ECMA 31140. PERSPECTIVES ON COMPUTATIONAL MODELING FOR ECONOMICS
PROBLEM SET 9
DUE DATE: MARCH 11TH

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You are encouraged to work and discuss in groups, but you must submit your work individually. Answers must be legibly hand-written or typed. All assignments are due electronically on Canvas, attach code. Assignments are due at 12:30 PM. Late problem sets *will not be accepted*

1. Computing policies for the monetary model. (100 points)

In class we have consider the a monetary model where the Bellman equation is given by:

$$\mathcal{V}(m,\theta) = \max_{c,m'} \left[\theta u(c) + \beta \sum_{\theta' \in \Theta} \mathcal{V}(m',\theta') Q(\theta,\theta') \right],$$

subject to:

$$m' = \frac{m}{1+\gamma} - c + y + \tau$$

and subject to the CIA constraint:

$$c \leq \frac{m}{1+\gamma}$$

Assume that the utility function is given by $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$, and that:

$$\sigma = 2, \beta = 0.98, y = 1, \gamma = 0.02, \tau = 0.0234$$

Assume also two possible values for the shock $\Theta = \{\theta_1, \theta_2\} = \{0.74, 1.36\}$, and the Markov transition matrix is given by:

$$Q(\theta,\theta') = \Pr(\theta'|\theta) \equiv \begin{bmatrix} Pr(\theta_1|\theta_1) & Pr(\theta_2|\theta_1) \\ Pr(\theta_1|\theta_2) & Pr(\theta_2|\theta_2) \end{bmatrix} = \begin{bmatrix} 0.73 & 0.27 \\ 0.27 & 0.73 \end{bmatrix}$$

a) Use a grid of 1000 points to solve for the policy functions $g(m,\theta), c(m,\theta)$ using VFI. (50)
b) Use a grid of 1000 points to solve for the policy functions $g(m,\theta), c(m,\theta)$ using EGM. (50)

Date: March 4, 2025.

2. Computing distributions. (100 points)

Once you obtained policies $g(m, \theta_1)$ and $g(m, \theta_2)$, in this exercise you will compute distributions. Take into account all information regarding parameters provided in Question 2. Consider however a grid for the distributions that is finer than the grid used in Question 2. Let π_1, π_2 be the ergodic distribution corresponding to the matrix $Q(\theta, \theta')$.

a) Consider the following recursions:

$$\Psi_{s+1}(m', \theta_j) = \Psi_s\left(g^{-1}(m', \theta_j), \theta_j\right)$$

with the initial distribution given by:

$$\Psi_0(m_i, \theta_j) = \left\{\Psi_0(m_1, \theta_j) + [\Psi_0(m_M, \theta_j) - \Psi_0(m_1, \theta_j)]\frac{m_i - m_1}{m_M - m_1}\right\} \times \pi_j$$

with: $\Psi_0(m_1, \theta_j) = 0, \Psi_0(m_M, \theta_j) = 1$.

Find the limiting distributions for each case ($j = 1, 2$), by iterating on the recursions. (50)

b) Consider the following recursions now:

$$\Psi_{s+1}(m', \theta_j) = \sum_{\theta \in \Theta} Q(\theta, \theta_j)\Psi_s\left(g^{-1}(m', \theta), \theta\right)$$

$j = 1, 2$, with initial distributions given by:

$$\Psi_0(m_i, \theta_j) = \left\{\Psi_0(m_1, \theta) + [\Psi_0(m_M, \theta) - \Psi_0(m_1, \theta)]\frac{m_i - m_1}{m_M - m_1}\right\} \times \pi_j$$

with: $\Psi_0(m_1, \theta_j) = 0, \Psi_0(m_M, \theta_j) = 1$.

Find the limiting distributions for each case ($j = 1, 2$), by iterating on the recursions. (50)

3. Computing equilibrium. (120 points)

Consider the same set up as in Questions 2 and 3, but omit the information that $\tau = 0.0234$.

a) Find the equilibrium of the model. Use either the iterative scheme discussed in class or Bisection method. (100)

b) Plot policy functions and distributions in equilibrium. (20)