Written Exam for the M.Sc. in Economics August 2013

Monetary Economics: Macro Aspects

Master's Course

16 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) A higher degree of substitutability between consumption goods makes aggregate inflation more costly in a New-Keynesian model with Calvo price setting.

(ii) In the simple Poole model for the choice of operating procedures for monetary policy (where output stability is all that matters), more exogenous volatility in the goods market favors the adoption of an interest-rate operating procedure.

(iii) In the Barro and Gordon inflation bias model, the optimal commitment rule involves more stable inflation compared with discretionary policymaking.

QUESTION 2:

Inflation targeting and noisy data

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

$$x_t = \mathrm{E}_t x_{t+1} - \sigma^{-1}\left(\widehat{i}_t - \mathrm{E}_t \pi_{t+1}\right), \qquad \sigma > 0, \tag{1}$$

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

where x_t is the output gap (output's deviation from the flexible-price output), $\widehat{i}_t$ is the nominal interest rate's deviation from steady state, π_t is goods price inflation. E_t is the rational expectations operator conditional upon all information up to and including period t. Inflation is assumed to be observed with some error such that

$$\pi_t^o = \pi_t + e_t, \tag{3}$$

where π_t^o denotes observed inflation, and e_t is a mean-zero, serially uncorrelated shock accounting for noise in the data. It is assumed that the central bank sets the nominal interest rate according to a simple rule:

$$\widehat{i}_t = \phi \pi_t^o, \qquad \phi > 1. \tag{4}$$

(i) Describe in detail the micro foundations behind (1) and (2).

(ii) Solve for x_t and π_t [Hint: Conjecture that solutions are linear functions of e_t.], and explain how the policy-rule parameter ϕ affects output gap and inflation fluctuations.

(iii) Does this model lend support to the view that a central bank should respond strongly towards observed inflation? Why/Why not?

QUESTION 3:

Monetary shocks and imperfect information

Consider a version of Lucas' flex-price model where individuals live on isolated islands, and after each period are randomly relocated to another island. Letting superscript "i" denote island variables, and no superscript denote economy-wide average variables, four central equations describing the economy are

$$Y_t^i = \left(N_t^i\right)^{1-\alpha}, \qquad 0 < \alpha < 1, \tag{1}$$

$$C_t^i = Y_t^i, \tag{2}$$

$$u_{1-N}\left(C_t^i, M_t^i/P_t^i, 1-N_t^i\right) = \left[(1-\alpha)\frac{Y_t^i}{N_t^i}\right] u_C\left(C_t^i, M_t^i/P_t^i, 1-N_t^i\right), \tag{3}$$

$$\begin{aligned} u_C\left(C_t^i, M_t^i/P_t^i, 1-N_t^i\right) &= u_{M/P}\left(C_t^i, M_t^i/P_t^i, 1-N_t^i\right), \qquad 0 < \beta < 1, \\ &\quad +\beta \mathrm{E}^i u_C\left(C_{t+1}, M_{t+1}/P_{t+1}, 1-N_{t+1}\right), \end{aligned} \tag{4}$$

where Y_t is output in period t, N_t is employment, C_t is consumption, M_t is the nominal money supply at the end of the period, and P_t is the price level. The function u is increasing and concave in all arguments, and u_j denotes the partial derivative of u with respect to variable j. E^i denotes expectations conditional on local information.

(i) Discuss equations (1)–(4) and explain how a change in the real money supply can have real effects in the model.

The stochastic process for the log of nominal money on island i, m_t^i, is given by

$$m_t^i = \gamma m_{t-1}^i + u_t + u_t^i, \qquad 0 < \gamma < 1, \tag{5}$$

where u_t^i is an island-specific shock with mean zero and variance σ_i^2, and u_t is an aggregate shock with mean zero and variance σ_u^2. The shocks u_t and u_t^i are assumed independent, and the informational assumptions are as follows: On island i, variables m_t^i and γm_{t-1}^i are known. The variables u_t and u_t^i, cannot be observed; their sum, however, can be inferred perfectly.

(ii) Discuss how such imperfect information about u_t and u_t^i can affect equilibrium real behavior as a result of a change in aggregate nominal money, i.e., a change in u_t.

(iii) Derive $\mathrm{E}^i\left[u_t | u_t + u_t^i\right]$ under the assumption that expectations about u_t are formed by use of a linear least squares projection. (Hint: agents make an estimate of u_t, which is a linear function of what is observed, $\widehat{u}_t = \kappa\left(u_t + u_t^i\right)$, where κ is the estimation coefficient minimizing the squared forecast error.) Discuss how σ_i^2 and σ_u^2 affect expectations about u_t and thereby the magnitude of real effects of nominal shocks.