Final Test/Exam: Macroeconomics (M8674)

ISCTE-IUL, Instituto Universitário de Lisboa
IBS Business School

May 27, 2024

- ***The Exam includes all the three questions below (135 minutes)***
- ***The final-test includes only questions 2 and 3 (90 minutes)***

Question 1 (100 points)

Using the Pluto notebook "*Exam2024.jl*" and the attached file "*USdata.csv*", answer the questions ***in the notebook***.

Question 2 (100 points)

Consider a simple model with Rational Expectations:

$$\begin{aligned} y_t &= \beta \mathbb{E}_t y_{t+1} + x_t \\ x_t &= \phi + \alpha x_{t-1} + \varepsilon_t \quad , \quad \varepsilon_t \sim \mathcal{N}(0, \sigma^2) \\ w_t &= \delta x_t + 2 \\ v_t &= \mu y_t + 5 \end{aligned}$$

1. What are the Blanchard-Kahn conditions? Why are they relevant in modern macroeconomics? Explain succinctly. **(15 points)**
2. What constraints must we impose upon the parameters to ensure that the Blanchard-Kahn conditions are satisfied? **(15 points)**
3. Solve for the model's deterministic steady-state (or long-term equilibrium). **(20 points)**
4. Given the following parameter values, what are the long-term equilibrium levels of y_t and x_t, according to the hypothesis of *conditional expectations*? **(30 points)**

$$\beta = 0.8 \ , \ \phi = 10 \ , \ \alpha = 0.5 \ , \ \delta = 1 \ , \ \mu = 0.1$$

5. Now, consider that the system is in its long-term equilibrium. If in a given period t, x_t suffers a shock equal to -1 (and no more shocks afterward), what happens to x_t and y_t? And what will their values be in $t+1$? **(20 points)**

Question 3 (100 points)

Consider the standard version of the New Keynesian Model. Assume that the central bank sets the nominal interest rate (i) according to the Taylor Rule below, where its decision-making process (x) ***is not*** immune to random forces (ε^x). The remaining equations are all standard ones:

$$\hat{y}_t = \mathbb{E}_t\hat{y}_{t+1} - \frac{1}{\sigma}\left(i_t - \mathbb{E}_t\pi_{t+1} - r_t^n\right) \quad \text{(IS)}$$

$$i_t = \pi_t + r_t^n + \phi_\pi\pi_t + \phi_y\hat{y}_t + x_t \quad \text{(Taylor Rule)}$$

$$\pi_t = \kappa\hat{y}_t + \beta\cdot\mathbb{E}_t\pi_{t+1} \quad \text{(AS)}$$

$$r_t^n = \rho_r\cdot r_{t-1}^n + \varepsilon_t^r \quad , \quad \varepsilon_t^r \sim \mathcal{N}(0,1) \quad \text{(Natural real interest rate)}$$

$$x_t = \rho_x\cdot x_{t-1} + \varepsilon_t^x \quad , \quad \varepsilon_t^z \sim \mathcal{N}(0,1) \quad \text{(Decision making shocks)}$$

where $\{\hat{y}, i, \pi, r^n, \hat{c}, x_t, \varepsilon\}$ are, respectively, output gap, nominal interest rate, inflation rate, natural real interest rate, real consumption, decision making process, and a random disturbance; while $\{\beta, \sigma, \theta, \phi_y, \phi_\pi, \rho_x, \rho_r, \psi, \alpha\}$ are parameters assuming the following values:

β	σ	θ	ϕ_y	ϕ_π	ρ_x	ρ_r	ψ	α	r_t^n
0.95	1.3	0.8	0.6	0.5	0.5	0.6	1.2	0.65	0

with

$$\kappa = \frac{\psi(1-\theta)(1-\theta\beta)}{\theta}.$$

1. Confirm that if the Monetary Policy function follows a Taylor Rule like the one above, the output gap ($\hat{y}_t$) ***will not*** be affected by changes in the natural interest rate. **(15 points)**

2. Write the model in state-space form (matrix form). *We advise you to follow the order used in our classes: first, the predetermined variable(s), then the AS curve, and finally the IS curve.***(35 points)**

3. Using the notebook "*NKM-with-DecisionShock.jl*", what kind of dynamics (stability/instability) do we have in this model? **(15 points)**

4. Using the notebook "*NKM-with-DecisionShock.jl*", simulate the impact on all variables of an exogenous shock of $+1$ or -1 on x_t, and display such impact in a plot. **(25 points)**

5. Which variables are more responsive to this interest rate shock? **(10 points)**

End of test