HW 9: Due on Oct. 25th before class.

1. (Textbook, 7th e, chapter 8, question 1)

An economy described by the Solow model has the following production function:

\[ y = \sqrt{k} \]

a. Solve for the steady-state value of \( y \) as a function of \( s, n, g, \) and \( \delta \).

b. A developed country has a saving rate of 28 percent and a population growth rate of 1 percent per year. A less developed country has a saving rate of 10 percent and a population growth rate of 4 percent per year. In both countries, \( g=0.02 \) and \( \delta=0.04 \). Find the steady-state value of \( y \) for each country.

c. What policies might the less developed country pursue to raise its level of income?

2. (Textbook, 7th e, chapter 8, question 2)

In the United Stated, the capital share of GDP is about 30 percent, the average growth in output is about 3 percent per year, the depreciation rate is about 4 percent per year, and the capital-output ratio is about 2.5. Suppose that the production function is Cobb-Douglas, so that the capital share in output is constant, and that the United States has been in a steady state.

a. What must the saving rate be in the initial steady state?

b. What is the marginal product of capital in the initial steady state?

c. Suppose that public policy raises the saving rate so that the economy reaches the Golden Rule level of capital. What will the marginal product of capital be at the Golden Rule steady state? Compare the marginal product at the Golden Rule steady state. Explain.

d. What will the capital-output ratio be at the Golden Rule steady state?

e. What must the saving rate be to reach the Golden Rule steady state?
3. (Textbook, 7th e, chapter 8, question 5)

The amount of education the typical person receives varies substantially among countries. Suppose you were to compare a country with a highly educated labor force and a country with a less educated labor force. Assume that education affects only the level of the efficiency of labor. Also assume that the countries are otherwise the same: they have the same saving rate, and the same depreciation rate, the same population growth rate, and the same rate of technological progress. Both countries are described by the Solow model and are in their steady state. What would you predict for the following variables?

a. The rate of growth of total income.
b. The level of income per worker.
c. The real rental price of capital.
d. The real wage.

4. (Textbook, 7th e, chapter 8, question 6)

This question asks you to analyze in more detail the two-sector endogenous growth model presented in the text.

a. Rewrite the population function for manufactured goods in terms of output per effective worker and capital per effective worker.
b. In this economy, what is break-even investment (the amount of investment needed to keep capital per effective worker constant)?
c. Write down the equation of motion for k, which shows Δk as saving minus break-even investment. Use this equation to draw a graph showing the determination of steady-state k. (This graph will look much like those we used to analyze the Solow model.)
d. In this economy, what is the steady-state growth rate of output per worker Y/L? How do the saving rate s and the fraction of the labor force in universities u affect this steady-state growth rate?
e. Using your graph, show the impact of an increase in u. Describe both the immediate and the steady-state effects.
f. Based on your analysis, is an increase in u an unambiguously good thing for the economy? Explain.