

Exercise session #4 - Solow model

Problem 1 - Unemployment in Solow model

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 .

- Express output per worker ($y = Y/L$) as a function of capital per worker ($k = K/L$) and the natural rate of unemployment. Describe the steady state of this economy.
- Suppose that some change in government policy reduces the natural rate of unemployment. 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.

Problem 2 - Stylized facts in Solow model

Prove each of the following statements about the steady state with population growth and technological progress in the Solow model (you can use Cobb-Douglas production function $Y = K^\alpha(EL)^{1-\alpha}$).

- The capital–output ratio is constant.
- Capital and labor each earn a constant share of an economy’s income.
- Total capital income and total labor income both grow at the rate of population growth plus the rate of technological progress, i.e. $n + g$.
- The real rental price of capital is constant, and the real wage grows at the rate of technological progress g . (Hint: The real rental price of capital equals total capital income divided by the capital stock, and the real wage equals total labor income divided by the labor force.)

Problem 3 - Endogenous growth model - 2 sectors

This question asks you to analyze in more detail the two-sector endogenous growth model presented in the text. You can assume production function in the form $Y = K^\alpha(E(1-u)L)^{1-\alpha}$

- Rewrite the production function for manufactured goods in terms of output per effective worker and capital per effective worker. (in goods production sector),
- In this economy, what is break-even investment (the amount of investment needed to keep capital per effective worker constant)?
- 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 . (Hint: This graph will look much like those we used to analyze the Solow model.)
- 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?
- Using your graph or just intuition, describe the impact of an increase in u . Describe both the immediate and the steady-state effects.
- Based on your analysis, is an increase in u an unambiguously good thing for the economy? Explain.

Questions

Lecture 7: Solow model continued

- Define the Golden rule level of capital (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?
- How would you define exogenous growth models + give an example.
- How would you define endogenous growth model + give an example.
- How do we attain endogenous growth in AK type models?
- When are constant returns to capital input reasonable assumption?