Monetary Policy
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Regular Exam
May, 15, 2025
Total time: 2 hours. Total points: 20

Instructions:

Please sit in alternate seats. This is a closed-book, closed-note exam. Please get rid of everything but pen/pencil. In your answer explain all the steps in your reasoning. Keep answers short; I don't give more credit for long answers, and I can take points off if you add things that are wrong or irrelevant.

I (12 pts.)

(1 pt.) (a) Explain how banks provide maturity transformation in the Diamond-Dybvig model?

(1 pt.) (b) What are the key insights of the Kiyotaki-Wright model?

(1 pt.) (c) What are the tools of a central bank?

(1 pt.) (d) What are the effects of an open market purchase?

(1 pt.) (e) What is the transmission mechanism of monetary policy?

(1 pt.) (f) Explain why money is non-neutral when prices are sticky.

(1 pt.) (g) What is counterfactual monetary policy? Give an example.

(1 pt.) (h) What is the Lucas critique?

(1 pt.) (i). State four benefits of a positive anticipated inflation.

(1 pt.) (j). Why can the lower bound on nominal interest rates be a difficulty for monetary policy?

(1 pt.) (k). What is unconventional monetary policy?

(1 pt.) (l). Explain the time inconsistency problem of discretionary monetary policy.

II (8 pts.)

Consider an economy similar to the one studied in class and where the variables have the usual meaning. The utility function of the representative household is a function of consumption, C_t, and labor, N_t,

$$\sum_{t=0}^{\infty} \beta^t \left(\ln C_t - \frac{N_t^{1+\theta}}{1+\theta} \right), \tag{1}$$

where $0 < \beta < 1$ is the intertemporal discount factor, and $\theta > 0$. The household's budget constraint of period t is:

$$P_t C_t + B_t = \mathcal{W}_t + P_t w_t N_t, \tag{2}$$

where P_t is the price level, B_t, the holdings of a nominal bond with nominal interest rate i_t, $\mathcal{W}_t = (1 + i_{t-1}) B_{t-1}$ is initial wealth at the beginning of period t, and w_t the real wage.

Firms hire labor, N_t^d, to produce output, Y_t, according to the production function:

$$Y_t = A_t \left(N_t^d\right)^a \tag{3}$$

where A_t denotes labor productivity and $0 < \alpha \leq 1$.

(1 pt.) (a) Define the equilibrium for this economy.

Answer: A competitive equilibrium is a vetor of prices $\{P_t, w_t, i_t\}_{i=1}^{\infty}$, and quantities $\{C_t, N_t, Y_t, B_t\}_{i=1}^{\infty}$ such that:

(i) Given the prices $\{P_t, w_t, i_t\}_{i=1}^{\infty}$, and initial wealth $\mathcal{W}_1$, the vector $\{C_t, N_t, B_t\}_{i=1}^{\infty}$ maximizes the household utility function (1) and satisfies the budget constraint (2)

(ii) Given the vector of prices $\{P_t, w_t\}_{i=1}^{\infty}$, the quantities $\left\{N_t^d, Y_t\right\}_{i=1}^{\infty}$ maximize profits and satisfy the production function (3), and

(iii) Markets clear: $C_t = Y_t$, $N_t^d = N_t$ and $B_t = 0$.

(1 pt.) (b) Determine the supply of labor.

Answer:

$$\begin{aligned} MRS_{N,C} &= w \\ C_t N_t^{\theta} &= w_t, \\ N_t &= \left(\frac{w_t}{C_t}\right)^{\frac{1}{\theta}} \end{aligned}$$

(1 pt.) (c) Determine the demand for labor.

Answer:

$$\begin{aligned} MP_N &= w \\ aA_t \left(N_t^d\right)^{a-1} &= w_t, \\ N_t^d &= \left(\frac{w_t}{aA_t}\right)^{\frac{1}{a-1}} \end{aligned}$$

(1 pts.) (d) Determine the equilibrium real wage, consumption and labor.

Answer:

$$A_t \left(N_t\right)^a N_t^{\theta} = aA_t \left(N_t\right)^{a-1} \Rightarrow N_t = a^{\frac{1}{1+\theta}}$$

$$C_t = A_t a^{\frac{a}{1+\theta}}$$

$$w_t = aA_t \left(a\right)^{\frac{a-1}{1+\theta}}$$

(1 pt.) (e) Define the real interest rate as $1 + r_t = (1 + i_t)\frac{P_t}{P_{t+1}}$. Determine the real interest rate.

Answer: From the Euler equation:

$$\begin{aligned} \frac{1}{C_t} &= \beta(1 + r_t)\frac{1}{C_{t+1}} \Rightarrow \\ 1 + r_t &= \frac{A_{t+1}}{\beta A_t} \end{aligned}$$

(1 pt.) (f) Assume the central bank sets the nominal interest rate, $i_t = x_t$, where $x_t > 0$ is exogenous. Is the price level determined? And inflation? Explain.

Answer: Define $1 + \pi_{t+1} \equiv \frac{P_{t+1}}{P_t} = x_t \frac{\beta A_t}{A_{t+1}}$, for $t = 0, 1, 2, 3, ...$

This implies that inflation, π_1, π_2, ... is determined. The price level is not determined.

(1 pt.) (g) How would your answer to question (f) change if the economy was stochastic?

Answer:

$$\begin{aligned} 1 &= \beta E_t \left[\frac{C_t}{C_{t+1}} (1 + x_t) \frac{P_t}{P_{t+1}} \right] \Rightarrow \\ 1 &= \frac{(1 + x_t)}{A_t} E_t \left(A_{t+1} \frac{P_t}{P_{t+1}} \right) \end{aligned}$$

Can only determine the $E_t \left(A_{t+1} \frac{P_t}{P_{t+1}} \right)$ for $t = 0, 1, 2, 3, .$

(1 pt.) (h) How would your answers to question (f) change if the rule was instead $i_t = x_t + \phi \pi_t$, with $\phi > 1$. Explain?

Answer: The definition of the real rate is

$$r_t = i_t - \pi_{t+1},$$

replacing the rule in this equation, iterating forward, and assuming $\lim_{t \to \infty} \frac{\pi_t}{\phi^t} = 0$:

$$\pi_t = \sum_{j=0}^{\infty} \frac{1}{\phi^{j+1}} \left(r_{t+j} - x_{t+j} \right).$$