Macroeconomic Theory
Comprehensive Exam 2018

May 10, 2018

You have three and a half hours for this exam. Neither books nor class notes are permitted. No electronic devices are permitted.

The exam consists of 3 pages. There are 150 points in total. The short questions account for a total of 50 points. The long questions account for a total of 100 points. Answer all questions.

Please read the whole exam before starting. Wherever you do maths, explain briefly what you are doing.

Short Questions (10 points each)

1. Explain why we cannot directly apply recursive methods (dynamic programming) to some problems that can be solved in sequence form. Give two examples.
2. Consider a standard real business cycle model with elastic labor supply. Aggregate productivity follows a stationary *iid* stochastic process on a positive domain. Suppose that the economy is initially in its steady state. Starting from there, how does it react to an above-average realization of productivity? (This is observed before households take any decisions.) Explain in words the optimal reaction of households and its implications for aggregate output, consumption, investment, labor supply and the real interest rate. Draw the time paths of productivity and of output. Explain.
3. What is the curse of dimensionality? How does it affect methods (like value function iteration) used to solve dynamic stochastic models? Use a maximum number of 10 lines.
4. What is the equity premium puzzle? Use a maximum number of 10 lines.
5. Explain the concept of *self-insurance*. In what circumstances may households want to self-insure? Briefly discuss if and why (or why not) self-insurance arises under the following utility specifications:

   (a) $u(c) = c$,

   (b) $u(c) = -\frac{1}{2}(\bar{c} - c)^2$, where $\bar{c}$ is a constant greater than the household's maximum possible lifetime income,

   (c) $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma}$.

   (A graphical illustration may help.)

Long question 1 (50 points)

Consider the problem of an unemployed agent looking for a job. The agent is infinitely lived, discounts future utility using a discount factor $\beta \in (0, 1)$, and values only consumption with a utility function $\ln c$. While unemployed, the agent has no labor income and receives a transfer b per period. In addition, he/she has initial assets a, which can either be consumed or invested, yielding a constant net return r next period. The agent may find a job with the constant probability p. A job provides constant labor income $w > b$ per period and is kept forever. The investment opportunity remains. Assume that $\beta(1 + r) = 1$ always holds.

1. (10 points) First consider an agent who has a job.
   (a) Write down and solve the problem of an agent who has a job.
   (b) What is the value of a job? What does it depend on?
2. (6 points) Now write down the problem of an unemployed agent and derive the Euler equation.
3. (8 points) Compare the unemployed agent's consumption level to that of an unemployed agent who is unemployed forever and has the same level of assets. Explain the difference.
4. (16 points) Analyze the agent's path of consumption and assets as follows.
   (a) Show that it is not optimal for an unemployed agent to have a flat consumption profile.
   (b) Derive an expression for the growth rate of consumption as a function of current consumption.
   (c) What does the consumption path of an unemployed agent look like?
   (d) What are the implications for the path of assets? Also give an intuitive explanation for the paths.
5. (10 points) Now suppose that the agent can choose job search effort. More effort e has a linear utility cost, but a positive and diminishing effect on the job finding probability p.
   (a) Write down the agent's problem. Derive a first order condition for effort, assuming an interior solution.
   (b) How does effort vary with wealth?
   (c) Suppose that a policy maker would like to shorten unemployment duration in this economy. His tool for doing so is the profile of support payments $\{b_t\}_{s=1}^{\infty}$ over an unemployment spell. The average payment over the spell should be b, as above. What should the policy maker do? (Give a qualitative answer. Explain. No derivations needed.)

Long question 2 (50 points)

Consider an economy populated by identical household-producers that maximize the function

$$\sum_{t=s}^{\infty} \beta^{t-s} \left(\log(c_t) + b \log\left(m_t\right)\right)$$

where $\beta \in (0,1)$ is the subjective discount rate, c_t is consumption, m_t is the real money stock, and $b > 0$. Utility maximization is subject to the constraint

$$c_t + m_t + k_t = y_t + \frac{m_{t-1}}{1+\pi_t} + (1-\delta)k_{t-1} + \tau_t,$$

where y_t is output, k_t is the capital stock, and τ_t is a lump-sum transfer from the government. The production function is

$$y_t = (k_t)^{\alpha}$$

where $0 < \alpha < 1$.

a) (10 points) Write the problem of the representative household-producer in recursive form.

b) (10 points) Derive and interpret the Euler equations for the two assets in this economy.

c) (10 points) Is money dominated in terms of rate of return by capital? Explain.

d) (10 points) Derive the money demand function in this economy. Explain.

e) (10 points) Would it be appropriate to estimate this money demand function using an ordinary least squares regression? Explain.