INTRODUCTION TO ECONOMICS

Economic Growth[a]

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[a] Based on Ch. 22 of "*Principles of Economics*" by Betsey Stevenson & Justin Wolfers.

Chapter Objective

- Understand what determines the rate of economic growth.

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Roadmap (1 of 4)

- **Economic Growth Facts**

  Learn how economies have grown over time.

- The Ingredients of Economic Growth

  Uncover the ingredients for economic growth.

- The Analytics of Economic Growth

  Understand how workers, capital accumulation, and technological progress work together to create economic growth.

- Public Policy: Why Institutions Matter for Growth

  Find out why government institutions matter for economic growth.

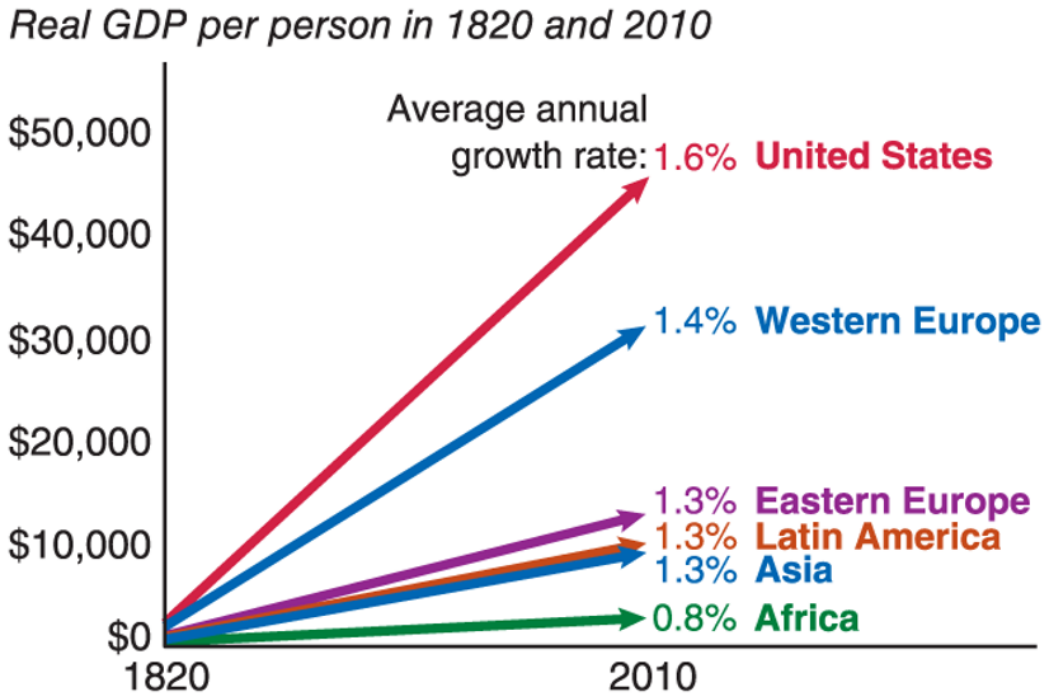
How has economic growth varied throughout history?

- It is estimated that between 1 million B.C. and 1200 A.D. GDP per person was around $200 per year.
- People lived as hunters and gatherers.
- Around 12,000 years ago, people began to farm.

What finally changed economic growth rates?

- Agricultural advances resulted in more food and less hunger.
- Fewer people needed to work on farms.
- The Industrial Revolution sparked tremendous economic growth.
- Economic growth led to higher standards of living and longer lives.

Economic Growth over the Past Two Centuries



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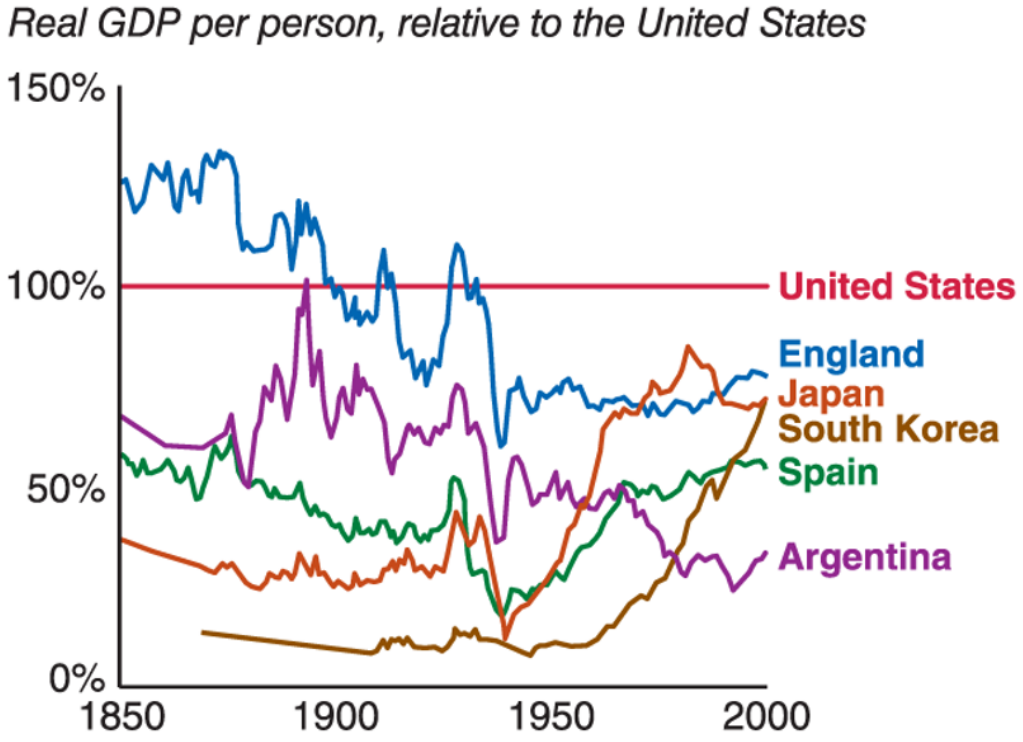
Growth Disasters and Miracles



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Review: Why does economic growth matter?

