Name: ____. Code: ______________

Nova School of Business and Economics
Macroeconomics 1103, 2013-2014, 1st Semester
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TAs: João Vaz, Paulo Fagandini, and Pedro Freitas

Problem Set 6

Due Date: November 29, Friday

Turn in your problem set at Biblioteca 3, by 17:00

Turning in the problem sets is optional. The problem sets can be done in groups, but they have to be turned in individually.

To facilitate the organization of problem sets, please turn in your problem set with your name and code filled out as above, on the top of the first page. You may use this page as a cover page of your problem set.

1. Suppose that an economy is subject to shocks to the interest rate, in accordance to the New-Keynesian model. Obtain the predictions of the model about GDP, consumption, wages, and other macroeconomic variables. Consider that the economy is initially in equilibrium. Use diagrams to justify your results. Compare the predictions with the data.

2. Consider the possibility of stabilization policy, according to the New Keynesian model.

a. What are the difference of the effects of stabilization policy with fiscal policy and with monetary policy? Use pages 546-549 of the book.

b. Read the text on pages 550-551. What can be said about the timing of fiscal and monetary policies?

3. Business cycle simulation. Continue from the last problem set to make your own business cycle simulation.

From the last problem set, the production function is $y_t = z_t k_t^{\alpha} N_t^{1-\alpha}$. Suppose that z_t varies according to $z_t = z_{t-1}^{0.95} e^{0.05\varepsilon_t}$, where ε_t is a random shock with uniform distribution $[-0.5, +0.5]$. ε_t are the productivity shocks. Suppose that $z_0 = 1$, $\beta = \dfrac{1}{1.05}$ and $\alpha = 0.3$. Consider that the economy starts at the steady state. That is, k_0 is equal to the value of capital such that $k_{t+1} = k_t$, calculated in the last problem set.

Using Excel, define columns for t, ε_t, z_t, i_t, c_t, y_t, w_t, and r_t. Make a simulation with 100 periods, $t = 0, 1, ..., 100$. Use the function $rand()$ in Excel to define a value for ε_t for each period. To do this, write $= rand() - 0.5$ in the cells. To avoid having the values of ε constantly changing, use "paste especial," "values", and copy and paste the values of the column over itself.

a. With $z_0 = 1$, obtain the values of z_t for $t = 1, 2, ...$ With k_t and z_t, calculate i_t, c_t, y_t, w_t, and r_t.

b. Make a graph of i_t, c_t, y_t over time. Make a graph of w_t, r_t, c_t, and i_t versus y_t (use "scatter plot," do not connect the points).

c. Discuss your results. Do you obtain expansions and recessions? Do you obtain cycles with variable duration? How do consumption and investment vary with output? What about the interest rate? What is the correlation between these variables and output?

4. Question 3 simplifies the calculations by having full depreciation, $\delta = 1$. However, capital varies strongly because of this assumption. We will now work with an economy with $\delta < 1$. However, the solution obtained in question 3 cannot be used if $\delta < 1$. We will then use overlapping generations. This exercise, with some changes in notation, is taken from chapter 9 of DLS. There is a link to this book on the course webpage.

With overlapping generations, a new generation is born in every period. Each generation lives for two periods. In each period, there is a young and an old generation. The optimization problem of a person that was born in period t is

$$\begin{aligned} \max \quad & \log c_t^t + \log c_{t+1}^t \\ \text{s.t.} \quad & c_t^t + k_{t+1} = w_t \\ & c_{t+1}^t = r_{t+1} k_{t+1} + (1-\delta)\, k_{t+1}. \end{aligned} \tag{1}$$

In the first period, the consumer works, receives w_t as labor income, and saves k_{t+1}. In the second period, as old, the consumer lends the capital k_{t+1} to production at the beginning of the period and receives interest payments plus depreciated capital at the end of the period. The consumer works $N_t = 1$. The production function is given by $y_t = z_t k_t^{\alpha} N_t^{1-\alpha}$.

a. Given the maximization problem (1), obtain the optimal decision of k_{t+1} as a function of the wage.

b. Write the value of wages w_t and interest rates r_t as a function of k_t. With $N_1 = 1$ and your answer in item *a*, obtain capital, wages, and interest rates in the steady state (with $z_t = 1$ for all periods).

Aggregate consumption at t is given by the sum of the consumption of the young and of the old, $C_t = c_t^t + c_t^{t-1}$. Aggregate consumption plus investment is equal to total production,

$$c_t^t + c_t^{t-1} + i_t = y_t.$$

Investment is given by $i_t = k_{t+1} - (1-\delta)\, k_t$. k_t is equal to capital at t and k_{t+1} is equal to your solution in item *a*.

Suppose that $\alpha = 0.3$ and $\delta = 0.05$. Suppose that z_t varies as in question 1, $z_t = z_{t-1}^{0.95} e^{0.05\varepsilon_t}$, with ε_t uniform $[-0.5, 0.5]$ and $z_0 = 1$. Create columns for z_t, y_t, i_t, k_t, C_t, w_t and r_t in Excel and analyze the evolution of the variables. Capital at $t = 0$ is equal to capital in the steady state.

c. Does the evolution of the variables agree with the data on economic fluctuations? With a scatter plot in Excel, calculate the coefficient b in $\log C_t = a + b \log y_t$. It is enough to add a trend and select the option to show the equation. Do the same for $\log i_t$. What do you obtain? How do your results change with full depreciation, $\delta = 1$?

d. Permanent shock. Suppose that $z_0 = 1$ and that $z_t = 1.5$ for all $t > 0$. Show the evolution of the variables over time. What happens to investment? And to the interest rate? How to explain the evolution of r_t and i_t?

e. Temporary shock. Do the same for $z_0 = 1$, $z_1 = 1.5$, and $z_t = 1$ for $t \geq 2$.