



# Soochow University International Programs

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2021 SCUIP Winter Session I  
ECON202



# Lecture 5: Production and Growth

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ECON202: Macroeconomics  
Soochow University



# Long Run and Short Run

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- Consider a president who is trying to ensure a bright future for the country and, thereby, his or her place in history.
- This president will want to know about long-run economic theories.
- Now consider a president who is simply trying to get the economy going quickly so he or she will win the next election, which is six months away.
- This president will want to know about short-run economic theories.

# Long Run and Short Run (Cont'd)

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- The solution to a macroeconomic problem depend on
  - whether you want a quick solution or
  - whether you are looking far into the future
- In the next several topics, we will look at long run problems and their solutions.

# Production and Growth

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- A country's standard of living depends on its real GDP per capita.
- At any given point in time, there are vast differences in real GDP per capita – and its annual rate of growth – among countries.
- For any given country, standards of living can change dramatically over time.
- How can we explain these facts?

# Production and Growth (Cont'd)

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- Within a country there are large changes in the standard of living over time.
- This gives us hope that things can get better.
- It also raises the question: Why do standards of living change over time?

# Economic Growth Around the World

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- Living standards, as measured by real GDP per person, vary significantly among nations.
- Why?

# A Picture Is Worth a Thousand Statistics



The United Kingdom is an advanced economy. In 2011, its GDP per person was \$36,010. A negligible share of the population lives in extreme poverty, defined here as less than \$2 a day. A baby born in the United Kingdom can expect a relatively healthy childhood: Only 5 out of 1,000 children die before reaching age 5. Educational attainment is high: Among children of high school age, 98 percent are in school.



# A Picture Is Worth a Thousand Statistics (Cont'd)

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Mexico is a middle-income country. In 2011, its GDP per person was \$15,390. About 5 percent of the population lives on less than \$2 a day, and 16 out of 1,000 children die before age 5. Among those of high school age, 71 percent are in school

# A Picture Is Worth a Thousand Statistics (Cont'd)

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Mali is a poor country. In 2011, its GDP per person was only \$1,040. Extreme poverty is the norm: More than three-quarters of the population lives on less than \$2 per day. Life is often cut short: 176 out of 1,000 children die before age 5. And educational attainment in Mali is low: Among those of high school age, only 31 percent are in school.

# The Variety of Growth Experience

Country	Period	Real GDP per Person		Growth Rate (per year)
		At Beginning of Period <sup>a</sup>	At End of Period <sup>a</sup>	
Brazil	1900–2014	\$ 828	\$15,590	2.61%
Japan	1890–2014	1,600	37,920	2.59
China	1900–2014	762	13,170	2.53
Mexico	1900–2014	1,233	16,640	2.31
Germany	1870–2014	2,324	46,850	2.11
Indonesia	1900–2014	948	10,190	2.10
Canada	1870–2014	2,527	43,360	1.99
India	1900–2014	718	5,630	1.82
United States	1870–2014	4,264	55,860	1.80
Pakistan	1900–2014	785	5,090	1.65
Argentina	1900–2014	2,440	12,510	1.44
Bangladesh	1900–2014	663	3,330	1.43
United Kingdom	1870–2014	5,117	39,040	1.42

<sup>a</sup>Real GDP is measured in 2014 dollars.

The highest number is 7.72 times the smallest.

The highest number is 16.77 times the smallest.



# Economic Growth Around The World

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- The poorest countries have average levels of income that have not been seen in the United States for many decades.
- What did the poor countries do wrong?
- What did the US do right?



# Economic Growth Around The World (Cont'd)

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- Differences in annual growth rates that seem small become large when compounded for many years.
  - Compounding refers to the accumulation of a growth rate over a period of time.
- This gives us hope. Even small increases in growth rates can have a significant effect in the end.

