Review Questions – Economic Growth I

QUESTIONS FOR REVIEW

1. In the Solow model, how does the saving rate affect the steady-state level of income? How does it affect the steady-state rate of growth?
2. Why might an economic policymaker choose the Golden Rule level of capital?
3. Might a policymaker choose a steady state with more capital than in the Golden Rule steady state? With less capital than in the Golden Rule steady state? Explain your answers.
4. In the Solow model, how does the rate of population growth affect the steady-state level of income? How does it affect the steady-state rate of growth?

PROBLEMS AND APPLICATIONS

1. LaunchPad • Country A and country B both have the production function

$$Y = F(K, L) = K^{1/3}L^{2/3}.$$

   a. Does this production function have constant returns to scale? Explain.

   b. What is the per-worker production function, $y = f(k)$?

   c. Assume that neither country experiences population growth or technological progress and that 20 percent of capital depreciates each year. Assume further that country A saves 10 percent of output each year and country B saves 30 percent of output each year. Using your answer from part (b) and the steady-state condition that investment equals depreciation, find the steady-state level of capital per worker for each country. Then find the steady-state levels of income per worker and consumption per worker.

   d. Suppose that both countries start off with a capital stock per worker of 1. What are the levels of income per worker and consumption per worker?

   e. Remembering that the change in the capital stock is investment less depreciation, use a calculator (or, better yet, a computer spreadsheet) to show how the capital stock per worker will evolve over time in both countries. For each year, calculate income per worker and consumption per worker. How many years will it be before the consumption in country B is higher than the consumption in country A?

2. In the discussion of German and Japanese postwar growth, the text describes what happens when part of the capital stock is destroyed in a war. By contrast, suppose that a war does not directly affect the capital stock, but that casualties reduce the labor force. Assume the economy was in a steady state before the war, the saving rate is unchanged, and the rate of population growth after the war is the same as it was before.

   a. What is the immediate impact of the war on total output and on output per person?

   b. What happens subsequently to output per worker in the postwar economy? Is the growth rate of output per worker after the war smaller or greater than it was before the war?

3. LaunchPad • Consider an economy described by the production function: $Y = F(K, L) = K^{0.4}L^{0.6}$.

   a. What is the per-worker production function?

   b. Assuming no population growth or technological progress, find the steady-state capital stock per worker, output per worker, and consumption per worker as a function of the saving rate and the depreciation rate.

   c. Assume that the depreciation rate is 15 percent per year. Make a table showing steady-state capital per worker, output per worker, and consumption per worker for saving rates of 0 percent, 10 percent, 20 percent, 30 percent, and so on. (You might find it easiest to use a computer spreadsheet.) What saving rate maximizes output per worker? What saving rate maximizes consumption per worker?

   d. Use information from Chapter 3 to find the marginal product of capital. Add to your table from part (c) the marginal product of capital net of depreciation for each of the saving rates. What does your table show about the relationship between the net marginal product of capital and steady-state consumption?

4. "Devoting a larger share of national output to investment would help restore rapid productivity growth and rising living standards." Do you agree with this claim? Explain, using the Solow model.

5. Draw a well-labeled graph that illustrates the steady state of the Solow model with population growth. Use the graph to find what happens to steady-state capital per worker and income per worker in response to each of the following exogenous changes.

   a. A change in consumer preferences increases the saving rate.

   b. A change in weather patterns increases the depreciation rate.

   c. Better birth-control methods reduce the rate of population growth.

d. A one-time, permanent improvement in technology increases the amount of output that can be produced from any given amount of capital and labor.

6. Many demographers predict that the United States will have zero population growth in the coming decades, in contrast to the historical average population growth of about 1 percent per year. Use the Solow model to forecast the effect of this slowdown in population growth on the growth of total output and the growth of output per person. Consider the effects both in the steady state and in the transition between steady states.

7. In the Solow model, population growth leads to steady-state growth in total output, but not in output per worker. Do you think this would still be true if the production function exhibited increasing or decreasing returns to scale? Explain. (For the definitions of increasing and decreasing returns to scale, see Chapter 3, "Problems and Applications," Problem 3.)

8. Consider how unemployment would affect the Solow growth model. Suppose that output is produced according to the production function $Y = K^{\alpha}[(1 - u)L]^{1-\alpha}$, where K is capital, L is the labor force, and u is the natural rate of unemployment. The national saving rate is s, the labor force grows at rate n, and capital depreciates at rate δ.

a. Express output per worker ($y = Y/L$) as a function of capital per worker ($k = K/L$) and the natural rate of unemployment (u).

b. Write an equation that describes the steady state of this economy. Illustrate the steady state graphically, as we did in this chapter for the standard Solow model.

c. Suppose that some change in government policy reduces the natural rate of unemployment. Using the graph you drew in part (b), describe how this change affects output both immediately and over time. Is the steady-state effect on output larger or smaller than the immediate effect? Explain.