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

Macro C
Final Exam

February 16, 2015

3-hour 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).

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

In models that have real money balances in the households' utility function, hyperdeflations can be ruled out when money is essential (i.e. when the marginal utility of money increases faster than the rate at which real balances go to zero).

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

When a country has an exchange rate peg with an escape clause it will experience both unexpected deflation and output loses when the escape clause is not invoked.

3 (80 points)

Consider an economy where individuals live for two periods, and population is constant. 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 (in capital and/or government debt, if this exists). Production features positive spillovers from the aggregate capital stock, such that for firm i that hires labor and capital, output is given by

$$Y_t^i = (K_t^i)^\alpha (K_t N_t^i)^{1-\alpha}$$

where K is the aggregate capital stock in the economy, K^i and N^i are the amounts of capital and labor hired by the firm (since there is no population growth, take the aggregate amount of labor, N, to be normalized to one). There is no capital depreciation. Markets for factors are competitive resulting in factors being rewarded their marginal products, r_t and w_t.

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

a) Show that r_t is independent of the capital stock, and that $w_t = (1-\alpha)K_t$. (if you can't prove this result, you can solve the remaining questions assuming it). 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.

Suppose now that at t_0, with the economy in steady state, the government decides to eliminate the social security system and makes the following announcement: In period t_0 the old receive τw_{t_0}, but the young make contributions only for $\gamma\tau w_{t_0}$ with $0 \leq \gamma \leq 1$. The difference, $(1-\gamma)\tau w_{t_0}$, is financed by issuing debt that is bought by the young. From period t_0+1 onwards the government collects no social security contributions nor pays benefits. It keeps the debt at constant level $(1-\gamma)\tau w_{t_0}$, financing interest payments through a lump sum tax on the young.

c) For the case $\gamma = 0$, how does this shock initially affect the economy? What are the effects of the shock on consumption and saving in period t_0, and on K_{t_0+1} (compared to consumption, saving and capital accumulation in the previous steady state). Do those young in t_0 benefit from this policy change? And the old? Explain.

d) Repeat the previous analysis when $\gamma = 1$.

4 (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, $E[m]$, 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. Flexible price firms set their prices after m is known, while rigid price firms set their prices before m is known.

After m is observed, a fraction α of the rigid price firms has the opportunity to change its price after paying a cost $c > 0$. Call the price chosen by these firms p^u (u for update).

Thus you can think that when the benefit of changing prices, which is proportional to the absolute value of the difference between m and $E[m]$, is high, these firms will find it profitable to update their prices. Define θ as the probability that these firms will find profitable to update prices (thus, θ depends on the volatility of m and on c). The remaining fraction $1-\alpha$ of rigid price firms cannot change their prices, no matter how profitable it would be to do so.

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 rigid price firms follows:

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

where expectations are rational (i.e. subject to information known when setting prices, and knowing how other producers set prices). Since fraction q of firms have rigid prices the price level satisfies $p = qp^r + (1-q)p^f$ when no rigid price firms find it profitable to update prices, and $p = q(1-\alpha)p^r + (1-q)p^f + q\alpha p^u$ when rigid price firms find it profitable to update prices and do so if allowed.

a) Show that $p^u = p^f$. Find p^f in terms of p^r, m and the parameters of the model (ϕ q, α and θ). 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 marginal response of output to an unanticipated change in m, is larger for small shocks (i.e. when no rigid price firms find it optimal to change prices). Interpret. Does output become more or less responsive to an unanticipated change in m when there is an increase in α? Interpret.