Instituto Superior de Economia e Gestão
Monetary Policy
Midterm
2025, March 13th

Duration: 2 hours. Use the notation employed in class in your answers. Please provide short answers to all questions.

I (12 pts.)

(1.5 pts.) (a) Explain, in the context of the Diamond-Dybvig model, how banks enhance overall economic efficiency and consumer welfare.

Answer: In the Diamond-Dybvig model, banks serve as a critical mechanism for liquidity transformation, helping to mitigate inefficiencies caused by mismatched time preferences of consumers. Banks allow risk pooling, ensuring those who need early withdrawals can access funds, while others keep their deposits for long-term gains. While banks are efficient in normal conditions, the model also shows that they are vulnerable to runs when depositors panic.

(1.5 pts.) (b) What are the main insigths of the Kyotaki-Wright model?

Answer: The Kyotaki-Wright model explains how money can emerge as a medium of exchange in an economy where agents trade goods. The model assumes a barter economy where agents randomly meet and trade. In a pure barter system, trade is inefficient because both parties must want what the other offers. This friction creates an incentive for a commonly accepted medium of exchange (money) to emerge.

(1.5 pts.) (c) How is money supply determined?

Answer: Money supply is determined by a combination of central bank policies, commercial bank lending behavior, and public demand for cash vs. deposits. The central bank influences money supply through Open Market Operations, Discount Loans and Reserve Requirements. Commercial banks create money by lending out deposits. and people by holding more cash or deposits

(1.5 pts.) (d) What is the transmission mechanism of monetary policy?

Answer: The monetary policy transmission mechanism describes how central bank by changing the monetary instruments affect the economy, influencing inflation, output, and employment. It works through several channels.

(1.5 pts.) (e) What is the interest rate channel of monetary policy?

Answer: A change in the policy interest rate affects money markets and long-term interest rates too. Ceteris paribus, if expected inflation changes less than the nominal rate then the real interest rate changes in the same direction. Borrowing, savings, consumption, and investment change, which affects aggregate demand.

(1.5 pts.) (f) What are the tools of monetary policy at the ECB?

Answer: The ECB sets three key interest rates that influence borrowing and lending in the economy: Main Refinancing Operations (MRO) Rate, Deposit

Facility Rate, Marginal Lending Facility Rate, open market operations, and reserve requirements in normal times. In crises, it turns to quantitative easing (QE) and forward guidance to support the economy

(1.5 pts.) (g) What is the federal funds rate?

Answer: The federal funds rate is the interest rate at which banks in the United States lend excess reserves to each other overnight

(1.5 pts.) (h) How does the Fed achieve the target level/range for the fed funds rate?

Answer: The Federal Reserve controls the federal funds rate through: (i) open market operations (OMO): Buying securities → Increases bank reserves → Lowers the fed funds rate (ii) Interest on Reserve Balances (IORB): Raising the IORB rate encourages banks to hold reserves instead of lending → Pushes the fed funds rate up, (iii)) Discount Rate : A higher discount rate discourages borrowing and tightens credit.

II (5 pts.)

Consider a representative household that obtains utility from consumption C_t and suffers disutility from supplying labor N_t according to period t utility function:

$$u(C_t, N_t) = \log(C_t) - \frac{(N_t)^a}{a},\ a > 1.$$

Assume there is a large number of identical firms, except for the fact that a fraction s of them has sticky prices, while the remaining fraction, $1 - s$, sets prices flexibly. Firm i produces output $Y_t(i)$ using labor $N_t(i)$ according to the following technology

$$Y_t(i) = A_t N_t(i),$$

where A_t denotes labor productivity. Firms are monopolistically competitive and face the following demand for their own product

$$Y_t(i) = \left(\frac{P_t(i)}{P_t}\right)^{-\epsilon} Y_t,\ \epsilon > 1$$

where $P_t(i)$ is the firm's individual price level, P_t is the aggregate/average price level and Y_t is aggregate demand. Let W_t denote the aggregate/average nominal wage in the economy. Firms set the price for their product $P_t(i)$ to maximize profits subject to technology and demand for their product.

