UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Exam: **ECON4325 – Monetary Policy, spring 2012**

Date of exam: Monday, June 21, 2012 **Grades are given: June 12, 2012**

Time for exam: 2.30 p.m. – 5.30 p.m.

The problem set covers 4 pages

Resources allowed:
- No resources allowed

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 percent weight, problem 2 is given 20 percent weight, and problem 3 is given 50 percent weight.

Problem 1a

In the period between the Monetary Policy Report (MPR) 1-2011 and the MPR 1-2012, Norges Bank has changed its loss function quite significantly. Imagine that you work as a senior advisor at Norges Bank in May 2011. The governor has just gotten a first draft with the new loss function (later to be presented in MPR 1-2012), but the draft only provides a sketch of the new equation. You are asked to provide a draft that explains what the changes are, why those changes are made, and whether the changes might have unfortunate consequences. He also asks for your personal opinion on whether the loss function should be changed. In your answer, you should give an independent and intuitive explanation for your choice of loss function, and you should start with a presentation of both the old loss function and the new proposal. Your written answer should exceed one page, but be no more than four pages long.

Problem 1b

Explain the main idea behind Diamond-Dybvig's model for a bank run. Explain to what extent a similar mechanism may be relevant for the debt crisis in the euro area. Your answer should be no more than two pages long.

Problem 1c

What are the three types of inefficiencies in the New Keynesian model used in this course? In your opinion; are these inefficiencies realistic? In your answer, which should not be more than two pages long, you can assume that wages are flexible.

Problem 1d

What do we mean by the "the financial accelerator"? Explain briefly.

Problem 2a

Gali, Gertler and Lopez-Salido (2007) (GGL-S) derive the following equation (with a slight re-writing):

$$\frac{\Delta_t}{\bar{U}_t \bar{C}_t} = \Phi \tilde{y}_t - \frac{1}{2}[(\sigma + \varphi) - \Phi(1 + \varphi)]\tilde{y}_t^2 \qquad (1)$$

State briefly what the equation measures. What is the effect of an increase in φ, i.e. a reduction in the labour supply elasticity? Show by use of graphics and explain. Interpret your results.

Problem 2b

In the GGL-S paper, what does it mean that "wages are allocative", and why does this assumption matter for the possibility to distinguish between the wage markup and the price markup? Explain briefly.

Problem 3

It can be shown that the non-policy block of equilibrium behavior in the New Keynesian model can be explained by the following two equations:

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa \tilde{y}_t + u_t, \qquad 0 < \beta, \kappa < 1 \qquad (2)$$

$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - \frac{1}{\sigma}[i_t - E_t\{\pi_{t+1}\}], \qquad (3)$$

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

where $\tilde{y}_t = \left(y_t - y_t^{natural}\right)$ is the output gap in period t, i_t is the nominal interest rate, $\frac{1}{\sigma}$ is the intertemporal elasticity of substitution, 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 is committed to the following Taylor rule:

$$i_t = \phi_\pi \pi_t + \phi_{\tilde{y}} \tilde{y}_t, \qquad \phi_\pi > 1, \ \phi_{\tilde{y}} > 0 \qquad (4)$$

where $\phi_\pi, \phi_{\tilde{y}}$ are parameters set by the central bank.

a) The evolution of inflation in this economy is to a large extent determined by the parameter κ, which is defined as:

$$\kappa = \frac{(1-\theta)(1-\beta\theta)}{\theta} \frac{(1-\alpha)}{1-\alpha+\alpha\varepsilon}\left(\sigma + \frac{\varphi+\alpha}{1-\alpha}\right)$$

where $(1-\theta)$ measures the fraction of firms that can reset their prices in any given period, while a fraction θ keep their prices unchanged. β is the discount factor, α is a measure of decreasing return to scale (Hint: α affects price setting behavior in two different ways), ε is the demand elasticity, whereas σ and φ from the intertemporal optimality condition for the household are the inverses

of the elasticity of substitution and the Frisch elasticity of labor supply respectively.

