|  |
| --- |
| **Exercises from old exams to chapters in B & W with solutions.** |

|  |
| --- |
| **Chapter 3** |

**Exercise 1**

Consider an economy where aggregate production Y, is described with the production function Y=F (K, L).

1. In the Solow model, what do we assume about marginal productivity and returns to scale?

**Answer:**

We assume diminishing marginal productivity and constant returns to scale.

1. In a Solow model explain the Steady state, by using words and a diagram.

Answer: In equilibrium at the intersection of the saving schedule and the depreciation line, gross investment and depreciation are equal. Then the capital-labour ratio no longer changes.

1. As a follow up to question b), explain what happens if capital accumulation is greater than zero.

**Answer:**

The sign of the capital accumulation tells us where the economy is heading. If greater than zero, then the capital stock per capita is rising and the economy is growing.

1. According to the Solow model, explain the convergence hypothesis.

**Answer:**

The more distant a country’s GDP is from its steady state, the faster it will grow in subsequent years.

**Exercise 2**

1. According to the Solow’s decomposition, three sources of economic growth are identified. What are they?

**Answer:**

Capital accumulation, population growth and technological progress.

1. In a Solow model with no population growth and no technological progress, analyze the effect of an increased depreciation rate on the capital labour ratio and the output labour ratio.

**Answer:**

Both the capital labour ratio and the output labour ratio decline. Shift the depreciation line to the left.

1. Explain the statement: “In a Solow model with no population growth and no technological progress, we can not explain permanent, sustained growth”.

**Answer:**

In a basic Solow model (with no population growth and no technological progress), capital accumulation can explain high living standard and growth during the transition to the steady state, but the law of diminishing returns to scale kicks in. In steady state there is no economic growth. In other words; according to this model, we don’t know the reason for long term growth.

**Exercise 3**

1. In the Solow model, what are the assumptions of the production function on intensive form?
2. Use the Solow model to discuss if capital accumulation can proceed without bounds.
3. What are the main conclusions about long run growth in the Solow model, if we take population growth and technological progress into account?

**Answer:**

1. A production function is a theoretical relationship linking aggregate output to inputs of factors of production. The intensive form is obtained by dividing by labour. Fig 3.3 shows that the output – labour ration grows with the capital – labour ratio (k). The principle of declining marginal productivity implies that the curve becomes flatter as k increases.
2. The capital labour ratio stops changing when investment is equal to depreciation (Steady State). When using a fig like this it is important to define the curves and to explain the movement towards the equilibrium.
3. In equilibrium (Steady State) we have both growths in GDP and in GDP per labour (living standard). GDP per labour grows at the same rate as technological progress (A).

**Exercise 4**

1. What is a production function?
2. In the Solow model, what are the assumptions of the production function?
3. What is the Steady State and the Golden Rule in a Solow model?
4. Use the Solow model to explain what will happen if a country increases their savings rate.
5. What does the Solow model predict about growth in rich countries (high GDP per capita) compared to poor countries (low GDP per capita) and what is it called?

**Answer:**

1. A production function is a theoretical relationship linking aggregate output to inputs of factors of production.
2. Assumptions: Diminishing marginal productivity: Output (Y) grows with capital (K), but the principle of declining marginal productivity implies that the curve becomes flatter as K increases. Constant returns to scale: A doubling of all inputs leads to a doubling of output.
3. Steady State is when the capital – labour ratio stops changing. Then investments are equal to depreciation. Golden Rule: the proposition that per capita consumption is maximized in a growing economy at the point at which the marginal product of capital is equal to the growth rate.
4. If a country increases their savings rate, they will get a temporary boost. Once the new steady state has been reached, no further growth effect can be expected from a higher savings rate. Increased savings does not affect long run growth.
5. The Solow model predicts that poorer countries should grow faster than richer ones. It is called the Convergence hypothesis: The more distant a country’s GDP is from its steady state, the faster it will grow in subsequent years. This is also explained by using the term: Catching up.

**Exercise 5**

1. Define the production function in intensive form.
2. What do we assume about marginal productivity and returns to scale in a Solow model?
3. Explain Steady State in a Solow model.
4. What is the Golden Rule in a Solow model?
5. What are the consequences of “disobeying” the Golden Rule?

**Answer:**

1. The production function is a theoretical relationship linking aggregate output to inputs of factors of production. Intensive form is obtained by dividing both sides by labour.
2. In the Solow model we assume diminishing marginal productivity (the increases in output becomes smaller and smaller as you add more capital per labour) and constant returns to scale (a doubling of all inputs will double outputs).
3. Steady State is when the capital – labour ratio stops changing. Then investments are equal to depreciation.
4. Golden Rule: the proposition that per capita consumption is maximized in a growing economy at the point at which the marginal product of capital is equal to the growth rate.
5. Higher capital labour ratio than following the Golden Rule, is called dynamic inefficient. Then it is permanently possible to raise consumption by reducing saving. The opposite is called dynamic efficient. Then higher future consumption requires early sacrifices.