Macroeconomics | Lecture 4

Saving, Diminishing Returns and the Power of Ideas

Group Activity - 3 -

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How this block runs. You work in your home group of three or four, textbook open. Roles rotate: **Scribe**, **Reporter**, **Sceptic**, **Timekeeper**.

- **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 economy in the Solow model, solved for its long run, 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. In the **Solow model**, output per worker is $y = Ak^{1/3}$, where k is **capital per worker** and A is **total factor productivity (TFP)**. Capital builds up through saving and wears out through depreciation: $\Delta k = s\,y - d\,k$, where s is the **saving rate** and d the **depreciation rate**. At the **steady state** investment just covers depreciation, so k and y stop changing. **Diminishing returns** means each extra unit of capital adds less output than the last. An **idea** (a recipe, a design) is **nonrival**: many people can use it at once without using it up, which is why ideas need not run into diminishing returns.

Phase 1 – Concept checks

~10 MIN

ConcepTest 1. In the Solow model, with productivity A unchanged, a country that permanently raises its saving rate ends up with

(a) a permanently *faster* growth rate of income per worker.

(b) a permanently *higher level* of income per worker, but the same long-run growth rate.

(c) lower income per worker.

(d) no change at all.

ConcepTest 2. With no improvement in technology (so A is fixed), the Solow model predicts that the long-run growth rate of income per worker is

(a) equal to the saving rate.

(b) equal to the depreciation rate.

(c) zero.

(d) rising without limit.

ConcepTest 3. An idea, such as a recipe or a piece of software, differs from a loaf of bread because an idea is

(a) rival: only one person can use it at a time.

(b) nonrival: many people can use it at the same time without using it up.

(c) always free to produce.

(d) never valuable.

ConcepTest 4. Why can ideas keep growth going in the long run when adding capital cannot? Because, unlike a machine, a new idea

(a) wears out faster than capital.

(b) can be used by everyone at once and does not run into diminishing returns the way capital does.

(c) is always cheap to produce.

(d) is rival.

Phase 2 – The desk problem

~20 MIN

One economy, solved for its long run

An economy produces with $y = Ak^{1/3}$. Capital builds up by saving and wears out by depreciation, $\Delta k = s\,y - d\,k$, so in the long run capital settles where investment just covers depreciation, $s\,y = d\,k$. Take productivity $A = 1$ throughout.

(a) The steady state (worked for you). Set $s\,A\,k^{1/3} = d\,k$ and solve for k:

$$k^{2/3} = \frac{sA}{d}, \qquad k^* = \left(\frac{sA}{d}\right)^{3/2}, \qquad y^* = A\,(k^*)^{1/3} = \left(\frac{sA}{d}\right)^{1/2}.$$

With $s = 0.20$ and $d = 0.10$, this gives $k^* = 2^{3/2} \approx 2.83$ and $y^* = 2^{1/2} \approx 1.41$.

(b) A thriftier neighbour. A second country is identical but saves twice as much, $s = 0.40$, with the same $d = 0.10$. Using $y^* = (s/d)^{1/2}$, find its steady-state output per worker.

(c) How much richer? By what percentage is the high-saving country richer per worker in the long run? It saves *twice* as much; is it *twice* as rich?

(d) The growth rate. Once each country has reached its steady state, what is the long-run growth rate of income per worker in each? In one sentence: did doubling the saving rate buy a higher *level* of income or a faster *growth rate*?

Phase 3 – The case

~25 MIN

The recipe that fed a subcontinent

How to run this. Read the story with your group. The ending is hidden on purpose. Do the reasoning in questions 1 and 2, commit a written prediction to question 3 before the reveal, and do not search the internet.

The story. In the 1940s Mexico could not grow enough wheat to feed itself and imported about half its supply. An agronomist named Norman Borlaug spent years at a research station crossing thousands of wheat plants. He was after a plant that put its energy into grain rather than a tall stalk, and that resisted disease. By the mid-1950s he had it: a short, stiff-strawed "dwarf" wheat

that carried far more grain without falling over. It cost a farmer almost nothing to plant the improved seed instead of the old one. The hard part, working out how to breed it, had been done once, and the knowledge could then be used by anyone.

The story stops here.

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

1. A tractor helps one farm at a time; the recipe for dwarf wheat can be planted by every farmer in the world at once. Which of the two, in the language of the lecture, is **nonrival**, and why does that matter for long-run growth?
2. In the Solow model, piling up more of the same capital runs into diminishing returns. Explain in one or two sentences why a better idea, such as an improved seed, does not face the same limit.
3. **Predict.** By 1956 Mexico had gone from importing half its wheat to a very different position. What do you think happened to Mexican wheat output, and how far do you think this one line of research spread?
4. What does this case say about the deepest source of long-run growth, and why cannot a poor country simply save and invest its way to the frontier?

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