

LECTURE 23: GROWTH AND DEVELOPMENT I

I do not see how one can look at figures like these without seeing them representing possibilities. Is there some action a government of India could take that would lead the Indian economy to grow like Indonesia's or Egypt's? If so, *what* exactly? If not, what is it about the “nature of India” that makes it so? The consequences for human welfare involved in questions like these are simply staggering: once one starts to think about them, it is hard to think about anything else.

—Nobel Prize Laureate Robert Lucas “On the Mechanics of Economic Development.” *Journal of Monetary Economics*. July 22, 1988, pp. 5. [Original emphasis]

I. Growth Changes Everything

a. If you’ve ever been to a developing country, the differences between it and the United States (and other wealthy countries) are profound.

You might often find the following:

- i. The tap water is not safe to drink.
- ii. Roads and buildings with poor upkeep.
- iii. Poor sanitation and no indoor plumbing.
- iv. Many people with exhausting and/or dangerous jobs, if they have a job at all.
- v. Irregular or no electricity.
- vi. Poor nutrition and scant medical care.

b. This list is not exhaustive the severity of each item will change based on where you go. But the overarching theme can be summed up as:

Poverty is misery. Poverty kills.

c. And it is not a small problem. Over a billion people live on less than \$1.25 a day. Billions more live in substantially diminished conditions.

- i. In contrast, the typical American lives on \$82.79 per day.¹

II. The Solow Model

a. Recall we typically measure wealth by GDP, or Y.

- i. What causes Y to increase? More labor (L), the skill level of those workers (e), technology (A), and capital (K).²

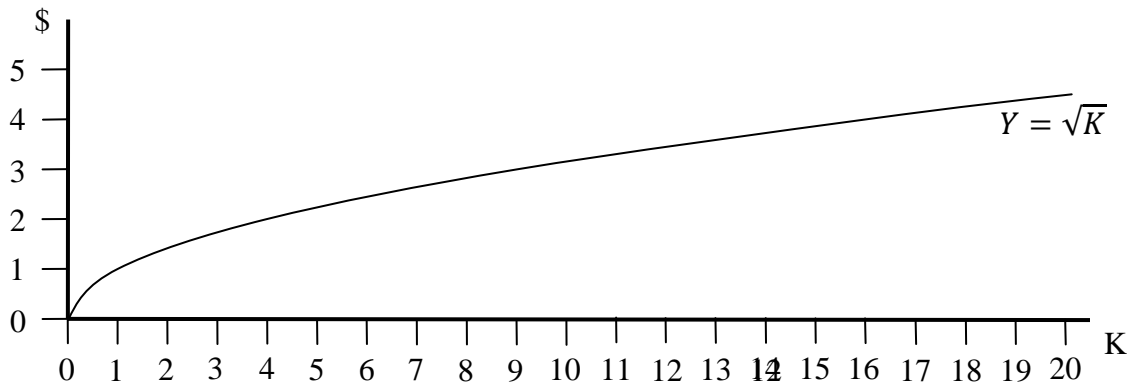
¹Based on 2016 real median individual income (\$30,240), divided by 365.25 days. From FRED database: <https://fred.stlouisfed.org/series/MEPAINUSA672N>

²We call capital “K” to avoid confusion with consumption (C) and because in German, capital is “kapital.” (Many economics working on the role of capital in the economy at the time this became a popular abbreviation were German-speaking, including Karl Marx, Eugen Böhm von Bawerk, and F.A. Hayek.)

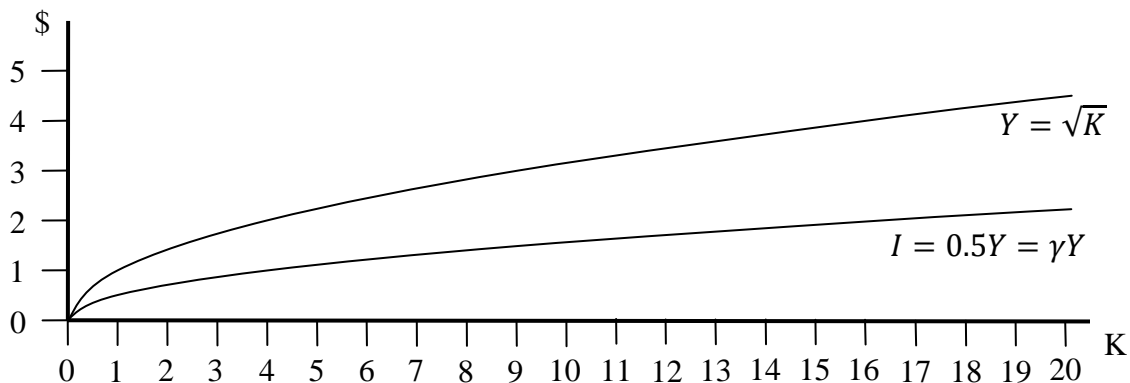
- ii. In other words, $Y = F(A, K, eL)$
- b. Let us focus on physical capital. The more tools each person has at her disposal, the more productive that person can be.
 - i. In the short-run, it's tricky to increase education levels, population, and technology. But capital can change readily through different levels of investment.
 - ii. So this model starts by holding everything else constant.
- c. Each additional unit of capital has less and less of an impact on productivity. This is called the *diminishing marginal productivity of capital*.
- d. One way to capture this idea is with the equation,

