

Written Exam for the M.Sc. in Economics summer 2015

**Monetary Economics: Macro Aspects**

Master's Course

12 June

(3-hour closed-book exam)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by “eksamen på dansk” in brackets, you must write your exam paper in Danish.

**This exam question consists of 3 pages in total (including this page)**

Questions 1, 2 and 3 each weigh 1/3. These weights, however, are only indicative for the overall evaluation.

### QUESTION 1:

Evaluate whether the following statements are true or false. Explain your answers.

- (i) In a flex-price world with cash-in-advance constraints on investment and consumption, a positive inflation rate is optimal as it encourages capital accumulation.
- (ii) A central bank operating under “strict inflation targeting” should never respond to the output gap.
- (iii) In the simple New Keynesian model with goods-price rigidities, the optimal rate of inflation is zero because this maintains households’ purchasing power.

### QUESTION 2:

#### Money-in-the-utility-function and money demand

Consider an infinite-horizon economy in discrete time, where utility of the representative agent is given by

$$U = \sum_{t=0}^{\infty} \beta^t u(c_t, m_t), \quad 0 < \beta < 1, \quad (1)$$

with

$$u(c_t, m_t) \equiv b \ln c_t + (1 - b) (m^F \ln m_t - m_t), \quad 0 < b < 1, \quad m^F > 0.$$

Agents maximize utility subject to the budget constraint

$$\begin{aligned} c_t + k_t + m_t &= f(k_{t-1}) + \tau_t + (1 - \delta) k_{t-1} + \frac{1}{1 + \pi_t} m_{t-1}, & 0 < \delta < 1 & \quad (2) \\ &\equiv \omega_t, \end{aligned}$$

where  $c_t$  is consumption,  $m_t$  is real money balances at the end of period  $t$ ,  $k_{t-1}$  is physical capital,  $\tau_t$  are monetary transfers from the government, and  $\pi_t$  is the inflation rate. Function  $f$  satisfies  $f' > 0$ ,  $f'' < 0$ .

(i) Derive the relevant first-order conditions for optimal behavior [Hint: Set up the value function  $V(\omega_t) = \max_{c_t, m_t} \{u(c_t, m_t) + \beta V(\omega_{t+1})\}$  and substitute out  $\omega_{t+1}$  by (2) and  $k_t$  by  $k_t = \omega_t - c_t - m_t$ .] Interpret the first-order conditions intuitively.

(ii) Show that the first-order conditions can be combined into

$$\frac{u_m(c_t, m_t)}{u_c(c_t, m_t)} = \frac{i_t}{1 + i_t}, \quad (3)$$

where  $f_k(k_t) + 1 - \delta = (1 + i_t) / (1 + \pi_{t+1})$  defines  $i_t$  as the nominal interest rate. Discuss (3) and explain whether steady-state superneutrality holds in the model.

(iii) Apply the particular functional form of  $u$  and characterize the monetary policy that maximizes the utility of the representative agent and find the corresponding optimal steady-state real balances. Explain the results intuitively.

### QUESTION 3:

Consider the following “New-Keynesian” log-linear model of a closed economy:

$$x_t = \mathbf{E}_t x_{t+1} - \sigma^{-1} (\widehat{i}_t - \mathbf{E}_t \pi_{t+1}) + u_t, \quad \sigma > 0, \quad (1)$$

$$\pi_t = \beta \mathbf{E}_t \pi_{t+1} + \kappa x_t, \quad 0 < \beta < 1, \quad \kappa > 0, \quad (2)$$

$$\widehat{i}_t = \phi \pi_t + \varepsilon_t, \quad \phi > 1, \quad (3)$$

where  $x_t$  is the output gap,  $\widehat{i}_t$  is the nominal interest rate’s deviation from steady state, and  $\pi_t$  is goods-price inflation,  $u_t$  is a mean-zero i.i.d. shock and  $\varepsilon_t$  is a mean-zero, i.i.d. “policy shock”.  $\mathbf{E}_t$  is the rational-expectations operator conditional upon all information up to and including period  $t$ .

- (i) Explain in words how (1) and (2) can be derived from a micro-founded model, and explain the monetary transmission mechanism.
- (ii) Derive the solutions for  $x_t$  and  $\pi_t$ . [Hint: Conjecture that the solutions are linear functions of  $\varepsilon_t$  and  $u_t$ , and use the method of undetermined coefficients.] Comment on the role of the policy parameter  $\phi$  in terms of the output gap’s and inflation’s dependence on  $\varepsilon_t$  and  $u_t$ .
- (iii) Examine whether the parameter  $\phi$  can be chosen such that the output gap and inflation are stabilized completely. Discuss whether such a situation is desirable, and whether its potential attainment is realistic.