- Before modern civilization, there was little to no economic growth.
- Each generation lived exactly the same as its ancestors, largely hand-to-mouth.
- With advancements in agriculture, fewer people needed to work on farms.
- This led to the Industrial Revolution, which resulted in levels of economic growth never before experienced.
- Small differences in economic growth amplify over time, resulting in “rich” countries.

Roadmap (2 of 4)

- Economic Growth Facts

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The Production Function

The **production function** describes the methods by which inputs are transformed into outputs.

Production function
Methods for transforming inputs into output

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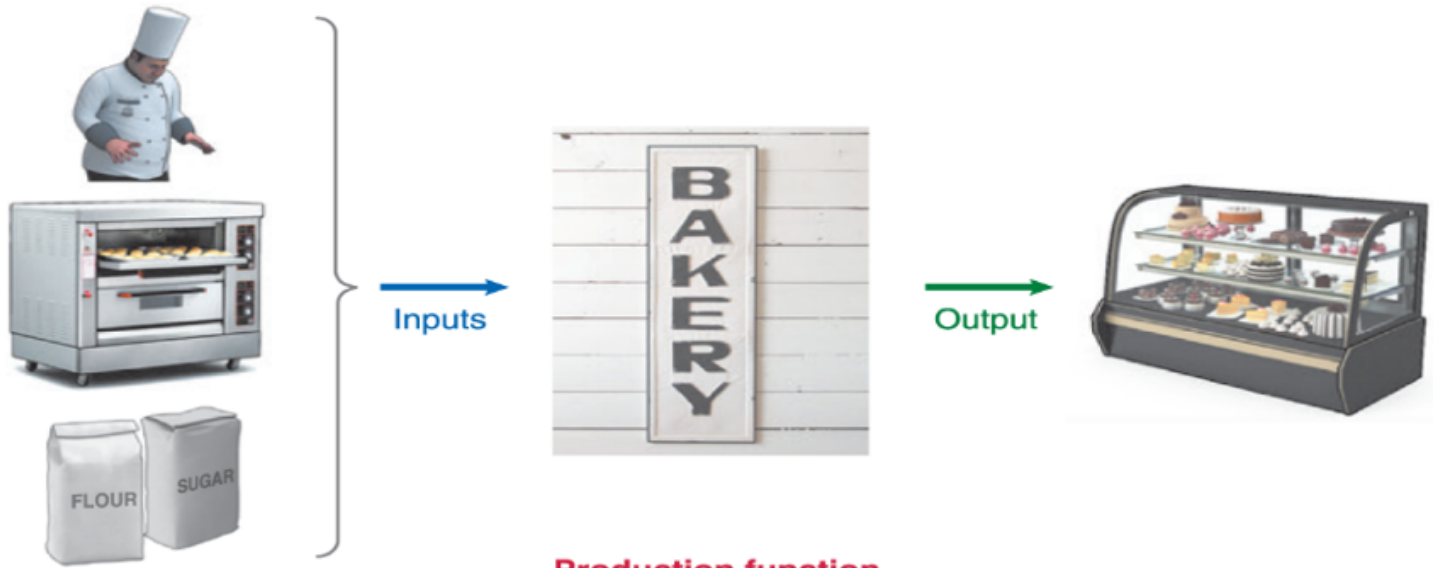
It is like a cookbook for economic growth.

How do businesses transform inputs into outputs?

The production function describes the management techniques your company uses to transforms inputs into outputs.



Production function
Methods for transforming inputs into output

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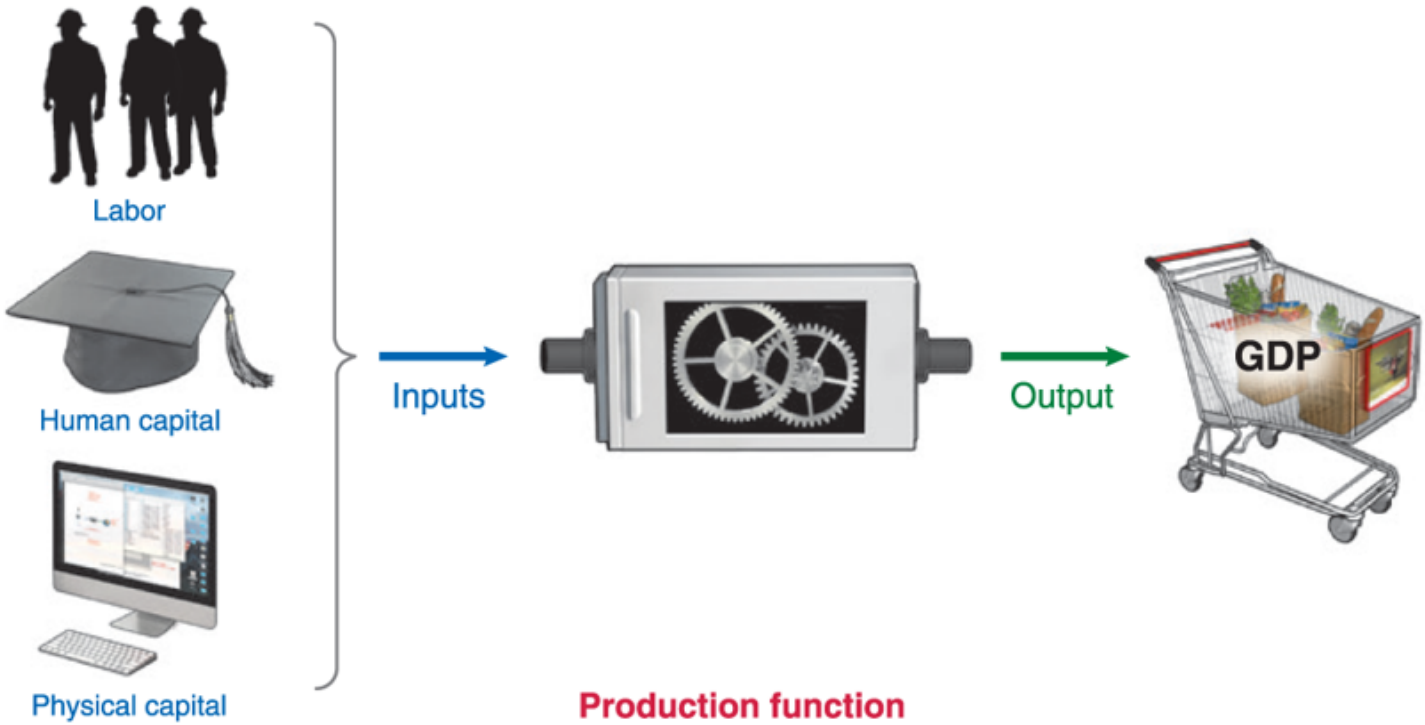
Managers must acquire the right ingredients and mix them in appropriate proportions.

