

Written Exam at the Department of Economics summer 2017

Macroeconomics III

Final Exam

June 7, 2017

(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.

When firms have monopolistic power in price setting, and no barriers to change prices, the equilibrium is inefficient and money is non-neutral.

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

Since governments spend mostly on non-tradable goods, and the productivity of tradables grows at a faster rate than the productivity of non-tradables, countries where the public sector increases at a faster rate experience a real exchange rate appreciation.

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

If the government announces that next year a distortionary capital income tax will be replaced by a lump sum tax (keeping government spending constant), consumers will respond immediately by increasing consumption.

4 (60 points) Consider an economy where individuals live for two periods, and population is initially constant. Identical competitive firms maximize the following profit function:

$$\pi^F(K_t^i, L_t^i) = AK_t^{i\alpha} L_t^{1-\alpha} - w_t L_t^i - r_t K_t^i,$$

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 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 and social security benefits. The old receive return r_{t+1} for their savings.

Suppose that the government runs a balanced pay-as-you-go social security system in which each young household contributes a fraction $0 < \tau < 1$ of their wages that is received by the old (τw_t are then the benefits received by the old in period t).

a) Characterize individual saving behavior by solving the individual's problem of optimal intertemporal allocation of resources. 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.

Assume that the economy is initially in the steady state. Now unexpectedly there is a permanent flow of temporary immigrants. Immigrants arrive when young, have same preferences as residents, and are assumed to get employment. They have no children and leave the country just before they die. The ratio of temporary immigrant workers to native resident workers is n (i.e. the economy moves to a regime of constant population at a higher level driven by immigration). Both immigrants and residents receive the same wage, but only residents make contributions to, and receive benefits from, social security. Immigrants only use their capital income to fund their old age consumption. (You can think of the setup as attempting to study the effects of immigration into the informal labor market)

The government decides to adjust the social security tax such that the initial old generation receives the same benefits that they would have received in the absence of immigration. Denote by τ' the new contribution rate. Assume that parameters are such that the economy is always dynamically efficient.

Note that to solve what follows you have to consider the general equilibrium effects that the flow of immigrants has on wages and the interest rate.

b) Characterize τ' as a function of τ , n , and α . What is the effect of the shock on capital accumulation in the first period (compared to capital accumulation in the previous steady state)? And on the new steady state? Explain. [Hint: saving from residents and immigrants are different and capital is the aggregate of these savings]

c) Show that the initial old are strictly better off with immigration, even though they receive the same benefits. Show that the disposable income of the first young generation of residents is lower. Explain.

5 (60 points) Assume that the monetary policy in the Eurozone is determined according to credible rules, such that equilibrium inflation for the euro is given by

$$\pi^{eu} = \frac{1}{1 + \lambda^{eu}} \epsilon^{eu}$$

where ϵ^{eu} is a supply shock in Europe, characterized as white noise with variance σ_{eu}^2 . Consider now the following equations that characterize the behavior of the Danish economy

$$\begin{aligned}\pi &= m \\ x &= \theta + (\pi - \pi^e) - \epsilon\end{aligned}$$

where π is the inflation rate, π^e the expected inflation rate, m the rate of growth of money, x is output (or rate of growth of output), θ the stochastic level for potential output (or the potential growth rate of output), and ϵ is a supply shock. Assume that all shocks are independent from each other, and across time, with zero mean and known variances ($\sigma_\theta^2, \sigma_\epsilon^2, \sigma_{eu}^2 > \sigma_\epsilon^2$). Sequential decision making implies that the private sector forms expectations on inflation after only observing θ , while the monetary authority determines m after observing $\theta, \pi^e, \epsilon^{eu}$, and ϵ . Finally assume that society evaluates policy according to the following loss function

$$E[L(\pi, x)] = \frac{1}{2}(E(\pi)^2 + \lambda E(x - \bar{x})^2)$$

where $\lambda > 0$ measures the relative importance of policy objectives with respect to output deviations from target level \bar{x} , and inflation deviations from target level of 0. For all realizations of θ , distortions in the economy imply that $\bar{x} - \theta > 0$.

a) Characterize the optimal monetary policy rule under commitment and find the equilibrium inflation and output outcomes. How does policy respond to supply shocks in Europe, ϵ^{eu} ?

b) Find equilibrium inflation and output under a credible peg of the krone to the euro. Is the outcome better or worse than a)? Explain.

c) Assume now that the supply shocks of Europe and Denmark are correlated (positively or negatively, and denote ρ the coefficient of correlation). Find the social loss function under a credible peg of the krone to the euro. For what value of ρ it is most convenient to peg the krone to the euro? Explain.