

Homework 3
Chapter 6

1. The information below describes the current state of a growing closed economy.

- Production function: $Y_t = K_t^{1/2}(Q_t N_t)^{1/2}$
 - Production per effective worker $y_t = k_t^{1/2}$
 - Growth rate of effectiveness $g_E = 0.03$
 - Growth rate of workers $n = 0.02$
 - Depreciation rate $d = 0.01$
 - Saving rate $s = 0.36$
- a) Write and explain the equation which determines the long-run equilibrium value of capital per effective worker.
 - b) Use your equation and the numbers above to solve for the steady-state values of (1) capital per effective worker and (2) output per effective worker.
 - c) Illustrate your answer to part (a) with the help of a Solow diagram. (Labels are very important.)
 - d) Use the graph above to show how an increase in the savings rate affects the equilibrium level of capital per effective worker. Explain how output is affected.
 - e) What are the steady-state growth rates of capital per worker and output per worker?

2. Two economies, Hare and Tortoise, each start with a real GDP per person of \$5000 in 1950. Real GDP per person grows 3% per year in Hare and 1% per year in Tortoise. In the year 2000, what will be real GDP per person in each economy? Make a guess first; then use a calculator to get the answer.

3. Over the past twenty years an economy's total output has grown from 1000 to 1300, its capital stock has risen from 2500 to 3250, and its labor force has increased from 500 to 575. All measurements are in real terms. Calculate the contributions to economic growth of growth in capital, labor, and productivity:

- a. assuming that $\alpha=0.3$
 - b. assuming that $\alpha=0.5$.
4. An economy has the per-worker production function $y_t = 3k_t^{0.5}$. The depreciation rate is 0.1, and the population growth rate is 0.05. Saving is $S_t=0.3Y_t$.
- a. What are the steady-state values of the capital-labor ratio, output per worker, and consumption per worker?
 - b. Repeat part (a) for a saving rate of 0.4 instead of 0.3.
 - c. Repeat Part (a) for a population growth rate of 0.08 with a saving rate of 0.3.
 - d. Repeat Part (a) for a production function of $y_t = 4k_t^{0.5}$. Assume that the saving rate and population growth rate are at their original values.

5. According to the Solow model, how would each of the following affect consumption per worker in the long run (that is, in the steady state)? Explain.
 - a. The destruction of a portion of the nation's capital stock in a war.
 - b. A permanent increase in the rate of immigration (which raises the overall population growth rate).
 - c. A permanent increase in energy prices
 - d. A temporary rise in the saving rate
 - e. A permanent increase in the fraction of the population in the labor force (the population growth rate is unchanged).

6. An economy is in steady state with no productivity change. Because of an increase in acid rain, the rate of capital depreciation rises permanently.
 - a. According to the Solow model, what are the effects on steady-state capital per worker, output per worker, consumption per worker, and the long-run growth rate of the total capital stock?
 - b. In an endogenous growth model, what are the effects on the growth rates of output, capital, and consumption of an increase in the depreciation rate of capital?