Understanding the World Economy
Master in Economics and Business

Why are some countries richer than others? – Part 2

Lecture 2

Nicolas Coeurdacier
nicolas.coeurdacier@sciencespo.fr
Lecture 2: Why are some countries richer than others? – Part 2

1. Do countries catch up with economic leaders?

2. Institutions and growth

3. R&D and growth
Reminder
Output per worker growth ($g_y$) dynamics in the Solow model

Countries starting further away from their steady-state capital stock are growing at a faster pace.

Zero growth from capital accumulation

$g_y$ vs $k_t$
Do countries converge?

• According to the Solow growth model, poorer countries (in terms of capital stock per worker) should grow faster.

• Does it hold in the data?

• Investigate link between future growth and initial income per capita.
Do economies converge?
Round I: Advanced economies
Do economies converge?  
Round II: The U.S. states

Figure 11.2  
The average growth rate of state per capita income for 1880–2000, shown on the vertical axis, is negatively related to the log of per capita income in 1880, shown on the horizontal axis. Thus, absolute β convergence exists for the U.S. states.
Do economies converge?
Round III: European Regions

Figure 11.8
Growth rate from 1950 to 1990 versus 1950 per capita GDP for 90 regions in Europe. The growth rate of a region’s per capita GDP for 1950–90, shown on the vertical axis, is negatively related to the log of per capita GDP in 1950, shown on the horizontal axis. The growth rate and level of per capita GDP are measured relative to the country means. Hence, this figure shows that absolute $\beta$ convergence exists for the regions within Germany, the United Kingdom, Italy, France, the Netherlands, Belgium, Denmark, and Spain. The numbers shown identify the regions; see table 11.9.
Do countries converge?
Round V: The World

If economies converge then expect negative correlation: countries with high GDP in 1960 should grow more slowly as capital earns a low return.

Source: PWT
The convergence puzzle

• According to theory, poorer countries should catch-up with advanced economies.
• In the data, prediction holds when looking at similar regions/countries...
• … But does not hold when looking at the whole sample of countries.
• Convergence puzzle?
Decreasing returns to capital and capital flows

Crucial implication

• With decreasing returns to capital, a country with a low level of capital stock should have a higher marginal product of capital.
• Investing in poor countries should bring higher returns.
• Capital should flow towards poor countries.
Countries with low levels of capital should have higher returns on capital.

Marginal Product of Capital

![Graph showing the relationship between capital and marginal product. The curve decreases as capital increases, indicating diminishing returns.](Image)
The Lucas Puzzle

- Low level of capital per worker in poorer countries should imply higher returns to capital in these countries.
- In theory capital should massively flow towards poorer countries.
- In the data, low level of capital flows to poorer countries and often in the wrong direction. Many developing markets are lending to rich countries.
Reconciling the evidence

• When we look at all economies no evidence of convergence.

• When we examine very similar countries strong evidence of convergence.

• How can we explain this mixed evidence concerning convergence?

- take into account that steady states can differ across countries!
Output, TFP and capital per worker

Output per worker in a country such that:

\[ \text{Output per worker} = y = Ak^\alpha \]

\[
\frac{y_{\text{China}}}{y_{US}} = \left(\frac{A_{\text{China}}}{A_{US}}\right) \left(\frac{k_{\text{China}}}{k_{US}}\right)^\alpha
\]

Differences in output per worker across countries should reflect:
- differences in capital stock per worker
- differences in technology \( A = \text{Total Factor Productivity TFP} \)
China is poorer than the U.S. because of a lower TFP and because of a lower capital stock.
Differences in TFP are crucial to understand differences in income per capita. Differences in capital stock matters but to a smaller extent.

