

Introductory Macroeconomics for Engineers

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IE 1

Final Exam Preparation

Question 1

1. Why do we study macroeconomics? (0.25 pts)
2. What is the point of using models in Macroeconomics? (0.5 pts)
3. What is the difference between macroeconomics and microeconomics? (0.25 pts)

Question 2

1. What is the definition of GDP? (1 pt)
2. What are the three approaches to measuring GDP? Provide the formula for each approach. (1.5 pt - 0.5 per approach)
3. What is the difference between nominal and real GDP? (0.5 pt)

Question 3

Mention at least four of Kaldor's stylized facts. (0.5 pt each)

Question 4

Suppose that total output (GDP) in an economy is produced using the following production function:

$$Y = AF(K, N) = AK^\alpha L^{1-\alpha},$$

Where Y is total output, K is capital, L is labor, A is total factor productivity, and $\alpha \in (0, 1)$ is the capital share of output.

1. Show that F has constant returns to scale, i.e., that $F(\lambda K, \lambda L) = \lambda F(K, L)$ for all $\lambda > 0$. (1 pt)

2. Compute $\frac{\partial Y}{\partial K}$ and $\frac{\partial Y}{\partial L}$. (1 pt each)
3. Use the log transformation to compute the growth rate of output, g_Y , in terms of the growth rates of capital, g_K , labor, g_L , and total factor productivity, g_A . (2 pt)
4. Suppose that output from t to $t + 1$ grows 10%. The capital stock grows from 50 to 60 euros, and the labor force grows from 10 to 12 workers. Suppose that $\alpha = 0.3$.
 - (a) Calculate the growth rate of capital and labor. (1 pt each)
 - (b) Calculate the growth rate of total factor productivity. (1 pt)

Question 5

Recall the Solow model, whose dynamics are given by the following equation:

$$K_{t+1} = sAK_t^\alpha L_t^{1-\alpha} + (1 - \delta)K_t$$

Where K_t is the capital stock, L_t is the labor force, s is the savings rate, δ is the depreciation rate, and A is total factor productivity.

1. Transform the equation above into a per-worker basis. (2 pts)
2. Graph the per-worker capital stock, k_{t+1} , as a function of the per-worker capital stock, k_t . (2 pt)
3. Show the dynamics of the per-worker capital stock, k_{t+1} in the graph using the curve $k_{t+1} = k_t$. (1 pt)
4. Solve for the equilibrium level of capital per worker, k^* . (2 pt)
5. What is the growth rate of the per-worker capital stock in the steady state? (1 pt)

0.1 Bonus Question

Where does the savings rate parameter, s , come from in the Solow model? (1 pt)