UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Exam: **ECON4325 – Monetary Policy**

Date of exam: Thursday, May 26, 2011   **Grades are given: Wednesday, June 15, 2011**

Time for exam: 09:00 a.m. – 12:00 noon

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 50 percent weight, problem 2 is given 10 percent weight, and problem 3 is given 40 percent weight.

Problem 1 consists of four separate problems. They should be answered briefly, intuitively and precisely. Problem 2 should be answered briefly, intuitively and precisely. Problem 3 should be answered in depth and detail.

Problem 1a

Imagine that you work as an economic advisor at the Bank of England. In two days there will be a monetary policy meeting and the current key policy Bank Rate level is 0.5 %. The economic development since the last monetary policy meeting (i.e. new information) is as explained below. Based on the information below (taken from a 2011 Monetary Policy meeting minutes), write an interest rate recommendation to the governor. You should give a thorough, independent and intuitive explanation for your choice of monetary policy decision; your written answer should exceed one page, but be no more than three pages long.

Economic developments since the previous Monetary Policy meeting

Financial markets
- o The path expected for official sterling interest rates had moved up over the month, with a 25 basis point increase in the key policy Bank Rate fully priced in within six months. The sterling had depreciated against the euro but appreciated against the dollar.

The international economy
- o Expectations for global GDP growth in 2011 had risen to 4.5%. The rebound in world demand had been associated with a notable pickup in global inflation, with the IMF's measure of global CPI inflation rising from just over 1% in mid-2009 to almost 4%. Much of the rise in global inflation had reflected a rise in commodity prices. Some commodity prices could rise further if the global economy continued to grow robustly.

- o The depreciation of sterling had led to substantial increases in UK import prices. More recently, rises in global prices, particularly reflecting higher commodity prices, had added further upward pressure.

Domestic demand and output
- o Real GDP had declined by 0.5% and appeared likely to have been somewhat weaker than expected in the previous *Inflation Report*. Nominal domestic demand had increased by 6.8% over the last year, above its average growth rate for the decade before 2007. At 5.1%, overall nominal GDP growth had been somewhat slower. The outlook for growth remained highly uncertain.

- o Exports of goods and services had grown by 7.5% over the last year, considerably faster than the 2000-07 average. More recent data had been consistent with continued growth in export. Import growth had been stronger than previously expected by the Committee.

Supply, costs and prices
- o Twelve-month CPI inflation had risen to 3.7% in last month, up from 3.3% in the previous month. The advance estimate for twelve-month CPI inflation for this month is 4.0%. The near-term outlook for inflation had risen markedly relative to the last *Inflation Report* following further rises in commodity and other import prices. Inflation was likely to pick up to between 4% and 5% in the near term, and to remain well above the target throughout 2011.

- o During 2012, inflation was likely to fall back, however, the prospects for inflation in the medium term were highly uncertain, the chances of inflation being either above or below the target in the medium term was broadly equal.

- o Overall employment had increased gradually over the last six months and earnings growth had remained subdued. Whole economy regular pay growth remained below its pre-recession average.

Problem 1b

Recall Woodford's model with Financial Intermediation (in the paper "Financial Intermediation and Macroeconomic Analysis"). What is the main feature of Woodford's model that makes it different from a standard IS-LM model, or IS-MP model?

Problem 1c

Explain in words and by the use of a loss function Norges Bank's four criteria for an appropriate interest rate path.

Problem 1d

Explain the concept "the inefficiency gap" used by Gali, Gertler and Lopez-Salido (2007). Assume that both consumption and employment increase considerably, relative to trend. Is this possible to rationalize as an efficient fluctuation? Explain why/why not. Is it possible to rationalize as an inefficient fluctuation? Explain why/why not. Explain under what assumption(s) it is possible to distinguish empirically between the wage markup and the price markup.

Problem 2

In the New Keynesian Model, inflation is a result of aggregate consequences of carefully reasoned price-setting decisions made by firms based on their current and future cost conditions.
It can be shown that inflation evolves in the following way:

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \frac{(1-\theta)(1-\beta\theta)}{\theta}\Theta\widehat{mc}_t, \qquad 0 < \beta, \theta < 1 \qquad (1)$$

where π_t is the inflation rate in period t, $\widehat{mc}_t$ is the log deviation of marginal cost from its steady state value mc, $(1-\theta)$ 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 and $\Theta = \frac{(1-\alpha)}{1-\alpha+\alpha\varepsilon} \leq 1$, where α is a measure of decreasing return to scale and ε is the demand elasticity.

Describe in words the evolution of the inflation rate in period t. (Hint: The more parameters interpreted, the higher is the score).

Problem 3 – Optimal Monetary Policy in the New Keynesian Model

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:

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

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

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

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 loss function is:

$$L_t = \frac{1}{2} E_t \left[\sum_{i=0}^{\infty} \beta^i \left\{ (\pi_{t+i} - \pi^*)^2 + \lambda \tilde{y}_{t+i}^2 \right\} \right], \qquad \pi^* = 0 \tag{4}$$

where π^* is the zero inflation target. It can be shown that even when the central bank targets the natural level of output, as it does in this case, there can be gains from commitment. Hence, assume that the central bank commits to a policy rule for the target variable $\tilde{y}_t$ contingent on the cost push shock in the following way:

$$\tilde{y}_t = \gamma u_t, \tag{5}$$

where each value of γ will relate to one particular rule.

a) Substitute the policy rule into the New Keynesian Phillips curve (i.e. in equation 2) and solve for the equilibrium inflation rate by the method of undetermined coefficients.

b) Express equilibrium inflation in terms of $\tilde{y}_t$ and the cost push shock, and show that the optimal value of γ within the simple family of policy rules (i.e. the constrained optimum), is:

$$\gamma^* = \frac{-\kappa}{\lambda (1 - \beta \rho)^2 + \kappa^2} \tag{6}$$

Explain why γ^* is negative.

c) What is equilibrium output gap and equilibrium inflation under this optimal policy? Interpret the solutions. (Hint: The more parameters interpreted, the higher is the score).

d) Explain briefly in words how one finds the equilibrium interest rate under this policy.

e) Describe the term "leaning against the wind" by the use of words and the equilibrium solutions for inflation and the output gap.