

Lecture 12

The Solow Model and Convergence

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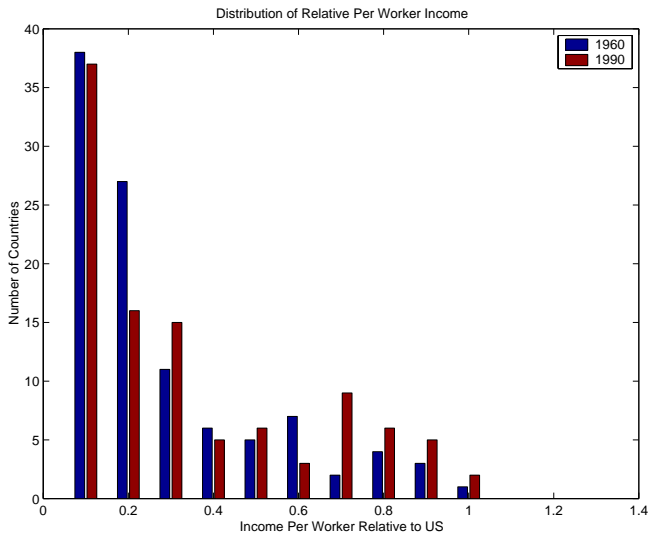
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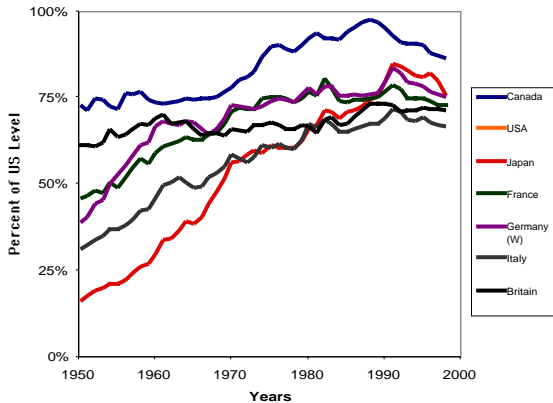
Some Development Facts

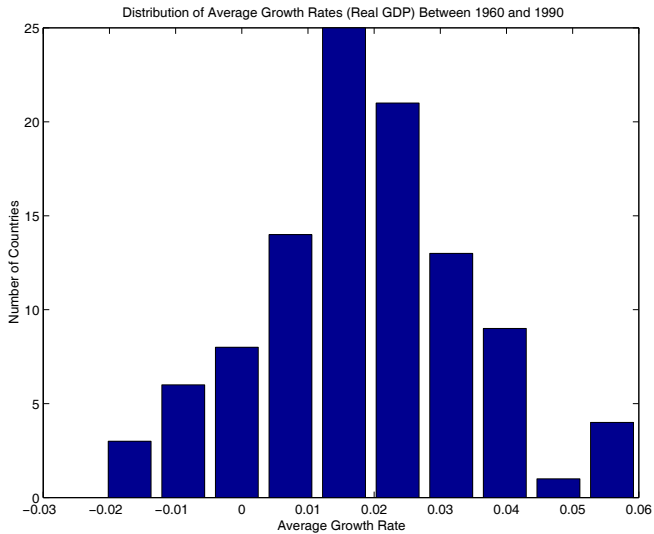
Stylized facts for cross-country comparisons.

- 1 Enormous variation of per worker income across countries.
- 2 Enormous variation in growth rates of per worker income across countries.
- 3 Growth rates are not constant over time for a given country.
- 4 Countries change their relative position in the international income distribution.



Output per Capita as a Share of US Level





Evaluation of the Model: Development Facts

- Differences in income levels across countries explained in the model by differences in s , n and d .
- Variation in growth rates: in model *permanent* differences can only be due to differences in rate of technological progress g .
Temporary differences can be explained by transition dynamics.
- That growth rates are not constant over time for a given country can be explained by transition dynamics and/or shocks to n , s and d .
- Changes in relative position: in the model countries whose s moves up, relative to other countries, move up in income distribution. Reverse with n .

The Convergence Hypothesis

- Fact: Enormous variation in incomes per worker across countries
- Question: Do poor countries eventually catch up?
- Convergence hypothesis: They do, in the right sense.
- Main prediction of convergence hypothesis: Poor countries should grow faster (per capita) than rich countries.
- Why? Recall:

$$\frac{\dot{k}}{k} = sk^{\alpha-1} - (n + d), \text{ and: } \frac{\dot{y}}{y} = \alpha \frac{\dot{k}}{k}$$

The Solow Model and Convergence

- Analyze countries with same s, n, d, α, g
- Eventually same growth rate of output per worker and same level of output per worker (*absolute* convergence).
- Countries starting further below the balanced growth path (poorer countries) should grow faster than countries closer to balanced growth path.
- Seems to be the case for the sample of now industrialized countries.
- World capital markets should speed this process. Capital should flow from rich (high $K \Rightarrow$ low MPK) to poor countries (low K , high MPK).

