Written Exam for the M.Sc. in Economics August 2014

Monetary Economics: Macro Aspects

Master's Course

15 August

(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 4 pages in total including this page.

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

Henrik Jensen
Department of Economics, University of Copenhagen

QUESTION 1:

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

(i) The Friedman rule for optimal monetary conduct implies that the central bank should target zero inflation.

(ii) Under optimal inflation targeting, a positive coefficient on the output gap in the associated interest-rate rule implies that the central bank has preferences for stable output.

(iii) In the simple New-Keynesian model, a history-dependent monetary policy is disadvantageous.

QUESTION 2:

Nominal and real rigidities and monetary policy

Consider an economy with time dependent, staggered price setting, where in any period half of intermediate goods producers sets a price, which is fixed for two periods. Let $\overline{p}_{t+j}$ be the log of prices fixed for periods $t+j$ and $t+j+1$, and note that aggregate prices p_t are given by $p_t = \frac{1}{2}\overline{p}_{t-1} + \frac{1}{2}\overline{p}_t$.

(i) It can be shown that profit maximization leads to the following pricing rule for firms resetting prices in period t:

$$\overline{p}_t = \frac{1}{2}\left(p_t + \mathrm{E}_t p_{t+1}\right) + \frac{1}{2}\left(v_t + \mathrm{E}_t v_{t+1}\right), \tag{1}$$

where v_t is log of real marginal costs and E_t is the rational expectations operator. Explain the economics behind (1).

Assume that real marginal costs are linearly related to real output y_t,

$$v_t = \gamma y_t, \qquad 1 \geq \gamma > 0, \tag{2}$$

and that aggregate demand can be characterized by

$$m_t - p_t = y_t, \tag{3}$$

where m_t is log of the nominal money supply. The money supply is assumed to follow a random walk, i.e., $\mathrm{E}_t m_{t+1} = m_t$.

(ii) Show that (1), (2) and (3) along with the definition of p_t can be solved for the following pricing rule:

$$\overline{p}_t = a\overline{p}_{t-1} + (1-a)\, m_t, \qquad a = \frac{1-\sqrt{\gamma}}{1+\sqrt{\gamma}}. \tag{4}$$

[Hint: Rewrite (1) as a second-order difference equation in $\overline{p}_t$ as a function of m_t only, and solve it by the method of undetermined coefficients by conjecturing $\overline{p}_t = a\overline{p}_{t-1} + (1-a)\, m_t$.]

(iii) Interpret (4) and explain how the persistence of monetary shocks depends on the degree of real rigidity (here interpreted as the inverse of γ).

QUESTION 3:

Cash-in-advance and optimal monetary policy

Consider a flex-price economy with a cash-in-advance constraint on consumption purchases. Life-time utility of the representative household is

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

where c_t is consumption in period t and the function u satisfies $u' > 0$, $u'' < 0$. Households satisfy the budget constraint

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

and the cash-in-advance constraint

$$c_t \leq \frac{m_{t-1}}{1+\pi_t} + \tau_t. \tag{2}$$

In (1) and (2), k_{t-1} is physical capital at the end of period $t-1$, f is a production function with $f' > 0$, $f'' < 0$, τ_t are real government monetary transfers, $0 < \delta < 1$ is the depreciation rate, m_{t-1} is real money balances at the end of period $t-1$, π_t is the inflation rate, i_{t-1} is the nominal interest rate on bonds, b_{t-1} is the real stock of bonds at the end of period $t-1$.

(i) Discuss the model and explain the constraints (1) and (2).

(ii) Let the value function V be defined by

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

where

$$\omega_{t+1} = f(k_t) + \tau_{t+1} + (1-\delta) k_t + \frac{m_t}{1+\pi_{t+1}} + (1+r_t)(\omega_t - c_t - k_t - m_t)$$

follows by (1) with $1 + r_t \equiv (1+i_t)/(1+\pi_{t+1})$, and where μ_t is the Lagrange multiplier on (2). Show by dynamic programming that optimal behavior results in

$$i_t = \frac{\mu_{t+1}}{V_\omega(\omega_{t+1}, m_t)}.$$

Interpret this condition economically.

(iii) Does this economy exhibit superneutrality in steady state? What is the optimal nominal interest rate? Explain.