ISCTE — INSTITUTO UNIVERSITÁRIO DE LISBOA

MSc in Economics

MACROECONOMICS

Sample Final Test

15 October 2014 **Duration: 2.00 h**

Group I – 2.5 points each

Answer only 2 questions in this group

1. How important is the Solow model for the development of the Real Business Cycle model? Explain.
2. In your opinion, what are the main reasons that, in the mid 1990s, led the New Keynesian model to become the dominant model in modern macroeconomics, in detriment of the Real Business Cycle model. Elaborate upon your explanation.
3. What is the basic concept or instrument used in macroeconomics in order to confront the output we get from theoretical models with empirical data. Explain.

Group II – 5 points each exercise

Answer only to 3 exercises from the following set: A,B,C,D

A. Real Business Cycles. Assume a small scale Real Business Cycle model, in which three fundamental functions are as follows:

$$\begin{aligned} K_t &= (1-\delta)K_{t-1} + I_t \quad , \quad \delta = 0.2 \\ Y_t &= A_t K_{t-1}^{\alpha} N_t^{1-\alpha} \quad , \quad \alpha = 0.5 \\ C_t + I_t &= Y_t \end{aligned}$$

Capital letters represent variables measured in actual values, and the symbols closely follows materials covered in classes. It is also known that in the steady state the following information holds: $C_t/Y_t = 0.8$, $I_t/K_t = 0.01$, the rate of growth of $A_t = 2\%$, the rate of growth of $N_t = 1\%$, and the rate of growth of $C_t = 2.5\%$.

1. Rewrite this small version of the model with variables expressed in terms of growth rates.
2. Calculate, relatively to the "steady state", the values for the growth rates of Y_t, I_t and K_t.
3. Assume now that the rate of growth of C is a stochastic process given by the following equation
$$c_t = aE_t c_{t+1} - br_t \quad , (a, b) > 0$$
where r_t represents the growth rate of the marginal value of capital. Determine the equilibrium level of c_t.
4. Now consider also that
$$r_t = 0.025 + 0.5r_{t-1} + \varepsilon_t$$
with ε_t as white noise. Recalculate all growth rates in the steady state, given this new information.

Hint. For (1,2) just see the slides provided in the classes about the RBC model. For (3), this is a rational expectations equation that you know already quite well how to solve. For (4), using the result in (3), and the information in (4), a new value for c_t in the steady state will be obtained. Obviously, a value that represents the expected value of c_t, not the actual value, because this depends upon the shocks at every period of time.

B. Rules versus Discretion. Assume that the Central Bank's loss function is given by the quadratic function:
$$L = u^2 + \gamma\pi^2$$
u is the unemployment rate, γ is a parameter, and π is the inflation rate.
We know that $\gamma = 2.5$ and that the behavior of the supply side of the economy can be described by the following Phillips curve:
$$u = u^n - \alpha(\pi - \pi^e)$$
where u^n is the natural level of unemployment, π^e is the level of expected inflation, and $\alpha = 15$. Finally assume that private agents have rational expectations
$$\pi^e = \pi.$$

1. Determine the level of optimal inflation in the case of discretionary behavior by the central bank.
2. Determine the same as in the previous question, but now having the central bank displaying commitment to maintain inflation at the level of its natural rate.
3. Explain why the result in (2) is better than the result in (1).
4. Explain either by your own words, or by some sophisticated approach, what would happen in both scenarios above, if private agents had adaptive expectations instead of rational expectations.

Hint. Just follow the slides of the "Rules versus Discretion", slide 8 onwards, and apply the same reasoning to this particular case. I leave the last question to your logic.

C. NKM's IS function. Consider the following Euler equitation in the New Keynesian Model

$$u'(C_0) = \beta \cdot \left[u'(C_1) \frac{(1+r_0)}{(1+\pi_1)} \right]$$

where r_0 is the short term nominal interest rate, π_1 is the inflation rate between periods 0 and 1, and β is the subjective intertemporal discount factor. C stands for consumption.