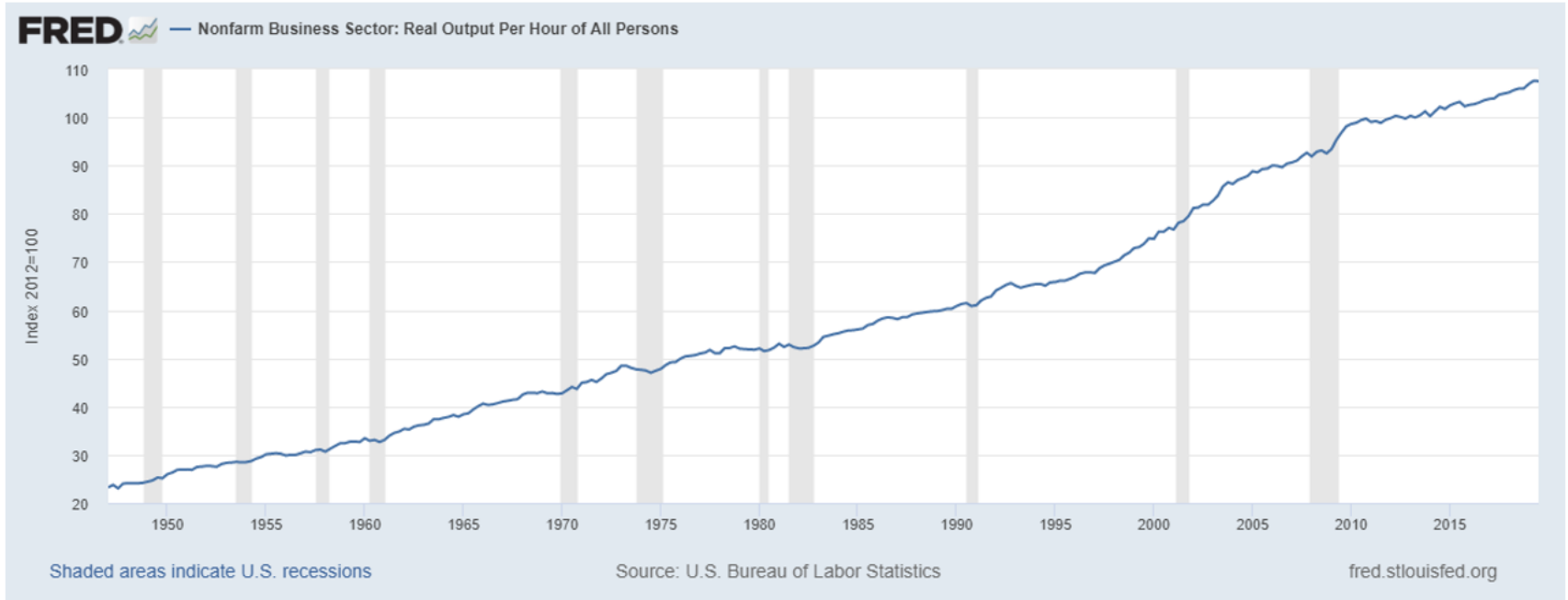


# Productivity is Key

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- **Productivity** refers to the market value of the goods and services that a worker can produce from each hour of work.
- Productivity plays a key role in determining living standards for all nations in the world.
- People in high-productivity countries produce
  - more per hour, and
  - things that can be sold at higher prices

# Productivity: Output per Hour



# Determinants of Productivity

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- Factors of Production
  - Physical capital per worker
  - Human capital per worker
  - Natural resources per worker
- Technological knowledge
- Government policies





# Physical Capital

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- **Physical Capital** is the stock of equipment and structures that are used to produce goods and services.
  - Tools used to build or repair things.
  - Computer software
  - Office buildings, factory buildings, shopping malls, schools, etc.
  - Infrastructure, such as, railway lines, bridges, etc.  
(These are usually provided by governments)

# Physical Capital (Cont'd)

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- Physical capital is a produced or human-made factor of production.
- At any given date, more physical capital means fewer consumer goods.
- This is an unavoidable tradeoff.



# Human Capital

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- **Human Capital** refers to the knowledge and skills that workers acquire through education, training, and experience.
  - Like physical capital, human capital raises a nation's ability to produce goods and services.
  - Like physical capital, at any given date human capital can be acquired only by sacrificing current consumption.
  - This is an unavoidable tradeoff.

# Natural Resources

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- **Natural Resources** are inputs used in production that are provided by nature
  - Example: land, rivers, and mineral deposits
  - Renewable resources include trees and forests
  - Non-renewable resources include petroleum and coal
- The search for reserves of natural resources such as petroleum and coal – or the purchase of these resources from elsewhere – usually requires a sacrifice of current consumption.



