UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Exam: **ECON4325 – Monetary Policy**

Date of exam: Friday, June 1, 2018 **Grades are given:** June 19, 2018

Time for exam: 09.00 – 12.00

The problem set covers 6 pages (incl. cover page)

Resources allowed:

- No written or printed resources – or calculator - is 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: A, B, and C. In the grading, part A is given 30 % weight, part B is given 20 % weight, and part C is given 50 % weight.

Part A (30 %)

This part contains three short problems. You must answer all three of them to get full score.

a)

In the standard New-Keynesian model, the slope of the Phillips curve (κ), is defined as:

$$\kappa = \left(\sigma + \frac{\phi + \alpha}{1 - \alpha}\right)\left(\frac{1-\theta}{\theta}\right)(1 - \beta\theta)\left(\frac{1-\alpha}{1-\alpha+\alpha\epsilon}\right).$$

- Explain what θ is and why $\frac{\partial \kappa}{\partial \theta} < 0$.
- Explain what ϵ is and why $\frac{\partial \kappa}{\partial \epsilon} < 0$.

b)

Central Bank		Banks		Households/Firms	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
Bonds	Reserves	Reserves	Deposits	Capital/housing	Loans
		Bonds		Deposits	
		Loans	Equity	Bonds	Equity

Figure 1: Simplified balance sheets

Imagine that you are a senior advisor at a central bank. The central bank follows a flexible inflation targeting regime. The output and inflation gaps are negative, and the nominal interest rate is 0 %. The governor wants to evaluate whether quantitative easing or credit easing might help the central bank in achieving the monetary policy targets. Write a note where you

i) Describe what quantitative easing and credit easing is.

ii) Describe the theory underpinning each of the two balance sheet policies.

iii) Provide a recommendation on future action.

Your written answer should be no more than three pages long.

c)

The definition of GDP in a closed economy is

$$Y_t = C_t + I_t + G_t \tag{1}$$

where Y_t is GDP, C_t is consumption, I_t is investment, and G_t is government spending. Log-linearize equation (1).

Part B (20 %)

In this problem, we are going to solve the household problem under various assumptions. The household problem is

$$\max_{C_t, N_t, B_t} \mathbb{E}_t \sum_{k=0}^{\infty} \beta^k U(C_{t+k}, N_{t+k}) \tag{2}$$

subject to

$$P_t C_t + \frac{B_t}{1+i_t} \leq B_{t-1} + W_t N_t + D_t \tag{3}$$

$$\lim_{T\to\infty} \mathbb{E}_t \left\{ \beta^{T-t} \frac{U_{C,T}}{U_{C,t}} \frac{B_T}{P_T} \right\} \geq 0 \tag{4}$$

where C_t is consumption, N_t is hours worked, B_t is nominal bonds, P_t is the price of consumption goods, i_t is the nominal interest rate, W_t is the nominal wage, D_t is dividends from firms, $\beta \in [0, 1)$ is the discount rate, and U is the utility function.

a)

Assume that $U(C_t, N_t) = \frac{C_t^{1-\sigma}-1}{1-\sigma} - \frac{N_t^{1+\phi}}{1+\phi}$ and show that the first order conditions are

$$C_t^{-\sigma} \frac{W_t}{P_t} = N_t^{\phi} \tag{5}$$

$$C_t^{-\sigma} = \beta(1+i_t)\mathbb{E}_t \left\{ C_{t+1}^{-\sigma} \frac{P_t}{P_{t+1}} \right\} \tag{6}$$

b)

Interpret equation (5) and (6). What are the trade-offs involved for the household?

c)

Assume now that $U(C_t, N_t) = \frac{1}{1-\sigma}\left(C_t - \frac{N_t^{1+\phi}}{1+\phi}\right)^{1-\sigma}$ (Greenwood-Hercowitz-Huffman preferences) and show that labor supply is given by

$$\frac{W_t}{P_t} = N_t^{\phi} \tag{7}$$

d)

Consider now an economy with a distribution of households. How would you approach data to distinguish between the two models of labor supply (equation (5) and (7))? Which model do you think is most reasonable?

Hint: What does the two models imply for the labor supply of rich (consume much) and poor households? Who should work most (rich or poor, high or low wages)?

Part C (50 %)

In this problem, we are going to solve for optimal monetary policy under various assumptions. The underlying model is from Clarida-Gali-Gertler (1999):

$$L_t = \frac{1}{2}\mathbb{E}_t \sum_{k=0}^{\infty} \beta^k [\lambda x_{t+k}^2 + \pi_{t+k}^2] \tag{8}$$

$$\pi_t = \kappa x_t + \beta \mathbb{E}_t \pi_{t+1} + u_t \tag{9}$$

$$x_t = -\eta[i_t - \mathbb{E}_t \pi_{t+1}] + \mathbb{E}_t x_{t+1} \tag{10}$$

$$u_t = \rho u_{t-1} + \epsilon_t \tag{11}$$

$$\epsilon_t \sim N(0, \sigma_\epsilon) \tag{12}$$

where x_t is the output gap, π_t is the inflation rate, u_t is the cost-push shock, ϵ_t is an i.i.d. innovation to the cost-push shock, and $\lambda > 0$, $\beta \in [0, 1)$, $\kappa > 0$, $\eta > 0$ and $\rho \in [0, 1)$ are parameters. We find optimal monetary policy by minimizing the loss function (8) subject to the model equations.

a)

Solve the problem above for **optimal monetary policy under discretion** and show that the first order conditions can be combined to yield the "leaning against the wind" condition:

$$\lambda x_t = -\kappa \pi_t \tag{13}$$

b)

Interpret equation (13). Under which parameter settings is it optimal to always fully stabilize output? And which parameters imply that it is optimal to always fully stabilize inflation?

c)

Solve the model under discretion such that π_t, x_t, and i_t are functions only of the cost-push shock (u_t).

d)

Assume now that the central bank for some reasons wants the output gap to be positive by b units:

$$L_t = \frac{1}{2}\mathbb{E}_t \sum_{k=0}^{\infty} \beta^k [\lambda (x_{t+k} - b)^2 + \pi_{t+k}^2]$$

and that the Phillips curve has no discounting:

$$\pi_t = \kappa x_t + \mathbb{E}_t \pi_{t+1} + u_t$$

The model solution is now:

$$\pi_t = \frac{\lambda}{\lambda(1-\beta\rho)+\kappa^2} u_t + \frac{\lambda}{\kappa} b$$
$$x_t = -\frac{\kappa}{\lambda(1-\beta\rho)+\kappa^2} u_t$$

Explain the intuition for why b enters the optimal solution for inflation, but not output.

e)

Under optimal monetary policy under (unconstrained) commitment, the first order conditions are:

$$-\kappa\pi_{t+k} = \begin{cases} \lambda x_{t+k} & \text{if } k = 0 \\ \lambda(x_{t+k} - x_{t+k-1}) & \text{if } k > 0 \end{cases}$$

The first-order conditions can be rewritten to

$$\beta^k \lambda x_{t+k} = -\beta^k \kappa \sum_{j=0}^{k} \pi_{t+j} \tag{14}$$

Interpret equation (14). Explain why it is different from the "leaning against the wind" condition under discretion (13).