

# EC1B5 | Macroeconomics

## Chapter 7

# Economic Growth

### Additional Practice Questions:

#### **Book Question 2**

Currently, some of the fastest growing countries in the world remain desperately poor. For example, of the top five fastest-growing economies in 2016, three—Iraq, Burma, and Nauru—had real per capita GDP that were 101st, 162nd and 112th in the world, respectively. (Source: CIA Factbook estimates for 2016, PPP basis.) This seems like something of a contradiction. Using the equations for growth given in the chapter, explain why a country that has a very low real per capita GDP can also have a very high growth rate.

*Answer:*

Recall that the equation for growth from year  $t$  to year  $t + 1$  is

$$\text{Growth}_{t,t+1} = \frac{Y_{t+1} - Y_t}{Y_t}$$

So a lower number in the denominator means that even a small figure in the numerator will result in a large growth rate. For example, in 2016, Burma had a GDP of only \$311 billion and a population of 56.9 million, resulting in a GDP per capita of around \$5,466. However, an increase in GDP per capita of just \$100 (which hardly makes Niger a rich country) would result in a GDP figure of \$316.69 billion, and a GDP growth rate of

$$\frac{\$316.69 \text{ billion} - \$311.00 \text{ billion}}{\$311.00 \text{ billion}} = 0.018 \text{ or } 1.8\%$$

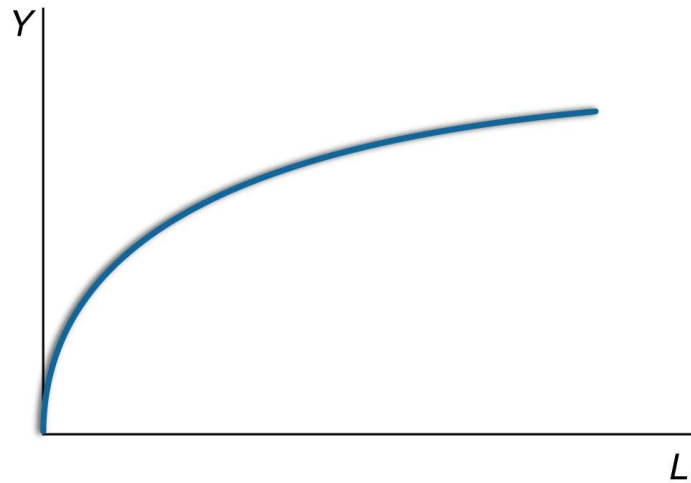
By contrast, a \$100 increase in U.S. GDP per capita (from \$57,300 to \$57,400) reflects a GDP growth rate of only 0.2 percent.

Mathematically, these results are due to the much larger base in the United States compared to the much smaller one in Niger.

#### **Book Question 7**

The concept of diminishing returns to a factor of production applies not only to physical capital but to labor as well. Use the concept of diminishing returns to labor to explain and illustrate why there was no sustained growth in living standards prior to the Industrial Revolution. Draw a graph to illustrate the relationship between population and real GDP, where population is measured on the x- axis. Explain how your graph changes after the Industrial Revolution.

*Answer:* The relevant graph is below:



Note that real GDP increases at a decreasing rate, as is also the case with capital. Barring technological change, this does not allow for an increase in living standards, especially as the population continues to grow.

The Industrial Revolution led to the invention of capital and technology that shifted the production function upward in terms of both labor and capital.

### **Book Question 8**

In Question 8, we discussed the Malthusian cycle prediction. Under what conditions might the Malthusian cycle be a reality as it was in the preindustrial age?

*Answer:*

As long as technological advancements in agriculture can keep up with population growth on the one hand and increased food consumption due to increased wealth in developing countries on the other, the Malthusian cycle is unlikely to become a problem. However, should climate change destroy mass amounts of previously arable land, freshwater supplies run out, technological advancements slow down, and population growth remain constant, the Malthusian cycle may very well be a problem in the future.

### **Book Appendix Question 1**

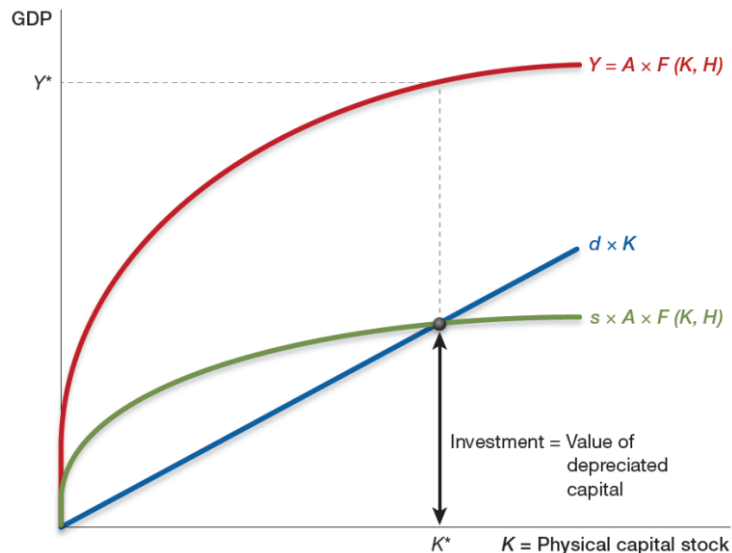
Use a diagram to represent the Solow growth model using the aggregate production function and the relationship between the physical capital stock and aggregate saving.

- Which point in the figure represents the steady-state equilibrium? Why?
- Use the diagram to show the impact of an increase in human capital on GDP.

