Homework #8: Replication of Aiyagari

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In this homework, we replicate the Aiyagari model. The household solves:

$$\begin{aligned} v(a,\varepsilon) &= \max_{\{c,a'\}} u(c) + \beta \sum_{\varepsilon' \in E} v(a',\varepsilon')\,\pi(\varepsilon',\varepsilon) \\ & \quad s.t. \\ c + a' &= (1+r)\,a + w\exp(\varepsilon) \\ a' &\geq \underline{a}, c \geq 0 \end{aligned}$$

The process for ε (in logs) follows an $AR(1)$ process with mean zero, SD of the innovation equal to 0.10, and autocorrelation coefficient equal to 0.90. Discretize it through a 7-state Markov chain by using the Rouwenhorst method. The borrowing limit is $\underline{a} = 0$, i.e., the agent is not allowed to accumulate any unsecured debt. Period utility is given by a CRRA utility with risk aversion parameter $\gamma = 2$, and the discount factor is $\beta = 0.96$. Set the production technology to a CRS Cobb-Douglas function with labor share equal to $2/3$, and set capital depreciation rate equal to 0.08.

(a) Solve the household problem by using your favorite global solution method (finite element or spectral method). It is perfectly fine if you use the code you wrote for the past homeworks.

(b) Solve for the equilibrium interest rate of this economy. Try the Monte Carlo simulation method and one other of the methods I discussed to approximate/simulate the invariant distribution. Compare results and speed.

(c) Compute the amount of precautionary capital stock in this economy, i.e. the difference between the equilibrium K^* and its counterpart when the interest rate equals the complete market value $r^{CM} = 1/\beta - 1$.