ISCTE–IUL, Exam, Macroeconomics, MSc Economics, 4/1/2016.

ISCTE — INSTITUTO UNIVERSITÁRIO DE LISBOA

Master in Economics

Macroeconomics

Exam

4 January 2016 **Duration: 2 hours**

Group A – 50 points (25 points each question)

Question 1 (Matlab). Using your knowledge about the Matlab package, write down a simple code in order to:

1. To represent a matrix A of type (3×3) :

$$A = \begin{bmatrix} 1 & 0 & -3 \\ 2 & 4 & 6 \\ 2 & 0 & 9 \end{bmatrix}.$$

2. To calculate the determinant of A, the inverse of A, the eigenvalues of A, the list of all elements of column 1 of A, and the list of all elements of line 2 of A.

3. To obtain a solution to $\mathbf{E}_t\mathbf{z}_{t+1}$, given the following expression

$$\mathbf{A} \cdot \mathbf{E}_t\mathbf{z}_{t+1} = \mathbf{B} \cdot \mathbf{z}_t + \mathbf{C} \cdot \mathbf{v}_t$$

   where $\mathbf{z}_{t+1}, \mathbf{z}_t, \mathbf{v}_t, \mathbf{C}$ are vectors, while $\mathbf{A}$ and $\mathbf{B}$ are matrices.

4. To show the dynamics of the following stochastic processes (x_t, y_t):

$$\begin{aligned} x_{t+1} &= 2 + 0.5x_t + \varepsilon_t \\ y_{t+1} &= 100 + x_{t+1} + \varepsilon_t \end{aligned}$$

where ε_t is a IID random variable, with mean equal to zero and variance equal to 1. In Matlab this random variable is written as: `randn(1)`. Simulate the dynamics of this process for $t = [1, 80]$ in a `yyplot`.

Question 2 (HP filter). Consider the following figure, which represents the percentage deviations from trend of real GDP and the inflation rate, for the US economy between 1947 and 2014 (the straight line represents the least squares regression line) Those % deviations were calculated by using the Hodrick–Prescott filter (HP filter).

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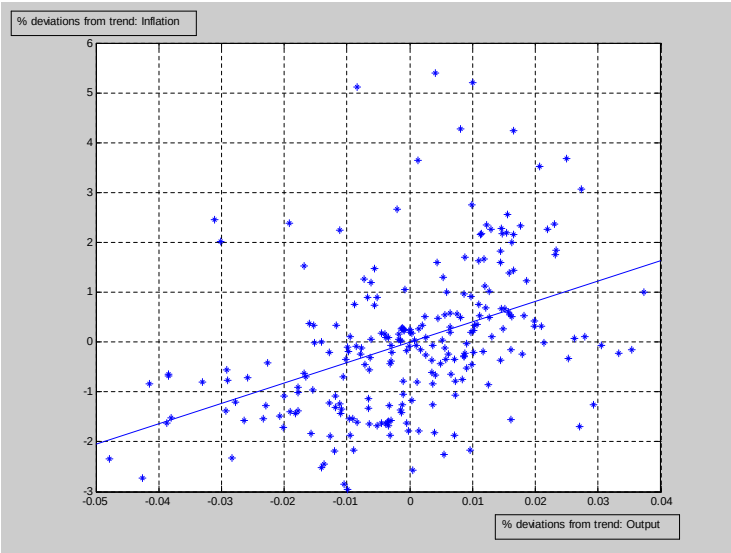

The HP filter is obtained through the formula

$$\min_{\tau_t} \sum_{t=1}^{T} \{(y_t - \tau_t)^2 + \lambda[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2\}$$

where y_t is the original series, τ_t is the smooth trend and $(y_t - \tau_t)$ is the HP filtered series and λ is a well known parameter.

1. What happens to the filter in two extreme cases $\lambda = 0$, $\lambda \to \infty$?
2. What are the major advantages regarding the linear trend, and the linear trend with breaks?
3. What are the main limitations of this filter. Explain in detail.
4. What is the relevance of the relationship above for macroeconomic policy?

Group B – 50 points

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

$$\begin{aligned} K_t &= (1-\delta)K_{t-1} + I_t \quad , \quad \delta = 0.2 \\ Y_t &= A_t K_{t-1}^{\alpha} N_t^{1-\alpha} \quad , \quad \alpha = 0.5 \\ C_t + I_t &= Y_t \\ A_t &= (1+0.02)A_{t-1} + v_t \quad , v_t \tilde{} N(0,1) \end{aligned}$$

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: $C_t/Y_t = 80\%$, $I_t/K_t = 1\%$, the rate of growth of $N_t = 1\%$, and the rate of growth of $C_t = 3\%$.

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
$$c_t = 0.5E_t c_{t+1} - 0.6r_t$$
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.

Group C – 50 points

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. Discuss the preferences of the Central Bank implicit in the L function above.
2. Determine the level of optimal inflation in the case of discretionary behavior by the central bank.
3. 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.
4. Explain either by your own words, or by some sophisticated approach, what would happen in both scenarios above, if the private agents had adaptive expectations instead of rational expectations.

Group D – 50 points

NKM's IS function. Consider the following Euler equation 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 CRRA utility function

$$U(c_t) = \frac{C_t^{1-\sigma}}{1-\sigma}, \ \sigma > 0$$

   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 the starting of an upturn of economic activity 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.

The end of the test