

## Lecture 2: Growth, Infrastructure, and Technological Change

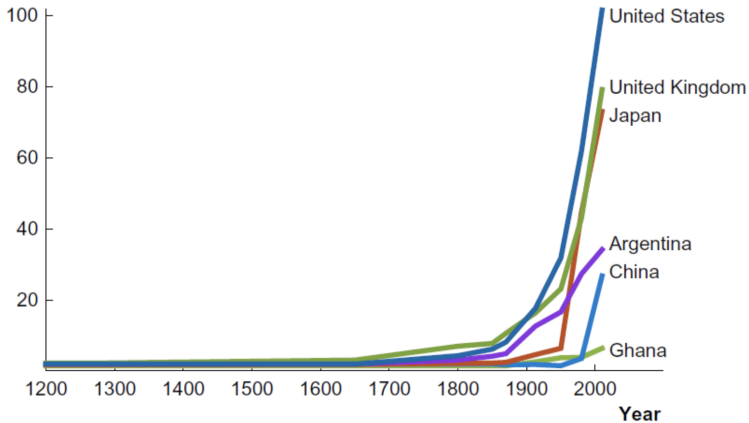
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## Reminder from last week: The Great Divergence (1/2)

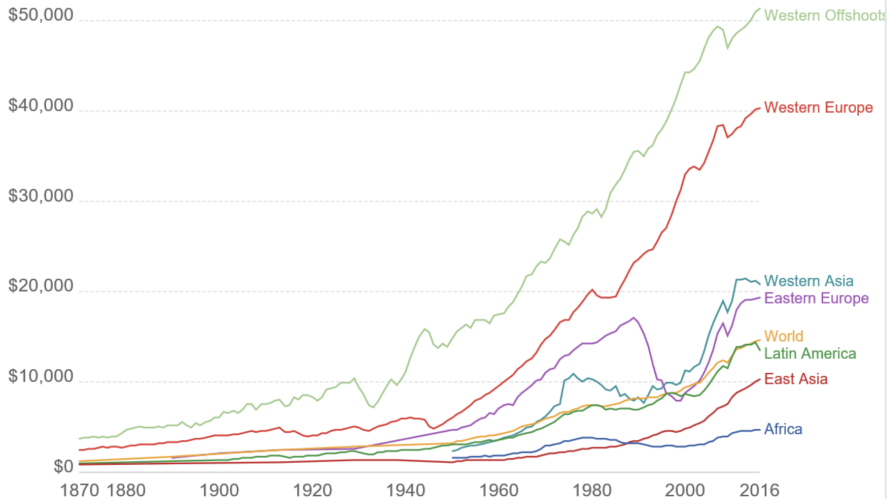
**GDP per person (multiple of 300 dollars)**



## Reminder from last week: The Great Divergence (2/2)

### GDP per capita

GDP per capita adjusted for price changes over time (inflation) and price differences between countries – it is measured in international-\$ in 2011 prices.



Source: Maddison Project Database (2018)

## The Big Challenge Faced by GDP

- ▶ There are many familiar challenges associated with measuring nominal GDP in a given country in a given time period.
- ▶ And there are many familiar challenges associated with generating measures of real GDP for a given country over time.
- ▶ But producing measures of real GDP across countries at a given point in time is particularly challenging.
- ▶ "Traditional" strategy: Use exchange rates to convert nominal GDPs into a common currency and use this as a measure of relative living standards.

## Remarks on the Traditional Approach

1. It gets rid of the units problem, but not clear why exchange rate is appropriate when considering non-tradeables.
2. Doesn't address the fact that the purchasing power of 1 CFA varies across countries.
3. Measuring purchasing power across countries is the huge challenge, especially when there are large differences in levels of development.
  - ▶ Standard approach is to value a common basket, but what if there is no common basket?
  - ▶ Advanced economy items can be notoriously expensive in low income countries, potentially leading one to conclude that purchasing power is very low in poor countries.
  - ▶ International Comparison Program of WB updates purchasing power comparisons every few years. 2005 revisions are widely believed to have erred in underestimating purchasing power in low income countries, and this was undone by the 2011 revisions. (See e.g., Deaton, AEJ Macro 2017). This has a large impact on the quantitative assessment of differences in living standards.