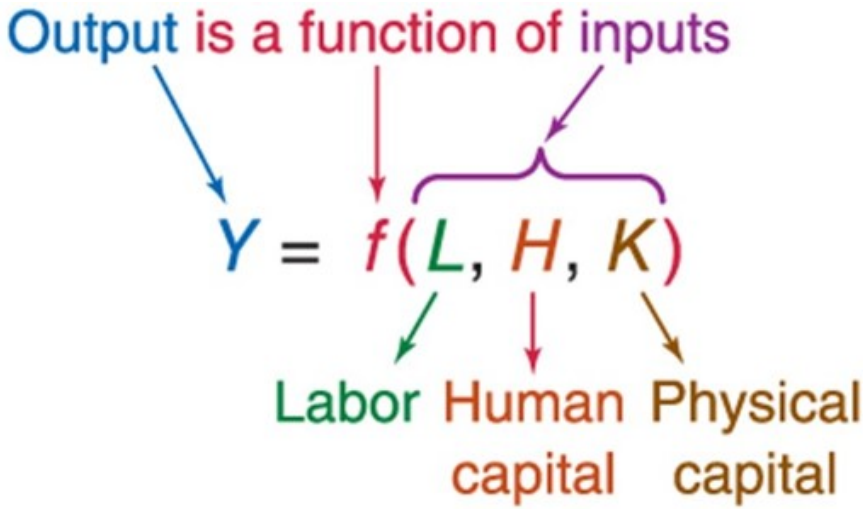
The Aggregate Production Function

The **aggregate production function** relates total output (GDP) to the quantity of inputs employed.



Human capital: Skills that workers bring to the job **Physical capital**: Tools, machinery, and structures

The Aggregate Production Function: A Mathematical Representation



What does the aggregate production function tell us about economic growth?

A country will produce more output if

1. it employs more workers.
2. its workers become more highly skilled.
3. it accumulates more physical capital.

Improving the recipe can also lead to more output.

Ingredient One: Labor and Total Hours Worked

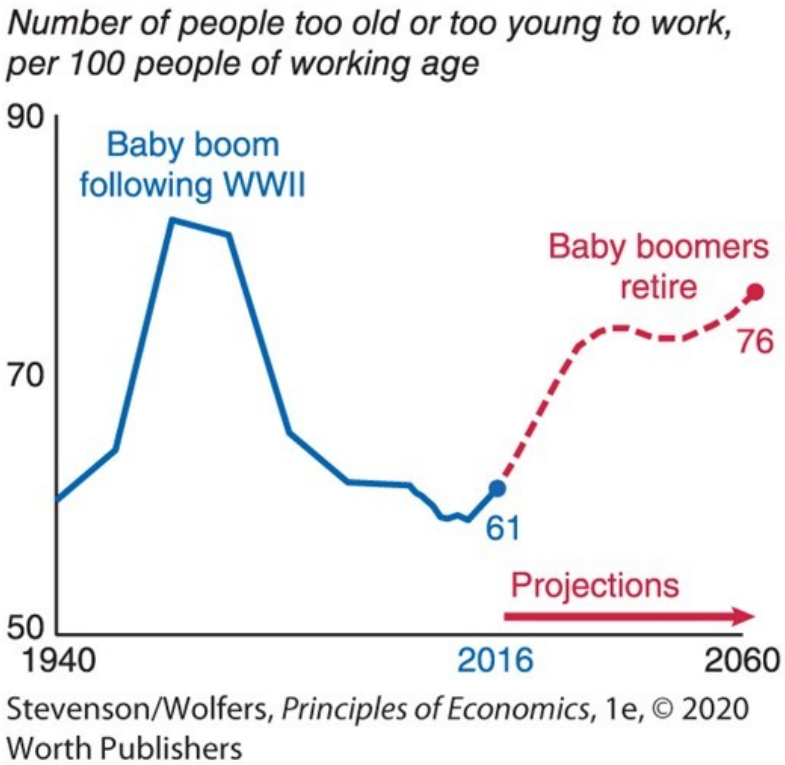
Labor input is measured as the total number of hours worked across the whole economy.

The more labor that workers do, the more output gets produced.

Population boosts total GDP but not GDP per person.

Some demographic factors can inhibit economic growth.

- The dependency ratio is the number of people too young or too old to work per 100 people of working age.
- The dependency ratio rose sharply due to the post-WWII baby boom.



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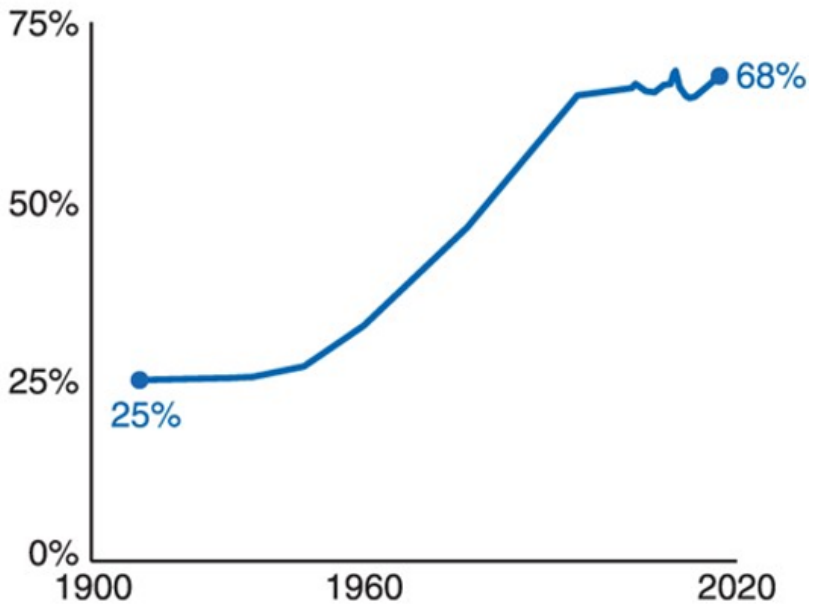
Some demographic factors can enhance economic growth.

