UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Exam: **ECON4325 – Monetary Policy**

Date of exam: Monday, May 19, 2014 **Grades are given: June 6, 2014**

Time for exam: 2.30 p.m. – 5.30 p.m.

The problem set covers 6 pages

Resources allowed:

- No resources allowed (except if you have been granted use of a dictionary from the Faculty of Social Sciences)

The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

The exam consists of three parts, 1, 2 and 3. In the grading, problem 1 is given 30 per cent weight, problem 2 is given 20 per cent weight, and problem 3 is given 50 per cent weight. When a max page limit is given it should be respected, but is <u>not</u> required (i.e. a shorter answer may be just as good).

Problem 1a

The following article was printed in the Financial Times on 6 May 2014:

Bank of England to weigh options on rate rise:

"The Bank of England will have its first detailed discussion about raising interest rates this week as it weighs how to take the steam out of the housing market without derailing Britain's economic recovery.

Positive economic data and surveys continue to suggest that Britain's upswing is gaining momentum. It is likely that the room for rapid non-inflationary growth is now used up.

Unemployment is now 6.9 % and growth is predicted to become firmly established at 2.7 % in 2014 and 2.5 % in 2015. The BoE has pointed out that price pressures appear low, with the annual rate of inflation falling to 1.6 per cent in March.

Some Monetary Policy Committee (MPC) members think the falling level of unemployment masks a deeper problem of underemployment, which will keep the lid on inflation as the economy expands.

Kevin Daly, of Goldman Sachs, said: "With activity indicators suggesting upside risks to our growth forecasts and given the still disappointing performance of productivity, we view the risks to our BoE forecast as being skewed towards an earlier rate hike."

In the following, it is taken for granted that you are familiar with the BoE's monetary policy regime and forward guidance strategy to the extent that we have covered it at the seminars.

Imagine that you are working as a senior advisor at the Bank of England when this article is published, and that the next monetary policy meeting is one week away. Governor Mark Carney has read the FT article and asks you to write a recommendation on what to do with the interest rate at the next meeting. Your draft should make use of what you have learned in this course in general and the information given in the above-mentioned FT article in particular.

Mr. Carney asks for your personal opinion and your draft should therefore give an independent and intuitive explanation for your choice of interest rate decision. In your answer, you should also state your opinion on whether the BoE's use of forward guidance over the last year has been credible, since the market now seems to be expecting a rate hike, and give a clear recommendation on how to pursue forward guidance in the future.

Your written answer should exceed one page, but be no more than four pages long.

Problem 1b

The 2014 Norges Bank Watch Report made 6 main comments on how Norges Bank could improve its conduction of monetary policy. Briefly explain what these 6 main comments were. Your answer should be no more than one page long.

Problem 1c

Norwegian banks have a high corporate loan exposure in the commercial property market. The market price of commercial properties is one (of the four) main indicators used by the Norges Bank to assess potential financial vulnerabilities.

From 2004 to 2008 there was a strong increase in commercial property prices, and loans to firms investing in commercial properties also rose markedly.

Assume that the commercial property market is dominated by companies that buy commercial properties (partly financed by credit) and rent office space to other firms producing goods.

1. Sketch how you could include these agents into an otherwise standard Bernanke Gertler and Gilchrist (1999) framework (as taught in the lectures by Leif Brubakk).

2. Describe in some detail the effects on debt and commercial property prices in your model – and the interaction between them – following a surprise reduction in the key policy rate.

Your answer should be no more than two pages long.

Problem 1d

Briefly describe what is meant by the Taylor principle in general and its role in the New Keynesian model applied in the course. Then describe, again briefly, the role of the Taylor principle in a Fisherian model with Markov switching between an active and passive monetary policy regime as described in Davig and Leeper (2007). Does the duration of a stay in a passive regime matter for the results? Explain. Your answer should be no more than one page long.

Problem 2

It can be shown that the first order conditions for the household maximization problem in the real business cycle model in this course are:

$$\Omega_t = \frac{N_t^{\varphi}}{C_t^{-\sigma}} = \frac{-\partial U / \partial N_t}{\partial U / \partial C_t} \tag{1}$$

$$Q_t = \beta E_t \left\{ \frac{C_{t+1}^{-\sigma}}{C_t^{-\sigma}} \frac{P_t}{P_{t+1}} \right\} = \beta E_t \left\{ \frac{\partial U / \partial C_{t+1}}{\partial U / \partial C_t} \Pi_{t+1}^{-1} \right\} \tag{2}$$

where Ω_t is the real wage; N_t is hours worked; C_t is consumption; $\frac{1}{\varphi}$ is the Frisch elasticity, which measures how willing the household is to substitute leisure for hours worked when the real wage changes; $\frac{1}{\sigma}$ is the intertemporal elasticity of substitution, which measures how willing the household is to substitute consumption over time when the real interest rate changes (it is also a measure of how valuable consumption is to the household); U denotes the utility function; P_t denotes the aggregate consumption price level; Q_t denotes the aggregate bond price level; $0 < \beta < 1$ is the discount factor and Π_{t+1} denotes the gross inflation rate in period t+1. All subscripts t denote period t. It is assumed that the one period risk free nominal bond, which is bought at price Q_t pays one nominal unit of money on maturity.

