Lecture 4: Economic Growth Model

Instructor: Fei Tan

@econdojo @BusinessSchool101 Saint Louis University

Course: Macroeconomics 201

Date: September 13, 2025

The Road Ahead

1. Measuring Standard of Living
2. Economic Growth Model

Standard of Living Revisited

- Cross-country comparison of standard of living
  - purchasing power parity (PPP) numbers
  - GDP/GDP per capita constructed with common set of prices for all countries
  - downloadable from Penn World Tables
- Why using PPP numbers
  - exchange rate vary a lot
  - systematic differences in prices across countries
- We measure long-run economic growth by percentage increase in PPP numbers over long periods

$$\text{growth rate} = \frac{Y_t - Y_{t-n}}{Y_{t-n}} \times 100\%, \quad n \sim \text{decades}$$

Growth in Rich Countries

	Annual Growth Rate Output per Person (%)	Real Output per Person (2005 dollars)		
	1950–2009	1950	2009	2009/1950
France	2.5	7,112	30,821	4.3
Japan	3.9	3,118	31,958	10.2
United Kingdom	2.0	10,400	33,386	3.2
United States	1.9	13,183	41,102	3.1
Average	2.6	8,453	34,317	5.2

Notes: The data stop in 2009, the latest year (at this point) available in the Penn tables. The average in the last line is a simple unweighted average. *Source:* Alan Heston, Robert Summers, and Bettina Aten, Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011

- Large increase in output per capita
- Convergence of output per capita across countries

Economic Growth Model

Aggregate production function

$$Y = F(K, N) \qquad (\text{e.g. } Y = AN)$$

- Notations
  - Y = aggregate output
  - K = aggregate capital
  - N = aggregate employment
- Three assumptions
  - constant returns to scale

$$xY = F(xK, xN) \qquad \text{for any } x$$

  - decreasing returns to capital & labor

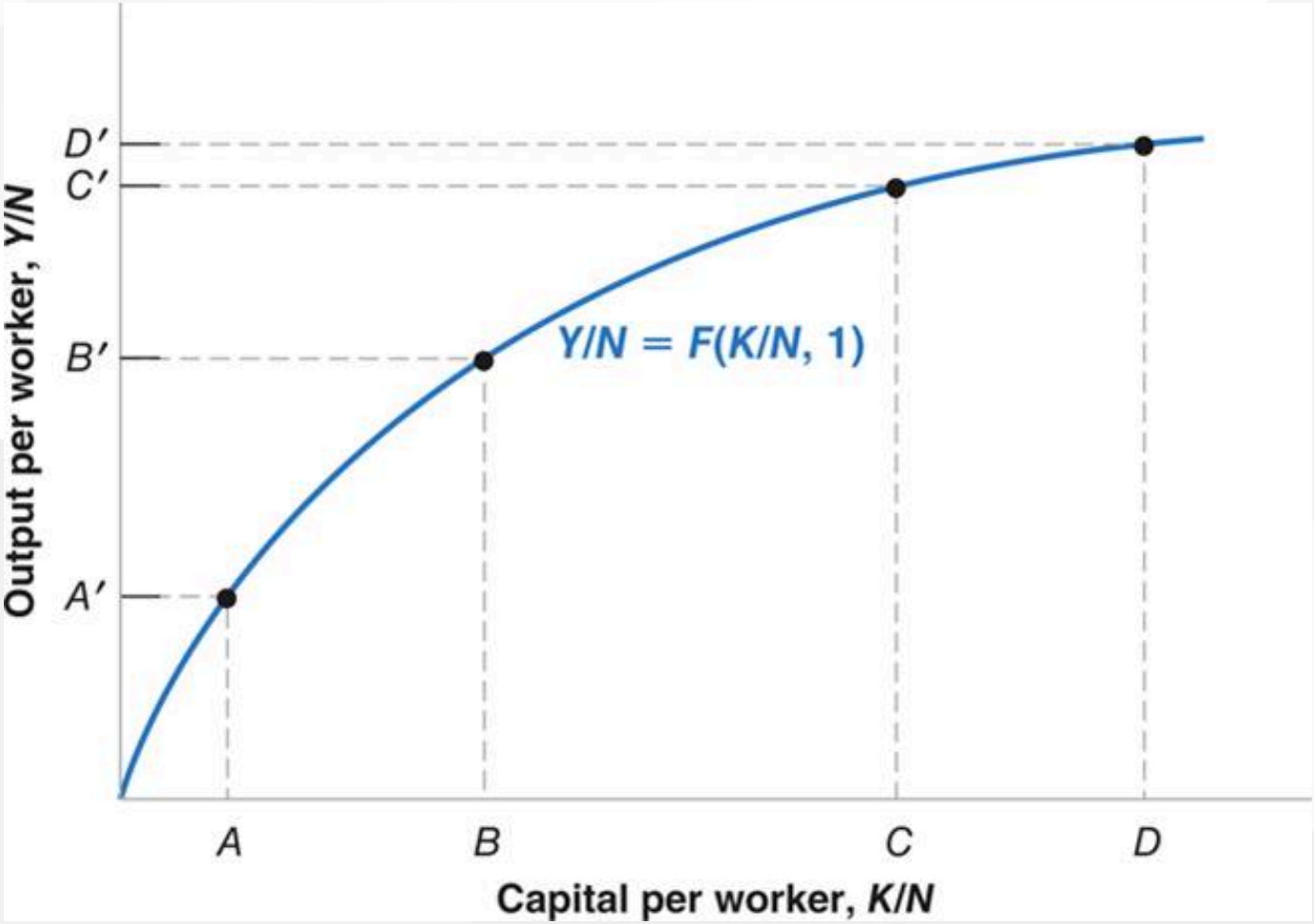
Economic Growth Model (Cont'd)

