

Written exam for the M. Sc. in Economics 2010-I

Advanced Macroeconomics 2

Master's Course

January 8, 2010

(3-hours 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.

The weighting of the problems is:

Problem 1: 40 %, Problem 2: 40 %, Problem 3: 20 %.¹

¹The percentage weights should only be regarded as indicative. The final grade will ultimately be based on an assessment of the quality of the answers to the exam questions in their totality.

Problem 1 Consider a Blanchard OLG model for a closed economy with a public sector, public debt, and lump-sum taxation. The dynamics of the economy are described by the differential equations

$$\dot{C}_t = (F_K(K_t, L) - \delta - \rho)C_t - m(\rho + m)(K_t + B_t), \quad (1)$$

$$\dot{K}_t = F(K_t, L) - \delta K_t - C_t - G, \quad (2)$$

$$\dot{B}_t = [F_K(K_t, L) - \delta] B_t + G - T_t, \quad (3)$$

the condition

$$\lim_{t \rightarrow \infty} B_t e^{-\int_0^t [F_K(K_s, L) - \delta] ds} = 0, \quad (4)$$

and a requirement that households satisfy their transversality conditions. Here, C_t is aggregate private consumption, K_t is physical capital, L is population = labor supply, B_t is public debt, G is government spending on goods and services, T_t is net tax revenue (= gross tax revenue – transfer payments), and F is an aggregate neoclassical production function with constant returns to scale and satisfying the Inada conditions. The other symbols stand for parameters and all these are positive; L and G are positive constants. A dot over a variable denotes the derivative wrt. time t .

- a) Briefly interpret the equations, including the parameters.
- b) Assuming $B_0 > 0$ and a balanced budget for all $t \geq 0$, construct a phase diagram and illustrate the path that the economy follows, for a given K_0 . It is understood that G and B_0 are “modest” relative to the production possibilities of the economy, given this K_0 . Comment on the phase diagram.
- c) Suppose that two countries, country I and country II, are well described by the model. The countries are similar at time $t = 0$, except that they differ wrt. B_0 and possibly also T_0 (but they have the same K_0). Comment on the implied long-run differences between the countries.
- d) Suppose country I has been in its steady state until time t_0 . Then, suddenly fiscal policy shifts such that $T_t = \bar{T}$ where \bar{T} is a constant which is smaller than the tax revenue in the old steady state. Define what is meant by fiscal policy being sustainable. Is the fiscal policy (G, \bar{T}) sustainable? Why or why not? *Hint:* there may be different approaches; one approach uses that if a is a positive constant, then $\int_{t_0}^{\infty} e^{-a(t-t_0)} dt = 1/a$.
- e) Suppose that at time $t_1 > t_0$, where $t_1 - t_0$ is relatively large, fiscal policy in country I again changes such that for $t \geq t_1$ the government budget is balanced. Construct a phase diagram to illustrate the path that the economy follows for $t \geq t_1$. Illustrate by graphical time profiles the evolution of T_t, B_t, C_t , and K_t for $t \geq 0$. Comment.

Problem 2 Consider the following dynamic model in continuous time for a closed economy:

$$\begin{aligned}\dot{Y}_t &= \lambda(D(Y_t, R_t, \omega) + G - Y_t), \quad \lambda > 0, 0 < D_Y < 1, D_R < 0, 0 < D_\omega < 1, \\ \frac{M_t}{P} &= L(Y_t, i_t), \quad L_Y > 0, L_i < 0, \\ i_t &= \alpha + \beta Y_t, \quad \beta > 0, \\ R_t &= \frac{1}{Q_t}, \\ \frac{1 + \dot{Q}_t^e}{Q_t} &= r_t = i_t - \pi_t^e,\end{aligned}$$

where a dot over a variable denotes the derivative wrt. time t , and the superscript e denotes subjective expectation. Further, Y_t = output, R_t = real interest rate on a consol, ω = an index of the general degree of confidence, G = government spending on goods and services, M_t = money supply, P = output price, i_t = nominal short-term interest rate, π_t = rate of inflation, π_t^e = expected rate of inflation, Q_t = real price of a consol. The variables G , P , and ω are exogenous. The initial value of Y , Y_0 , is historically given. The central bank uses open market operations to adjust its policy instrument, i_t , in accordance with a desired counter-cyclical policy rule.

For some of the questions below, this formula may be helpful:

$$R_t = \frac{1}{Q_t} = \frac{1}{\int_t^\infty e^{-\int_t^s r_\tau d\tau} ds}.$$

- a) Briefly interpret the model, including the parameters.

Suppose expectations are rational and that speculative bubbles never arise.

- b) To characterize the movement over time of the economy, derive the dynamic system in Y and R implied by the model. Draw the corresponding phase diagram and illustrate the path that the economy follows. Comment.
- c) How does the steady-state value of Y depend on G and ω ?

Suppose that the economy has been in its steady state until time $t_0 > 0$.

- d) At time t_0 an unanticipated downward shift in the confidence parameter occurs. But after this shift everybody rightly expects the degree of confidence and the monetary policy rule to remain unchanged for a long time. As to fiscal policy, suppose the political regime is such that market participants rightly expect the fiscal policy to remain unchanged. Illustrate by a phase diagram and by graphical time profiles the evolution of R_t, r_t, Q_t, Y_t , and M_t for $t \geq 0$. Comment.

- e) Assume that a long time has passed and that the economy has settled down at its new steady state after the drop in confidence. Then unexpectedly, at time $t_1 > t_0$, there is a shift in the political regime and government spending is immediately raised to the level $G' > G$. After this shift in fiscal policy everybody rightly expects G to remain unchanged forever. Illustrate by a phase diagram and by graphical time profiles what happens to R_t, r_t, Q_t, Y_t , and M_t for $t \geq t_1$. Comment.
- f) We now change the scenario somewhat in the sense that the rise in government spending does not take place immediately after the new government has come to power. Instead, we assume that at time t_1 the new government credibly announces an upward shift in government spending to the level G' to take place at time $t_2 > t_1$. After this shift everybody rightly expect the level of spending to remain unchanged forever. Illustrate by a phase diagram and by graphical time profiles what happens to R_t, r_t, Q_t, Y_t , and M_t for $t \geq t_1$. Comment.

Problem 3 *Short questions*

- a) Make a list of different monetary transmission mechanisms. Make sure that both classical and Keynesian-style monetary transmission channels are included in the list. Briefly discuss.
- b) To combat the sharply rising unemployment in the U.S., the Obama government decided to increase government spending substantially and the U.S. now has a huge government budget deficit. In response to this policy, economist Robert Barro from Harvard University declared that the policy was likely to raise expected future taxation considerably and as a result of this there would not be much of a stimulating effect on current aggregate demand and production. Briefly discuss.
- c) “According to neoclassical macroeconomics, the rate of money growth is irrelevant for welfare.” True or false? Why?

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