Homework 3

Juan Herreño Johannes Wieland

April 14, 2024

1. Repeat the exercise for lab (2) using the implicit method as opposed to the explicit method. Try using $\tilde{\Delta} = 0.5$. You will need to tell Matlab that the Matrix A is sparse. look for the function spdiags. I invite you to try to do this on your own first. If you fail and get frustrated after a fair try, then you can go find how to do this from Ben Moll's codes on his website. But trying first will let you see the logic of this transition matrix. Report the run time of each method using the tic toc functions.

2. Use your codes from last class. Show that once you change the parameters of the model in the right way (which is that way?), the solutions using discrete and continuous time coincide.

3. Start from the solution of problem 1. We are going to replace our assumption that households receive an endowment $y = 1$. Instead we will replace it with a profit function

$$\pi = f(k) - rk$$

where

$$f(k) = 0.5k^{0.5}.$$

This entrepreneur now has a two-stage problem. First she will decide optimal capital demand to maximize her profits. Then she will decide how much to consume. Capital markets are perfect so the entrepreneur can choose k with no relation to the value of a. Solve that problem.

4. Choose your production function: To make things more interesting, let's consider the case of an entrepreneur living under extreme financial frictions but a choice of technology. There are two technologies at the disposal of the entrepreneur, a good, and a bad technology:

$$f_B(k) = 0.5k^{\alpha},$$

and

$$f_G(k) = 0.8\left(\max\{k-\kappa, 0\}\right)^{0.5}.$$

The profits of using technology x are

$$\pi_x = f_x(k) - rk.$$

The good technology is more productive, but it does not run with capital less than κ. The entrepreneur cannot borrow, so $k \leq a$. The problem of the entrepreneur has three layers. One is to choose her production technology, the second one is to choose optimal capital demand, and the third one is to choose consumption and savings. Solve this problem using $\kappa = 0$, $\kappa = 0.1$, and $\kappa = 0.4$. Use the parameterization for the rest of the parameters of question 1. Notice that profits here depend on a.