Computational Methods for Economics, UC Davis

Problem Set 4

Aiyagari Model

Emile Marin

September 2022

A typical household solves the following problem

$$\max \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\mu} - 1}{1-\mu}, \qquad \mu > 0$$

subject to

$$\begin{aligned} c_t + a_{t+1} &= w_t l_t + (1 + r_t) a_t \\ \log l_{t+1} &= \rho \log l_t + \sigma \left(1 - \rho^2\right)^{\frac{1}{2}} \varepsilon_{t+1}, \qquad \varepsilon_{t+1} \sim N(0,1) \\ a_{t+1} &\geq 0 \end{aligned}$$

The variable c_t is consumption, l_t is labour endowment and a_t is asset holdings in period t. The labour endowment shock is distributed independently across a continuum of households. In addition, households are liquidity constrained; they cannot have negative asset holdings.

Output is produced using a technology given by $k^\theta n^{1-\theta}$ where k is the capital stock and n is labour. The stock of capital is assumed to depreciate at the rate δ each period. Given that we are interested in studying a stationary equilibrium, the stock of capital, labour, wage rate and interest rate will be constant over time. This will be our trick to solve this model without getting into too much trouble (no macroeconomic uncertainty).

Let $\beta = 0.96$, $\mu = 3$, $\theta = 0.36$, $\delta = 0.08$, $\rho = 0.6$ and $\sigma = 0.4$.

(a) Consider the incomplete Aiyagari code provided on Canvas:

1. Introduce the (precoded) routines for capital supply and demand

2. Code a bisection to solve for equilibrium the interest rate

(b) The code provided solves the Aiyagari model using Value Function Iteration. This is reliable but slow. Replace the capital supply routine with one based on VFI with interpolation/ howard's algorithm *and/or* projection methods with time iteration and the engoenous grid method.