# Technological Knowledge

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- **Technological Knowledge** refers to our scientific understanding of the best ways to produce various goods and services.
- Human capital, which we saw earlier, refers to the resources expended in transmitting this understanding to the labor force.
- Increases in technological knowledge require investment in research and development.
- This usually requires a sacrifice of current consumption.

# Government

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- The availability of physical capital, human capital, natural resources, and technology does not guarantee that these resources will be properly utilized.
- Government must:
  - provide proper incentives for households and firms in private sector
  - provide public goods and conserve common resources
  - ensure law and order

# Case Study: Are natural resources a limit to economic growth?

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- Not necessarily
- Innovation has enabled us to do more and more with less and less
- Prices of most natural resources (adjusted for inflation) have actually been stable or falling.

# Economic Growth and Public Policy

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- Government policies that raise productivity and living standards include policies that:
  - Encourage saving and investment
  - Encourage investment from abroad
  - Encourage education and training
  - Establish secure property rights and maintain political stability
  - Promote free trade
  - Promote research and development
  - Provide roads, bridges, and other infrastructure



# The Importance of Saving and Investment

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- If we use fewer resources to produce consumption goods, we will have more resources to
  - Produce physical capital
  - Acquire human capital through education
  - Increase our technological knowledge by doing research and development



# The Importance of Saving and Investment (Cont'd)

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- But there is a tradeoff: more saving means less current consumption
  - It is not clear whether government should encourage individuals to sacrifice current consumption for the sake of a brighter future.
- Moreover, the accumulation of physical capital is subject to diminishing returns and the catch-up effect.

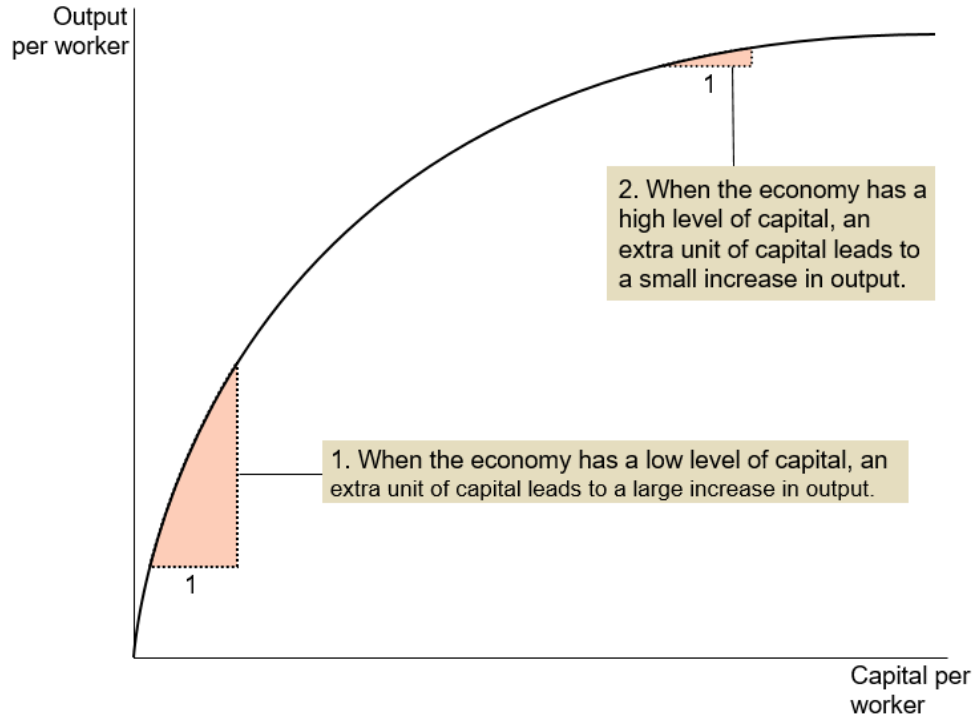


# Diminishing Returns and the Catch-up Effect

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- As the stock of capital rises, the extra output produced from an additional unit of capital falls
  - this property is called **diminishing returns**
- Because of diminishing returns, an increase in the rate of investment in physical capital leads to higher growth only for a while.

