Written Exam for the B.Sc. in Economics - Fall 2014

Macro C
Final Exam

January 6, 2015

3-hours closed book exam

Please note that the language for this exam is English.

The points for each question should guide you in allocating time to answering them (they add up to 180, thus proportional to the total time you have for the exam).

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

The Lucas model proves that, even if there is a statistical relation between output and inflation (a Philips curve), there is no scope for policymakers to increase output by announcing an increase in the rate of money growth.

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

It is known that delegating monetary policy on a conservative independent central bank always leads to a higher level of social welfare than a currency peg. Thus, it is a policy mistake in Denmark to have the krone pegged to the euro (probably due to inertia in monetary institutions inherited for historical reasons, or to the lobbying of banks to secure cheaper funds from abroad).

Problem 1 (80 points)

1) Consider an economy where households maximize the following intertemporal utility:

$$U = \int_0^\infty \left[\ln c_t + v(m_t) \right] e^{-(\rho-n)t} dt \tag{1}$$

where c is per capita consumption in the household, ρ is a time discount factor, $n < \rho$ is the rate of population growth, m are real money balances per capita. Function v represents the value of money balances for the household. This function has two components, a positive term derived from money services in transaction, and a negative term that relates to property crimes and reflects that carrying large sums of money might make a household a more likely target of criminals.

Use the following functional relation for $v(\cdot)$:

$$v(m) = \ln m - \gamma m \tag{2}$$

where the term γm captures the utility costs of crime. For simplicity a crime in this economy does not reduce victim's money balances (think of the household as insured) but has costs in terms of utility.

Assume that there are many identical competitive firms that hire labor and capital to produce the consumption good with a CRS technology. Firms maximize the following profit function:

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

where K_t and L_t denote the quantities of capital and labor employed by the firm. Assume $0 < \alpha < 1$. There is no capital depreciation.

Households supply labor inelastically. Assume that households can save in capital or money, and that household i's real budget constraint in per capita terms is given by,

$$\dot{a}_t = (r_t - n)a_t + w_t + z_t - (c_t + (\pi_t + r_t)m_t)$$

where $a_t \equiv k_t + m_t$ are asset holdings, r_t is the real interest rate, w_t the wage rate, π_t the rate of inflation, and z are per capita lump sum transfers received from the government (can be negative)

a) Interpret the terms related to real money holdings in the household's dynamic budget constraint. Find the first order conditions for the firms' maximization problem that characterize how much capital and labor a firm demands at given factor prices, and solve for prices as a function of k_t, the per capita level of capital.

b) Set up the Hamiltonian, stating which are the control, state and costate variables. Find the FOC that characterize the households' maximization problem, including the transversality condition. Find the equations that characterize the steady state in this monetary economy, assuming that the government prints money at rate σ. Is money superneutral? What is the optimal quantity of money, and does the Friedman rule apply? Explain.

Suppose now that there is a tax on capital income, $r_t k_t$, whose proceeds are rebated lump sum to households. The tax rate is $\tau_t > 0$. [Since capital income taxes are redistributive, this policy might imply that there is heterogeneity, but since you only care about the effect of taxes on aggregates you can use a representative agent model.]

c) Show how capital income taxation affects the dynamic budget constraint, the Hamiltonian, and the first order conditions.

d) How is the demand for money in the steady state, m^*, affected by an increase in τ_t. Does taxation affect k^* and c^*? Is money still superneutral? Explain.

Problem 2 (60 points)

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

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

where r_t is the interest rate at which firms can borrow capital, w_t is the wage rate, K_t and L_t denote the quantities of capital and labor employed by the firm, and $A > 0$ is

total productivity. Assume $0 < \alpha < 1$. Capital depreciates fully after one period. Utility for young individuals born in period t is

$$U_t = \ln(c_{1t}) + \frac{1}{1+\rho} \ln(c_{2t+1}), \quad \rho > -1$$

where c_{1t} is consumption when young, and c_{2t+1} consumption when old. Young agents work a unit of time (i.e. their labor income is equal to the wage they receive). Old agents do not work and provide consumption through saving and social security benefits (when a social security system is in place). The old get return r_{t+1} for their savings.

Suppose that the government runs a balanced pay-as-you-go social security system in which the young contribute a fraction $0 < \tau^s < 1$ of their wages that is received by the old ($\tau^s w_t$ 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.

b) Find the capital accumulation equation that gives k_{t+1} as a function of k_t. Find the level of capital in steady state. Can the economy be dynamically inefficient in this steady state? Explain.

Assume that the economy is initially in the steady state. Now unexpectedly the social security system is dismantled such that τ^s is set to zero and no contributions are raised neither in the present nor the future. No benefits will be paid in the future. To pay benefits to the initial old generation public debt, B, is issued (assume that the initial old receive the same benefits as they would have received if the social security system was not dismantled). This debt is bought by the young. The government will follow a policy of rolling over the debt and using taxes, τ^d, collected on labor income, to pay for the interest on debt.

c) How does this shock affect the economy? What are the effects of the shock on consumption and capital accumulation in the first period (compared to consumption and capital accumulation in the previous steady state)? Explain. Do the young in the first period benefit from this policy change? And the old? Explain.