Figure 1.a: Growth Rate Versus Initial Per Capita GDP

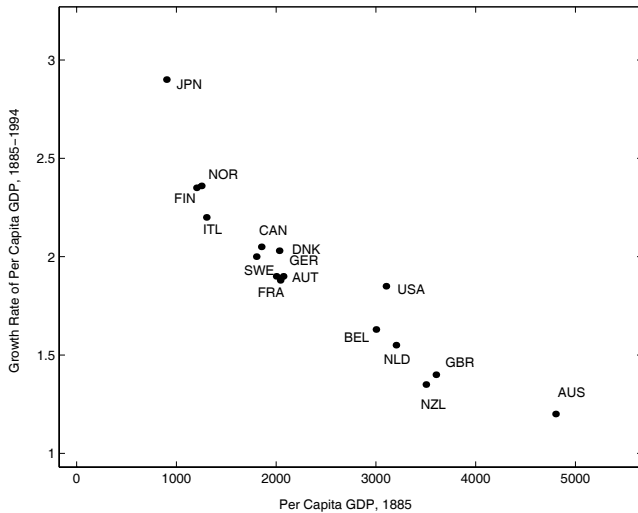
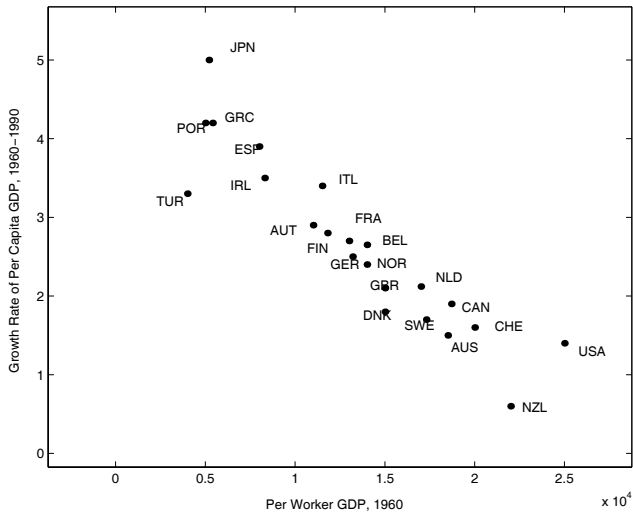


Figure 1.b: Growth Rate Versus Initial Per Capita GDP

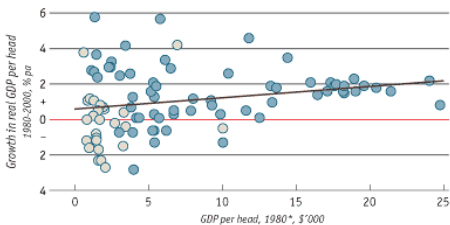


An alternative view

● Sub-Saharan Africa

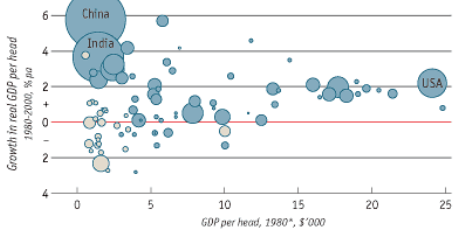
Growth in GDP per head

1



Growth in GDP per head, proportional to population in 1980

2



Sources: Penn World Tables; Stanley Fischer

*1996 prices

Conditional Convergence

- Countries with same g but potentially differing s, n, d, α .
- Countries have different balanced growth path.
- Countries that start further below *their* balanced growth path (countries that are poor relative to their BGP) should grow faster than rich countries (relative to their BGP). This is called *conditional* convergence.
- Data for full sample lend support to conditional convergence.
- Industrialized countries as of 1885: similar savings rates, population growth rates.
- US States: Strong evidence of convergence across states. Again similar technology, saving, population. Baro and Sala-i-Martin (1992)

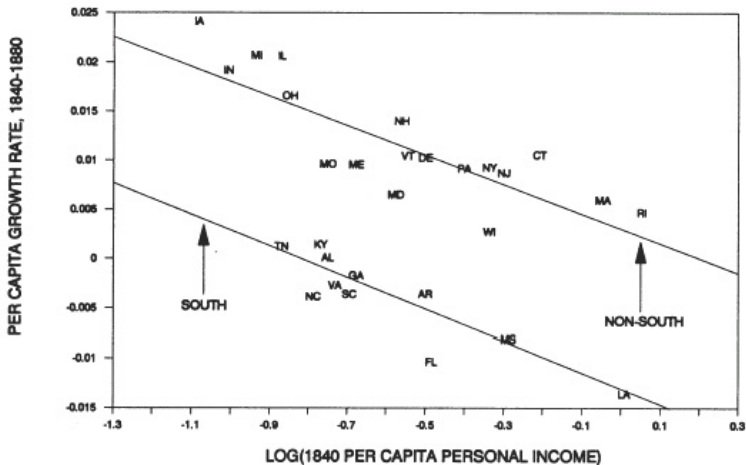


FIG. 2.—Growth rate from 1840 to 1880 vs. 1840 per capita income

Conclusion: The Solow Growth Model

- Offers a simple and elegant account of a number of growth facts.
- Leaves unexplained factors that make countries leave (or not attain) their BGP.
- Leaves unexplained why certain countries have higher s , n than others.
- Leaves unexplained technological progress, the source of growth.