# Illustrating Diminishing Returns



# Diminishing Returns and the Catch-up Effect (Cont'd)

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- In the long run, a higher rate of investment in physical capital leads to a higher level of productivity and income, but not to faster growth of productivity and income.
- Saving and investment must be used intelligently, not just to accumulate more and more physical capital, but to pay for education and research and automation.

## Diminishing Returns and the Catch-up Effect (Cont'd)

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- The **catch-up effect** implies that poor countries would grow more rapidly than rich countries that are otherwise similar.
  - From 1960 to 1990, the United States and South Korea devoted a similar share of GDP to investment. Yet the United States experience mediocre annual growth of about 2%, while South Korea experienced spectacular growth of more than 6%.



# The Importance of Saving and Investment (Cont'd)

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- Also, investment (in physical capital, human capital, and technological knowledge) can be done with foreign resources, by removing barriers to foreign investment.
  - However, part of the output produced with the help of foreign investment will, naturally, go to the foreigners who made the investment.

# Investment from Abroad

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- Governments can increase capital accumulation and long-term economic growth by encouraging investment from foreign sources.
- Investment from abroad takes several forms:
  - Foreign Direct Investment  
Capital investment owned and operated by a foreign entity
  - Foreign Portfolio Investment  
Investments financed with foreign money but operated by domestic residents



# Investment from Abroad (Cont'd)

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- Foreign investors will take their earnings – interest and profits – back to their own currencies.
- Still, foreign investment creates jobs and raises productivity and wages.
- Foreign direct investment is one way of poor countries to learn and use of state-of-the-art technologies.

# Investment from Abroad (Cont'd)

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- For poor countries, foreign investment may be the only route to progress, especially if their incomes are barely enough to cover their essential consumption needs.
- To attract foreign investment, governments must
  - protect the property rights of investors and
  - provide adequate infrastructure (roads, ports, etc.)

# Education

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- For a country's long-run growth, education is at least as important as investment in physical capital.
  - In the United States, each year of schooling raises a person's wage, on average, by about 10 percent.
  - In poor countries, the payoff is even larger.
  - Thus, one way the government can enhance the standard of living is by building schools and providing subsidies to students.

# Education (Cont'd)

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- An educated person might generate new ideas that might expand society's pool of knowledge and provide an **external benefit** to others.
  - When deciding how much education to acquire, the typical individual pays attention to the prospect of earning higher wages but ignores the external benefit of his education to the rest of society.
  - Therefore, it makes sense for the government to give individual a subsidy as an extra incentive to go to school.



# Education (Cont'd)

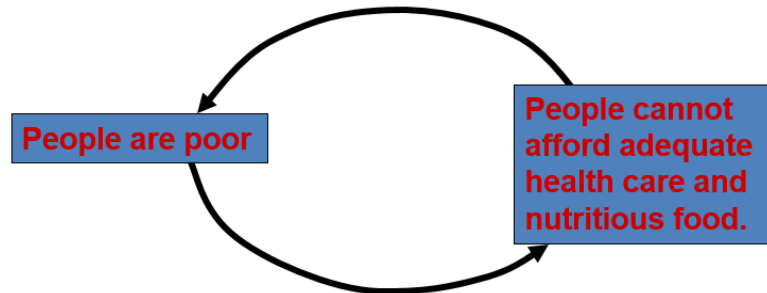
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- One problem facing some poor countries is the brain drain – the emigration of many of the most highly educated workers to rich countries.
  - If the recipient of education subsidies in a poor country emigrates to a rich country, the poor country loses its investment and the rich country gains a worker who was educated at another country's expense.

# Health and Nutrition

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- Less healthy workers are less productive.
- Less healthy workers impose an **external cost** on the rest of society: they can infect others.
- Countries can get caught in a vicious cycle.
  - This provides a justification for government efforts to encourage saving and investment to push economic growth.



# Robert Fogel's Research

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- In Great Britain in 1780, about one in five people were so malnourished that they couldn't do manual labor.
- As nutrition improved, so did productivity
  - The causation probably runs both ways: better nutrition makes us more productive and higher productivity makes better nutrition affordable.