$$Y = \sqrt{K}$$

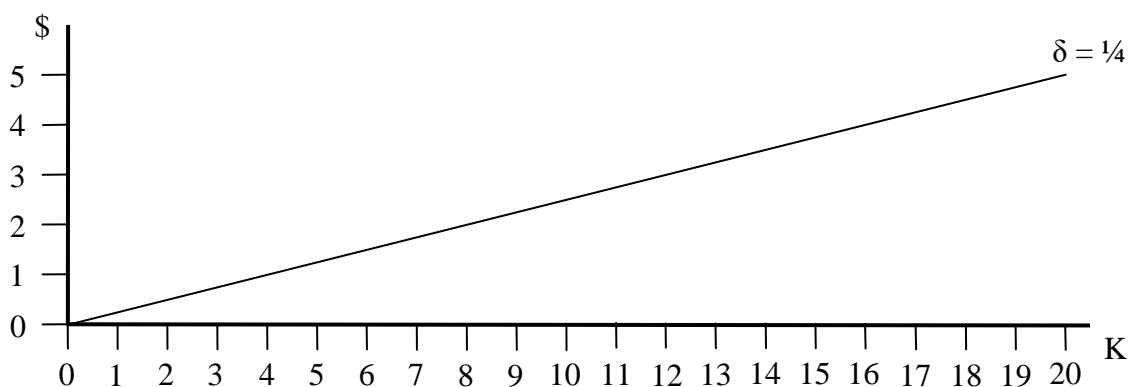
- i. More K means more Y (the line slopes up).
- ii. But each additional unit of K means Y increases at a slower and slower pace (the line is concave).



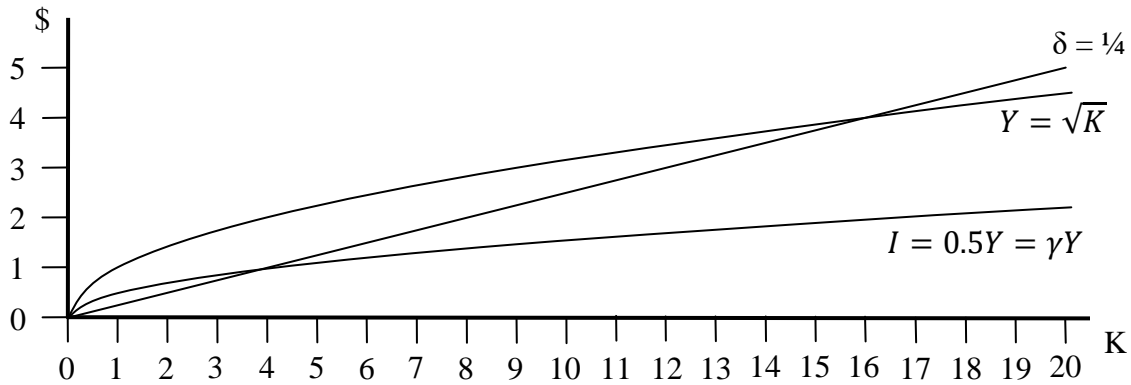
- iii. Recall that there are two things that can happen to output: consumption (C) and investment (I). Because savings = investment, our MPS is the portion of output that goes to capital. Let γ , or gamma, be our MPS. Suppose $\gamma = 0.5$. Thus:



- e. The other side of this model is *depreciation*—the tendency for capital to break down. All capital breaks down—machines wear out, roads develop potholes, harbors become silted, etc.
- i. Depreciation is symbolized by δ , or delta.
 - ii. It's expressed as a fraction, such as 0.2. That means 20% of this country's capital wore out.
 - iii. Depreciation is a complex idea—different machines have different rates, the depreciation for each machine is not constant—but we'll assume it's a constant value for all capital to illustrate the idea the model is showing us. Let's assume depreciation is $\frac{1}{4}$. That means if the economy has four units of capital, one unit will fall apart.



- iv. So some of an economy's production must be dedicated to replace capital that fell apart. We can capture this idea by combining this with the other graph. (For simplicity, our y-axis will just be labeled Y, for GDP; that is what we care about, after all.)
- f. Thus we have the Solow Growth Model:



- i. When investment $>$ depreciation, the capital stock is growing. In the next period (month, quarter, year), the output will be bigger.
- ii. When investment $<$ depreciation, the capital stock is shrinking. Machines are breaking down faster than people can replace them.
- iii. When investment = depreciation, the capital stock and the output are constant in each time period. This is what Solow called the steady state. Here, our steady state is 4 units of K, producing 2 units of output. One of those units goes to consumption, and the other goes to investment. That investment exactly replaces the one unit we lost to depreciation.