Homework 1
OSE-Summer School
2019

Felix Kubler

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Instructions:

- Please answer all the questions that you can and want to asnwer
- Please send me code and results per e-mail by Wednesday morning
- Please work in groups.

Questions:

1. **(Asset market equilibrium).**
   Suppose there are two periods and S states of the world in the second period. There is a single perishable consumption good. There are H agents with endowments $e^h = (e_0^h, \tilde{e}^h) \in I\!R_+^{S+1}$ and identical von Neumann-Morgenstern utility

$$U^h(c) = v(c_0) + \frac{1}{S}\sum_{s=1}^{S} v(c_s), \text{ with } v(c) = \frac{c^{1-\gamma}}{1-\gamma}, \gamma > 1.$$

   Suppose $H = 2$, $S = 4$, $e^1 = (1, 1, 2, 1, 2)$, $e^2 = (1, 3, 1, 3, 1)$, $J = 2$ with $A^1 = (1, 1, 1, 1)$, $A^2 = (1, 1, 1.5, 1.5)$.

   (a) Define a financial markets equilibrium and write down a system of equations (first order conditions and market clearing) that characterize this equilibrium.

   (b) Use Python to compute the equilibrium prices and allocations for $\gamma = 2$, $\gamma = 4$, $\gamma = 8, \gamma = 166$.

2. **(Dynamic programming).**
   Use value function iteration to write a computer program that cannot lose in Tic-Tac-Toe.

3. **(Ramsey I)** Suppose there is a single agent with $\beta = 0.9$, $v(c) = \log(c)$, there are two states which are iid with equal probabilities $\pi_1 = \pi_2 = 0.5$ and the firm's production function is

$$f(k, 1) = 0.9k^{0.3} + 0.3k, \quad f(k, 2) = 1.1k^{0.3} + 0.9k$$

Discretize the possible capital values to 50 points. Use value function iteration to compute the policy functions (one for each shock) for consumption and investment. Plot these functions. Now use 500 points for admissible capital levels and redo the exercise.