Describe in words how the evolution of inflation in period t depends on the size of κ (Hint: The more parameters interpreted, the higher is the score).

b) Explain in words (very short) what the Taylor principle is, and why it should be fulfilled. Is it fulfilled in this economy?

c) We assume that equations 2, 3 and 4 yield a unique equilibrium solution, and that this solution is the divine coincidence. Explain in words (very short) what this means.

d) Use the method of undetermined coefficients to show that the equilibrium solutions for inflation and output gap in this economy in the presence of a cost-push shock equal:

$$\pi_t = \psi u_t = \Lambda\left[\sigma(1-\rho) + \phi_{\tilde{y}}\right]u_t \quad (5)$$

$$\tilde{y}_t = \chi u_t = -\Lambda(\phi_\pi - \rho)u_t \quad (6)$$

where $\Lambda = \frac{1}{\kappa(\phi_\pi - \rho) + (1-\beta\rho)\left[\sigma(1-\rho) + \phi_{\tilde{y}}\right]} > 0$

Describe, <u>by interpreting signs only</u>, how equilibrium inflation and the output gap are affected by a positive cost-push shock. Explain how the results depend on whether the Taylor principle is fulfilled, and whether the divine coincidence can be achieved in the presence of a cost-push shock. In your answer you can assume that Λ will stay positive regardless of whether the Taylor principle is fulfilled.

e) A positive cost-push shock affects the output gap through many different channels: Through persistence, through the interest rate due to the shock's effect on inflation, through inflation expectations and through different multiplier effects caused by the initial change in the output gap. During your calculation of the total effect χ in problem 3d, before simplifying the expression, you found the following:

$$\chi = \frac{-\frac{\phi_\pi}{\sigma(1-\beta\rho)} + \frac{\rho}{\sigma(1-\beta\rho)}}{1-\rho + \frac{\kappa\phi_\pi}{\sigma(1-\beta\rho)} + \frac{\phi_{\tilde{y}}}{\sigma} - \frac{\kappa\rho}{\sigma(1-\beta\rho)}}$$

from which all these effects can be interpreted one-by-one.

Study equations 2, 3 and 4, as well as the expression for χ, and describe in words how the output gap is affected by a positive cost-push shock and how the result depends on the different parameters. (Hint: The more elements of the

economic mechanism you describe (i.e. the more of the seven expressions mentioned in the expression for χ) , the higher is the score.

f) Now, assume that the central bank instead of committing to a rule makes use of discretion and conducts optimal monetary policy from minimizing the following loss function:

$$L_t = \frac{1}{2}\left\{\lambda^* \tilde{y}_t{}^2 + (\pi_t - \pi^*)^2\right\} + F_t, \quad \pi^* = 0 \ , \tag{7}$$

subject to $\pi_t = \kappa \tilde{y}_t + f_t,$ (8)

where π^* is the zero inflation target and where

$F_t \equiv \frac{1}{2} E_t \sum_{k=1}^{\infty} \beta^k \left\{\lambda^* \tilde{y}_{t+k}{}^2 + (\pi_{t+k} - \pi^*)^2\right\}$ and $f_t \equiv \beta E_t \pi_{t+1} + u_t$

represent that the central bank must take expectations as given when formulating monetary policy. Households are expected to have rational expectations and the central bank target the natural rate of output.

Explain why the central bank must take expectations as given when deriving optimal monetary policy in this setting. Derive the first order conditions and show that they can be combined in the following way:

$$\tilde{y}_t = -\frac{\kappa}{\lambda^*}\pi_t \tag{9}$$

(Hint: When deriving the first order conditions, equation (9) can be found directly without solving any of the first order conditions forward). The optimal policy under discretion in the presence of a cost-push shock is known as "leaning against the wind". Explain this concept based on the variables and parameters described in equation (9).

g) It can be shown that equilibrium standard deviations for inflation and the output gap in the presence of a cost-push shock are:

$\sigma_\pi = \left(\frac{\lambda^*}{\kappa^2 + \lambda^*(1-\beta\rho)}\right)\sigma_u$ and $\sigma_{\tilde{y}} = -\left(\frac{\kappa}{\kappa^2 + \lambda^*(1-\beta\rho)}\right)\sigma_u$ respectively.

Use these standard deviations to draw the efficient policy frontier $\left(\sigma_{\tilde{y}}, \sigma_\pi\right)$ and explain how we should expect equilibrium and output gap volatility for Norway to change given the new loss function presented in the last Monetary Policy Report.