<table>
<thead>
<tr>
<th>Country</th>
<th>Observed capital per person, $k$</th>
<th>Predicted per capita GDP with U.S TFP</th>
<th>Observed per capita GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1.269</td>
<td>1.083</td>
<td>0.966</td>
</tr>
<tr>
<td>Japan</td>
<td>1.178</td>
<td>1.056</td>
<td>0.760</td>
</tr>
<tr>
<td>Italy</td>
<td>0.926</td>
<td>0.975</td>
<td>0.686</td>
</tr>
<tr>
<td>Spain</td>
<td>0.840</td>
<td>0.944</td>
<td>0.661</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.671</td>
<td>0.876</td>
<td>0.828</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.174</td>
<td>0.559</td>
<td>0.201</td>
</tr>
<tr>
<td>South Africa</td>
<td>0.162</td>
<td>0.546</td>
<td>0.182</td>
</tr>
<tr>
<td>China</td>
<td>0.147</td>
<td>0.528</td>
<td>0.172</td>
</tr>
<tr>
<td>India</td>
<td>0.061</td>
<td>0.394</td>
<td>0.084</td>
</tr>
<tr>
<td>Burundi</td>
<td>0.006</td>
<td>0.180</td>
<td>0.010</td>
</tr>
</tbody>
</table>
Differences in TFP crucial to understand differences in income per capita.
Conditional convergence

• The Solow model does not predict convergence unconditionally.

• *Everything else equal*, countries with lower capital stock should grow faster.

• Countries with same steady-state should converge

  = *conditional convergence*

• Countries with lower TFP should not catch-up.

• Importance for growth is *distance from steady-state* which can be different across countries.
Conditional convergence: an illustration
Which country should grow faster?

\[ I = \delta k \]

\[ sA^{US} k^\alpha = sA^{Canada} k^\alpha \]

Initial conditions:
\[ A^{Rwanda} < A^{US} = A^{Canada} \]
\[ k^{Rwanda} < k^{Canada} < k^{US} \]
Conditional convergence

• Only when countries share the same steady state should we see convergence. Explains why only see evidence for convergence amongst similar countries.

• Explains why many African countries do not catch up with Europe/U.S.

• Suggests that wealthier economies will persistently stay wealthier, but within wealthier economies should see evidence of catch up.

• The big question is what determines countries steady states and more specifically countries TFP?
An answer to the Lucas Puzzle?

- The marginal productivity of capital of a country depends on the level of capital but also on the efficiency at which the capital is used.

- If countries with low levels of capital have also lower technology (lower TFP), marginal product of capital can be equalized across countries.

- Contrary to Lucas’ intuition, data show small differences in the marginal product of capital across countries (Caselli and Feyrer (2007)).
If countries with low levels of capital have also lower TFP, marginal product of capital can be equalized across countries.
Production function

Output produced

Buildings and machinery

Labour input

Technical knowledge and efficiency

Rest of the lecture focuses on third input – TFP
What is behind TFP?

Two main aspects to TFP

I) Efficiency

A country may use its factors of production inefficiently and produce below the possibility frontier e.g., bureaucratic obstacles, poor institutions, etc.

II) Technology

A country may produce at the production possibility frontier but improvements in technology push the frontier out and enable more output to be produced for given factors of production
The double-dividend of TFP

Output per worker

$y = Ak^\alpha$

$\uparrow$

Higher $A$

$k^* \rightarrow k^{**}$

Capital per worker $k$
Lecture 2 : Why are some countries richer than others? – Part 2

1. Do countries catch up with economic leaders?

2. Institutions and growth

3. R&D and growth
What is behind TFP?

Two main aspects to TFP

I) **Efficiency**

   A country may use its factors of production inefficiently and produce below the possibility frontier e.g., bureaucratic obstacles, poor institutions, etc.

II) **Technology**

   A country may produce at the production possibility frontier but improvements in technology push the frontier out and enable more output to be produced for given factors of production.
What are institutions?

• Wide ranging concept

• “rules of the game” – formal and informal constraints on political, economic and social interactions.

• Particular organisational entities, procedural devices, regulatory frameworks.

• “Good” institutions establish incentives to reduce uncertainty and encourage efficiency.
Measuring institutions

Institutional factors have many dimensions. Just as for firms the internal organisation of countries matter.

