Written Exam at the Department of Economics summer 2018

Monetary Policy

Final Exam

June 5

(3-hour closed book exam)

Answers only in English.

This exam question consists of four (4) pages in total (including this page)

NB: If you fall ill during an examination at Peter Bangsvej, you must contact an invigilator in order to be registered as having fallen ill. In this connection, you must complete a form. Then you submit a blank exam paper and leave the examination. When you arrive home, you must contact your GP and submit a medical report to the Faculty of Social Sciences no later than seven (7) days from the date of the exam.

Be careful not to cheat at exams!

- You cheat at an exam, if during the exam, you:
- Make use of exam aids that are not allowed
- Communicate with or otherwise receive help from other people
- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Or if you otherwise violate the rules that apply to the exam

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 the simple New-Keynesian model, the central bank should refrain from policies that affect inflation expectations as this will worsen the inflation-output gap trade off.

(ii) According to the Friedman rule, the optimal rate of inflation is zero.

(iii) Under a nominal interest-rate operating procedure, monetary policymaking performed without knowledge of the realizations of current shocks can be improved by using money stock data as an intermediate target whenever money-market shocks are predominant in the economy.

QUESTION 2:

Consider an economy formulated in discrete time, where the utility of a representative agent is given by

$$\sum_{t=0}^{\infty} \beta^t u\left(c_t\right), \quad 0 < \beta < 1, \tag{1}$$

where c_t is real consumption and $u' > 0$, $u'' < 0$. The agent faces the budget constraint

$$\begin{aligned} \omega_t &\equiv f\left(k_{t-1}\right) + \tau_t + \left(1-\delta\right) k_{t-1} + \frac{m_{t-1} + \left(1+i_{t-1}\right) b_{t-1}}{1+\pi_t} \\ &= c_t + k_t + m_t + b_t, \end{aligned} \tag{2}$$

where k_{t-1} is real capital at the end of period $t-1$, f is a production function with $f' > 0$, $f'' < 0$, τ_t denotes real monetary transfers from the government, $0 < \delta < 1$ is the rate of depreciation of capital, m_{t-1} denotes real money holdings at the end of period $t-1$, i_{t-1} is the nominal interest rate on bonds (denoted b_{t-1} in real terms), and π_t is the rate of inflation.

The agent also faces a cash-in-advance constraint on consumption:

$$c_t \leq \frac{m_{t-1}}{1+\pi_t} + \tau_t. \tag{3}$$

(i) Characterize the optimal choices of consumption, capital and real money holdings. For that purpose use that the agent's optimization problem can be stated as

$$V(\omega_t, m_{t-1}) = \max_{c_t, k_t, m_t} \left\{ u(c_t) + \beta V(\omega_{t+1}, m_t) - \mu_t \left(c_t - \frac{m_{t-1}}{1+\pi_t} - \tau_t \right) \right\},$$

where μ_t is the multiplier on (3) and

$$\omega_{t+1} = f(k_t) + \tau_{t+1} + (1-\delta) k_t + \frac{m_t}{1+\pi_{t+1}} + R_t (\omega_t - c_t - k_t - m_t), \quad R_t \equiv \frac{1+i_t}{1+\pi_{t+1}}.$$

Then derive and interpret these optimality conditions:

$$u_c(c_t) = \beta R_t V_\omega(\omega_{t+1}, m_t) + \mu_t,$$

$$\beta V_\omega(\omega_{t+1}, m_t) [f_k(k_t) + 1 - \delta] = \beta R_t V_\omega(\omega_{t+1}, m_t),$$

$$\beta \frac{1}{1+\pi_{t+1}} V_\omega(\omega_{t+1}, m_t) + \beta V_m(\omega_{t+1}, m_t) = \beta R_t V_\omega(\omega_{t+1}, m_t).$$

Finally, show that by use of the envelope theorem one finds

$$V_\omega(\omega_t, m_{t-1}) = \beta R_t V_\omega(\omega_{t+1}, m_t),$$

$$V_m(\omega_t, m_{t-1}) = \mu_t \frac{1}{1+\pi_t}.$$

(ii) Define $\lambda_t \equiv V_\omega(\omega_t, m_{t-1})$, and derive the expression for the nominal interest rate, i_t, as a function of μ_{t+1} and λ_{t+1}. Explain this relationship with particular focus on the role of a binding or non-binding cash-in-advance constraint.

(iii) Show formally that monetary policy—different rates of nominal money growth—has no real effects in the steady state of this economy. Explain the result. Which variables will, on the other hand, be affected by different long-run nominal money growth rates? Explain.

QUESTION 3:

Consider the following simple New-Keynesian model of a closed economy:

$$x_t = \mathrm{E}_t x_{t+1} - (i_t - \mathrm{E}_t \pi_{t+1} - r) + u_t, \tag{1}$$

$$\pi_t = \beta \mathrm{E}_t \pi_{t+1} + \kappa x_t, \qquad 0 < \beta < 1, \quad \kappa > 0, \tag{2}$$

$$i_t = r + \delta \pi_t, \qquad \delta > 1, \tag{3}$$

where x_t is the output gap, i_t is the nominal interest rate, r is the steady-state real interest rate, π_t is goods-price inflation, and u_t is a mean-zero i.i.d. shock. E_t is the rational-expectations operator conditional upon all information up to and including period t.

(i) Describe in detail how equations (1) and (2) arise from optimal decisions by representative agents in the economy. Discuss briefly why $\delta > 1$ is assumed.

(ii) Assume that stabilizing the output gap, x_t and π_t is preferable. Discuss why this is a reasonable assumption often made in this type of model.

(iii) Evaluate formally whether stabilizing x_t and π_t perfectly *at the same time,* is possible in the model by appropriate choice of δ. Explain. [Hint: Conjecture that the solutions for x_t and π_t are linear functions of u_t, and use the method of undetermined coefficients.]. Discuss the associated solution for the nominal interest rate.