Department of Economics **Boğaziçi University**

EC 205 Macroeconomics I

Fall 2023

Problem Session 4

$$Y(K,L) = K^{0.4}L^{0.6}$$

1) Consider an economy described by the production function given above.

a) Does the production function have constant returns to scale?

b) What is the per-worker production?

c) Assume that the depreciation rate is 15% per year. Make a table showing steady state capital per worker, output per worker, and consumption per work effort for saving rates of 0,10, and 20 percent and so on.

d) What saving rate maximizes output per worker? What saving rate maximizes consumption per worker?

e) Calculate MPK for each of the saving rates in the table. What does your table show about the relationship between the net marginal product of capital and the steady-state consumption?

2) Examine the effects of the following exogenous changes on the steady-state level of income per worker and capital per worker. Show your work on a graph.

a) A change in consumer preferences decreases the saving rate.

b) Birth-control methods spread.

c) A change in weather patterns increase the depreciation rate.

d) A one-time, permanent technological improvement increases both labor and capital productivity.

3) Consider the Solow-Model we covered in class with zero-population growth. Suppose that production technology is of the Cobb-Douglas form. We showed graphically in class that a higher depreciation rate causes the steady-state level of per-capita capital and output to decrease.

a) Can we verify that steady-state level of per-capita capital decreases as depreciation rate δ increases? Present an analytical solution (long-run capital being a function of only the parameters) instead of using graphs. If so, how? Be precise and use the appropriate math in your answer.

b) We also showed graphically that a higher saving rate causes the steady-state level of per-capita capital and output to increase. Can we verify that steady-state percapita capital increases as the saving rate s increases, by using an analytical solution? If so, how? Be precise and use the appropriate math in your answer.

4)

a) Consider the Solow model with constant population growth, in which the population growth is constant and equal to n. Show graphically the effect of an increase in the population growth rate n. In your graph, put kt is on the horizontal and kt+1 is on the vertical axis, and also use the 45-degree line. Describe your steps in detail.

b) Consider the Solow model with constant population growth n. Find an analytical solution for the steady-state level of per-capita capital, per-capita output, per-capita saving, and per-capita consumption for the Cobb-Douglas technology.

c) Suppose that you are given that $\delta = 0.15$, $s = 0.20$, $n = 0.10$, $A = 5$, and $\alpha = 0.4$ What would be the values of the steady-state level of per-capita capital, the steady state level of per-capita output, the steady-state level of per-capita saving, and the steady-state level of per-capita consumption for the Solow-model with population growth where the production function is of the Cobb-Douglas form.