Problem 2a

Give an intuitive interpretation of equations (1) and (2) above. In your answer you should state the difference between the intratemporal and the intertemporal optimality conditions. Your answer should be no more than two pages long.

Problem 2b

Show that the log-linearized version of equation (1) can be displayed as the labor supply schedule:

$$n_t = \frac{1}{\varphi}\omega_t - \frac{\sigma}{\varphi}c_t \qquad (3)$$

Problem 2c

It can be shown that the log-linearized equilibrium solutions for output and unemployment in the real business cycle model as discussed in this course can be presented in the following way:

$$y_t^* = \frac{1+\varphi}{\sigma(1-\alpha)+\alpha+\varphi}a_t + \frac{(1-\alpha)\log(1-\alpha)}{\sigma(1-\alpha)+\alpha+\varphi} = \psi_{ya}a_t + \xi_y \qquad (4)$$

$$n_t^* = \frac{1-\sigma}{\sigma(1-\alpha)+\alpha+\varphi}a_t + \frac{\log(1-\alpha)}{\sigma(1-\alpha)+\alpha+\varphi} = \psi_{na}a_t + \xi_n \qquad (5)$$

where a_t describes technology, which follows a stationary AR(1) process; y_t^* denotes equilibrium output; n_t^* denotes equilibrium employment and $0 < \alpha < 1$ is a measure of decreasing return to scale. The log-linearized production function for the firm in this model is:

$$y_t = a_t + (1-\alpha)n_t \qquad (6)$$

Based on the information given above and on your knowledge of the real business cycle model in this course, explain how equilibrium output and employment (given by equations (4) and (5)) will change in the presence of a positive technology shock. In your answer, you should assume that the real wage increases following the shock, that $\varphi > 1$ and that $\sigma > 1$. The more of the parameters included in ψ_{ya} and ψ_{na} that are interpreted, the higher the score. The parameters included in ξ_y and ξ_n need not be interpreted, but you should state the signs and explain the effect of ξ_y and ξ_n on equilibrium output and unemployment respectively.

Your answer should be no more than two pages long.

Problem 3

It can be shown that the non-policy block of equilibrium behavior in the New Keynesian model (as discussed in this course) can be explained by the following two equations:

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa\tilde{y}_t + u_t, \qquad 0 < \beta, \kappa < 1 \qquad (7)$$

$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - \frac{1}{\sigma}[i_t - E_t\{\pi_{t+1}\}], \qquad (8)$$

$$u_t = \rho_u u_{t-1} + \hat{u}_t, \quad 0 < \rho_u < 1$$

where $\tilde{y}_t = \left(y_t - y_t^{natural}\right)$ is the output gap in period *t*, κ is a measure of price rigidity, β is the discount factor, i_t is the nominal interest rate, u_t is the cost-push shock and $\hat{u}_t$ is white noise. u_t is known when monetary policy is determined. Introducing monetary policy, the central bank loss function is:

$$L_t = \frac{1}{2}E_t\left[\sum_{i=0}^{\infty}\beta^i\{(\pi_{t+i} - \pi^*)^2 + \lambda\tilde{y}_{t+i}^{\,2}\}\right], \qquad \pi^* = 0 \qquad (9)$$

where π^* is the zero inflation target and λ denotes the relative weight that the central bank puts on the output gap.

Problem 3a

Assuming rational expectations, explain why the central bank has to take expectations as given in this model. Furthermore, state the central bank's minimization problem. Your answer should be less than one page long and by words only.

Problem 3b

Based on the information given in problem 3a, reformulate the loss function in equation (9) and show that the first order conditions for inflation and the output gap following the central bank's minimization problem are given by:

$$\pi_t = \frac{\lambda}{\lambda + \kappa^2}[\beta E_t\pi_{t+1} + u_t], \qquad (10)$$

$$\tilde{y}_t = -\frac{\kappa}{\lambda + \kappa^2}[\beta E_t\pi_{t+1} + u_t], \qquad (11)$$

Problem 3c

Combine equations (10) and (11) and use the resulting equation to explain the concept "leaning against the wind" as used in Clarida, Gali and Gertler (1999). In your answer, which should provide a detailed description of central bank optimal policy behavior, you may consider the parameter κ as a measure of price rigidity. Your answer should exceed one page but be no more than two pages long.

Problem 3d

Iterate equation (10) forward and show that the reduced form solution for inflation equals:

$$\pi_t = \left(\frac{\lambda}{\kappa^2 + \lambda(1 - \beta\rho_u)} \right) u_t \qquad (12)$$

Find the reduced solution for the output gap and give a thorough interpretation of both solutions.

Problem 3e

Explain briefly and by words only how there can be gains from introducing commitment in this model.