“Determinants of Economic Convergence of Countries and Firms: Evolution of Per Capita Income and Labor Productivity and TFP”

Course on Inclusive Growth Analytics

by

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1. Evolution of Per Capita Income by Regions: Usually growing through time
1. Relative Per Capita GDP: Catching-up?

- The evolution of Per Capita GDP can be obtained for the US, EU and Spain, relative to say Latin America and Caribbean region (LACR), South East Asian countries (SEA), etc.

\[
\left( \frac{\text{GDP}_{\text{ppp}}}{\text{Pop}} \right)_J \times \left( \frac{\text{LFemployed}}{\text{Pop}} \right)_K = \left( \frac{\text{GDP}_{\text{ppp}}}{\text{LFemployed}} \right)_J \times \left( \frac{\text{Pop}}{\text{LFemployed}} \right)_K
\]

- where J= USA, EU and Spain
- and K= Chile, China, LACR and the SEA region.
1. Chile: Convergence relative to US and EU.

A. Per capita income:

B. Labor productivity:

C. Demographic factor:

E.U (15) includes: Austria, Belgium, Denmark, Deutschland, Finland, France, U.K, Greece, Ireland, Italy, Luxemburg, Netherlands, Spain, Sweden and Portugal.

Source: Penn World Table Version 6.2, Center for International Comparisons at the University of Pennsylvania, September 2006.
1-3. Chile: Convergence relative to US, EU and LAT

Figure 1

Per Capita Income in Chile Relative to U.S, E.U (15) and Latin America (7)
(1960-2005)

Labor Productivity in Chile Relative to U.S, E.U (15) and Latin America (7)
(1960-2005)

Employment-Population Rate in Chile Relative to U.S, E.U (15) and Latin America (7)
(1960-2005)

Relationship Chile-USA
Relationship Chile-EU (15)
Relationship Chile-Latin America (7)
1-3. China: Convergence relative to the US and EU

Figure 1.5


1. GDP Per Capita in Selected Countries and Developing Regions: Convergence relative to the US (comparable PPP) ?

**Latin American and Caribbean countries** included in calculation of Real GDP per capita of the region: Argentina, Bolivia, Brazil, Barbados, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Haiti, Jamaica, Mexico, Nicaragua, Panama, Peru, Paraguay, Trinidad & Tobago, Uruguay and Venezuela.

**South East Asian countries** included in calculation of Real GDP per capita of the region: Brunei Darussalam, Cambodia, Indonesia, Lao People’s Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam.

Sources:
- For individual countries: Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.1. Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002.
- For regions: World Bank, World Development Indicators.
2. Labor Productivity: (GDP/Working Labor Force) in Selected Countries and Regions: Convergence relative to the US?

Latin American Countries in sample

South East Asian countries in sample

Latin American and Caribbean countries included in calculation of labor productivity of the region:
Argentina, Brazil, Chile, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Peru, and Venezuela.

South East Asian countries included in calculation of Real GDP per capita of the region:
Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam.
4. Main conclusions

- In most cases we observe that there is cross-country convergence in per capita income if there is convergence in labor productivity.
- Two main ways to increase labor productivity:
  - A) Increase the (K/L) ratio, or capital deepening, by increasing productive investment.
  - B) Increase the total factor productivity (TFP).
4. Alternative convergence Analysis:

- **Absolute $\sigma$-convergence**: Income dispersion among several countries is reduced through time.

- **Absolute $\beta$-convergence**: Per capita income growth of poor countries is faster than the per capita income growth of rich countries.

- **Conditional $\beta$-convergence**: Per capita income growth of poor countries is larger than the per capita income growth of rich countries, after controlling for important differential factors (empirical result: estimated conditional convergence rate 2% or 3%).
4.1 Evolution of Per Capita Income Dispersion (no absolute $\sigma$-convergence)
4.1 Absolute $\beta$-Convergence

Barro and Sala-i-Martin, there is absolute $\beta$-Convergence if poor economies tend to grow faster than rich ones.

For a given cross section of $i$ countries ($i = 1 \ldots n$), the rate of growth of country $i$ between periods $T$ and $T-t$, $g_{i,t,T}$ will be negatively related with the country’s initial level of income per capita $y_{i,t}$, with $\beta'$ value being approximately equal to speed of convergence from the actual level of income towards its long-run steady state.

$$g_{i,t,T} = a - \beta'*y_{i,t} + e_{i,t,T}$$

$t=1960, 1965, \ldots, 2000$ and $T=2005$
4.1 Is there absolute $\beta$-convergence? NO

Figure 7. Absolute Convergence. 1960-2005. Growth rate vs Initial value of per capita GDP

$y = 0.0035x - 0.0095$
4.2 Conditional $\sigma$-convergence

- conditional $\sigma$-parameter is calculated as the dispersion of

$$y_{it} - \hat{\omega}_1Z_{it} + \hat{\omega}_2Z_{i,t,T}$$

- Estimated from the regression:

$$y_{it} = a + \omega_1Z_{it} + \omega_2Z_{i,t,T} + e_{it}$$
4.2 Conditional $\sigma$-convergence

Figure 23. Evolution of Absolute $\sigma$. Standard deviation of per capita GDP across countries per year. 1960-2005e

<table>
<thead>
<tr>
<th>Year</th>
<th>Absolute $\sigma$</th>
<th>Conditional $\sigma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>1965</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>1970</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>1.30</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>1.70</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>1.80</td>
<td></td>
</tr>
</tbody>
</table>
4.2 Conditional β-convergence

**Convergence:** Growth rate of GDPpc at PPP filtered by control variables vs Initial GDP. Panel estimation, 1960-2005

\[ y = -0.0414x + 0.4151 \]