# Robert Fogel's Research (Cont'd)

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- As nations get richer, people eat more, and the population gets taller.
  - From 1775 to 1975, the average caloric intake in Great Britain rose by 26 percent, and the height of the average man rose by 3.6 inches.
  - From 1962 to 1995, the average caloric intake in South Korea rose by 44 percent, and the height of the average man rose by 2 inches.
- Studies have found that height is an indicator of productivity.
  - Taller workers tend to earn more, especially in poor countries.





# Property Rights and Political Stability

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- **Property rights** refer to the ability of people to exercise authority over the resources they own.
  - Enforcement of property rights is an important prerequisite for the free-market system to work.
  - It is necessary for investors to feel that their investments are secure.  
(This requires a stable political and judicial system)

# Free Trade

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- Trade is, in some ways, a type of technology.
- A country that eliminates trade restrictions will experience the same kind of economic growth that would occur after a major technological advance.
  - Suppose a country's opportunity cost of a ton of wheat is 5 tons of rice. If this country can import a ton of wheat by exporting 3 tons of rice, it is as if the country's technology has improved.

# Free Trade (Cont'd)

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- Some countries engage in ...
  - ... inward-oriented trade policies, avoiding interaction with other countries
  - ... outward-oriented trade policies, encouraging interaction with other countries
- A country that adopts inward-oriented policies will have to make everything it needs, including the things it can't produce efficiently.

# Free Trade: Geography

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- Trade depends not only on government policy but also on geography.
- Countries with natural seaports find it easier to trade and prosper.
- Many of the world's major cities are located close to oceans.
- Africa has suffered because many of its countries are landlocked.

# Research and Development

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- The advance of technological knowledge has led to higher standards of living.
  - Most technological advance comes from research by private firms and individual inventors.
  - Government can encourage the development of new technologies through research grants, tax breaks, and the patent system.
- New knowledge has [external benefits](#).
- Private researchers will consider only the gains that they can get from their innovations; they will ignore the external benefits.
- Therefore, it makes sense for the government to subsidize or fully fund research, especially on basic or fundamental science that is valuable but will not be done by private businesses.



# Population Growth

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- Population growth affects the per capita availability of other factors of production:
  - Stretching natural resources
  - Diluting the capital stock
  - Promoting technological progress
- The overall effect of population growth on economic growth is ambiguous.
- It is, therefore, unclear what the government should do about population growth.

# Stretching Natural Resources

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- Thomas Malthus (1766-1834) had argued that, because of diminishing returns in agriculture, food production could not keep pace with population growth, leading to widespread famines.
- Boy was he wrong!
  - Although the world's population has increased six fold over the past two centuries, living standards are on average much higher today.
  - Diminishing returns lost out to human ingenuity.



# Diluting the Capital Stock

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- If each family has a large number of children, it would be difficult to ...
  - ... Educate them all. The kids may grow up with less human capital, as a result.
  - ... equip them all with the necessary physical capital



# Promoting Technological Progress

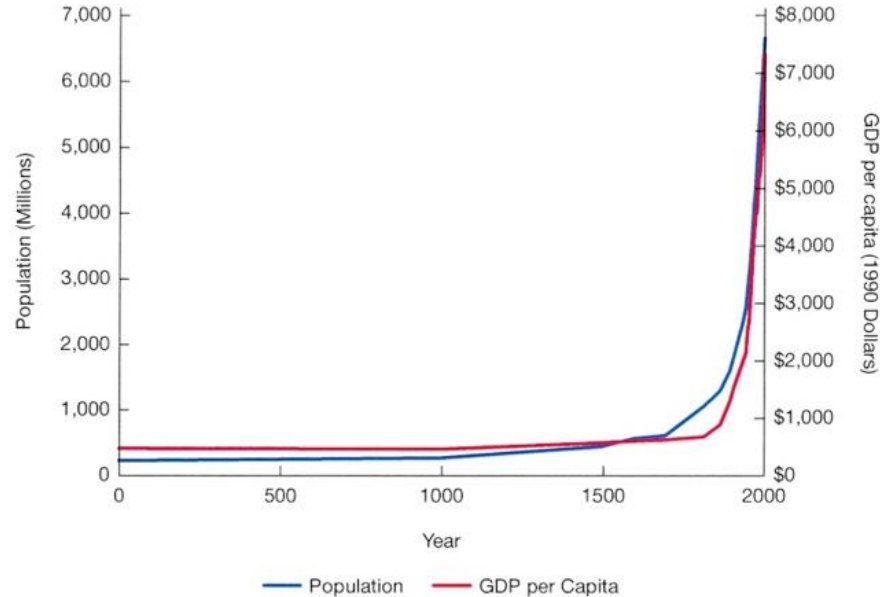
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- If there are more people,
  - There are more scientists, inventors, and engineers to contribute to technological advance.
  - There is a larger market for innovative goods. This increases the incentive to innovate.
- Over the broad span of human history, the world's rate of economic growth has increased as world population has.
- Some countries are using economic incentives to encourage population growth.  
e.g. Greece, Hungary, Italy

