Economic Growth and Development

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November 29, 2021
Outline

• Economic Growth:
  o Why do the richest countries grow at 2% per year?

• Economic Development:
  o Why are some countries 50x richer than others?
Name that Country

• Life expectancy is less than 50 years

• 1 out every 10 infants dies before the age of one

• More than 90% of households have no electricity, refrigerator, telephone, or car

• Fewer than 10% of adults have completed high school.

What country is it?
Name that Country

- Life expectancy is less than 50 years
- 1 out every 10 infants dies before the age of one
- More than 90% of households have no electricity, refrigerator, telephone, or car
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What country is it?

The United States circa 1890!
The Power of Economic Growth

• In just a century, the U.S. is completely transformed
  ○ Almost all households have electricity, refrigerators, cell phones, and cars
  ○ Overwhelming majority graduates from high school, many college
  ○ New goods: air-conditioning, dishwashers, jet planes, skyscrapers, contraception, smartphones

• Health: Life expectancy in 1900 = 50 years, today 79 years
  ○ The richest person in the world in the mid 1800s — the great European financier Nathan Rothschild — died from an infection that $10 of antibiotics would cure today.
GDP per Person has Grown by a Factor of 15 since 1870

PER CAPITA GDP (2020 DOLLARS)
U.S. Long-Run Economic Growth

2.0% per year
Rule of 70

• Simple rule for growth rates and “years to double”

\[
\text{Years to Double} = \frac{70}{g}
\]

• Or you can use to calculate the growth rate:

\[
g = \frac{70}{\text{Years to Double}}
\]

• Example:
  o \( g = 2\% \Rightarrow \text{Years to Double} = 35 \) (U.S.)
  o \( g = 7\% \Rightarrow \text{Years to Double} = 10 \) (China, India)
  o \( \text{Years to Double} = 25 \Rightarrow g \approx 3\% \)
The Theory of Economic Growth

• Where does long-run growth come from?
  ○ The discovery of new ideas and technologies!

• Ideas are special (Paul Romer, 2018 Nobel Laureate)
  ○ Standard goods: barrel of oil, hour of a surgeon’s time
  ○ Ideas: calculus, HTML, chemical structure of a new drug

  *Ideas are infinitely usable*

• Implication for economic growth:

  Standard good: Income per person \( \propto \) Computers per person

  Ideas: Income per person \( \propto \) Ideas (not per person!)

  *Each invention potentially makes everyone better off!*

  *E.g. semiconductors, the WWW, mRNA vaccines*
Framework for Understanding Frontier Growth

• Growth models often work like this:

\[
\text{Economic growth} = \text{Research productivity} \times \text{Research effort}
\]

• Let’s look at some data to see what we can learn...
Moore’s Law – Steady exponential growth

The curve shows transistor count doubling every two years.
Summary of Evidence

- Moore’s Law
  - 18x harder today to generate the doubling of chip density
  - Have to double research input every 10 years!

- Qualitatively similar findings in rest of the economy
  - Agricultural innovation (yield per acre of corn and soybeans)
  - Medical innovations (new drugs or cancer mortality)
  - Publicly-traded firms
  - Aggregate economy

*New ideas are getting harder to find!*
Implications for Growth Theory

• Where does long-run growth come from?

\[
\text{Economic growth} = \text{Research productivity} \times \text{Research effort}
\]

2% ↓ (falling) ↑ (rising)

• Ideas are getting harder and harder to find

• A “Red Queen” model of economic growth:

We have to run faster and faster just to maintain constant exponential growth at 2%
Recent Growth in GDP per Person

Average growth in GDP per person over the preceding decade
Research Employment in Select Economies

**European Union (15 countries)**
- 1981-2002: 3.7%
- 2002-2015: 3.1%

**United States**
- 1981-2002: 3.2%
- 2002-2014: 2.1%

**Japan**
- 1981-2002: 3.3%
- 2002-2015: 0.5%
U.S. R&D Spending Share

SHARE OF GDP

0% 1% 2% 3% 4% 5% 6%


Software and Entertainment
Government R&D
Private R&D
Average Income: Top 0.1% and Bottom 99.9%

THOUSANDS OF 2009 CHAINED DOLLARS

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Bottom 99.9%</th>
<th>Top 0.1%</th>
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<tbody>
<tr>
<td>1920</td>
<td>5.4</td>
<td>0.72%</td>
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<tr>
<td>1930</td>
<td>11.0</td>
<td>2.30%</td>
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<tr>
<td>1940</td>
<td>14.2</td>
<td>1.82%</td>
</tr>
<tr>
<td>1950</td>
<td>18.6</td>
<td>6.86%</td>
</tr>
<tr>
<td>1960</td>
<td>24.0</td>
<td>0.72%</td>
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<td>1970</td>
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<td>1980</td>
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<td>1990</td>
<td>51.2</td>
<td>6.86%</td>
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<tr>
<td>2000</td>
<td>64.0</td>
<td>2.30%</td>
</tr>
<tr>
<td>2010</td>
<td>72.8</td>
<td>1.82%</td>
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The Future of U.S. Growth?

• Headwinds
  ○ Ideas are getting harder to find
  ○ Educational attainment is leveling out
  ○ Population growth slowing in advanced countries

• Tailwinds
  ○ China and India (each as populous as US/Japan/Europe)
  ○ How many future Thomas Edisons and Jennifer Doudnas are waiting to realize their potential?

