

Exercise session 7

Course: Mathematical methods in Economics

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Problem 1

1. List assumptions that a neoclassical production function $Y_t = F(A_t, K_t, L_t)$ must satisfy.
2. Distinguish between the Hicks neutral, capital augmenting and labor augmenting technological progress. Depict your intuition in isoquant graphs.
3. Setup the firm maximization problem and derive the factor prices under perfectly competitive markets. Find the firm's profit.

Problem 2

Derive the growth accounting identity in discrete and continuous times. Discuss estimation of that identity.

Problem 3

1. Express the production function $Y(K_t, L_t) = A_t K_t^\alpha L_t^{1-\alpha}$ in *per capita* terms. Explain intuition behind this formulation and link it to the Kaldor stylized facts.
2. Setup the law of motion of capital. Express it in *per capita* terms for three cases: (i) no population and technological growth; (ii) population growth rate is n and technology does not grow (iii) population growth rate is n and technology growth rate is a .
3. Define the steady state capital-labor ratio, k^* , and find its steady-state level for the three cases. Depict it graphically in the locus (k_t, y_t) and (k_{t+1}, k_t) .
4. Derive the capital growth rate, $\frac{k_{t+1} - k_t}{k_t}$ and depict it graphically in $(\frac{k_{t+1}}{k_t}, k_t)$ locus.

Problem 4

1. Setup consumer's maximization problem and find the Golden capital-labor ratio for the case of technology and population growth.
2. How does the Golden rule capital-labor ratio compare to the steady state one? What is the saving rate s ?

Problem 5

Reflect upon the effect of the saving rate, depreciation and technology on k^* , y^* and c^* .