(1 pt.) (a) Derive the households' intratemporal optimal condition. You should arrive to the expression:

$$C_t \left(N_t\right)^{a-1} = \frac{W_t}{P_t}$$

(1 pt.) (b) State the firm's maximization problem and solve for the optimal pricing decision of the individual firms. You should get

$$P_t(i) = \frac{\varepsilon}{\varepsilon - 1}\frac{W_t}{A_t}.$$

(1 pt.) (c) Using the optimal condition for labor supply, show that the real wage in the economy can be written as:

$$\frac{W_t}{P_t} = \frac{(Y_t)^a}{(A_t)^{a-1}}.$$

(1 pt.) (d) Use the expression for the real wage to rewrite the firm's optimal pricing decision as a function of the markup, aggregate output, labor productivity and the aggregate price level. Then, get the expression for the natural level of output. Finally, use the expression for natural output to obtain the firm's optimal pricing decision as a function of aggregate output, natural output and the aggregate price level. You should get:

$$P_t(i) = \frac{(Y_t)^a}{(Y_t^n)^a} P_t.$$

(1 pt.) (e) Write the loglinear version of the final expression for the desired price found in the previous point. Characterize the (loglinear) price set by flexible price firms and by sticky price firms. Finally, aggregate those prices to derive the (loglinear) expression for the aggregate price level. When doing so, for simplicity set $Y_t^e = Y_t^{n,e}$. You should obtain:

$$p_t = p_t^e + \frac{(1-s)}{s} a \left(y_t - y_t^n\right).$$

Answer: see lecture 8

III (3 pts.)

Consider the New Keynesian model which is characterized by 3 equations. The Phillips Curve (NKPC),

$$\pi_t = \beta E_t \left(\pi_{t+1}\right) + \kappa \widetilde{y}_t, \ 0 < \beta < 1, \ \kappa > 0$$

where $\widetilde{y}_t$ is the output gap. The Dynamic IS equation (DIS)

$$\widetilde{y}_t = E_t \left(\widetilde{y}_{t+1}\right) - \frac{1}{\sigma} \left(i_t - E_t \left(\pi_{t+1}\right) - r_t^n\right), \ \sigma > 0$$

where r_t^n $(= \rho)$ is the natural interest rate. And the policy rule

$$i_t = \rho + \theta \pi_t + v_t, \ \theta > 0, \ \rho > 0$$

where

$$v_t = \rho_v v_{t-1} + \varepsilon_t, \ 0 < \rho_v < 1$$

ε_t is a stochastic variable with mean zero.

(1.5 pts.) (a) Solve these equations for the endogenous variables $(\widetilde{y}_t, \pi_t)$. Assume that the endogenous variables $(\widetilde{y}_t, \pi_t)$ are functions of the exogenous shock v_t,

$$\widetilde{y}_t = av_t \text{ and } \pi_t = bv_t,$$

and use the method of undetermined coefficients to determine a and b.

Answer:

$$bv_t = \beta b\rho_v v_t + \kappa a v_t$$

$$av_t = a\rho_v v_t - \frac{1}{\sigma}\left(\theta b v_t + v_t - \theta b \rho_v v_t\right)$$

or

$$\begin{aligned} b &= \beta b\rho_v + \kappa a \\ b &= \frac{\kappa a}{1-\beta\rho_v} \end{aligned}$$

$$\begin{aligned} a\left(1-\rho_v\right) &= -\frac{1}{\sigma}\left(\theta b\left(1-\rho_v\right)+1\right) \\ a &= -\frac{1}{\sigma\left(1-\rho_v\right)} - \frac{1}{\sigma}\theta b \\ \left(1+\frac{\theta}{\sigma}\frac{\kappa}{1-\beta\rho_v}\right)a &= -\frac{1}{\sigma\left(1-\rho_v\right)} \\ a &= -\frac{1}{\sigma\left(1-\rho_v\right)}\left(1+\frac{\theta}{\sigma}\frac{\kappa}{1-\beta\rho_v}\right)^{-1} < 0 \end{aligned}$$

(1.5 pts.) (b) What is the effect of a monetary policy shock? Is it according with the evidence? Show your work.

Answer: As $a < 0$ then $b = \frac{\kappa a}{1-\beta\rho_v} < 0$. If $\varepsilon_t > 0$ then $\widetilde{y}_t = a\varepsilon_t < 0$ and $\pi_t = b\varepsilon_t < 0$. This is according with the VAR evidence, for example.