STUDY CENTER
GERZENSEE

**Swiss Program for Beginning Doctoral Students in Economics 2006**

**Midterm Exam in Macroeconomics**

**Saturday, July 29, 2006, 09.00h – 11.00h**

1. You are allowed to use all material that you want (lecture notes, books, etc.) with the exception of PC's.
2. Please do **not** mention your name on top of the pages, but only your identification number. (The exams will be graded anonymously.) If you use the back side of a page, put your ID number there as well.
3. Please answer questions on the same page or the back side of the page. (The exams will be separated in order to be sent to the different professors.)
4. Please use **a pen** to guarantee that your answers can be read without problems.
5. Please **write legibly**. Your exams will be photocopied for grading.
6. Answers should be **concise and precise!** The space provided should be sufficient to answer each question.
7. No cell phones!
8. Please have your ID card ready on the desk. The TA will check your ID cards and have you sign a list.
9. Good luck!

ID-Number:________________________________________

**Abstract**

There are two sections of this examination.

**Part A: Shorter questions (4 questions, 15 points each)**

You should provide a short and clear answer to each: there is no reason to exceed the provided space (1 page per question).

**Part B: Longer questions (2 questions, 30 points each)**

These questions frequently have a cumulative structure, with the results of early parts helping you answer the later parts. Dynamic optimization theory (and common sense) suggests that it is a good idea to read throught the whole question before starting to write answers to the question.

Unless specified otherwise, all parts of all problems are weighted equally.

There is a separate page for each part of each longer problem, so that you are not space constrained Do not feel that you must fill each page. No credit will be given for correct but extraneous information and some credit may be taken away for incorrect and extraneous information.

**Please write legibly using a dark pen.**

**Please write your Exam Code at the top of each page!**

## Short Questions

A.1. *Monopolistic Exporters* **(15 points)**

Suppose that exports are produced by a continuum of monopolistically competitive producers indexed by $i$. Firm $i$ uses labor ($N_{it}$) to produce $X_{it}$ units of exportable good $i$ using the technology:

$$X_{it} = AN_{it}. \tag{1}$$

For simplicity, assume that the export good is not consumed domestically. Demand for this good in the world market is given by:

$$X_{it} = \xi(P^*_{it})^{-\gamma}. \tag{2}$$

The variable $P^*_{it}$ denotes the dollar retail price of export good $i$. The price elasticity of demand for the export good is given by $\gamma > 1$.

Assume that to sell a unit of the exported good to foreign consumers, foreign retailers must add $\phi$ dollars of foreign distribution services. Assuming that the distribution industry is competitive implies:

$$P^*_{it} = P_{it}/S_t + \phi. \tag{3}$$

The variable $P_{it}$ denotes the producer price of the exported good expressed in local currency and $S_t$ is the exchange rate, expressed in units of local currency per dollar.

Producer $i$ maximizes profits, given by:

$$\Pi_{it} = P_{it}X_{it} - W_tN_{it},$$

where $W_t$ is the wage rate denominated in units of local currency.

(a) Show that the first-order conditions for this problem imply that all exporters charge the same price, which is given by:

$$P_{it}/S_t = \frac{\gamma(W_t/S_t)/A + \phi}{\gamma - 1}.$$

(Hint: start by expressing $\Pi_{it}$ as a function of $P_{it}$)

A.2. *A Small Open Economy* **(15 points)**

Consider the following problem for a representative consumer who lives in a small open economy that can borrow and lend at a constant real interest rate, $r$,

$$\max U = \sum_{t=0}^{\infty} \beta^t \log(C_t)$$

subject to,

$$a_{t+1} = (1+r)a_t + Y - C_t,$$
$$\lim_{t\to\infty} \frac{a_{t+1}}{(1+r)^t} = 0.$$

The variable $Y$ represents a constant, exogenous level of output. Suppose that agents in this economy are impatient ($\beta$ is low, i.e. agents attach low weight to the future), so $\beta < 1/(1+r)$.

(a) Show that the growth rate of consumption for this economy,

$$g = C_{t+1}/C_t - 1,$$

is negative, so that the economy enjoys high levels of consumption early on, but consumption declines over time.

(b) Show that consumption at time $t$ is proportional to the wealth of the economy at time $t$ $(a_t + Y/r)$,

$$C_t = (r - g)\,(a_t + Y/r)\,.$$

(Hint: you need to use the no-Ponzi game condition).

(c) Show that the current account, $a_{t+1} - a_t$ is negative, so the economy runs a current account deficit. What is limit of this current account deficit as $t$ goes to infinity?

