Productivity and income differences in the 20\textsuperscript{th} century

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Development accounting

• What can account for international income differences?
  – Maddison’s proximate causes of growth
• Hsieh and Klenow (2010):

\[
\frac{Y_i}{N_i} = A_i^{\frac{1}{1-\alpha}} \left( \frac{K_i}{Y_i} \right)^{\frac{\alpha}{1-\alpha}} \left( \frac{h_i L_i}{N_i} \right)
\]

GDP per capita  Capital/output  Human capital/capita
Income differences are predominantly traceable to productivity differences

Development accounting for 2011

Physical capital

Human capital

Productivity

Source: PWT 9.0, Feenstra et al. (2015)
Notes: Development accounting across 115 countries
But has that been a constant feature?

- 20th century has mostly been one of income divergence
- Asian ‘perspiration vs. inspiration’: has rapid physical capital accumulation given the expected income pay-off?
- Diminishing development returns to education:

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Context in the literature

• Comparing productivity growth over the long run of considerable interest

• Yet comparing relative productivity levels requires a different perspective
  – Measuring growth differs from measuring comparative levels
    (Feenstra, Inklaar and Timmer, 2015; Inklaar and Diewert, 2016; Inklaar and Rao, 2017)
Ingredient #1: Maddison Project Database 2018

• Documented in Bolt, Inklaar, de Jong and van Zanden (2018)
  – Distinguish a ‘growth’ data series and a ‘levels’ data series
• Rely on multiple cross-country income comparisons
  – Post-1950: PPPs from International Comparison Program; see also PWT
  – Pre-1950: Historical income comparisons, work of many economic historians, e.g. Ward and Devereux, van Zanden & co-authors
Methodological choice with important consequences

Real GDP per capita in 1900, US=1

Using the growth series to extrapolate from a modern income comparison can lead to notably different relative levels than using the most recent historical income comparison.

Source: Maddison Project Database 2018, Bolt et al. (2018)
Ingredient #2: New estimates of physical capital

- Builds on recent work
- Broader range of countries, at different levels of development
  - 38 countries in Europe, North America, Latin America and Asia
- Account for changes in relative prices of equipment and structures
- Implement a novel initialization method
  - Country-specific but without relying on steady-state assumption
- Note: estimates of total stock, not capital services
The change in physical capital

Considerable variation in 1900 capital/output ratios:

- Far away from a steady state
- Physical capital seems more important for development accounting in 1900 than 2011

Source: GDP per capita from Maddison Project Database 2018 (Bolt et al. 2018)
The change in human capital

Average years of schooling also showed more variation in 1900 than in 2011.
Development accounting: 2011

Notes: Development accounting across 38 countries
Development accounting: 1900

Development accounting for 1900

Physical capital

\[ \alpha (1 - \alpha) x \log \text{relative capital/output ratio} \]

log of \( \text{CGDP/capita (USA=1)} \)

Human capital

\[ \log \text{relative labor input per capita} \]

log of \( \text{CGDP/capita (USA=1)} \)

Productivity

\[ \alpha (1 - \alpha) x \log \text{relative TFP} \]

log of \( \text{CGDP/capita (USA=1)} \)

Notes: Development accounting across 23 countries
The rise of TFP

Coefficient on GDP per capita

Productivity

Human capital

Fixed capital

1900 1920 1940 1960 1980 2000 2020
Discussion

• Development is hard: putting in more physical and human capital will not automatically lead to higher productivity

• Increasing mismeasurement of capital?
  – Capital services vs. stocks
  – Omission of intangible assets
  – Ignoring dimensions of human capital unrelated to schooling