Written Exam at the Department of Economics summer 2018

Macroeconomics III
Final Exam

August 13, 2018

(3-hour closed book exam)

Please note that the language for this exam is English.

This exam question consists of 3 pages in total

NB: If you fall ill during the actual examination at Peter Bangsvej, you must contact an invigilator in order to be registered as having fallen ill. Then submit a blank exam paper and leave the examination. When you arrive home, you must contact your GP and submit a medical report to the Faculty of Social Sciences no later than seven (7) days from the date of the exam.

1 (20 points) Answer true, false, or uncertain. Justify your answer.

Assume that the productivities of tradables, g_T^i, and non-tradables, g_{NT}^i, respectively grow at the same rates across countries ($g_T^i = g_T$ and $g_{NT}^i = g_{NT}$ for all countries i), with the productivity of tradables growing at a faster rate than the productivity of non-tradables, ($g_T > g_{NT}$). Since governments spend mostly on non-tradable goods, countries where the size of the public sector relative to GDP increases at a faster rate experience a real exchange rate appreciation.

2 (20 points) Answer true, false, or uncertain. Justify your answer.

The Calvo model features price stickiness since, although all firms are in principle able to change their prices, only a fraction of them receive new information in each period, and it is only these firms that change their prices.

3 (20 points) Answer true, false, or uncertain. Justify your answer.

Aging will force countries that have a pay-as-you go social security system to reduce retirement benefits.

4 (60 points) Consider a Ramsey economy with a continuum of households and firms operating under perfect competition. There is no population growth, and the representative household is infinitely lived, has a unitary endowment of time each period, and maximizes the following objective function under perfect foresight:

$$\max_{c_t, x_t, k_{t+1}} \sum_{t=0}^{\infty} \beta^t \left[\log c_t + \frac{x_t^{1-\epsilon}}{1-\epsilon} \right]$$

subject to the budget constraint:

$$c_t + k_{t+1} = w_t(1 - x_t) + R_t k_t$$

where c_t is household consumption, x_t is the amount of leisure consumed (such that $1 - x_t$ is labor supply), w_t is the wage rate, k_{t+1} is saving assumed to be in capital, and $R_{t+1} = 1 + r_{t+1}$ is the gross return on that saving (we assume no depreciation of capital). $0 < \beta < 1$ is the time discount factor, and $0 < \epsilon < 1$ measures the concavity of leisure in preferences, and is thus related to the elasticity of labor supply.

Production technology is Cobb-Douglas such that the representative firm i takes factor prices as given and maximizes

$$\Pi_t^i = {K_t^i}^{\alpha} {L_t^i}^{1-\alpha} - r_t K_t^i - w_t L_t^i$$

where K_t^i is the demand for capital and L_t^i the demand for labor, and $0 < \alpha < 1$.

a) Write the Lagrangian for households' problem and derive its first order conditions with respect to c_t, x_t, and k_{t+1}. Derive the Euler equation and interpret it. Characterize the steady state for this economy.

b) Assume that the economy is in steady state and there is an unexpected permanent increase in parameter ϵ. Explain how this affects the steady state levels of capital, consumption and leisure.

c) Assume that the economy is in steady state, and the government introduces a capital income tax whose proceeds are rebated as a lump sum to households. How does this affects the steady state levels of capital, consumption and leisure? Explain.

5 (60 points) Consider an economy where individuals live for two periods, and population grows at rate $1+n$ (if $n<0$ population is contracting over time). Identical competitive firms maximize the following profit function:

$$\pi^F(K_t^i, L_t^i) = AK_t^{i\alpha} L_t^{i1-\alpha} - w_t L_t^i - r_t K_t^i,$$

where r_t is the interest rate at which firms can borrow capital, w_t is the wage rate, K_t^i and L_t^i denote the quantities of capital and labor employed by firm i, and $A>0$ is total factor productivity. Assume $0<\alpha<1$. Capital fully depreciates. Utility for young individuals born in period t is

$$U_t = \ln(c_{1t}) + \beta \ln(c_{2t+1}), \quad \beta > 0$$

where c_{1t} is consumption when young, and c_{2t+1} consumption when old. Young agents work one unit of time (i.e. their labor income is equal to the wage). Old agents do not work and provide consumption through saving, whose net return is r_{t+1}.

The economy benefits from international trade. To simplify the analysis, assume capital and goods markets are as in a closed economy (i.e. investment must be equal to saving). The benefits from trade are represented as if workers have effective time endowment of $1+t_1$ ($t_1 \geq 0$), and retirees have effective return on saving of $r_{t+1}+t_2$ ($t_2 \geq 0$). Consider two special cases. First, when benefits are higher for workers, such that $t_1>0$ and $t_2=0$. Second, when benefits are higher for retirees, such that $t_1=0$ and $t_2>0$.

a) Consider the case in which trade benefits workers. Characterize individual saving behavior by solving the individual's problem of optimal intertemporal allocation of resources (remember to treat the economy as closed, such that investment is given by domestic saving). Find the capital accumulation equation that gives k_{t+1} as a function of k_t (where k is capital per worker). Find the level of capital per worker in steady state.

b) Consider the case in which trade benefits retirees. Characterize individual saving behavior. Find the capital accumulation equation. Find the level of capital per worker in steady state. Is capital per worker higher or lower than in a)? Explain.

Assume that the economy is initially in the steady state. Now unexpectedly there is a trade war such that $t_1=t_2=0$.

c) How is steady state capital affected for both special cases considered in a) and b)? Consider the case in which trade benefited workers. Are workers or retirees initially better off by the trade war? Explain. Consider the case in which trade benefited retirees. Are workers or retirees initially better off by the trade war? Explain.