- Women entered the labor force in large numbers during WWII.
- Women were responsible for a large share of the growth in GDP per person.



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Ingredient Two: Human Capital

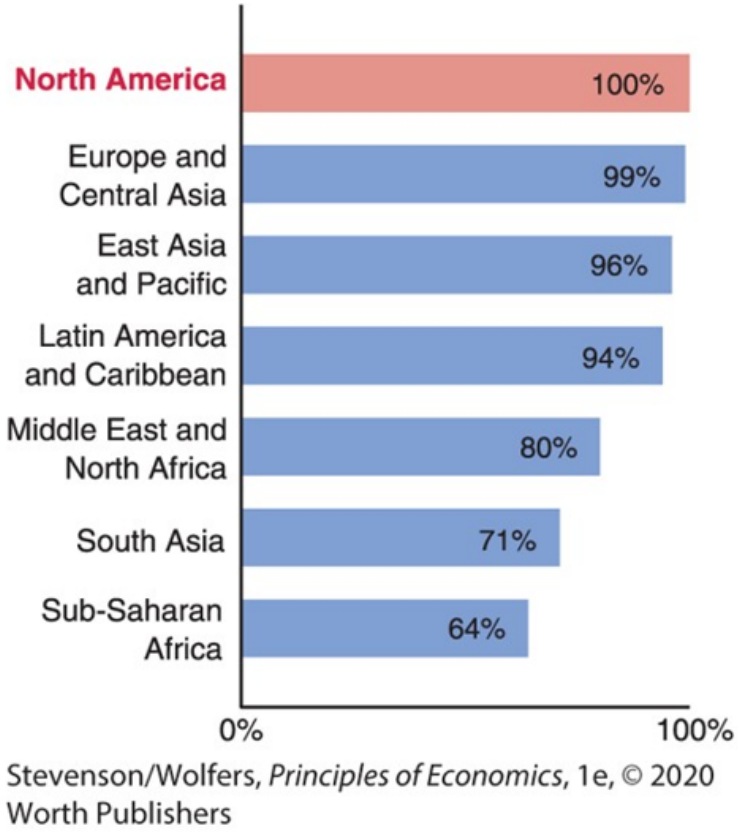
Output reflects the quantity of hours worked and the productivity of people at work.

Labor productivity is the quantity of goods and services that each person produces per hour of work.

Your labor productivity depends in part on your human capital.

Adult Literacy and Graduation Rates

Adult Literacy Rates Vary Across Regions



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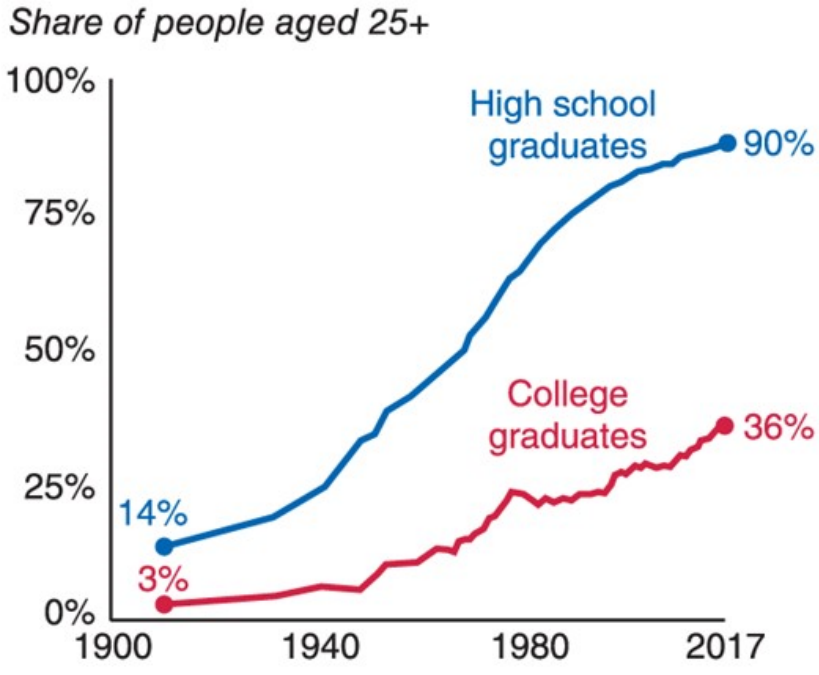
U.S. High School & College Graduation Rates.



