Exercise session #6 - Solow model II.

Problem 1 - Golden rule level of capital; D-F 92/5   Consider an economy in which production is characterized by the neoclassical function $Y = K^{0.2}(AL)^{0.8}$. Suppose that it has saving rate of 0.1, a population growth of 0.02, a technological growth of 0.02 and an average depreciation rate of 0.03.

1. Write this production function in per capita form, and find the steady-state values of k and y.

2. At the steady-state value of k, is there more or less capital then at the golden-rule level?

3. Determine what saving rate would yield the golden-rule level of capital in this model.

4. In the context of this neoclassical growth model, can a country have too much saving?

Problem 2 - Solow model; M 227/2

In the United States, 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.

1. What must the saving rate be in the initial steady state? [Hint: Use the steady-state relationship, $sy = (d + n + g)k$.]

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

3. 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 to the marginal product in the initial steady state. Explain.

4. What will the capital–output ratio be at the Golden Rule steady state? (Hint: For the Cobb–Douglas production function, the capital–output ratio is related to the marginal product of capital.)

5. What must the saving rate be to reach the Golden Rule steady state?

Problem 3 - Endogenous growth model (AK); D-F 92/4

Consider an economy whose production function is $Y = K^\theta (AL)^{1-\theta}$ with $A = 4K/L$. Suppose that it has a saving rate of 0.1, a population growth rate of 0.02 and an average depreciation rate of 0.03 and that $\theta = 0.5$.

1. Reduce the production function to the form $y = ak$. What is a?

2. What are the growth rates of output and capital in this model?

3. Interpret a. What are we really saying when we assume that the labor-augmenting technology, A, is proportional to the level of capital per worker?

4. What makes this an endogenous growth model?

Questions for review:

Lecture 6 + 7: Solow model

- How would you describe unconditional convergence? State the equation and explain the intuition.

- How would you describe conditional convergence? State the equation and explain the intuition.

- Which assumption on production function allows us to work with per capital values? What are the other two assumptions on neoclassical production function?

- What are the two causes of the change in the capital stock?

- How would you support the assumption of the constant saving rate on micro level?

- Define the steady-state condition in the Solow model with technological and population growth.

- What are the characteristics of the steady state in the Solow model?

- Draw the picture depicting the effect of increased saving rate on the steady state in the Solow model.

- Define the Golden rule level of capital in the Solow model (what is maximized, how do we compute it).

- Might a policy maker choose a steady state with more capital than in the Golden Rule steady state? Explain your answer.

- Might a policy maker choose a steady state with less capital than in the Golden Rule steady state? Explain your answer.

- In the Solow model, how does the rate of population growth affect the steady state **level of income per capita**?

- In the Solow model, how does the rate of population growth affect the steady state level of **growth of income per capita**?

- Define exogenous growth models + give an example.

- Define endogenous growth model + give an example.

- How do we attain endogenous growth in AK type models?

- When constant returns to capital input are a reasonable assumption?