UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Postponed exam: ECON4325 – Monetary Policy and Business Fluctuations

Date of exam: Friday, August 8, 2008

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

The problem set covers 5 pages (incl. cover sheet)

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.

4325 – Monetary Policy and Business Fluctuations

Exam, August 8, 2008

Before you start, please read the following:

- You can answer in either English or Norwegian.
- Answer all questions and write brief and concise answers!
- Allocate time spent on each question wisely.
- Good style will not matter for grades, but please write clearly.
- Good luck!

1 : True or false? (20%)

For each of the statements, true or false, explain why. *Be brief and concise!*

1. Norges Bank's inflation target is 2.0 per cent.
2. Certainty equivalence means that uncertainty does not matter for economic decisions.
3. Gjefsen, Krogh and Lerbak (2008) and Kydland and Prescott (1990) document that for Norwegian and U.S. time series, respectively, price level is contemporaneously negatively correlated with aggregate output and lags the business cycle with about two quarters.
4. According to Chari and Kehoe (2006), changes in the practice of monetary policy, like (i) that monetary policymakers have begun to concentrate on price stability and inflation control as their main objectives, and (ii) that many countries have changed their institutional frameworks for monetary policymaking and emphasized the importance of credibility, transparency, and accountability, most likely are due to advances made by macroeconomic theorists.

2 : Inflation and output (45%)

1. Set up a standard New Keynesian model consisting of (1) an inflation equation (a Phillips curve) and (2) a consumer Euler equation (an IS-equation). Explain intuitively the two equations.

2. Let monetary policy be described by a loss function in inflation and the output gap. Explain the optimal monetary policy response to a cost-push shock (a disturbance to the Phillips curve) and to a demand shock (a disturbance to the IS-equation).

3 : Business cycle models and measurement (35%)

Consider the following social planner's problem (or Pareto problem).[1]

$$\max_{\{c_t, l_t, x_t\}_{t=0}^{\infty}} \mathrm{E}_0 \left[\sum_{t=0}^{\infty} \beta^t u\left(c_t, l_t\right) \right]$$

subject to

$$\begin{aligned} c_t + x_t &\leq y_t, && \forall t \\ k_{t+1} &= (1-\delta) k_t + x_t && \forall t, \delta \in [0,1] \\ h_t + l_t &= 1, && \forall t \\ c_t, k_t, h_t, l_t &\geq 0, && \forall t \\ k_0 &> 0. && \text{given} \end{aligned}$$

Assume the following functional forms and law of motion for technology

$$z_{t+1} = \rho z_t + \varepsilon_{t+1}, \qquad \forall t, \rho \in [0,1]$$

where $\{\varepsilon_{t+1}\}_{t=0}^{\infty}$ is a white noise process.

[1] As we covered in class, our interest in the social planner's problem is based on the fact that the solution to the social planner's problem is the competitive equilibrium allocation. That is, there exists a set of prices such that the optimum solution can be decentralized as a competitive equilibrium with a price system that has an inner product representation. The social planner's problem is much easier to solve since we get rid of the prices and the individuals' budget constraint.

1. **Defining parametric classes**

   In keeping with the Solow tradition, we restrict our attention to economies that display balanced growth. In balanced growth, consumption, investment and capital all grow at a constant rate while hours stay constant. The basic observations about economic growth suggest that capital and labor shares of output have been approximately constant over time even while the relative price of these inputs have changed. This suggests a Cobb-Douglas prouction function of the form

$$y_t = z_t f\left(k_t, h_t\right) = z_t k_t^{\alpha} h_t^{1-\alpha}, \qquad \forall t, \alpha \in (0,1).$$

   Show that the factors' share of output are constant given this parametric class of technologies.

   As with the production technology, certain features of the specification of preferences are tied to basic growth observations. We restrict our attention to the U.S. economy where there is evidence that the per-capita leisure has stayed approximately constant while real wages have increased steadily. This imply that the elasticity of substitution between consumption and leisure should be near unity.

$$u\left(c_t, l_t\right) = \frac{\left(c_t^{\mu} l_t^{1-\mu}\right)^{1-\sigma}}{1-\sigma}, \qquad \forall t, \sigma > 0.$$

   Derive the expressions for (i) the elasticity of substitution between leisure and consumption and (ii) the intertemporal elasticity of substitution.

2. **Matching measurements to the model**

   The model economy is very abstract: it contains no government sector, no household production sector, no foreign sector and no explicit treatment of inventories. Accordingly, the capital stock for the model economy k includes capital used in all of these sectors plus the stock of inventories. Another example is the "Final consumption expenditure" series as reported by Statistics Norway and most other national statistical agencies.

   Briefly describe how you would adjust the "Final consumption expenditure" series reported by Statistics Norway to match the theoretical concept of "Consumption" in the current model economy.

Table 1: Calibration: Parameters and moments to match

Param.	Description	Moment to match
α	Capital's share	Avg. capital's share of output
β	Time preference	Avg. capital-to-output ratio
δ	Depreciation	Avg. investment-to-capital-stock ratio
μ	Weight on cons.	Avg. consumption-to-output ratio

Table 2: Calibration: Measured moments

Moment	Measurement
Average capital's share of output	0.35
Average capital-to-output ratio	3.32
Average investment-to-output ratio	0.21
Average consumption-to-output ratio	0.79

3. Matching the model to the measurements

We calibrate the remaining parameters by choosing them so that the de-trended balanced growth path of the model economy matches certain long-term features of the measured economy.

Show that in steady state, the intertemporal optimality condition implies

$$\beta\left(\alpha\left(\frac{k}{y}\right)^{-1}+1-\delta\right)=1$$

the intratemporal optimality condition implies

$$(1-\alpha)\left(\frac{c}{y}\right)^{-1}=\frac{1-\mu}{\mu}\frac{h}{1-h}$$

and the law of motion of the capital stock implies

$$\delta=\frac{x}{k}.$$

In order to determine h, we rely on microeconomic evidence. Most studies find that household allocate about one-third of their discretionary time – ie. time not spent sleeping or in personal maintenance activities – to market activities. We use $h = .33$.

Calibrate δ, β and μ.