Written Exam for the B.Sc. or M.Sc. in Economics 2009, August

Monetary Economics: Macro Aspects

Master's Course

Date: 18 August

(4-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.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students' self-service system.

This set contains four pages (beginning with this page)
All questions must be answered
In the evaluation, the three main questions will be weighted equally

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QUESTION 1:

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

(i) In Svensson's (1997, *European Economic Review*) model of inflation targeting, a more conservative central banker allows inflation to return to its target value at a slower rate.

(ii) In Fuhrer and Moore's backward-looking IS/AD model, an interest-rate rule violating the Taylor principle implies real equilibrium indeterminacy.

(iii) The difference between the domestic and foreign nominal interest rates on perfectly substitutable assets provides no information about the credibility of a fixed nominal exchange rate regime.

(iv) In the New-Keynesian model of Clarida, Galí and Gertler (1999, *Journal of Economic Literature*), a monetary policy based on past periods' policies is welfare improving.

QUESTION 2:

Monetary shocks and imperfect information

Consider a version of Lucas' flex-price "island model" where individuals live on local, isolated markets (or, islands), and after each period are randomly relocated to another market. Letting superscript "i" denote local/island variables, and no superscript denote economy-wide average variables, the 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 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 a "local" nominal disturbance with mean zero and variance σ_i^2, and where 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 assumption is the following. On island i, variables m_t^i and γm_{t-1}^i are known. The variables u_t and u_t^i, on the other hand, cannot be observed.

(ii) Discuss how this imperfect information about u_t and u_t^i can affect equilibrium real behavior towards 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 derive 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.) Discuss how σ_i^2 and σ_u^2 affect the expectations.

It can be shown that (log of) employment is given by

$$n_t=\Phi\left(1-\kappa\right)u_t, \qquad \Phi>0, \qquad 0<\kappa<1, \tag{6}$$

where κ is the estimation coefficient mentioned in the hint to Subquestion (iii).

(iv) The coefficient Φ is a function of the underlying parameters of the model. Explain intuitively what happens to Φ as

- agents become infinitely impatient, i.e., when $\beta\to 0$;
- agents' utility function becomes separable in consumption and real money balances;
- the stochastic process for nominal money becomes more persistent, i.e., γ increases.

QUESTION 3:

The instrument choice in monetary policymaking

Consider the following static, log-linear IS/LM-style model:

$$y = -\alpha i + u, \qquad \alpha > 0 \tag{1}$$

$$m = -ci + y + v, \qquad c > 0, \tag{2}$$

where y is output, i is the nominal interest rate, m is the nominal money supply, and u and v are mean-zero, independent shocks with variances σ_u^2 and σ_v^2, respectively. The objective of monetary policy is to minimize output variance, and policy is conducted before the shocks hit the economy.

(i) Discuss briefly (1) and (2), and derive optimal monetary policy when m is the instrument and when i is the instrument.

(ii) Show that i is preferable as the monetary policy instrument when

$$\left(1 + \frac{2c}{\alpha}\right)\sigma_u^2 < \sigma_v^2. \tag{3}$$

Discuss the intuition behind condition (3).

(iii) Consider an extension where

$$m = b + hi + \omega, \qquad h > 0, \tag{4}$$

is added to the model. In equation (4), b is the money base, which is now a possible monetary policy instrument, and ω is a mean-zero shock with variance σ_ω^2. The variable m is now interpreted as a broad measure of money. Is the case for using a nominal interest rate operating procedure strengthened or weakened relative to condition (3) in this extended version of the model? A thorough verbal discussion is sufficient.

(iv) Assume that monetary policymaking takes the form of a money base rule of the form $b = \mu i$. If there are no shocks to the monetary side of the model, $\sigma_v^2 = \sigma_\omega^2 = 0$, will a "pure" money base rule, $\mu = 0$, be optimal? Explain.