

Macroeconomics | Lecture 3

Why Are Some Countries So Rich? Production and Productivity

Group Activity - 2 -

· SJTU Summer School · Fatih Kansoy

How this block runs. You work in your home group of three or four, textbook open. Roles rotate: **Scribe, Reporter, Sceptic, Timekeeper**. Money is in US dollars (\$).

- **Phase 1, Concept checks (~10 min).** Each group votes together, argues for 90 seconds, then settles on one answer.
- **Phase 2, Desk problem (~20 min).** One pair of economies, taken apart with the production model, part by part.
- **Phase 3, Case (~25 min).** One real story, ending hidden. Your group commits a prediction, then we reveal what happened.

Word list. The **production function** $Y = AK^{1/3}L^{2/3}$ turns capital K and labour L into output Y ; A is **total factor productivity (TFP)**, how much output you get from given inputs. **Constant returns to scale** means doubling both inputs doubles output. Per worker, $y = Ak^{1/3}$, where y is output per worker and k is **capital per worker**. **Diminishing returns** means each extra unit of capital adds less output than the last. **Development accounting** splits the income gap between countries into a part due to capital and a part due to TFP. A **ratio (log) scale** turns constant growth into a straight line.

Phase 1 – Concept checks

~10 MIN

ConceptTest 1. A country's GDP per person is drawn on a **ratio (logarithmic) scale** and traces a straight, upward-sloping line. This means

- (a) GDP per person is constant over time.
- (b) GDP per person grows at a constant *percentage* rate.
- (c) GDP per person rises by the same number of dollars each year.
- (d) the country is shrinking.

ConceptTest 2. A firm produces with $Y = AK^{1/3}L^{2/3}$. If it doubles *both* its capital K and its workers L , output

- (a) more than doubles.
- (b) exactly doubles.
- (c) less than doubles.
- (d) does not change.

ConceptTest 3. With $Y = AK^{1/3}L^{2/3}$ and competitive markets, the share of total income paid to the owners of **capital** is

- (a) one-third.

- (b) two-thirds.
- (c) one-half.
- (d) it depends on the level of productivity A .

ConceptTest 4. Rich countries have about **8 times** the capital per worker of poor countries. Using $y = Ak^{1/3}$, differences in capital *alone* make a rich worker about how many times as productive?

- (a) 8 times.
- (b) 2 times.
- (c) 24 times.
- (d) the same, capital does not matter.

Phase 2 – The desk problem

~20 MIN

Why is the rich country rich: capital or productivity?

Two economies produce with the same per-worker function $y = Ak^{1/3}$, where y is output per worker, k is capital per worker, and A is total factor productivity. The data:

	Output per worker y	Capital per worker k
Rich country (R)	\$100,000	\$400,000
Poor country (P)	\$12,500	\$50,000

(a) **What capital alone predicts (worked for you).** If the two countries had the *same* productivity A , the only difference would be capital, and output per worker would differ by the capital ratio raised to the power $1/3$:

$$\left(\frac{k_R}{k_P}\right)^{1/3} = \left(\frac{400,000}{50,000}\right)^{1/3} = 8^{1/3} = 2.$$

Capital alone says the rich country should be only **2 times** richer per worker.

(b) **What is actually true?** Compute the *actual* output-per-worker ratio y_R/y_P from the table.

(c) **The missing piece: productivity.** The model fits only if the rich country also has higher TFP. Find the TFP ratio

$$\frac{A_R}{A_P} = \frac{\text{actual output ratio}}{\text{capital-predicted ratio}}.$$

(d) **Split the gap.** The rich country is 8 times richer per worker. Write this as capital $\times$ TFP, that is $8 = (\dots) \times (\dots)$. In one sentence: is being rich mainly about having more machines, or about being more productive with them?

Phase 3 – The case

~25 MIN

The economy that was going to overtake America

How to run this. Read the story with your group. The ending is hidden on purpose. Do the calculation in question 1, commit a written prediction to question 3 before the reveal, and do not search the internet.

The story. After the Second World War the Soviet Union grew very fast, by some estimates around 5 to 6 per cent a year through the 1950s. It did this by investing an enormous share of its output in factories and machines, and by moving millions of workers off farms and into industry. Its capital per worker climbed, year after year. The growth was so striking that the best-selling economics textbook of the age, by Paul Samuelson, printed a chart projecting that Soviet output would catch up with and then overtake the United States within a few decades. Most Western analysts agreed the gap was closing.

The story stops here.

Four questions (commit your answer to question 3 in writing before the reveal):

1. Use the model. If the Soviet Union keeps *doubling* its capital per worker but its productivity A does not improve, by how much does output per worker rise? (With $y = Ak^{1/3}$, the factor is $2^{1/3}$.) What does this say about growth bought with investment alone?
2. Soviet investment stayed very high into the 1970s and 1980s, yet growth slowed to a crawl. Using your answer to question 1, why can a high-investment economy still run out of steam?
3. **Predict.** Did the Soviet economy overtake the United States, as the textbooks expected?
4. What is the lesson for a fast-investing economy today, for example China?

End of activity handout. Solutions are distributed after the block.