## Some Descriptive Papers on Cross-Country Income Dynamics

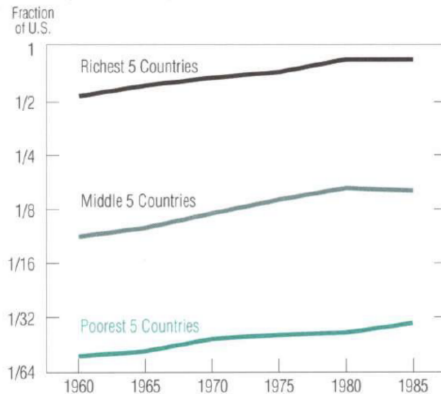
- ▶ Mankiw, Romer and Weil (QJE 1992)
- ▶ Parente and Prescott (Mpls Fed QR 1993)
- ▶ Pritchett (JEP 1997)
- ▶ McGrattan and Schmitz (Handbook of Macro 1999)
- ▶ Hausmann, Pritchett, and Rodrik (JEG 2005)
- ▶ Duarte and Restuccia (Richmond Fed QR 2006)
- ▶ B. Jones and Olken (Restat 2008)
- ▶ C. Jones (Handbook of Macroeconomics 2016)

## Parente and Prescott (1/6)



### Widespread Upward Shift

Average Real GDP Relative to 1985 U.S. Level for Selected Wealth Groups in the 102-Country Data Set During 1960–85



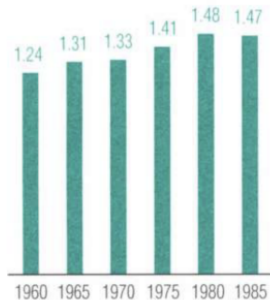
Source of basic data: Summers and Heston 1991

## Parente and Prescott (2/6)

### The Standard Deviation Measure of Wealth Disparity

Based on the Distribution of Relative Per-Capita GDP

Chart 2 In All 102 Countries: Increasing?





## Parente and Prescott (3/6)

Chart 3 In Western Europe: Decreasing?

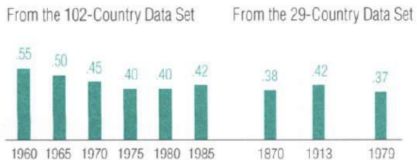
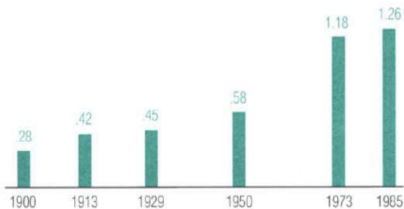


Chart 4 In Southeastern Asia: Definitely Increasing



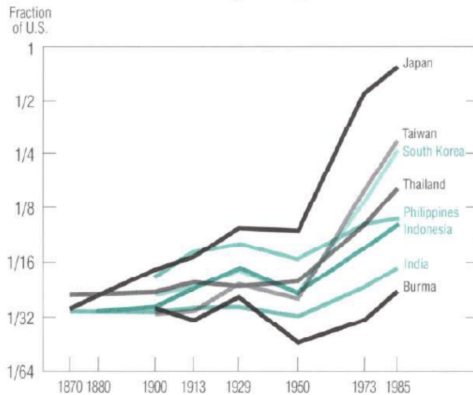
Source of basic data: Summers and Heston 1991, Maddison 1991,  
De Long 1988, Van der Eng 1992

## Parente and Prescott (4/6)

Chart 5

### Dramatic Divergence in Southeastern Asia

Per-Capita GDP Relative to 1985 U.S. Level  
for 8 Southeastern Asian Countries During 1870–1985



Source of basic data: Van der Eng 1992

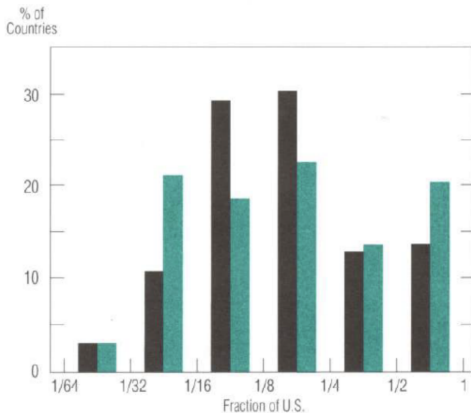
## Parente and Prescott (5/6)

Chart 6

### A Change in the Distribution of Wealth

Per-Capita GDP Relative to U.S. Level in the 102-Country Data Set

During 1960 ■ and 1985 ■



Source of basic data : Summers and Heston (1991)

## Parente and Prescott (6/6)

### Development Miracles and Disasters

Countries in the 102-Country Data Set With Largest Changes  
in Relative Wealth During 1960–85 (Expressed as Factor Changes)

Increases		Decreases	
Country	Factor Change	Country	Factor Change
Saudi Arabia	3.32	Zambia	2.63
Lesotho	3.19	Mozambique	2.63
Taiwan	2.60	Madagascar	2.50
Hong Kong	2.59	Angola	2.38
South Korea	2.40	Chad	2.13
Egypt	2.38	Liberia	2.04
Congo	2.18	Ghana	2.00
Japan	2.10	Zaire	1.96
Singapore	2.09	Nicaragua	1.85
Syria	1.89	Afghanistan	1.75