Per capita production function

$$\frac{Y}{N} = F\left(\frac{K}{N}, \frac{N}{N}\right) = F\left(\frac{K}{N}, 1\right) \qquad (\text{set } x = 1/N)$$

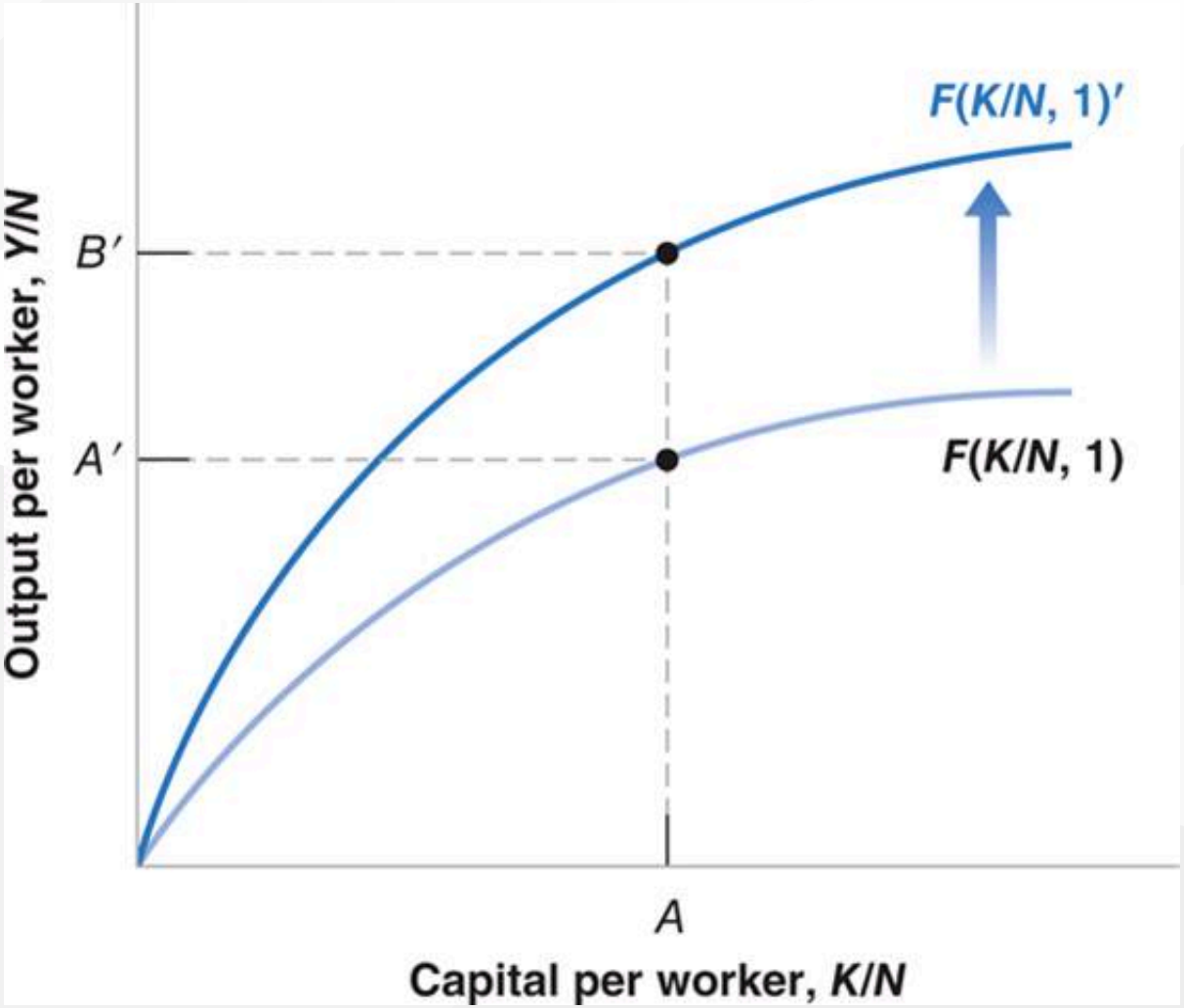
- Notations
  - Y/N = output per capita
  - K/N = capital per capita
- Sources of economic growth
  - capital accumulation
  - technological progress

Capital Accumulation



- Capital accumulation cannot sustain growth (why?)

Technological Progress



- Sustained growth requires sustained technological progress

Readings & Exercises

- Readings
  - HO: chapter 11
  - BJ: lecture 8 (supplementary)
- Exercises
  - HO: problem 2.8, 2.9
  - Let production function be $Y = \sqrt{K}\sqrt{N}$. Compute output when $K = 49$ and $N = 81$. If capital and labor double, what is output? It is constant returns to scale? Compute Y/N when $K/N = 4$.