**Fig. 21**

Convergence: Growth rate of GDPpc at PPP filtered by control variables vs Initial GDP. Panel estimation, 1960-2005

**Natural log of Initial GDPpc PPP**
4.2 Conditional β-convergence in Per Capita Income

Figure 24. Per capita GDP convergence speed from cross-section analysis. 1960-1995 to 2005e

- Low income countries
- Middle income countries
- High income countries
4.2 Conditional $\beta$-convergence in Per Capita Income

Fig. 22

Convergence in selected Countries. Growth rate of GDPpc at PPP filtered by control variables. 1960-2005e.
4.2 Important Aggregate Factors Affecting Conditional $\beta$-Convergence

- Life Expectancy
- Average number of years of Higher Education
- Public Expenditures to GDP Ratio
- Investment to GDP Ratio: infrastructures (energy, etc.)
- GINI index (inequality in per capita income)
- Lack of a well developed middle class (income dispersion)
4.2 Country and firm level conditional $\beta$-convergence

- **Conditional $\beta$-convergence**: the growth rate of a firm will be –positively- related to the distance to its own steady state.

- **Cross-country convergence** achieved after controlling for human, technological and institutional differences across countries ($Z_{i,t}$, $\bar{Z}_{i,t,T}$)

  $$g_{i,t,T} = a - \beta^*y_{it} + \omega_1^*Z_{i,t} + \omega_2^*\bar{Z}_{i,t,T} + e_{i,t,T}$$  

(2)

- **Cross-firm TFP convergence** (productivity catching-up) of less productive Spanish firms is on average faster than the productivity catching-up of more productive firms, but **only during the recession** period (1991-1995)
4.2 Conditional firm TFP convergence

- Firm level conditional $\sigma$-convergence in TFP of Spanish manufacturing firms
4.2 Firm’s TFP convergence: Leaders and Followers

Evolution of the differences of productivity growth rates of “technological” leaders and followers
4.2 Conditional firm TFP convergence through the business cycle
4.2 Firm TFP conditional $\beta$-convergence: System of equations (Heckman)

- Firm TFP conditional $\beta$-convergence controlling for the survival probability of the firm

$$g_i = a_\beta + b \pi_{i0} + \alpha' x_{i0} + u_i$$  \hspace{1cm} (3)

$$\pi_i = \mathbb{I}[a_\beta + b \pi_{i0} + \alpha' x_{i0} + \alpha' y_{i0} + \nu_i > 0]$$  \hspace{1cm} (4)

- With $g_i = T^{-1}(p_{iT} - p_{i0})$ in (3) being the productivity growth rate of the firm $i$ from the initial year $0$ to $T$ and from (4) dummy variable that takes value one when firm $i$ survives in the market between period $0$ and $T$. 
Conclusions:

- The previous conclusions on productivity catching up are robust even after controlling for the selection bias. That is, in Spain there is strong empirical evidence of faster firm $\beta$-convergence in productivity during recession periods in the early 1990s.

- Classifying firms as technological followers if firm´s TFP is in quintiles 1, 2, 3 and 4 of the productivity distribution of their industry and as leaders if the firm´s TFP is in the fifth quintile.
4.2 Firm conditional β-convergence

Conclusions on TFP catching-up:

- Follower firms show lower negative impacts of recessions than leader firms reflecting that there is convergence in productivity during recessions.

- Intuition: In recessions the most productive firms (leaders) grow at a lower rate than the rest of the firms. However in expansions, the leaders show higher and significant productivity growth rates creating a productivity divergence during expansions.
5.1 Infrastructures and Productivity (TFP)

- Well documented **Infrastructures GAP** in LAC and AFRICA
- Investment in infrastructures was reduced since 1980 in most developing countries (but in telecommunications)
- What are the main *bottle necks for productivity* in developing countries?
5.1 Firm Perceptions on Infrastructures by Regions

% of firms that perceive infrastructures as a serious constraint for economic growth

![Bar chart showing firm perceptions on infrastructures by regions](chart.png)

*Fuente: World Bank Investment Climate Surveys*
6.1 Conclusions and Policy Recommendations

Main factors affecting poverty (World Bank report):
   a) the **place of birth** (mainly isolated zones, etc.) and
   b) the **level of education of the parents**

- More **investment (private and public) and** higher public expenditures is needed and there is also a need of an **increase in fiscal pressure** to finance those public investments and expenditures.

- How can we do that? **Develop a larger middle income class** (part of the population that generates higher income tax revenues)

- Promote **directed economic growth** using of clean energies and clean production techniques (new technologies that reduce negative externalities, etc.), to reduce pollution and the negative effects of global warming.
6.2 Conclusions and Policy Recommendations

- **Establish clear rules of the game** (need of **public intervention** to create reliable institutions, assign property rights, fight against corruption, etc.) within each country (see results on ICA) and to create macroeconomic stability.

- **Capital deepening**: Need of higher private investment (FDI, etc.) and for public investments in developing countries: in R&D (special diseases of developing countries), infrastructure and on education and training.

- **Identify the main bottlenecks on TFP and promote policies that enhance productivity growth (TFP).**
IC surveys provide a unique a rich source of information to identify bottlenecks in IC variables.

Questions:

1. Is it possible to get robust productivity IC elasticities if we control for usually unobserved firm fixed effects?

2. Can we identify the relative importance of each block of IC variables on employment, wages, exports and FDI, and compare with firm perceptions?

3. Can we make inter-country comparisons of the IC results on productivity, employment, wages, exports and FDI?

4. Comparing the relative IC effects on country productivities: can we avoid the problem of comparing apples and oranges?

Answer: Yes if we apply the methodology discussed in the next lectures.