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

Monetary Economics: Macro Aspects

Master's Course

14 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 4 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 dynamic flex-price economy with a cash-in-advance constraint on consumption and investment purchases, the Friedman rule is optimal.

(ii) In the basic New-Keynesian model, the optimal policy response to an inflation shock (i.e., a "cost-push" shock) is time inconsistent.

(iii) In the Auerbach and Obstfeld (2005, *American Economic Review*) model, a temporary change in the money supply does not affect prices when the zero lower bound on the nominal interest rate binds.

QUESTION 2:

Inflation targeting and nominal interest rate rules

Consider the following model for output and inflation determination in a closed economy:

$$y_{t+1} = \theta y_t - \sigma^{-1}\left(i_t - \mathrm{E}_t\pi_{t+1}\right) + u_{t+1}, \qquad 0<\theta<1, \quad \sigma>0, \tag{1}$$

$$\pi_{t+1} = \pi_t + \kappa y_{t+1} + \eta_{t+1}, \qquad \kappa>0, \tag{2}$$

where y_t is log of output in period t, i_t is the nominal interest rate (the monetary policy instrument), π_t is the inflation rate, u_t and η_t are independent, mean-zero, serially uncorrelated shocks. E_j is the rational expectations operator conditional on information up to and including period j. It is assumed that $\sigma>\kappa$.

(i) Discuss equations (1) and (2), with emphasis on the monetary transmission mechanism and the stability properties in absence of policy intervention (a verbal discussion is sufficient).

The objective of the central bank is to conduct monetary policy so as to maximize

$$U = -\frac{1}{2}\mathrm{E}_t\sum_{j=1}^{\infty}\beta^j\pi_{t+j}^2, \qquad 0<\beta<1.$$

(ii) Show that the optimal interest rate rule is

$$i_t = \left(1 + \frac{\sigma - \kappa}{\kappa}\right)\pi_t + \sigma\theta y_t.$$

[Hint: Treat $\mathrm{E}_t y_{t+1} \equiv y_{t+1} - u_{t+1}$ as the policy instrument, and solve the maximization problem by dynamic programming treating π_t as the state variable. Use (2) to make the maximization unconstrained, and use (1) subsequently to derive i_t.]

(iii) Comment on the coefficient on π_t in the interest-rate rule, with special emphasis on how it affects the stability properties of the model. Also, discuss how the coefficients on π_t and y_t depend on the underlying parameters of the model, and evaluate whether the parameters reveal anything about the "strict" inflation-targeting preferences of the central bank.

QUESTION 3:

Monetary policy trade offs?

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

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

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

$$\widehat{i}_t = \phi\pi_t, \qquad \phi > 1, \tag{3}$$

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 and r_t^n is the natural rate of interest, which is assumed to be 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) Discuss (1) and (2) with focus on the underlying micro-economic foundations. What does (3) represent? Explain.

(ii) Derive the solutions for x_t and π_t. [Hint: Conjecture that the solutions are linear functions of r_t^n, and use the method of undertermined coefficients.] Comment on the role of the policy parameter ϕ in terms of the output gap and inflation's dependence on r_t^n, and discuss whether the parameter can be chosen such that the output gap and inflation are stabilized completely.

Assume that a welfare-relevant loss function can be written as

$$\mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{2} \left(\pi_t^2 + \lambda x_t^2 \right), \qquad \lambda > 0. \tag{4}$$

(iii) Derive the welfare-optimal values of x_t and π_t under discretionary policymaking [hence, equation (3) no longer applies]. For this purpose, treat x_t as the policy instrument, and show that the relevant first-order condition for optimal policy together with (2) yield the difference equation

$$\pi_t = \frac{\lambda \beta}{\kappa^2 + \lambda} \mathrm{E}_t \pi_{t+1}, \tag{5}$$

and that optimal inflation is therefore uniquely given by

$$\pi_t = 0.$$

Discuss why variations in the natural rate of interest do not appear in this solution, and discuss whether commitment of the central bank can improve on policymaking.