ECON 355: Homework 1
Spring 2021
C. Richard Higgins

This homework is due by the start of class February 10. Please upload a single pdf file with your answers to our shared folder on Google Drive. You should also upload your MATLAB code files.

1. A standard Solow model with no technological change has the following features:

$$\bar{A} = 10$$

$$\delta = 0.1$$

$$n = 0.02$$

$$\sigma = 0.15$$

$$F(K_t, H_t) = K_t^{0.4} H_t^{0.6}$$

a. What is the function, $g(k_t)$, for $k_{t+1} = g(k_t)$?
b. What is the stable steady state level of capital per worker?
c. Is the economy maximizing steady state consumption per worker? If not, what savings rate and what level of steady state capital per worker would maximize steady state consumption per worker?

2. The economy in question 1 is at the steady state for 10 periods. In the eleventh period, the savings rate increases to 30% and remains there. Simulate the economy for 100 periods (10 before the change, 90 with the new savings rate). Plot capital per worker, output per worker and consumption per worker on separate graphs for those 100 periods. Include the figures in the pdf. What do you notice in the figures?

3. A stochastic Solow model has the following features:

$$Y_t = A_t F(K_t, H_t) = A_t K_t^{0.4} H_t^{0.6}$$

$$A_t = \bar{A} Z_t$$

$$\bar{A} = 5$$

$$\ln Z_t = 0.6 \ln Z_{t-1} + 0.1\varepsilon_t$$

$$\delta = 0.025$$

$$n = 0.01$$

$$\sigma = 0.1$$

where ε is an independent, identically distributed random number from the standard normal distribution. Not that the productivity shock now follows an AR(1) process, so your analysis will be different than what we did in class.

a. What is the stable steady state level of capital per worker?
b. In MATLAB simulate the model for 100 periods starting from the steady state. Plot output per worker and capital per worker in separate figures. Include these in your pdf.
c. Repeat the exercise from part b but start at a level of capital per worker that is half of the steady state value. Plot output per worker and capital per worker in separate figures. Include these in your pdf.

4. Consider a Solow model where the savings rate depends on the marginal product of capital (in per worker terms). The model has the following features:

$$\bar{A} = 0.5$$

$$\delta = 0.1$$

$$n = 0.02$$

$$\sigma_t = \frac{1}{1 + 0.25k_t^{-0.75}}$$

$$F(K_t, H_t) = K_t^{0.25} H_t^{0.75}$$

a. What is the non-zero steady state level of capital per worker?

b. What is the function, $g(k_t)$, for $k_{t+1} = g(k_t)$?

c. Use MATLAB to determine if the steady state is stable. Create a grid of value from 0 to 10 for k_t for every 0.01 values and solve for $g(k_t)$ for these values. Plot this function with k_t on the x-axis and k_{t+1} on the y-axis. Include the figure in the pdf. Is the steady state stable?