

ECON 222
Macroeconomic Theory I
Winter Term 2009/10

Assignment 3

*Due: Drop Box 2nd Floor Dunning Hall by **noon March 19th 2010***

No late submissions will be accepted
No group submissions will be accepted
No "Photocopy" answers will be accepted

*Remarks: Write clearly and concisely. Devote some time to give the graphs, plots and tables a format easy to understand. Also the way you present your answers matter for the final grade. Even if a question is mainly analytical, **briefly** explain what you are doing, stressing the economic meaning of the various steps. Being able to convey your thoughts effectively is an asset also in real life.*

Question 1: TFP, and Output Growth (25 Marks)

Suppose a Country has the production function $Y = AK^{0.5}N^{0.5}$. The following table shows the macro-economic data for 2008 and 2009:

a) By how much did Total Factor Productivity (A) grow between 2008 and 2009? In order to get the TFP growth rate, this time do not rely on the growth accounting equation: compute the level of TFP in the two years and only then compute the growth rate. This is an alternative method to get the answer.

b) If TFP remains constant from 2009 to 2010 and the labour force increases from 121 to 144, how large will the capital stock need to be to produce output of 2300 in 2010?

	<i>2008</i>	<i>2009</i>
Y	2000	2200
K	1600	1681
N	100	121

Table 1: Question 1

c) Now suppose that the production function is $Y = AK^\alpha N^\beta$, with $\alpha + \beta = 1$. Suppose that you know that the growth rates of output (g_Y), capital stock (g_K) and labor force (g_N) were equal to:

$$\begin{aligned}g_Y &= 4\% \\g_A &= 1\% \\g_K &= 3\% \\g_N &= 3\%\end{aligned}$$

Can you say something about the value of α ?

Question 2: Long Run Economic Growth (25 Marks)

This question deals with the determinants of economic growth. The production function for this economy is the following:

$$Y = AK^\alpha N^{1-\alpha}$$

where Y is output; A is the level of productivity; K is the capital stock; N is the number of workers (all fully employed); and α is capital's share in output.

a) First, write this production in intensive form (i.e., where all variables are in per capita terms). You may use lower case letters to represent per capita variables. Next defining n as the growth rate of labour, d as the rate of depreciation and s as the savings rate (which is a constant fraction of output) derive an algebraic expression that shows what would be the level of saving per capita in this economy when it reaches a steady-state equilibrium. Would this equilibrium point be stable? Explain your reasoning and illustrate your results with a graph.

b) Using your graph showing the equilibrium position of the economy, show what would be the effect of an improvement in productivity and then separately a rise in the rate of depreciation of capital.

c) You are asked by the government to find the level of the capital-labour ratio that will maximise the level of consumption per capita – the “Golden Rule” level. You know the following about the economy: $A = 10$; $\alpha = 0.2$; the saving rate, $s = 0.25$; depreciation, $d = 0.10$; and the growth rate of the labour force, $n = 0.025$. First, derive an algebraic expression for the “Golden Rule” level of capital per capita (hint start by maximising the definition of steady consumption) and then calculate its actual level.

d) For the economy, assume that $\alpha = 0.3$ and that over a 20 year period, output grew by 2.8%, the capital stock, by 2.6% and the labour force, by 1.5%, all at annual rates. Write down the growth accounting equation and use it to estimate the contribution of productivity to annual average output growth.

Question 3: Capital, Population and Output Growth (25 Marks)

Consider two economies, say Italy and France, both of which have an aggregate production function of the form:

$$Y_t = A_t (K_t)^{0.25} (N_t)^{0.75}$$

Suppose that there is no capital depreciation, that is $d = 0$.

a) Assume for the moment that the Population in both Countries does not change over time, while the *TFP* evolves according to:

$$A_{t+1} = (1 + a)A_t$$

A statistician tells you that: 1) the growth rate in the aggregate capital stocks was the same in the two Countries, and 2) the *TFP* growth rates in Italy and France were $a_I = 0.12$ and $a_F = 0.08$, respectively. How much was the difference in the output growth rates?

Assume from now on that the *TFP* is constant and equal in the two Countries. For simplicity, consider the case where $A_t = 1$. On the other hand, Population in both Countries grows according to the formula:

$$N_{t+1} = (1 + n)N_t$$

b) The aggregate capital stock K_t in both countries is given by the following law of motion:

$$K_{t+1} = K_t + sY_t$$

Find the law of motion for the capital-labor ratio k_t by expressing k_{t+1} as a function of k_t , the savings rate s and the population growth rate n .

c) Suppose that in Italy the population growth rate is $n_I = 0.04$ while the savings rate is $s_I = 0.5$. Solve for the steady state values of y_I^* , k_I^* , and c_I^* .

d) France output per worker y_F^* is ten per cent greater than Italy's output per worker y_I^* . If k_F^* and k_I^* are the capital-labor ratios in France and Italy, what is the value of k_F^* ?

Question 4: Savings, Investment, and Current Accounts (25 Marks)

Consider an economy whose desired savings (S^d) and desired investment (I^d) are given by the following expressions:

$$\begin{aligned} S^d &= 650 + 1000r \\ I^d &= 820 - 1000r \end{aligned}$$

where r denotes the real interest rate.

a) Find the equilibrium in the Goods market for this economy, and represent it on a graph.

From now on, suppose there are only two large Countries in the world, say Canada (Ca) and the United States (US).

b) Assume, to start with, that both Countries are closed economies. Their desired consumption (C^d) and desired investment (I^d) are given by:

$$\begin{aligned} C_{Ca}^d &= 640 + c_{Ca}(Y_{Ca} - T_{Ca}) - 400r \\ I_{Ca}^d &= 300 - 400r \end{aligned}$$

$$\begin{aligned} C_{US}^d &= 960 + c_{US}(Y_{US} - T_{US}) - 600r \\ I_{US}^d &= 520 - 600r \end{aligned}$$

Moreover, output (Y), taxes (T), public expenditure (G), and the marginal propensity to consume (c) are as follows:

$$\begin{aligned} Y_{Ca} &= 2000; Y_{US} = 3000 \\ T_{Ca} &= 400; T_{US} = 600 \\ G_{Ca} &= 550; G_{US} = 600 \\ c_{Ca} &= 0.4; c_{US} = 0.4 \end{aligned}$$

Find the equilibrium real interest rates, savings and investment for the two closed economies. What are the equilibrium values for consumption?

c) Now assume that Canada and the US can freely trade with each other, and have access to the international market for borrowing and lending. Find the world real interest rate, and the current account balances for each Country. Compare: i) the world real interest rate to the real interest rates in the previous part, ii) consumption before and after the change.

d) What happens if you consider the world desired savings and investment and compare them to the ones in part a)? Comment on your findings.