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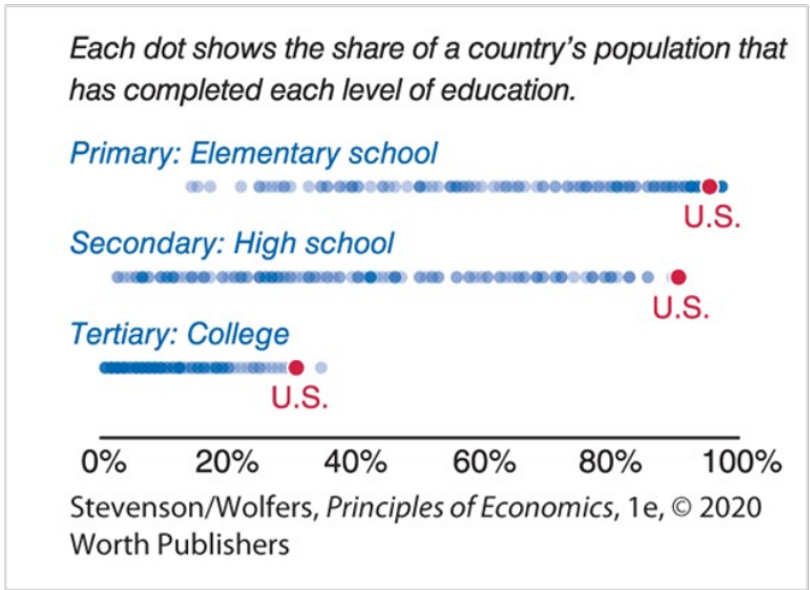
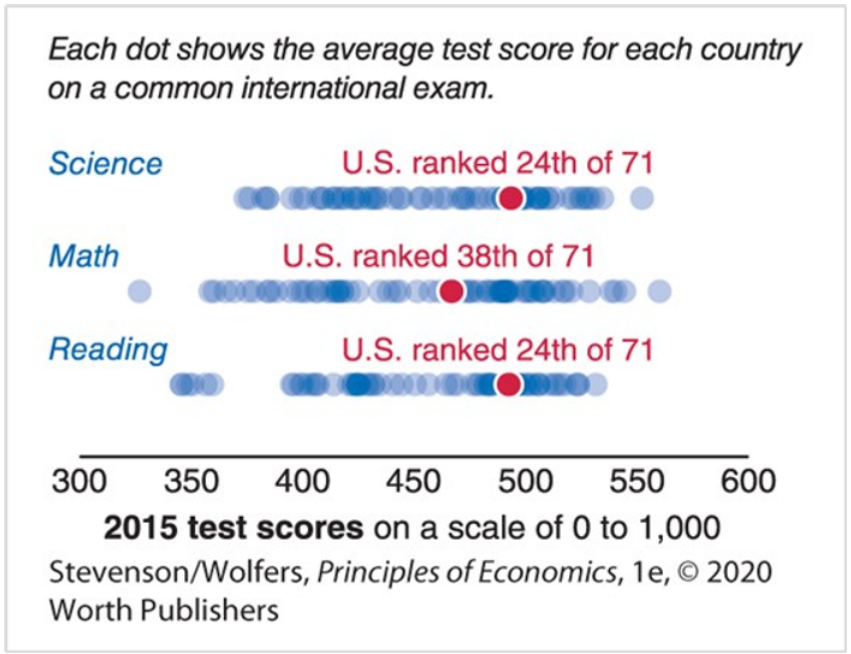
Quality versus Quantity

The United States Leads the World in Education



Average Exam Scores of 15 Years Around the World



Ingredient Three: Capital Accumulation

The equipment you work with also determines how much you can produce per hour.

Capital stock is the total quantity of physical capital used in the production of goods and services.

You are more productive when you have the right equipment.

Characteristics of Capital

- Physical capital is a complement to labor.
- Investment depends on the savings rate.
- Foreign investment builds the capital stock.

New Recipe for Combining Ingredients: Technological Progress

Technological progress

- refers to new methods for using existing resources.
- makes it possible to produce more from given resources.
- is embodied by computers.

Discussion Question: Compulsory Education

Children in the U.S. are required to attend school until age 16-18 (depending on the state). How does such a law likely impact human capital, labor productivity, the production function, and overall economic growth?

Clicker question (1 of 3)

The government changes the minimum working age to 21. Which inputs into the production function changed?

1. Labor
2. human capital
3. physical capital

Clicker question (1 of 3)

The government changes the minimum working age to 21. Which inputs into the production function changed?

1. Labor **correct**
2. human capital
3. physical capital

Clicker question (2 of 3)

The government provides a tax-free period for firms to purchase computers and tablets for employees. Which inputs into the production function changed?

1. Labor
2. human capital
3. physical capital

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The government provides a tax-free period for firms to purchase computers and tablets for employees. Which inputs into the production function changed?

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Clicker question (3 of 3)

The government mandates that community college education be tuition free. Which inputs into the production function changed?

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Clicker question (3 of 3)

The government mandates that community college education be tuition free. Which inputs into the production function changed?

1. Labor
2. human capital **correct**
3. physical capital

Review: The Ingredients of Economic Growth

- The production function describes the methods by which inputs are transformed into outputs.
- The aggregate production function links GDP to labor, human capital, and physical capital.
- A country will produce more by accumulating more labor, more human capital, or more physical capital.
- Technological progress also leads to economic growth.

Roadmap (3 of 4)

- Economic Growth Facts

  Learn how economies have grown over time.

- The Ingredients of Economic Growth

  Uncover the ingredients for economic growth.

- **The Analytics of Economic Growth**

  Understand how workers, capital accumulation, and technological progress work together to create economic growth.

- Public Policy: Why Institutions Matter for Growth

  Find out why government institutions matter for economic growth.

Analyzing the Production Function

The production function generates a number of important insights into the process of economic growth.

Insight one: Constant returns to scale means doubling inputs will double outputs.

Constant returns to scale refers to the situation when all inputs are increased by some proportion and output increases by the same proportion.

The *replication argument states* that to double output in your business you can replicate everything you are already doing.

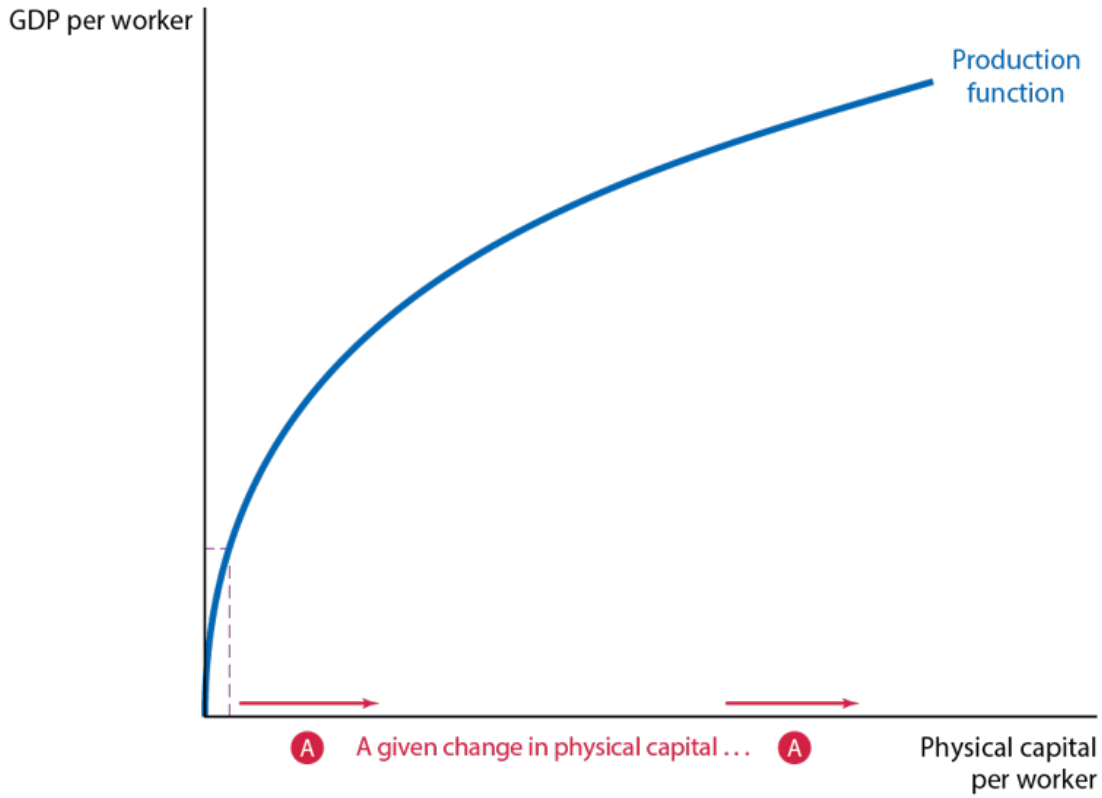
Insight two: There are diminishing returns to capital.