Source of basic data: Summers and Heston 1991

## Duarte and Restuccia

Table 4 Mobility Matrix—Relative Output per Worker

		$t + 20$				
		0-0.075	0.075-0.15	0.15-0.3	0.3-0.6	0.6-1.2
$t$	0-0.075	0.86	0.11	0.03	0	0
	0.075-0.15	0.38	0.46	0.11	0.05	0
	0.15-0.30	0.01	0.15	0.57	0.26	0.01
	0.3-0.6	0	0.02	0.22	0.48	0.28
	0.6-1.2	0	0	0	0.10	0.90

Table 5 Mobility Matrix by Quintile

		$t + 20$				
		Q1	Q2	Q3	Q4	Q5
$t$	Q1	0.78	0.21	0.01	0	0
	Q2	0.22	0.64	0.11	0.03	0
	Q3	0	0.14	0.62	0.24	0
	Q4	0	0.02	0.24	0.58	0.16
	Q5	0	0	0	0.16	0.84

Notes: Quintile  $i$  ( $Q_i$ ) includes countries within the  $20 \times (i - 1)$  and  $20 \times i$  percent of the distribution of relative output per worker.

## Jones (1/3)

GDP per person (US = 1) in 2011

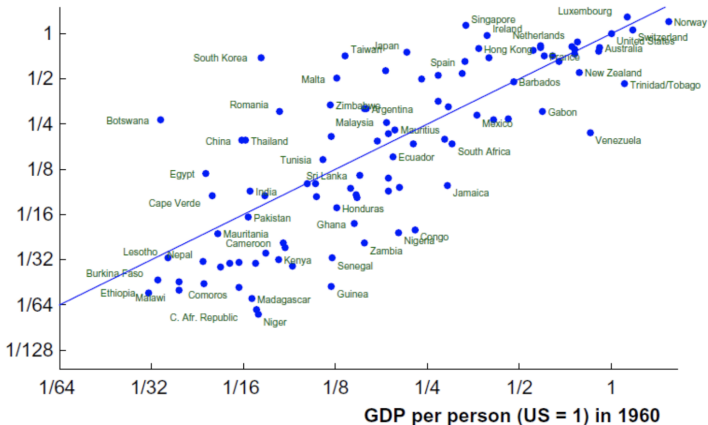
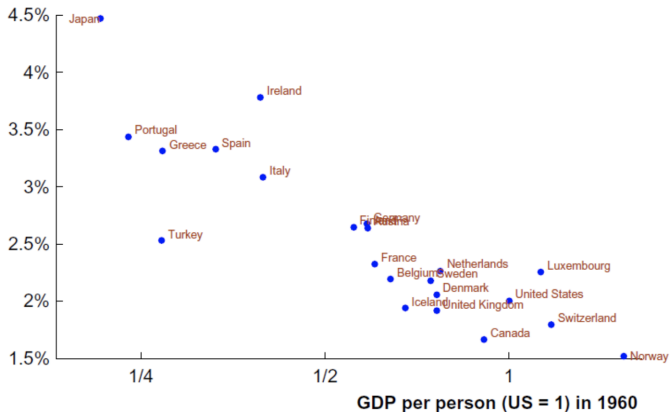


Fig. 24 GDP per person, 1960 and 2011. Source: *The Penn World Tables 8.0*.

## Jones (2/3)

Growth rate, 1960 – 2011



**Fig. 25** Convergence in the OECD. Source: *The Penn World Tables 8.0*. Countries in the OECD as of 1970 are shown.

## Jones (3/3)

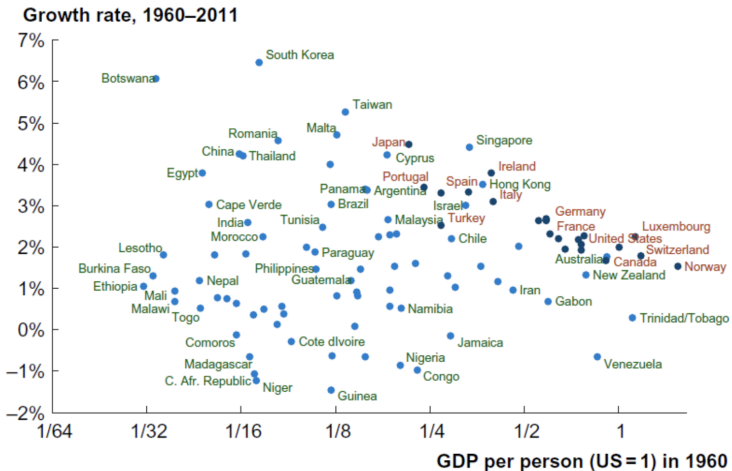


Fig. 26 The lack of convergence worldwide. Source: *The Penn World Tables 8.0*.



