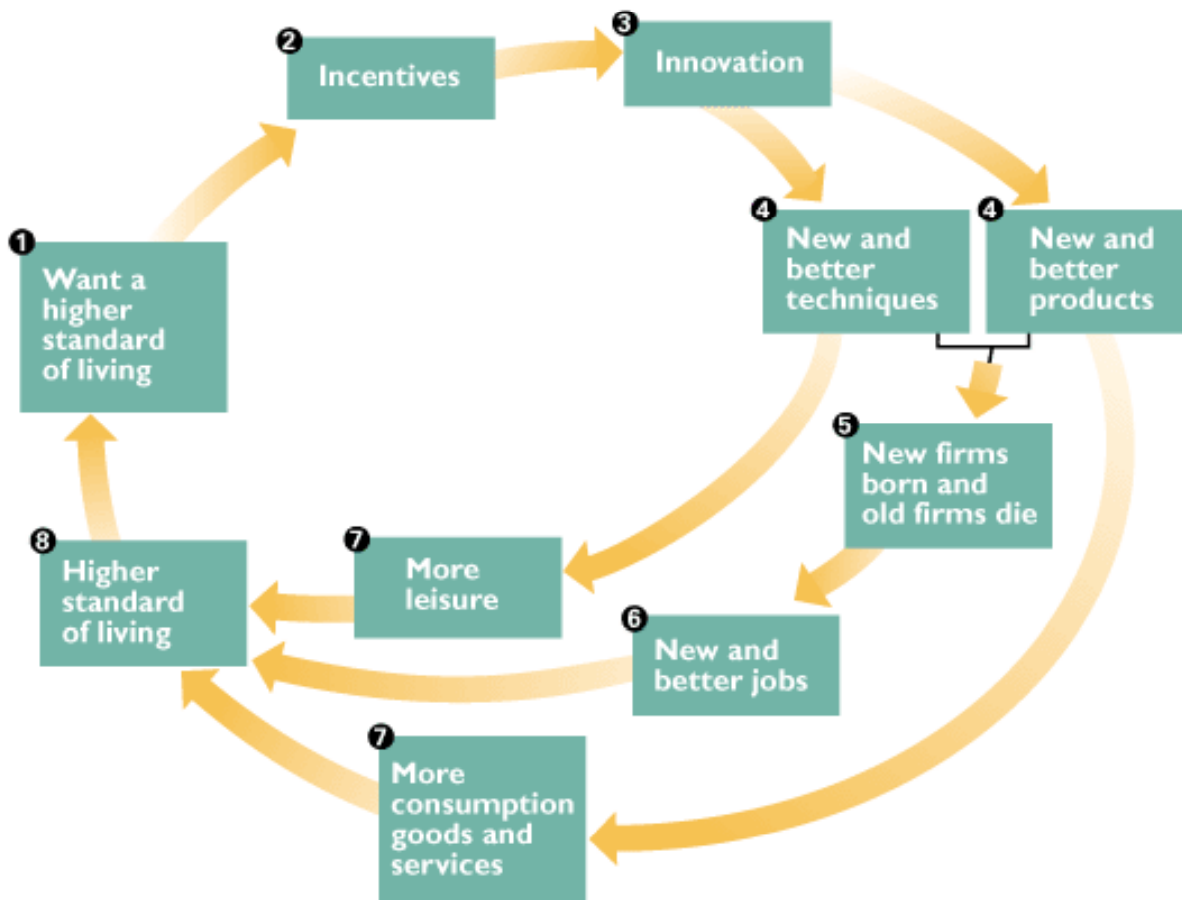
9.3 THEORIES OF ECONOMIC GROWTH



The result is...

8. A higher standard of living.

But people want a yet higher standard of living, and the growth process continues.



9.4 ACHIEVING FASTER GROWTH

■ Preconditions for Economic Growth

Economic freedom is the fundamental precondition for creating the incentives that lead to economic growth.

Economic freedom is a condition in which people are able to make personal choices, their private property is protected, and they are free to buy and sell in markets.

9.4 ACHIEVING FASTER GROWTH

Economic freedom requires the protection of private property—the factors of production and goods that people own.

Property rights are the social arrangements that govern the protection of private property.

Economic freedom also requires free markets.

9.4 ACHIEVING FASTER GROWTH

To achieve faster economic growth, we must increase

- The growth rate of capital per hour of labor or
- The growth rate of human capital or
- The pace of technological advance.

9.4 ACHIEVING FASTER GROWTH

■ Policies to Achieve Faster Growth

The main actions that governments can take to achieve these objectives are

- Create the incentive mechanisms
- Encourage saving
- Encourage research and development
- Encourage international trade
- Improve the quality of education

9.4 ACHIEVING FASTER GROWTH

Create Incentive Mechanisms

Economic growth occurs when the incentive to save, invest, and innovate is strong enough. These incentives exist only when private property is protected.

Encourage Saving

Saving finances investment, which brings capital accumulation.

Tax incentives can encourage saving, increase the growth of capital, and stimulate economic growth.

9.4 ACHIEVING FASTER GROWTH

Encourage Research and Development

Everyone can use the fruits of basic research and development efforts.

Because basic inventions can be copied, the inventor's profit is limited and so the market allocates too few resources to this activity.

Governments can direct public funds toward financing basic research, but it requires a mechanism for allocating public funds to their highest-valued use.

9.4 ACHIEVING FASTER GROWTH

Encourage International Trade

Free international trade stimulates economic growth by extracting all the available gains from specialization and trade.

Improve the Quality of Education

By funding basic education and by ensuring high standards in skills such as language, mathematics, and science, governments can contribute enormously to a nation's growth potential.

9.4 ACHIEVING FASTER GROWTH

■ How Much Difference Can Policy Make?

A well-intentioned government cannot dial up a big increase in the growth rate.

But it can pursue policies that will nudge the growth rate upward.

And over time, the benefits from these policies will be large.