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

Macro C
Final Exam

May 28, 2014

3-hour 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. If you are in doubt about which title you registered, please see the print of your exam registration from the students' self-service system.

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.

For money to be superneutral it is a necessary (but not sufficient) condition that consumers have an infinite planning horizon.

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

It is a policy mistake in Denmark (probably due to inertia in monetary institutions inherited for historical reasons) to have the krone pegged to the euro. It can now be shown that an independent central bank always leads to a higher level of social welfare than a currency peg.

Problem 1 (60 points)

Consider an economy where aggregate demand satisfies

$$y = m - p$$

where y is output, m is the aggregate amount of money supply, and p is the price level (all lower case variables are in logs). It is assumed that there are shocks to aggregate demand. This is modeled by having m stochastic and its expectation, $E[m]$, is known.

In this economy some firms have "flexible" prices and some have "rigid" prices, this distinction referring to the information available at the time of price setting. Let p^f denote the price set by a representative flexible price firm and p^r the price set by a

representative rigid price firm. Fraction q of firms have rigid prices, where q is a random variable independent of m satisfying $0 < q < 1$ and thus, $0 < E[q] = E[q|m] < 1$. Flexible price firms set their prices after m is known but without knowing the realization of q (thus must form expectations on q, and p), while rigid price firms set their prices before m and q are known (and thus must form expectations on m, q, and p).

Firms respond to an increase in aggregate demand by producing more, and in that case would have to pay higher wages to induce workers to work more. Since firms have some monopoly power in setting prices, they pass the increase in costs (the higher wages) into prices. Thus the desired relative price, $p_i^* - p$, set by firm i if there were no uncertainty is given by:

$$p_i^* - p = \phi y = \phi(m - p)$$

where ϕ measures the degree of real rigidity in the economy (how responsive prices are to aggregate demand). With uncertainty we assume that price setting by flexible and firm price firms follows:

$$\begin{aligned} p^f &= E[p_i^*|m] = (1-\phi)E[p|m] + \phi m \\ p^r &= E[p_i^*] = (1-\phi)E[p] + \phi E[m] \end{aligned}$$

where expectations are subject to information known when setting prices. Since fraction q of firms have rigid prices the price level satisfies $p = qp^r + (1-q)p^f$.

a) Find p^f in terms of p^r, m and the parameter of the model (ϕ and $E[q]$). Find p^r in terms of $E[m]$ and the parameters of the model.

b) Do anticipated changes in m (i.e. changes known at the time rigid price firms set their prices) affect y? Why or why not? Do unanticipated changes in m affect y? Why or why not?

c) Show that the response of output to an unanticipated change in m (taking as given the expectation $E[q]$), is larger the higher the realization of q. Interpret. Show that the response of output to an unanticipated change in m (taking as given the realization of q) is larger the higher is the expectation $E[q]$. Interpret.

Problem 2 (80 points)

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

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

where r_t^L 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. 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 must provide consumption through saving. The old get return r^D_{t+1} for their savings.

In this economy there are financial intermediaries that take deposits e_t from the young in period t paying them the rate r^D_{t+1} for this the following period. Intermediaries are regulated and are thus required to store the fraction γ of deposits as liquid assets on which they receive no return. The remaining fraction $1-\gamma$ they lend as capital to firms at rate r^L_{t+1} (note that for simplicity firms demand and repay these "loans" in period $t+1$). Competition between intermediaries implies that they make zero profits, i.e.

$$\pi^I_{t+1} = r^L_{t+1}(1-\gamma)e_t - r^D_{t+1}e_t = 0.$$

where π^I denotes intermediaries' profits. Thus the following relation must be satisfied every period: $r^L_t(1-\gamma) = r^D_t$.

Note: Think of the fraction γ of deposits that the intermediaries must store as "reserves" that make the economy stable for reasons exogenous to our capital accumulation model. We take this fact as given.

For points a) and b) you will receive partial credit if you assume $\gamma = 0$.

Suppose that the government runs a balanced pay-as-you-go social security system in which the young contribute a fraction d of their wages that is received by the old (you might think of dw_t as "benefits" received by the old in period t).

a) Find the first order conditions for the firms' maximization problem that characterize how much capital and labor a firm demands at given factor prices. As a function of capital per capita, k, what is the income that the representative old receives on his/her saving? And for a representative young on his/her labor services?

b) Find saving and capital accumulation in steady state.

Assume that the economy is initially in the steady state. Now unexpectedly γ is permanently increased (e.g. think that there is a permanent exogenous increase in volatility that makes the economy unstable unless reserves are increased).

c) How does this shock affect the economy? What are the effects of the shock on consumption and capital accumulation in the first period? Characterize analytically the new steady state. Find graphically the new steady state and the adjustment process for capital accumulation. Explain.

d) Now suppose the government wants to offset the effects of the increase in γ on capital accumulation. Show that this can be done by reducing social security contributions and benefits permanently (including the initial old, i.e. keeping the system balanced). Find the required reduction as a function of the given increase in γ. Will welfare be higher or lower after the shock? Explain.