

Supervision 2:
Economic growth and the Solow model

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Short Questions

1. Can aggregate income fall if individuals save more in the long run?
2. According to the Solow growth model, what relationship would you expect between the growth rate of GDP per capita and the initial level of GDP per capita across countries?
3. How does technological change affect income per capita in the Solow growth model? In this model, will firms find it profitable to undertake commercial research and development (R&D)? Explain.

Long Questions

1. Consider the Solow model of growth and set $A = 1$ without loss of generality. The production function is $Y = F(K, L) = K^{1/2}L^{1/2}$. Suppose that the savings rate s equals 11%, depreciation δ is 10%, and the population growth rate n is 1%.
 - (a) Use the production function to compute output per capita, $y = Y/L$, as a function of capital per person, $k = K/L$.
 - (b) What is the fundamental equation in the Solow model? Explain each term. Use it to compute the growth rate of capital per person as a function of k .
 - (c) In the steady-state, the growth rate of capital is zero. Using the parameters values assumed above, find the steady-state level of the capital stock, k^* . What is the golden rule level of capital?
 - (d) Imagine that this country is in its steady state, so its capital stock per person is k^* . Imagine that the country receives a gift of one unit of capital from the World Bank (so, suddenly, the capital stock is $k^* + 1$). Can you say what is going to happen to the growth rate after the donation? Why? What will the capital stock be in the long run? Explain.
 - (e) Suppose that the country doubles its savings rate to 22% following the advice of the World Bank. What will happen along the transition and in steady state? Illustrate your answer using the Solow diagram. What happens to consumption in the long run? Explain. [Hint: where is the golden rule level of capital stock?]

2. Consider an economy described by the Solow growth model: The production function is $Y = F(K, L) = \bar{A}K^\alpha L^{1-\alpha}$, the saving rate is s , the depreciation rate is δ and the population growth rate is n . Suppose that the economy is initially at its steady state. For each of the following situations, explain how the economy behaves over time, using the Solow diagram and/or the mathematical equations that describe the economy. Comment on both the evolution of output per capita, as well as the level of output in the economy
- (a) A large fire at a nuclear powerplant, which results in leaks of radioactive materials to the environment that generally cause poorer population health and reduced fertility.
 - (b) A new tax law exempts firms from paying taxes on investment related expenditures.
 - (c) An earthquake destroys large part of the economy's capital stock and is followed immediately by an epidemic that wipes out a large part of the population.
 - (d) A new technology is introduced that improves both the productivity and the durability of capital.