UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Exam: **ECON4325 – Monetary Policy**

Date of exam: Tuesday, May 21, 2013 **Grades are given: June 7, 2013**

Time for exam: 2:30 p.m. – 5:30 p.m.

The problem set covers 6 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 per cent weight, problem 2 is given 20 per cent weight, and problem 3 is given 50 per cent weight. Problem 1 and 2 should be answered briefly, intuitively and precisely. The max page limit should be respected, but is <u>not</u> required (i.e. a shorter answer may be just as good). If not stated otherwise, problem 3 should be answered in depth and detail.

Problem 1a

The following text was printed in the Financial Times (FT) on February 22, 2013:

"*For the first time since gaining independence in 1997, the Bank of England's (BoE's) policy makers admitted this month that inflation is likely to stick to above its 2 per cent target for the next two years […] If the new forecasts are correct, inflation will exceed the target for almost the whole period between 2008 and 2015.*

What's more, the Monetary Policy Committee said it had no intention of trying to tighten monetary policy to meet the target. Sir Mervin King has joined the ranks of BoE's top brass (toppsjefer) calling for more government bond buying. From the man credited with masterminding the UK's switch to inflation targeting, Sir Mervyn's apparent sanguinity (sorgløshet) over higher inflation is remarkable. It is, at the very least matched by governor-designate Mark Carney.

Simon Hayes, UK economist at Barclays, said: "When I'm asked to say where I think inflation will be in five years' time, now I'd say that it's more likely to be nearer 2.5 per cent than 2

per cent. In the past, I would've said that it would fall to target". […] The renewed prospect of more quantitative easing caused the pound to dive. More falls are expected. "The BoE seems happy with the growth consequences of a falling pound and not unhappy with the inflationary consequences", said David Bloom, a strategist at HSBC.

But investors' worries are not matched by the people in the street. Well-anchored household inflation expectations, plus high unemployment and lower rates of union membership, make a wage-price spiral unlikely. Michael Saunders, economist at Citibank said: "If rail fares are going to increase because the government subsidy for the rail network is falling, then that's nothing to do with the sort of supply and demand factors that monetary policy can control".

Imagine that you work as a senior advisor at the Bank of England in February 2013. The governor, Sir Mervyn King, felt confident that the decisions made and communicated at the latest monetary policy meeting were very clear and very good, but now, after having read the FT article, he is puzzled. Mark Carney, Mr. King's successor, seems to believe that nominal output targeting might be the right way to go in the future, but is it really? Mr. King wants to conduct the best possible monetary policy and realizes that he has too little information on the challenges involved if the BoE decides changing to output targeting. He seeks to be enlightened so that he can express a clear view to Mr. Carney the next time they meet.

As one of the top senior policy advisors at the Bank, you are asked to provide a draft that discusses the arguments in favor of and the challenges with switching from inflation targeting to output targeting.

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. King also asks for your personal opinion on how to read the market reactions in the article and on whether the BoE should switch to output targeting in the near future. In your answer, you should give an independent and intuitive explanation for your choice of target. Your written answer should exceed one page, but be no more than four pages long.

Problem 1b

In the monetary policy literature, a standard view is that there is no long run link between real and nominal variables (classical dichotomy), but that monetary policy may have effect on real variables in the short run due to nominal rigidities. Downward nominal wage rigidity (DNWR) represents a challenge to the standard view; there seems to be considerable empirical evidence that wages are rigid downwards in nominal terms, also in the long run.

Based on what you have learned in this course, describe the main sources of the presence of DNWR in the economy. Your answer should be brief and no more than two pages long.

Problem 1c

Assume that monetary policy can be explained by a simple Taylor rule with weight on both inflation deviations from its target and the output gap. How does the effect of a monetary policy shock on inflation and the output gap differ between the Bernanke, Gertler and Gilchrist model and the standard New Keynesian model as taught in this course? (Hint: Think in terms of impulse responses). Your answer should be brief, with no use of equations and no more than two pages long.

Problem 1d

At its Monetary Policy meeting in March 2013, Norges Bank kept the key policy rate unchanged, but lowered the interest rate path and communicated that the interest rate now was expected to stay unchanged until spring 2013 and low until spring 2014. The interest rate path was lowered the most for the years 2014 and 2015. What were the reason(s) for the central bank's choice of lowering the interest rate path? Your answer should be no more than one page long.

Problem 2a

In order to maximize welfare in the Barro Gordon model, the central bank is assumed to fully control inflation and minimizes the following loss function:

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda(y_t - y^*)^2\right], \tag{1}$$

where $\lambda > 0$ is the central bank's relative weight on the output gap and $\pi^* \geq 0, y^* > 0$ are the central bank's inflation target and output target respectively, and where the socially optimal output level, y^*, is larger than the natural output level in the economy, $y_t^{natural}$. Furthermore, the economy is supply-side driven where output is described by the Lucas supply curve:

$$y_t = y_t^{natural} + \gamma(\pi_t - \pi_t^e) + \varepsilon_t, \qquad \gamma > 1, E_{t-1}(\varepsilon_t) = 0 \qquad \text{and} \quad \pi_t^e = E_{t-1}\pi_t \tag{2}$$

When households hold rational expectations, it can be shown that realized inflation after the central bank has conducted optimal monetary policy equals:

$$\pi_t^{\,rational} = \pi^* + \lambda\gamma\left(y^* - y_t^{natural}\right) - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t, \qquad \lambda > \frac{1}{\gamma^2} \tag{3}$$

Solve for realized output in this economy and interpret both equation (3) and your solution for output. In your answer, you should identify the inflation bias, explain why the socially optimal output level cannot be achieved and describe how stabilization policy is conducted in the presence of a supply shock. The more variables/parameters interpreted, the higher is the score. Your answer may be as short as one page long.

Problem 2b

What can be possible solutions to the time-inconsistency problem in the Barro Gordon model? Your answer should be between one and three pages long.

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:

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa \tilde{y}_t + u_t, \qquad 0 < \beta, \kappa < 1 \tag{4}$$

$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - \frac{1}{\sigma}\left[i_t - E_t\{\pi_{t+1}\}\right], \tag{5}$$

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

where $\tilde{y}_t = \left(y_t - y_t^{natural}\right)$ is the output gap in period t, 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:

$$i_t = \phi_\pi \pi_t + \phi_{\tilde{y}} \tilde{y}_t + e_t, \qquad \phi_\pi > 1,\ \phi_{\tilde{y}} > 0 \tag{6}$$

$$e_t = \rho_e e_{t-1} + \hat{e}_t, \qquad 0 < \rho_e < 1 \text{ and } \rho_e < \rho_u$$

where $\phi_\pi, \phi_{\tilde{y}}$ are parameters set by the central bank, e_t is a monetary policy shock and $\hat{e}_t$ is white noise.

Problem 3a

Equations (4) and (5) are the key equations in the New Keynesian model, found through household and firm maximization problems. Describe briefly the difference between the intratemporal and intertemporal optimality conditions for the households, and explain how the household optimization problem in the New Keynesian model, as described in this course, differs from the classical monetary model. Your answer should be no more than one page long and by words only, no equations.

Problem 3b

Price rigidity is a key element in the New Keynesian model. With Calvo pricing, it can be shown that gross inflation in this economy equals:

$$\Pi_t^{1-\varepsilon} = \theta + (1-\theta)\left[\frac{P_t^*}{P_{t-1}}\right]^{1-\varepsilon}, \qquad \varepsilon > 1, 0 < \theta < 1 \tag{7}$$

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. ε is the demand elasticity, P_t^* is the optimal

price chosen by the firms who can reset prices in period t and P_{t-1} is the aggregate price level in period t-1.

For a steady state gross inflation rate equal to 1, log-linearize equation (7) around its steady state. Interpret the solution.

Problem 3c

Solve equation (4) (i.e. the NK Phillips curve) forward and explain the evolution of aggregate inflation in period t in this economy knowing that we have an infinite number of periods.

Also know that the parameter κ 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 $0 < \beta < 1$ is the discount factor, $0 < \alpha < 1$ is a measure of decreasing return to scale. $\sigma < 1$ and $\varphi > 1$ from the intertemporal optimality condition for the household are the inverses of the elasticity of substitution and the Frisch elasticity of labor supply respectively. In your answer, it might also be beneficial to remember that marginal cost deviation from steady state is given by:

$$\widehat{mc}_t = \left(\sigma + \frac{\varphi+\alpha}{1-\alpha}\right)\tilde{y}_t \qquad (8)$$

Problem 3d

We assume that equations 4, 5 and 6 yield a unique equilibrium solution. The Taylor principle holds. Use the method of undetermined coefficients (with the following guess parameters: α_u and α_e for the full effect on the output gap from a cost push shock and a monetary policy shock respectively, and ψ_u and ψ_e for the full effect on inflation) to find the equilibrium solutions for inflation and the output gap in this economy in the presence of both a monetary policy shock and a cost push shock. (Hint: Use equation (4), not the forward solution found in 3c.)

Interpret the solutions at some point in your calculation, whenever you find it more appropriate. Your full answer should include

1) Your calculation to the final solution for inflation and output gap in the presence of these two shocks.

2) A full interpretation of the economic mechanism from the moment the shock hits the economy till the full effect has been absorbed. Make sure to be clear on whether the output gap and inflation rises/falls in the presence of the shock.

In your calculation, you do not have to insert for κ but may consider κ a measure of price stickiness only. Also, you do not have to simplify the solutions, for instance, the solution for the full effect of a cost push shock on the output gap can look like this (no need for further simplification because it is easier to interpret this way):

$$\alpha_u u_t = \frac{-\left(\frac{\phi_\pi}{\sigma(1-\beta\rho_u)} - \frac{\rho_u}{\sigma(1-\beta\rho_u)}\right)}{1-\rho_u + \frac{\kappa\phi_\pi}{\sigma(1-\beta\rho_u)} + \frac{\phi_{\tilde{y}}}{\sigma} - \frac{\kappa\rho_u}{\sigma(1-\beta\rho_u)}} u_t$$

Problem 3e

Which shock is more likely to create the largest change in the variables, and why? Explain briefly.