The **law of diminishing returns** states that when one input is held constant, increases in the other inputs will, at some point, begin to yield smaller and smaller increases in output.

Diminishing Returns to Capital - Step 1

A given increase in physical capital per person raises GDP per worker, but at a diminishing rate.

A A given change in the capital stock will increase GDP per worker, but by how much depends on the how much capital you start with.



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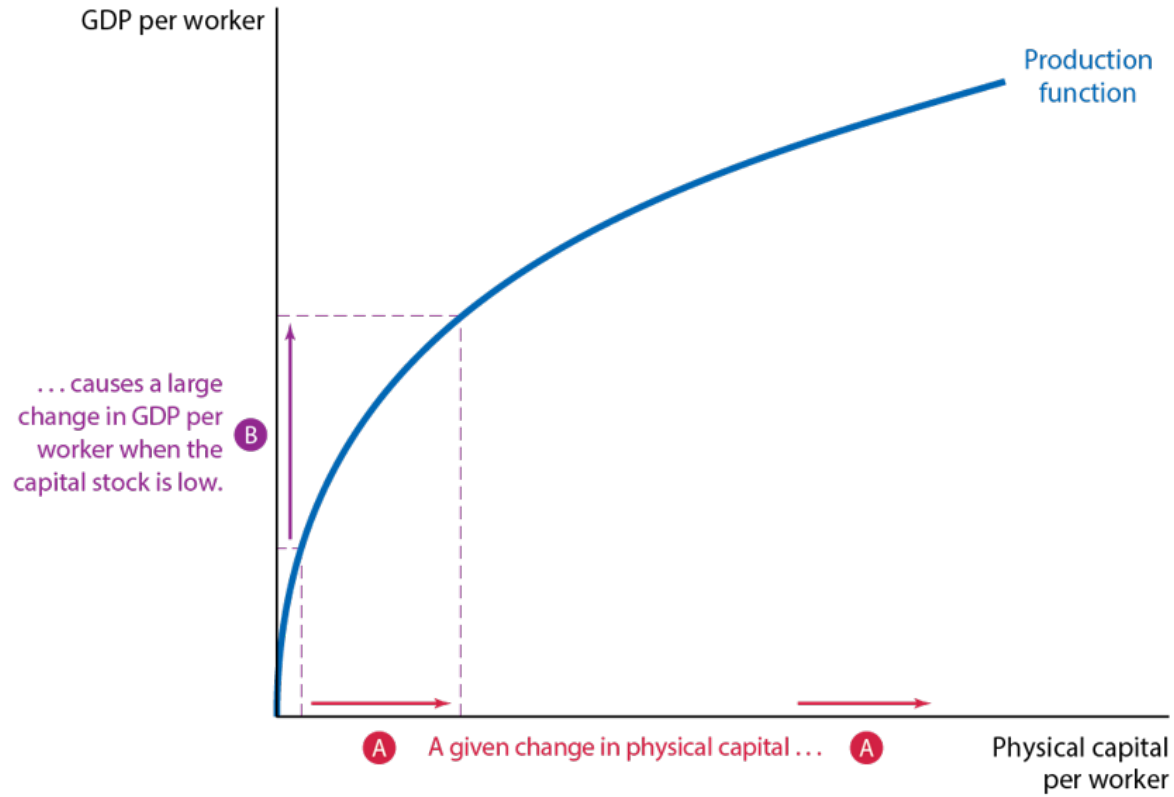
Diminishing Returns to Capital - Step 2

A given increase in physical capital per person raises GDP per worker, but at a diminishing rate.

- (A) A given change in the capital stock will increase GDP per worker, but by how much depends on the how much capital you start with.
- (B) When capital per worker is low to begin with, GDP per worker increases by a lot.