• Uncertainties
  ○ The shape of the future idea production function?
  ○ To what extent can machines/AI substitute for labor/researchers?
You will likely be 3 times richer than your grandparents!

PER CAPITA GDP (RATIO SCALE, 2020 DOLLARS)
Economic Development
Shanghai 1987
Why are some countries so much richer than others?

- Through the lens of a production function
  - Inputs versus productivity?

- Why do some countries have more inputs? Why more efficient?
  - Rules, institutions

- How do we understand “catch-up” growth?
The Cobb-Douglas Production Function

• The most common production function in all of economics:

\[ Y = \bar{A}K^{1/3}L^{2/3} \]

• Why constant returns to scale?
  ○ The standard replication argument...
  ○ Implies \( y = \bar{A}k^{1/3} \) where \( y \equiv Y/L \) and \( k \equiv K/L \)

• Why the exponents of 1/3 and 2/3?
  ○ The “labor share” of GDP...
The Importance of Capital versus TFP

• Which is more important in explaining income differences across countries?

• Compare the five richest and five poorest economies:

$$\frac{y_{rich}}{y_{poor}} = \frac{\bar{A}_{rich}}{\bar{A}_{poor}} \cdot \left(\frac{k_{rich}}{k_{poor}}\right)^{1/3}$$

70
14
5

• TFP is about three times as important as capital.
  ◦ So TFP accounts for 3/4 of cross-country income differences and capital accounts for 1/4.

*Poor countries are poor partly because of few inputs but also b/c of inefficiency in using those inputs.*
Why???

Why fewer inputs and why less efficiency?
What is this?
North versus South Korea: Institutions Matter!
Institutions, Property Rights, and Rule of Law

• Mancur Olson’s “natural experiments”
  ○ North vs. South Korea, East vs. West Germany, Rio Grande, China vs. Hong Kong, China since 1978

• Adopting bad policies can reduce incomes substantially
  ○ China’s Great Leap Forward (1960) – 30 million people died
  ○ Venezuela today – GDP has fallen by 60% since 2013

• But which institutions and policies?
  ○ Some governments “get it wrong” on purpose, because that maximizes their own rewards.
Misallocation and TFP

- Why do differences in institutions show up in TFP?
Misallocation and TFP

• Why do differences in institutions show up in TFP?

• Suppose economy = two firms making textiles
  (a) Not very productive, but owned by the Prime Minister’s sister
  (b) A small, dynamic startup — much more productive

  Good connections and bad property rights ⇒ the less productive firm is “favored” by loans, subsidies, etc.

• TFP = how efficiently resources are allocated
  o All inputs to low productivity firm ⇒ low TFP
  o Inputs allocated efficiently (e.g. markets/competition) ⇒ high TFP
FT Global 500 Startups in US vs Europe (creative destruction)

Source: http://www.economist.com/node/21559618
TFP in Advanced Economies

TOTAL FACTOR PRODUCTIVITY (2000=100)
Misallocation in the United States
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- Sandra Day O’Connor, Supreme Court Justice (1981–2006)
  - Graduated 3rd in her class at Stanford Law School, 1952
  - Only job offer in the private sector: legal secretary
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- Consider white men in U.S. business:
  
  1960: **94%** of doctors, lawyers, and managers
  
  2010: **60%** of doctors, lawyers, and managers
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• Over the past 50 years, the U.S. allocation of talent has improved! Accounts for
  ○ 40% of growth in GDP per person, and
  ○ 20% of growth in GDP per worker
Catch-Up Dynamics

Why are India and China growing at 7% per year?
The Dynamics of Catch-Up Growth

YEARS SINCE START OF RAPID GROWTH

GDP PER PERSON (US=100)

Japan

S. Korea

Taiwan

China

India
Investment in Physical Capital

**Graph: Investment in Physical Capital**

- **Y-Axis:** PERCENT OF GDP
- **X-Axis:** YEAR (1950-2020)

Lines represent:
- **Japan**
- **China**

Key points:
- Japan's investment consistently increases from 1950 to 2020.
- China's investment sharply increases starting around 2000.

Legend:
- China
- Japan
The Distribution of World Population by Income

1960: 2 out of 3 people lived on less than $7 per day.
2017: Only 1 out of 12!
Nobel Prize, 2019: RCTs in Development

• Abhijit Banerjee, Esther Duflo, and Michael Kremer
  ○ Break the “big” development problem down into many smaller problems
  ○ Study these problems using randomized controlled trials (RCTs), like in medicine

• Example: Which interventions improve education?
  ○ Giving schools free textbooks and flipcharts (no)
  ○ De-worming medicines for students (mixed)
  ○ Monitoring that teachers actually show up (yes)

• Stanford faculty Pascaline Dupas, Kate Casey, Arun Chandresekhar, Melanie Morten and others
Conclusion

- Differences in rates of economic growth matter more than almost anything else in the long run
  - Responsible for enormous improvements in living standards
  - Around the world and in the U.S.

- Institutions, property rights, and ideas matter
  - Incentives to create and use ideas
  - Allocating inputs to their most productive uses
Extra slides
Commodity Prices over the Long Run

EQUALLY-WEIGHTED PRICE INDEX (INITIAL VALUE IS 100)

What is graphed here?
World Growth over the Very Long Run

INDEX (1.0 IN INITIAL YEAR)

Per capita GDP

Population