ISEG
Monetary Policy
Midterm exam
Example

Duration: 1 hour and 20 minutes

The use of computers and calculators is forbidden. Use the notation employed in class in your answers to the questions. Please provide short answers to the questions in part I of this test.

Part I

(2 pts.) **1**. What are the tools the Federal Reserve can use to manipulate the federal funds rate?

Solution: (i) Open market operations (or changes in nonborrowed reserves), (ii) Discount loans (or changes in borrowed reserves), (iii) Changes in reserves requirements and (iv) Interest paid on reserves.

(2 pts.) **2**. Describe how the traditional monetary transmission mechanism works.

Solution:Expansionary monetary policy $\Longrightarrow$ r (real interest rate)$\downarrow$ $\Longrightarrow$ cost of borrowing $\downarrow$ $\Longrightarrow$ I (business investment) $\uparrow$ and C (housing and consumer durable expenditures) $\uparrow$ $\Longrightarrow$ Y^{ad} $\uparrow$

(2 pts.) **3**. Under what conditions can a Central Bank control long-term real interest rates? Explain.

Solution:(i) If inflation adjusts slowly over time, an expansionary monetary policy lowering the nominal short-term rate also lowers the real short-term rate, (ii) If the expectation hypothesis of the terms structure holds; This theory says that the long-term interest rate is an average of the expected future short term interest rates. And finally (iii) the lower real short term interest rate persists for some time.

(2 pts.) **4**. What are the empirical effects of an increase in the federal funds rate over the output and the price level?

Solution: In the short-run, the VAR results, suggest that output decreases and the price level changes little (not statistically different from zero). In the long run a permanent increase in the nominal interest rate increases long-run inflation and has a small effect (close to zero) on long-run output. A temporary increase in the nominal interest rate has small effects on long-run inflation and long-run output.

Part II

Consider an economy which lasts for 2 periods. Suppose the representative agent obtains utility from consumption C and suffers disutility from supplying labor N. The representative agent chooses $\{C_1, C_2, N_1, N_2\}$ to maximize lifetime utility

$$U(C_1, C_2, N_1, N_2) = \log(C_1) - \frac{(N_1)^a}{a} + \beta\left(\log(C_2) - \frac{(N_2)^a}{a}\right),\ a > 1$$

subject to the intertemporal budget constraint

$$C_1 + \frac{C_2}{1+r} = \frac{W_1}{P_1}N_1 + \frac{W_2}{P_2}\frac{N_2}{1+r},$$

where C_1 and C_2 are consumption in period 1 and 2 in real terms, W_1/P_1 and W_2/P_2 are real wages in period 1 and 2, N_1 and N_2 are labor supply in period 1 and 2, r is the real interest rate and β is the discount factor.

(2 pts.) **1**. Set up the Lagrangian for the problem of the representative household and derive the intertemporal Euler equation for consumption, as well as the two optimal conditions for the choice of labor in period 1 and 2.

Solution:

$$L = \log(C_1) - \frac{(N_1)^a}{a} + \beta\left(\log(C_2) - \frac{(N_2)^a}{a}\right) + \lambda\left(\frac{W_1}{P_1}N_1 + \frac{W_2}{P_2}\frac{N_2}{1+r} - C_1 - \frac{C_2}{1+r}\right)$$

$$C_1 = \frac{C_2}{\beta(1+r)}$$

$$\frac{1}{C_t}\frac{W_t}{P_t} = (N_t)^{a-1},\ \text{for } t = 1, 2$$

(2 pts.) **2**. Suppose that agents have a constant consumption path, but the monetary authorities aim at generating a growing consumption path (that is at decreasing current consumption relative to future consumption). What actions can the monetary authorities take? Briefly explain.

Solution:

Initially $C_2 = C_1 \iff \beta = 1 + r$. For $C_2 > C_1$ need to increase r, i.e. must have $\beta < 1 + r$.

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 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.

(2 pts.) **3.** State the firm's maximization problem and solve for the optimal pricing decision of the individual firms. Give the economic intuition for the optimal price explaining that it gives prices as a markup over nominal marginal cost.

Solution: see lecture 9

(2 pts.) **4.** Using the optimal condition for labor supply, show that the real wage in the economy can be written as

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

Solution: see lecture 9

(2 pts.) **5**. 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, derive 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.

Solution: see lecture 9

(2 pts.) **6**. 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 $Y_t^e = Y_t^{n,e}$.

Solution: see lecture 9.