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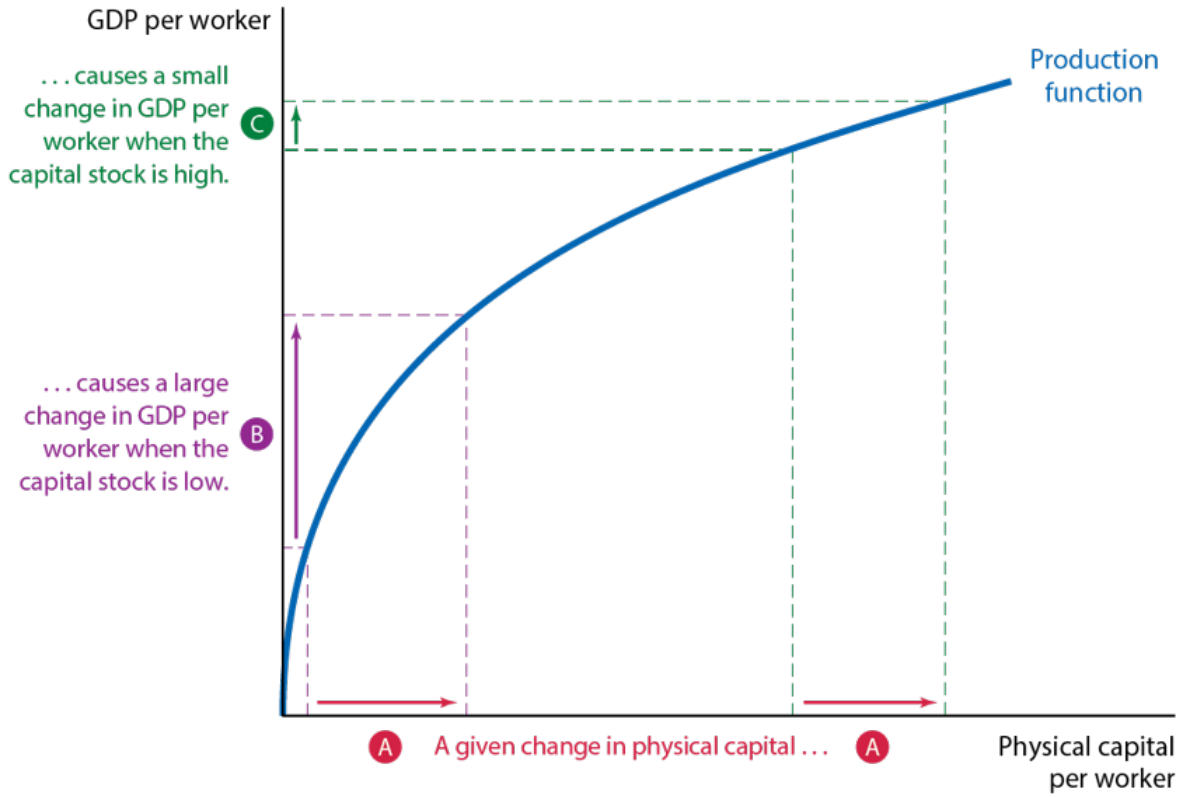
Diminishing Returns to Capital - Step 3

A given increase in physical capital per person raises GDP per worker, but at a diminishing rate.

- (A) A given change in the capital stock will increase GDP per worker, but by how much depends on the how much capital you start with.
- (B) When capital per worker is low to begin with, GDP per worker increases by a lot.
- (C) When capital per worker is high to begin with, GDP per worker increases by less.



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Insight three: Poor countries can enjoy catch-up growth.

- Diminishing returns implies poor countries can catch-up to wealthier ones.
- Investment in capital will have a large return for a relatively poor country.

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Additional Insights into Capital Accumulation: The Solow Model.

- The capital stock will grow as long as investment outpaces depreciation.
- Capital per worker (K/L) will eventually stop growing.

Key take-away of the Solow model

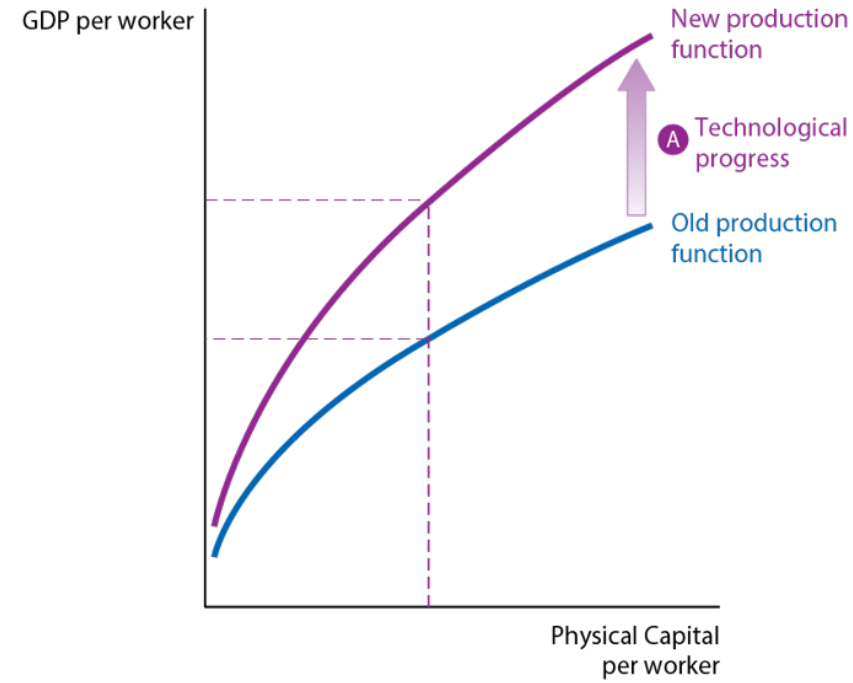
Capital accumulation can't sustain long-term economic growth.

Impact of Technological Progress

- The key to sustained economic growth is technology.
- Technology shifts the production function.
- The shift yields more output for a given capital-labor ratio.

Technological Progress Shifts the Production Function - Step 1

A Technological progress leads to an increase in the output produced with a given set of inputs.



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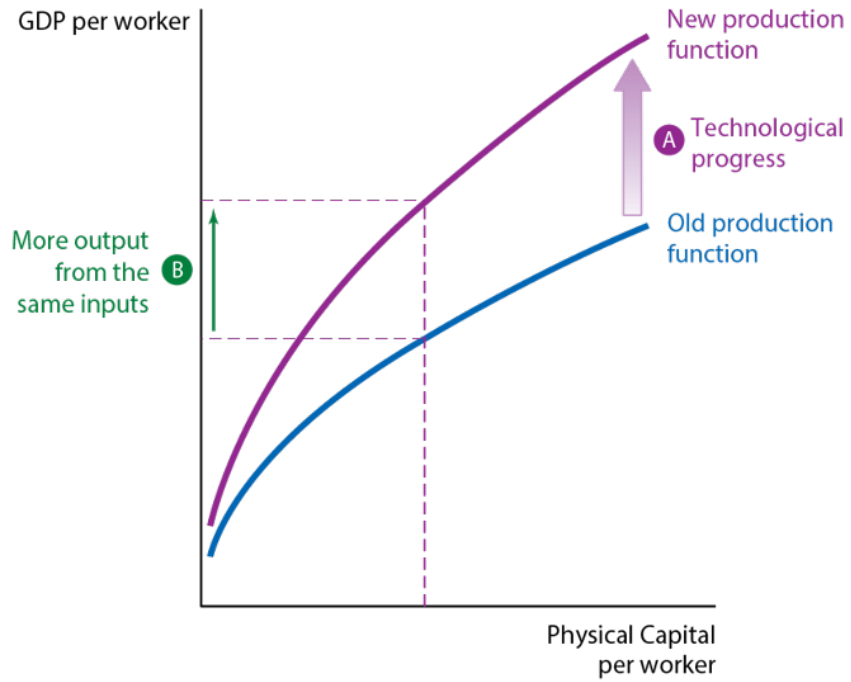
Technological Progress Shifts the Production Function - Step 2

A Technological progress leads to an increase in the output produced with a given set of inputs.

