Introduction to Growth: Harrod-Domar Theory

Dilip Mookherjee

Ec320 Lecture 2, Boston University

Sept 4, 2014

Recap of Main Points of Lecture 1

- We reviewed various dimensions of economic development: p.c.i., inequality/poverty, human development etc.
- Raised the question of how to prioritize these, and focus on a fewer dimensions (at least to start with)
- Such as p.c.i.
- Reviewed facts about p.c.i. differences across continents and countries, changes over time

Why Focus on Growth In P.C.I.?

- In 1800 if all countries were roughly at the same level of p.c.i., how could they be so different today?
- *Must be the case that p.c.i in the now-advanced countries grew must faster over the last two centuries*
- So we need to understand why some countries grew much faster than others

The Magic of Exponential Growth

- The logic of compounded growth rates are often counter-intuitive

- Problem: take two countries A and B, with p.c.i. growing at 1% and 5% annually, who have the same level of p.c.i. today. How much higher will B's p.c.i. be relative to A's in two generations (70 years)?

- **Hint:** Simple formula to remember: *If r is the annual growth rate of p.c.i., it will double in $\frac{70}{r}$ years*

- Answer: 16

Evolution of Growth since the Middle Ages

- Fastest growing country in the world during:
  - 1520-1820: Holland (0.2% p.a.)
  - 19th century: U.K. (1.2%)
  - 20th century: USA (2.2%)
  - Mid to Late 20th century: Japan, China (8-9%)

- So growth, and inter-country disparities in pci levels, are relatively recent phenomena

- Why did some countries grow faster than others?

Warning: Do Not Confuse Disparities between P.C.I. Levels with Disparities in Growth Rates

- While China p.c.i. has been growing at 8-9% over the past two decades (as against 1% for the US), its p.c.i level is still quite low ($\frac{1}{5}$ of US p.c.i. level)
- Ordering of China and US gets reversed if we look at p.c.i. levels versus growth rates
- A point which will recur...

Harrod-Domar Theory of Growth

- Oldest modern theory of growth (1940s)
- Focus on physical capital accumulation (Soviet experience)
- Assume GDP $Y_t = A.K_t$
- Implicitly assumes:
  - Labor is unproductive
  - Marginal product of capital A is constant
- *ICOR θ is defined to be $\frac{1}{A}$*
- Also assume a constant savings = investment rate of s, between 0 and 1 and that capital does not depreciate

Harrod-Domar Growth Formula

- These imply that growth rate of GDP is *A.s* or *[Marginal product of capital]* ∗ *[savings rate]*
- If capital depreciates at rate δ, then this falls to $A.s - \delta$
- What is growth rate of GDP per capita assuming population grows at constant rate *n*?
- Solve for *g* in $A.s + (1 - \delta) = (1 + g)(1 + n)$

Harrod-Domar Growth Formula

$$g = \frac{As - \delta - n}{1 + n}$$

- Growth rate is higher:
  - higher is savings rate
  - higher is capital productivity
  - lower is population growth rate
  - lower is depreciation rate

Harrod-Domar Growth Theory

- If assume these rates are all exogenous (unaffected by pci), then growth rate is exogenous
- Then it becomes a *theory*, which provides causal explanations for growth:
- Differences in growth rates across countries (or over time) can be explained by differences in behavior/culture (savings, demographics) and technology (capital productivity, depreciation)
- Protestant vs Catholic countries, role of Industrial Revolution etc.

The Solow (Neoclassical) Growth Theory

- Most well-known growth theory, which departs from H-D in one key respect:
- Departs from the assumption of a constant marginal productivity of capital: *diminishing returns to capital*
- And assume labor is a productive factor, also subject to diminishing returns

The Solow (Neoclassical) Growth Theory, contd.

- For instance, familiar Cobb-Douglas production function:

$$Y_t = AK_t^{\alpha} P_t^{1-\alpha}$$

- A denotes level of **Total Factor Productivity (TFP)**, measure of technical progress

The Solow (Neoclassical) Growth Theory, contd.

- Implies that for fixed population, marginal product of capital is decreasing in the amount of capital, and *is no longer exogenous: rate of return to investments is lower in rich countries*
- Now need to keep track of feedback loop from GDP to marginal product of capital