## Infrastructure

- ▶ Type of infrastructure
  - ▶ Energy
  - ▶ Transport
  - ▶ Telecommunications
  - ▶ Water
  - ▶ Sanitation
- ▶ Infrastructure Financing
  - ▶ operational expenditure (OPEX)
  - ▶ capital expenditure (CAPEX)
- ▶ Mode of financing? Debt, Taxation or Borrowing in Private Markets, PP
- ▶ Timing: early in development, late in Development.

## Growth and Infrastructure: Direct Channels

- ▶ Infrastructure as a factor of production either as a pure public good or intermediate input
- ▶ With factors being gross complements, an increase in the stock of infrastructure would raise the productivity of the other factors (labor, capital, etc.)
- ▶ Note, however, that the way infrastructure investments are financed is not neutral and that the risk of a crowding-out effect on private investment exists, especially if these investments are financed through taxation or borrowing on domestic financial markets.

## Growth and Infrastructure: Indirect Channels

- ▶ Maintenance and private capital durability:
  - ▶ infrastructure policy biased toward the realization of new investments at the detriment of the maintenance of the existing stock
  - ▶ Rioja (2003): maintenance is tax-financed, while new investments rely on soft international loans, more palatable to politicians as long as they do not have strings attached.
  - ▶ New investments may have higher “political visibility” and shorter “horizon” than maintenance, which only has gradual effects on the quality of the infrastructure stock (see for example Maskin and Tirole, 2007, and Dewatripont and Seabright, 2006).
  - ▶ Lower-than-optimal level of maintenance reduces the life-span of the existing stock of infrastructure itself. Rioja (1999) and Kalaitzidakis and Kalyvitis (2004).
  - ▶ It is documented that it also implies higher operative costs and reduced duration of private capital, such as trucks operating on low-quality roads or machines connected to unstable voltage lines.

## Growth and Infrastructure: Indirect Channels

- ▶ Adjustment costs.: Improvements in the stock of infrastructure capital are likely to reduce private capital adjustment costs, through at least two related channels.
  1. Lowering the logistic cost of such investments:
  2. allowing for the substitution of palliative private investments in devices such as electricity generators for more productive investments in machinery for example
    - ▶ Improvements in the stocks of infrastructure, as they make the services more reliable, reduce firms' necessity to invest in substitutes in order to hedge against potential service interruptions, thereby freeing up resources for private productive investment.
    - ▶ Reinikka and Svensson (2002) show that this may be aggravated by a selection effect, as the firms that actually invest in substituting devices are the bigger or more profitable ones, resulting in even larger investment shortfalls.

## Growth and Infrastructure: Indirect Channels

- ▶ Labor productivity: Another posited channel is the potential effect on labor productivity due to reductions in time wasted commuting to work and stress, as well as to the more efficient ways of organizing work time as a result of improved information and communication technology, learning by doing, etc. . .
- ▶ Impact on human development: Numerous studies have documented that better infrastructure induces improvement in both health and education, which increase labor productivity both in the short term by making the existing stock of human capital more effective, and in the medium and long term by inducing additional investment in education.
- ▶ Economies of scale and scope.: A few examples include better transport infrastructure that, by lowering transport costs, leads to economies of scale, better inventory management and a different pattern of agglomeration.

## Growth and Infrastructure: A Spatial Perspective

- ▶ What do we know about the spatial distribution of population and development?
- ▶ Development, industrialization and urbanization: one approach
  - ▶ Income elasticity for food less than one
  - ▶ Development leads to industrialization
  - ▶ Implies urbanization to the extent that industry is more urbanized
- ▶ Development, industrialization and urbanization: another approach
  - ▶ Elasticity between food and non-food less than one
  - ▶ Industrialization result of higher productivity growth in agriculture
  - ▶ Agricultural revolution preceded industrial revolution

## Gollin, Jedwab and Vollrath (JOEG 2016)

- ▶ Observation: urbanization in Africa and Middle East is occurring at lower levels of industrialization
- ▶ Driving force seems to be higher income from natural resources
- ▶ Leads to “consumption cities” instead of “production cities”
- ▶ Rationalizes “urbanization without industrialization”
- ▶ Role of trade is key

## Henderson, Squires, Storeygard and Weil (QJE 2018)

- ▶ Explores determinants of global distribution of economic activity
- ▶ Two groups of determinants:
  - ▶ Those important for agriculture
  - ▶ Those important for trade
- ▶ Puzzling finding: Agriculture explains much more of the variation in developed countries than in developing countries
- ▶ Possible explanation:
  - ▶ Early developers: structural transformation occurred when transport costs were still high, so cities located in agricultural regions
  - ▶ Late developers: not the case, so movements occurred and cities in coastal regions.
  - ▶ These initial spatial patterns have persisted



## Beyond Growth: Skill-Biased Technological Change



## Next Week

Productivity and Human Capital in Developing Countries.

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