B An economy with a given amount of capital per worker can now produce more output per person than before.



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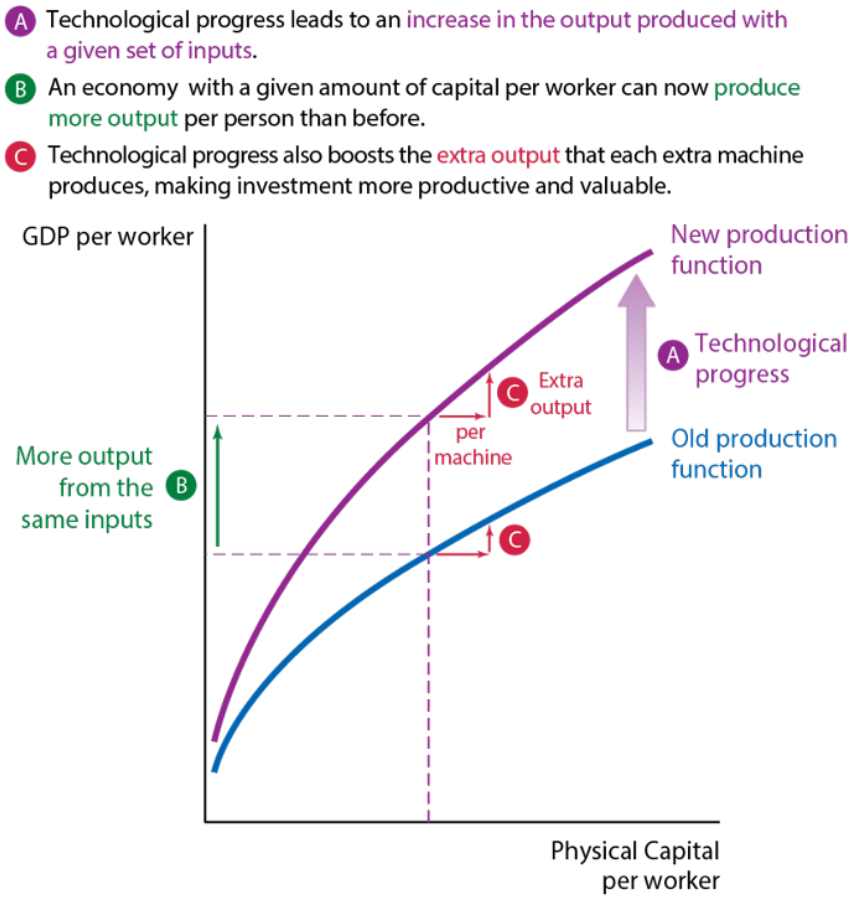
Technological Progress Shifts the Production Function - Step 3



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Where does technological progress come from?

Technological progress relies on new ideas.

Specifically, technological progress is driven by how quickly new ideas are created and how many resources are devoted to generating new ideas.

Why did growth take so long to occur?

- Technological progress requires resources.
- Before the agricultural revolution, there were no spare resources to devote to generating new ideas.
- Agricultural improvements freed people to pursue other tasks including new ideas.

Technological progress allowed us to break the cycle of poverty.

- Thomas Malthus, an 18th-century economist, believed that the world was forever doomed to subsistence living.
- He failed to predict technological progress outpacing population growth.

Is economic growth unlimited?

Economic growth is limited only by our imagination.

Ideas can generate unlimited growth.

New ideas are key to long-run economic growth. Idea-driven economic growth can be sustained because

1. ideas can be freely shared.
2. ideas do not depreciate with use.
3. ideas may promote other ideas.

However, the nonexcludable nature of ideas often leads to too little investment.

Discussion Question: Can we grow forever?

In a 2019 speech at the United Nations, Swedish youth climate activist Greta Thunberg stated

> *People are suffering. People are dying. Entire ecosytems are collapsing. We are at the beginning of a mass extinction and all you can talk about is money and fairytales of eternal economic growth.*

Discuss her quote. Can we have eternal economic growth? If so, what are the costs? If not, why not?

Review: Analyzing where economic growth comes from and if it will continue.

- Increases in output depend on whether constant or diminishing returns to capital exist.
- Diminishing returns means relatively poor countries may be able to catch up.
- The Solow model shows that investment in capital can led to economic growth but that the economy eventually enters into a steady state.
- Sustainable economic growth is driven by new ideas.

Roadmap (4 of 4)

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The Role of Incentives

- Institutions (ex. government) can provide incentives for people to invent new ideas and invest in human or physical capital.
- Key examples are
  1. property rights.
  2. government stability.
  3. efficiency of regulation.
  4. policy to encourage innovation.

How Property Rights Promote Economic Growth

Property rights grant control over a tangible or intangible resource.

Without property rights, there is no incentive to create wealth.

How Government Stability Promotes Economic Growth

A stable government makes economic growth more likely.

Corruption and political instability discourage investment and innovation.

How Efficient Regulation Promotes Economic Growth

Bureaucratic obstacles, including excessive regulatory oversight, can hinder economic growth.

Government Policy to Encourage Innovation and Economic Growth

Government strategies to encourage innovation include the following:

1. Create incentives through intellectual property laws.
2. Subsidize research and development.

Key Takeaways

- The key ingredients to economic growth are labor, human capital, physical capital, and technological progress.
- Capital accumulation leads to growth.
- Technology is key to ongoing growth.
- Institutions can incentivize economic growth.