1. Using the following utility function ($U(c_t) = \ln c_t$), and considering uncertainty in the model, determine the IS function in this model expressed in terms of percentage deviations from the long term trend.
2. Explain what happens in the current period if private agents expect an economic boom starting next year.
3. Explain what happens if there is an increase in expectations about inflation next year.
4. Assume that next year's inflation expectations go up by 1 percentage points. Taking into account that the Central Bank wants to control inflation, by how much should this bank change its short term interest rate, and when? Explain the logic of your answer.

Hint. Just follow the slides about the derivation of the Aggregate Demand in the New Keynesian Model, and replace the utility function there with the one that is given in the current exercise. Then use the logic behind the final look of this function to comment upon (2,3,4).

D. NKM and determinacy. Assume the New Keynesian Model represented by the usual structure: an Aggregate Supply function (AS), the demand side function (IS), and a simple rule for interest rate policy. The symbols are as follows: π_t is the inflation rate, x_t is the output gap, i_t is the nominal short term interest rate to be fixed by the central bank.

$$\begin{aligned} \pi_t &= \beta E_t \pi_{t+1} + \lambda x_t \\ x_t &= E_t x_{t+1} - a\left(i_t - E_t \pi_{t+1}\right) \\ i_t &= \theta \pi_t \end{aligned}$$

where (β, λ, a) are parameters.

1. Rewrite the model in matricial form, in order to study its stability.
2. For the following set of parameter values $\beta = 0.9$, $\lambda = 0.5$, $a = 2.7$, study the stability of this model in two different scenarios:

$$\begin{aligned} \text{Scenario A}: &\quad \theta = 0.6 \\ \text{Scenario B}: &\quad \theta = 1.2 \end{aligned}$$

3. What would you conclude about the main message of the New Keynesian Model as far as the fight against inflation is concerned?

Hint: There is an exercise in the set about "Rational Expectations"that has a structure very very similar to this one here. The solutions should also be very similar.

One key point is about the number of eigenvalues that lie outside the unit circle. Remember slide 41 in "Rational Expectations":

If the number of eigenvalues (λ_i) of $A^{-1} \times B$ that lie outside the unit circle ($|\lambda_i| > 1$)

- is equal to the number of forward-looking variables, there exists a unique and stable solution
- is larger than the number of forward-looking variables there is no stable solution
- is lower than the number of forward-looking variables there is an infinity of solutions

$$A = \begin{bmatrix} \beta & 0 \\ a & 1 \end{bmatrix}, A^{-1} = \begin{bmatrix} \frac{1}{\beta} & 0 \\ -\frac{a}{\beta} & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & -\lambda \\ a\theta & 1 \end{bmatrix}$$

$$A^{-1} \times B = \begin{bmatrix} \frac{1}{\beta} & 0 \\ -\frac{a}{\beta} & 1 \end{bmatrix} \times \begin{bmatrix} 1 & -\lambda \\ a\theta & 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{\beta} & -\frac{1}{\beta}\lambda \\ a\theta - \frac{a}{\beta} & \frac{a}{\beta}\lambda + 1 \end{bmatrix}$$

Scenario A:

$$\begin{bmatrix} \frac{1}{0.9} & -\frac{1}{0.9}0.5 \\ 2.7 \times 0.6 - \frac{2.7}{0.9} & \frac{2.7}{0.9}0.5 + 1 \end{bmatrix}, \text{ eigenvalues: } 2.923\,1, 0.688$$

Scenario B:

$$\begin{bmatrix} \frac{1}{0.9} & -\frac{1}{0.9}0.5 \\ 2.7 \times 1.2 - \frac{2.7}{0.9} & \frac{2.7}{0.9}0.5 + 1 \end{bmatrix}, \text{ eigenvalues: } 2.396\,2, 1.214\,9$$