- Legal system - Rule of law
- Protection of Property Rights
- Political Institutions
- Educational Institutions and Allocation of Talent
- Financial Institutions
- Regulatory Institutions
- Institutions for Macroeconomic Stabilization
- Institutions for Social Insurance...
World Bank Governance Indicators – Top 20

[Bar chart showing the top 20 governance indicators with countries like Norway, Sweden, Netherlands, Luxembourg, Denmark, and others listed.]

Source: World Bank, 2009
World Bank Governance Indicators – Bottom 20

Source: World Bank, 2009
Better institutions lead to higher GDP per capita?
Institutions and growth

• Does better institutions increase output per capita or the other way around?
• Institutions are endogenous to the process of development.
• Correlation is not causality.

• How can we identify the sense of the causality?
  – Find ‘exogenous changes’ in institutions in a given country (or a set of countries) and then look at growth outcomes.
  – ‘Natural experiment’.
  – ‘Instrumental variables’.

• Acemoglu, Johnson, Robinson (2001).
Do institutions matter – North and South Korea

GDP per capita

- South Korea
- North Korea
Do institutions matter – North and South Korea

Satellite Image of North and South Korea at Night, 2008
The colonial origins of comparative development

Figure 1. Reduced-form relationship between income and settler mortality

Source: Acemoglu, Johnson and Robinson (2001)
Institutions and rent seeking

• Economies flourish when institutions provide the right incentives
• Effort and investment in order to create value should be rewarded.
• Bad institutions encourage “rent seeking”, that is:
  – do not reward value creation
  – do reward value extraction

• Direct effect: waste of talent
• Indirect effect
  – Rent seeking is like a tax
    • Positive NPV projects may not be undertaken
  – Misallocation of resources
    • Dominated projects are selected. Negative NPV projects are undertaken
Institutions and rent seeking

• Kleptocracy
  – Equatorial Guinea

• This is an extreme case, is there a systematic effect?
  – Curse of raw materials
  – Doing business hurdles & corruption
The “Curse” of Raw Materials

Often find that countries rich in raw materials have disappointing growth.

Different potential channels

• Voracity effect – raw materials subverts institutions and leads to rent seeking (including civil conflict)

• Dutch disease – Due to high level of exports see sharp increase in real exchange rate which crowds out other sectors’ exports.

• Wastage and inefficiency – low levels of TFP
Countries with plentiful supply of raw materials growing at a slower pace?

Sachs and Warner 2001
Doing Business

• Starting new businesses can be an important source of growth.

• Ease of doing business greatly varies across countries. All countries requires firms to pass certain bureaucratic processes and often involves paying fees.

• Raises the possibility of using these bureaucratic processes to create a “hold up” problem with scope for corruption.
World Bank – Ease of Starting a Business

<table>
<thead>
<tr>
<th>Top 10 Economy</th>
<th>Ease of Doing Business Rank</th>
<th>Worst 10 Economy</th>
<th>Ease of Doing Business Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>1</td>
<td>Niger</td>
<td>172</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2</td>
<td>Eritrea</td>
<td>173</td>
</tr>
<tr>
<td>United States</td>
<td>3</td>
<td>Venezuela</td>
<td>174</td>
</tr>
<tr>
<td>Hong Kong, China</td>
<td>4</td>
<td>Chad</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sao Tome and Principe</td>
<td>176</td>
</tr>
<tr>
<td>Denmark</td>
<td>5</td>
<td>Burundi</td>
<td>177</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>6</td>
<td>Congo, Rep.</td>
<td>178</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Guinea-Bissau</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>8</td>
<td>African Rep.</td>
<td>180</td>
</tr>
<tr>
<td>Australia</td>
<td>9</td>
<td>Congo, Dem. Rep.</td>
<td>181</td>
</tr>
<tr>
<td>Norway</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Australia it takes 2 days to start a business up and costs equivalent of 0.8% GDP per capita, in Brazil it takes 152 days and costs 10.4%. In Suriname it takes 694 days and in Sierra Leone it will cost you 11 times GDP per capita.

