Thursday, July 5, 2007

UCLA

Department of Economics

Ph. D. Preliminary Exam

Macroeconomic Theory
(Spring 2007)

Instructions:

- You have 4 hours for the exam.
- Answer all 3 questions. All questions are weighted equally.
- Use a SEPARATE blue book to answer each question.
- Calculators and other electronic devices are not allowed.

Good Luck!

Question 1

Consider a neoclassical growth model with consumer durables. A representative agent has preferences defined over sequences of non-durables and services, c_t, a stock of durables, d_t, and leisure. In particular, preferences are given by $\sum_{t=0}^{\infty} \beta^t \left(\log c_t + A_1 \log d_t + A_2 \log(1-h_t)\right)$.

There is a single technology that is used to produce non-durable consumption and investment in capital (i_t) and consumer durables: $y_t = k_t^{\theta} h_t^{1-\theta}$, where $0 < \theta < 1$. The law of motion for the stock of capital is $k_{t+1} = (1-\delta)k_t + i_t$.

A. Suppose that investments in consumer durables depreciate 100 percent after two periods of use. Assume that the first period of use is the same as the period in which the durable is purchased and that investments in both capital and durables are irreversible. State the dynamic programming problem solved a social planner who gives equal weight to all households. Be complete and precise.

B. Derive a set of equations, including first order necessary conditions, that characterizes a solution to the problem of part A.

C. Characterize the steady state of this economy. Do the irreversibility constraints bind in this steady state? Explain.

D. Derive a log-linear approximation of the first order condition for hours worked. Explain your work.

E. Suppose that you are given the following statistics computed from U. S. data: (1) average labor's share; (2) the average capital to output ratio (annual); (3) the average consumer durable stock to output ratio (annual); (4) the average capital investment to output ratio; and (5) the average fraction of time that individuals spend working in the market sector. Suppose that a period is one quarter of a year. Your job is to calibrate the economy of part A so that the steady state matches the U.S. averages in these five respects. Show how these facts can be used to find values for A_1, A_2, β, θ, and δ. That is, give a set of equations that can be solved to obtain values for these parameters.

F. Formulate an economy similar to part A in which all three goods (non-durable consumption, durable consumption, and capital) are produced in three separate production sectors. In particular, suppose that output of sector j is given by a constant return to scale technology, $F^j(k_{jt}, h_{jt})$, for j = 1, 2, 3. Define *recursive competitive equilibrium* for such an economy. Include markets for the three types of output, labor, and capital services.

A Monetary Economy

Question 2 - Spring, 2007 UCLA Macroeconomics Comprehensive Exam

All questions equally weighted.

The representative consumer's preferences are given by:

$$\max \sum_{t=0}^{\infty} \beta^t \{\log(c_t) - \tfrac{n_t}{\varpi}^{\varpi})\}, \varpi \geq 1,$$

The household faces a CIA constraint and a wealth constraint as follows:

$$m_{t-1}/p_t \geq c_t + k_{t+1} - (1-\delta)k_t$$
$$w_t n_t + r_t k_t + (1-\delta)k_t + \frac{m_{t-1}}{p_t} \geq c_t + k_{t+1} + \frac{m_t}{p_t}$$

The firm's profit maximization problem is given by:

$$\max K_t^{\theta} N_t^{1-\theta} - w_t N_t - r_t K_t$$

The economy's resource constraint is given by:

$$Y_t = C_t + I_t + G_t$$

The government budget constraint and monetary policy are given by:

$$(M_t - M_{t-1})/p_t = G_t$$
$$M_t = (1+\mu)M_{t-1}$$

Government spending is not valued by the private sector.

(A) Define a competitive equilibrium for this economy, and solve for the first order necessary conditions.

(B) Assume a steady state exists for this economy. Solve for the growth rate of the money supply that maximizes steady state consumer welfare. Why doesn't this depend on the value of the parameter ϖ? Does this mean that welfare is invariant to the value of ϖ?

(C) Show that money is neutral in this economy, but that it is not superneutral.

(D) How does the steady state capital-labor ratio depend on the money supply growth rate? What is the economic intuition behind this result.

(E) Repeat question D, but with the assumption that investment is not subject to the CIA constraint.

Macro Comprehensive Exam Question 3
Summer 2007

Consider a two-period economy in which agents face uncertainty regarding their preferences over the timing of their consumption. Number the periods $t = 0, 1$. Each agent has preferences over consumption given by $\theta \log(c_0) + \beta \log c_1$, where θ is a random taste shock realized at the beginning of period $t = 0$. The shock θ is drawn from set $\Theta = \left\{\theta^1, \ldots, \theta^N\right\}$ with probabilities $\pi(\theta^n)$. We assume that $\pi(\theta^n)$ also represents the fraction of agents who receive shock θ^n. Let $\{c_0(\theta^n), c_1(\theta^n)\}_{n=1}^N$ denote a consumption allocation in this economy. Each period, each agent is endowed with y units of the consumption good. This good cannot be stored. The resource constraints for this economy are $\sum_{n=1}^N c_t(\theta^n)\pi(\theta^n) = y$ for $t = 0, 1$.

a) Bond economy

Assume that at date 0 agents only trade an uncontingent bond that pays off 1 unit of consumption for sure at date 1. Let q denote the price of this bond and $b(\theta^n)$ the quantity purchased by an agent with shock θ^n. Given this notation, agents have budget constraints

$$c_0(\theta^n) + qb(\theta^n) = y \text{ and } c_1(\theta^n) = y + b(\theta^n)$$

Solve for the equilibrium bond price q and the equilibrium allocation $\{c_0(\theta^n), c_1(\theta^n)\}_{n=1}^N$.

b) Full Information Social Optimum

Now solve for the allocation that maximizes the utilitarian social welfare function

$$\sum_{n=1}^N \left[\theta \log(c_0(\theta^n)) + \beta \log c_1(\theta^n)\right] \pi(\theta^n)$$

subject to the resource constraints. Define agents' marginal rate of substitution q^n by

$$q^n = \frac{\beta / c_1(\theta^n)}{\theta^n / c_0(\theta^n)}.$$

Is q^n equated across agents in the full information social optimum allocation? If so, call this q^*. Does q^* equal the q that you found in the bond economy in part a)? Does the social optimum allocation satisfy the budget constraints from the bond economy in part a)?

c) Private information

Now consider the problem of finding an optimal allocation $\{c_0(\theta^n), c_1(\theta^n)\}_{n=1}^N$ that is also incentive compatible in an economy in which agents' taste shocks θ^n are private information. Specifically, we say that an allocation is incentive compatible if

$$\theta^n \log(c_0(\theta^n)) + \beta \log c_1(\theta^n) \geq \theta^n \log(c_0(\theta^i)) + \beta \log c_1(\theta^i)$$

for all $i = 1, \ldots, N$. Is the allocation that you solved for in the bond economy in part a) incentive compatible? If you say yes, prove it. If you say no, give a specific example that violates the incentive compatibility constraints.

d) Optimal private information

Define an optimal allocation under private information as one that maximizes the utilitarian social welfare function in part b) subject to the resource constraints and the incentive compatibility constraints. Explain why the equilibrium allocation from the bond economy is not an optimal allocation under private information.