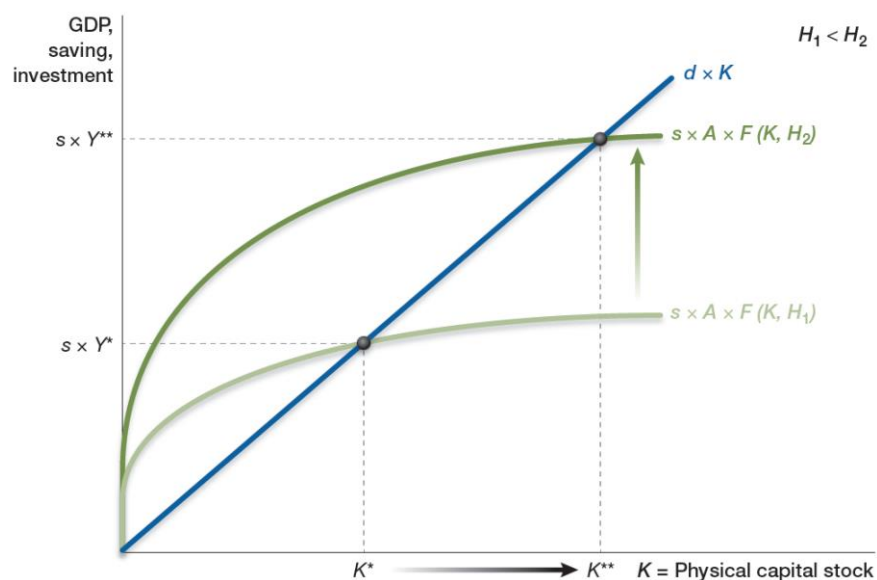
*Answer:*

The following figure represents the Solow growth model. The straight line represents the value of depreciated capital,  $d \times K$ . The curve labeled  $Y = A \times F(K, H)$  represents the aggregate production function, or more specifically, the relationship between aggregate incomes and the (physical) capital

stock, for a given level of efficiency units of labor (and for a given technology). The curve labeled  $s \times A \times F(K, H)$  shows the relationship between the level of investment and the capital stock given the saving rate of households,  $s$ . The distance between this curve and the horizontal axis at a given level of capital stock corresponds to aggregate saving or investment, while the distance between the curve labeled  $s \times A \times F(K, H)$  and the curve labeled  $Y = A \times F(K, H)$  represents consumption.



- In the figure, there is a unique point where the straight line labeled  $(d \times k)$  intersects the curve labeled  $s \times A \times F(K, H)$ , representing investment. This intersection gives the steady-state equilibrium capital level on the horizontal axis, marked as  $K^*$ , and the steady-state equilibrium output level on the vertical axis is  $Y^*$ . When the economy is in steady-state equilibrium, the level of investment (saving) and the value of depreciated capital are equal.
- The following figure shows the effect of an increase in human capital on aggregate output.

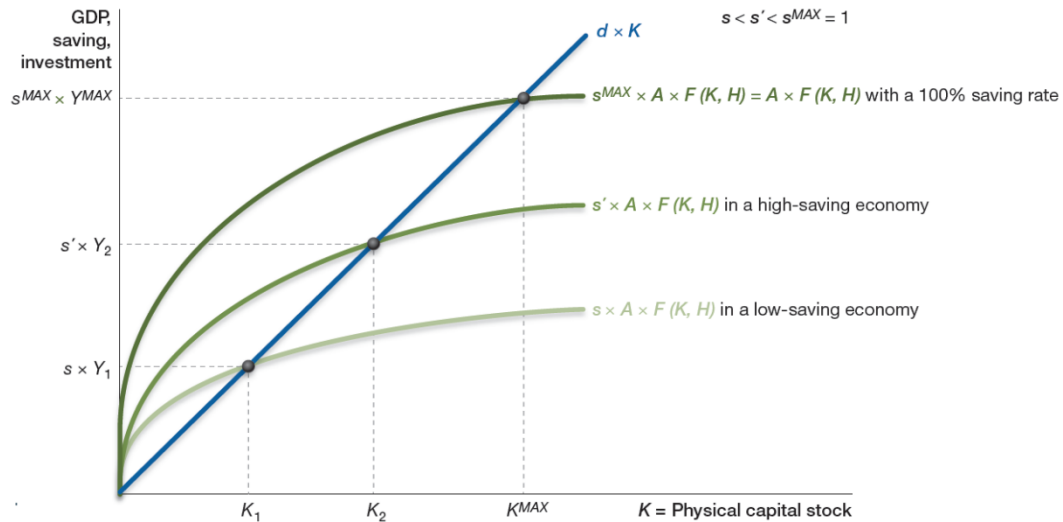


When the human capital of workers increases, the total efficiency units of labor also increases. This implies that the economy can produce more with the same capital stock and technology, so the curve for the aggregate production function shifts up. This leads to a new steady-state equilibrium with higher capital stock and aggregate income. In particular, the capital stock increases from  $K^*$  to  $K^{**}$  and aggregate income from  $Y^*$  to  $Y^{**}$ .

## Book Appendix Question 2

In 2016, Guinea topped the list of countries registering the lowest national savings, with savings forming −14.9 percent of GDP. This, however, does not mean that the economy doesn't have good prospects of potential growth given various internal positive components. Does this logic fit the Solow model? (Source: World Atlas, <https://www.worldatlas.com/articles/countries-with-the-least-savings-in-the-world.html>, April 25, 2017)

Answer:



In the figure, the Solow model shows that economies with higher saving rates have higher aggregate incomes but an increase in the saving rate cannot be the only source of sustained growth. Following the same line of thought, if a country suffers from low saving rates, it does not mean that it cannot witness growth.