2011 data
Corruption Perception Index, 2014

Source: Transparency International, 2014
Figure III

Corruption and Number of Procedures

The scatter plot shows the values of the corruption index against the (log) number of procedures for the 78 countries in our sample with nonmissing data on corruption.

Source: Djankov et al. (2002)
What is driving corruption?

• Poor institutions and inefficient judicial system
  - lack of enforcement of law
• Low income --- in particular for public employees
• Culture and social norms

Reference: ‘Economic Gangsters: Corruption, violence and the poverty of nations’, E. Miguel and R. Fisman
Lecture 2 : Why are some countries richer than others? – Part 2

1. Do countries catch up with economic leaders?

2. Institutions and growth

3. R&D and growth
What is behind TFP?

Two main aspects to TFP

I) Efficiency

A country may use its factors of production inefficiently and produce below the possibility frontier e.g., bureaucratic obstacles, poor institutions, etc.

II) Technology

A country may produce at the production possibility frontier but improvements in technology push the frontier out and enable more output to be produced for given factors of production.
Technology and growth

At the steady state, economy can no longer grow through capital accumulation *alone*.

Technology is the ‘growth miracle of capitalism’.

Output can always expand through technological progress.

In Solow, technological progress comes from the ‘sky’. In reality, the outcome of research (R&D). Technological progress is not a free lunch.

Need to think of what are the forces shaping incentives across time and countries to improve technology.
Research and Development

- if a country is far away from its steady-state, it can still grow through capital accumulation only.

- if a country is close to its steady state, it cannot continue to rely on capital accumulation only. However, TFP increases can still sustain economic growth.

Therefore as a country gets close to its steady state the incentives to encourage R&D rise strongly.

We would expect more R&D in

(a) Rich countries

(b) Economies that go through economic development.

R&D less important for poor countries that can rely on capital accumulation and copy technologies of the developed countries.
## R&D Expenditures

<table>
<thead>
<tr>
<th></th>
<th>U.S.</th>
<th>Other OECD</th>
<th>China</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D Spending ($billions)</td>
<td>400</td>
<td>600</td>
<td>150</td>
<td>25</td>
</tr>
<tr>
<td>% of G-20</td>
<td>34%</td>
<td>48%</td>
<td>13%</td>
<td>2%</td>
</tr>
<tr>
<td>R&amp;D (% of GDP)</td>
<td>2.88%</td>
<td>2.33%</td>
<td>1.70%</td>
<td>0.76%</td>
</tr>
</tbody>
</table>

Source: NSF Science and Engineering Indicators, 2012

## Composition of U.S. R&D, 2009

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>70%</td>
</tr>
<tr>
<td>Government</td>
<td>12%</td>
</tr>
<tr>
<td>Universities</td>
<td>14%</td>
</tr>
<tr>
<td>Non-profits</td>
<td>4%</td>
</tr>
</tbody>
</table>

Source: NSF Science and Engineering Indicators, 2012
Expenditure on R&D as % of GDP

Source: OECD 2009 (MSTI)
As Korea matures it invests more heavily in R&D

Korean R&D as % of GDP

Source: OECD 2009 (MSTI)
What is driving R&D?

R&D intensity varies across countries. Depends on incentives to create new goods and ideas.

• institutions and property rights.
• industrial structure and competition among firms
• size of the market
• education of workforce
• public intervention
Innovation and Competition. The inverted-U

Source: Aghion, Bloom, Blundell, Griffith and Howitt, 2005
Rich countries more R&D intensive – will create even further income differences - is a technological gap opening up?

Source: OECD 2006 (MSTI)
Technology spillovers in OECD

Average dollar value of 1 USD of R&D spent in each G-5 countries  

Keller (2002)
Summary

- TFP differences are essential to understand cross-country income differences. Also explains why many countries do catch up with respect to the most advanced nations.

- Changes in TFP over time are due to changes in institutions & policies, and technological progress. Differences in institutions across countries can have very long-lasting effects on development.

- As countries get richer they shift their source of growth from capital accumulation towards technological progress.

- Endogenous growth models can explain persistent differences in income per capita across countries if technology cannot be easily transferred across countries.