A.3. *Optimal consumption over time.* **(15 points)**

Consider the following basic intertemporal model of consumption choice, in which a household maximizes the objective function

$$U = u(c_0) + \beta u(c_1)$$

with $u_c(c) > 0$ and $u_{cc} < 0$.

$$c_0 + \frac{1}{1+r}c_1 = y_0 + \frac{1}{1+r}y_1$$

(a) Show that: If $\beta(1+r) > 1$, then $c_0 < c_1$.

(b) If saving is defined as $y_0 - c_0$, does the result in part (a) imply that a rise in the interest rate will lead to greater saving? Why or why not?

A.4 *Linear rational expectations models.* **(15 points)**

Consider the following two equation linear rational expectations model with two endogenous variables (P,R) and one exogenous variable (M). Neither endogenous variable is predetemined

$$\begin{aligned} M_t - P_t &= \alpha R_t \\ R_t &= (E_t P_{t+1} - P_t) \end{aligned}$$

(a) How many finite and infinite eigenvalues are there to this model? What values do finite eigenvalue(s) take??

(b) Reducing the system to a single dynamic equation in P, determine the range of values of $\alpha$ for which there is a unique stable RE equilibria. Show the form of that equilibrium .

# B. Longer questions

B.1 Fiscal Policy in the Neoclassical Growth Model (**30 points: 6 points per part** )

Consider the following version of the neoclassical growth model in which the government taxes consumption at rate $\tau^c$ and output at rate $\tau^y$.

$$\begin{aligned} U &= \int_0^\infty e^{-\rho t} \frac{C_t^{1-\sigma} - 1}{1-\sigma} dt \\ Y_t &= C_t(1+\tau^c) + I_t \\ Y_t &= (1-\tau^y) A K_t^{1-\alpha} N^\alpha \\ \dot{K}_t &= I_t - \delta K_t \end{aligned}$$

where $\rho > 0$, $0 < \alpha < 1$, and $\sigma > 0$.

The government adjusts government spending, $G_t$ so that the budget is always balanced,

$$\tau^c C_t + \tau^y A K_t^{1-\alpha} N_t^\alpha = G_t,$$

(a) Compute the steady state levels of output, investment, capital, and consumption.

(b) What is the effect on the steady state stock of capital of an increase in $\tau^c$?

(c) What is the effect on the steady state stock of capital of an increase in $\tau^y$?

(d) Suppose that $\alpha = 0$. In this case the economy grows at a constant rate. Compute the growth rate of output for this economy.

(e) What is the effect of an increase in $\tau^c$ on the growth rate of the economy?

(f) What is the effect of an increase in $\tau^y$ on the growth rate of the economy?

B.2. *Immigration and Macroeconomic Activity* **(30 points: 5 points per part)**. There has been a great deal of discussion in recent months about the effect of immigration on the U.S. economy and society.

Consider a closed economy with a neoclassical production function, exogenous technical progress and a fixed saving rate and a fixed population (the Solow model), as described by the following equations

$$\begin{aligned} \frac{d}{dt}K_t &= sY_t - \delta K_t \\ Y_t &= A_t K_t^{\alpha} N^{1-\alpha} \\ \frac{d}{dt}A_t &= \gamma A_t \end{aligned}$$

where K is the capital stock; Y is output; A is productivity; and N is the population. The parameters are the saving rate (s), the depreciation rate ($\delta$) and the growth rate of technical progress ($\gamma$).

(a) What is the steady-state growth path of this economy?

(b) Suppose that the economy starts with a level of the capital stock below this path. What is the nature of the transitional dynamics of output, capital, the real wage and the real interest rate?

(c) Suppose that there were two closed economies that never-the-less share a border. If the only difference is that the *level of* productivity is higher in the home country than the foreign country with both countries having the same growth rate of productivity and if each country is on its steady state path, what incentives would there be for workers to move to the home country from the foreign country? How large would these incentives be?

(d) Now suppose that workers move, so that the population of the home country is now $\theta N$ with $\theta > 1$ but that its capital stock is initially unchanged. What will be the immediate effects on output, the real wage and the real interest rate?

(e) Opponents of immigration sometimes argue that real wages will be permanently depressed by immigration. Is this view correct in the Solow model?

(f) Alternatively, suppose that the production function is $Y_t = A_t K_t^{\alpha} N^{\nu} L^{1-\alpha-\nu}$, where L is the quantity of land. Supposing that the home country is initially on a steady-state path and that there is a movement of workers as above (the population of the home country is now $\theta N$ with $\theta > 1$ but its capital stock is initially unchanged). What will be the immediate effects on output, the real wage and the real interest rate?

(g) Opponents of immigration sometimes argue that real wages will be permanently depressed by immigration. Is this view correct in this modification of the Solow model?