Econ 8861: Monetary Economics I
Fall 2022

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Problem set 2

Due Wednesday, September 21, 11.59pm by email. In addition to your codes, please compile a pdf that contains all requested figures and numbers.

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1 Transition dynamics in the standard incomplete markets model

Consider again the standard incomplete markets model with the same parametrization as in the first problem set. Suppose the economy is hit by a MIT shock at date $s = 0$, which perturbs aggregate endowments as follows:

$$Y_s = Y^{\text{ss}} + (\rho_\eta)^s \sigma_\eta,$$

with $\rho_\eta = 0.8$, $\sigma_\eta = 0.01$, and steady state endowments $Y^{ss} = 1$. