Written Exam for the M.Sc. in Economics
Summer 2010 (reexam)

Monetary Economics: Macro Aspects

Master's Course

August 18

(3-hour closed-book exam)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by "eksamen på dansk" in brackets, you must write your exam paper in Danish.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students' self-service system.

This set contains four pages (beginning with this page)

All questions must be answered

Questions 1 and 2 each weigh 25 % while question 3 weighs 50 %. These weights, however, are only indicative for the overall evaluation.

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QUESTION 1:

Evaluate whether the following statements are true or false. Explain your answers.

(i) In a simple New-Keynesian model (like in Benigno's 2009 exposition), increased government spending has no effects due to the offsetting decrease in private consumption.

(ii) In the simple cash-in-advance model with only consumption in the utility function, there is no unique optimal monetary policy.

(iii) With economic fluctuations predominantly arising in the money market, Poole's 1970 analysis of optimal operating procedures for monetary policy, suggests that output is best stabilized under a base money operating procedure.

QUESTION 2:

Monetary credibility problems and wage indexation

Consider an economy characterized by the following aggregate supply schedule:

$$y_t = p_t - w_t, \tag{1}$$

where y_t is log of output, w_t is log of nominal wages, and p_t is log of the price level. Nominal wage determination in period t is assumed to be characterized by one-period nominal wage contracts signed in period $t-1$. These contracts can be partly or fully indexed to the actual period-t price level. Nominal wages are therefore assumed to be given by:

$$w_t = (1 - \theta) \, \mathrm{E}_{t-1}\left[p_t\right] + \theta p_t, \qquad 0 < \theta \leq 1, \tag{2}$$

where $\mathrm{E}_{t-1}\left[p_t\right]$ is the (rationally) expected price level and θ is an indexation parameter.

(i) Derive the economy's aggregate supply schedule when nominal wages are determined according to (2). Interpret the expression.

(ii) Monetary policy is for simplicity modelled as a matter of setting p_t. It is determined by a central bank whose utility function is

$$U = \lambda y_t - \frac{1}{2} \left(p_t - p_{t-1}\right)^2, \qquad \lambda > 0. \tag{3}$$

Derive the utility-maximizing choice of p_t for given price expectations, subject to the aggregate supply schedule derived in (i), and derive the time-consistent, rational-expectations solutions for y_t and $p_t - p_{t-1}$. Discuss.

(iii) What is the optimal degree of nominal wage indexation in the economy, i.e., the optimal value of θ, when the central bank's utility function (3) is the welfare measure? Provide an intuitive explanation, and discuss whether the answer would change if the central bank's utility function is quadratic in output and equation (1) is replaced by $y_t = p_t - w_t - \varepsilon_t$, where ε_t is a supply shock.

QUESTION 3:

Money-in-the utility function models. Is the timing of utility flows important?

Consider a model of an economy formulated in discrete time, where representative individuals have utility functions

$$U = \sum_{t=0}^{\infty} \beta^t u\left(c_t, m_t\right), \qquad 0 < \beta < 1, \tag{1}$$

and budget constraints

$$f\left(k_{t-1}\right) + \tau_t + \left(1 - \delta\right) k_{t-1} + m_t = c_t + k_t + m_{t+1}\left(1 + \pi_{t+1}\right), \tag{2}$$

where c_t is consumption, m_t is real money balances at the *beginning* of period t, k_{t-1} is physical capital at the end of period $t-1$, τ_t are monetary transfers by the government, $0 < \delta < 1$ is capital's rate of depreciation and π_t is the inflation rate. The functions u and f are increasing and strictly concave in their arguments. Transfers are financed by money creation only, such that the public budget constraint reads $\tau_t = m_{t+1}\left(1 + \pi_{t+1}\right) - m_t$.

(i) Discuss the model. Emphasize the difference with the MIU model from the curriculum where per-period utility arises from *end-of-period* real money.

(ii) Derive the relevant first-order conditions for optimal individual behavior (where transfers are taken as given). For this purpose, use the value function

$$V\left(k_{t-1}, m_t\right) = \max \left\{u\left(c_t, m_t\right) + \beta V\left(k_t, m_{t+1}\right)\right\},$$

where the maximization is over c_t, m_{t+1}, k_t subject to (2). [Hint: Simplify the problem by using (2) to substitute out k_t in the value function]

(iii) Interpret the first-order conditions and show that they (along with the expressions for the partial derivatives of the value function derived using the Envelope Theorem) can be combined into the following system:

$$
\begin{aligned}
u_c\left(c_t, m_t\right) &= \beta R_t u_c\left(c_{t+1}, m_{t+1}\right), \\
\frac{u_m\left(c_{t+1}, m_{t+1}\right)}{u_c\left(c_{t+1}, m_{t+1}\right)} &= i_t,
\end{aligned}
$$

where $R_{t-1} \equiv 1 + f'\left(k_{t-1}\right) - \delta$ is the gross real interest rate, and $i_t \equiv R_t\left(1 + \pi_{t+1}\right) - 1$ is the nominal interest rate.

(iv) Is monetary policy steady-state superneutral in the sense that output, $y^{ss} = f\left(k^{ss}\right)$, is unaffected by inflation? Assess this formally and explain.

(v) Discuss the model's differences and similarities with the MIU model from the curriculum. Emphasize potential differences in the optimal steady-state inflation rate.