

Introductory Macroeconomics for Engineers

Martin A. Valdez

IE 1

Final Exam Preparation

Question 1

1. Why do we study macroeconomics? (0.5 pts)
2. Why do we use models in macroeconomics?(0.5 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 in an economy is given by 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)