# Alternative Perspectives on Population Growth

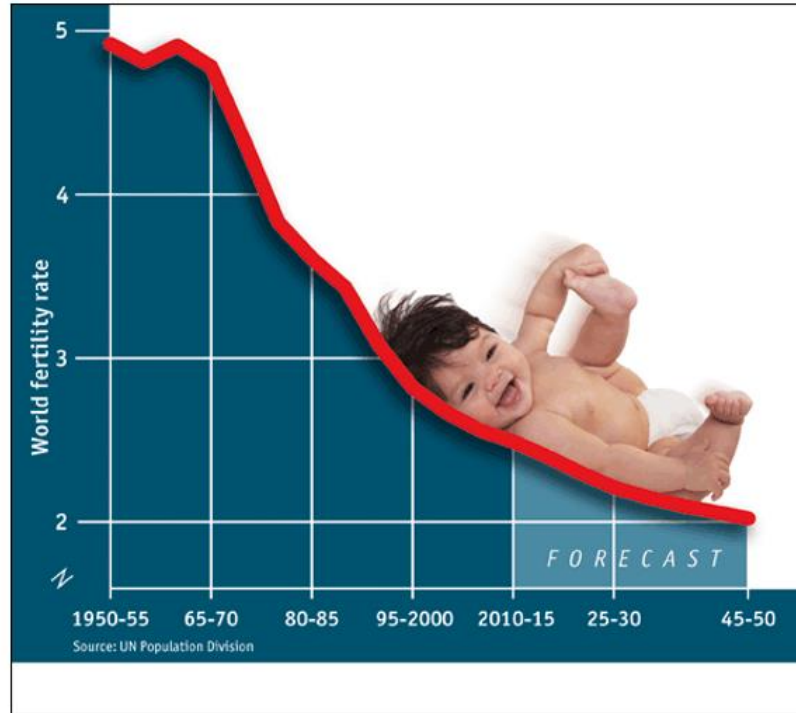
## World Population and Per-Capita GDP over the Very Long Run

World population has steadily grown from a little over 200 million people at the beginning of the Christian era to over six billion today, while per-capita GDP has risen dramatically, from under \$500 to over \$7,000 currently. Higher population appears to be positively associated with higher living standards, as endogenous growth theory predicts.



Source: Maddison, Angus. *Historical statistics, population and per capita GDP levels, 1-2006*. [www.ggdc.net/maddison/](http://www.ggdc.net/maddison/)

# The Economist, October 29, 2009



Once the fertility rate reaches 2.1 children per woman, the world's population will stabilize

# What Makes A Nation Rich?

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- According to Daron Acemoglu, an MIT economist, the answer is ...
- Government!
- Poor people are poor because they made the wrong choices.
- They made the wrong choices because their governments gave them the wrong incentives.
- Fix government to fix poverty.

# What Makes A Nation Rich? (Cont'd)

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- A NASA image released this week shows a recent night view of the Korean Peninsula.
- Apart from a spot of light in Pyongyang, North Korea is mostly cloaked in darkness, with South Korea (bottom right) on the side.



# What Makes A Nation Rich? (Cont'd)

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- The Mexico-USA border fence splits Nogales into two halves that are identical in every way except government.
- Median household income is \$30,000 on the USA side and \$10,000 on the Mexico side.





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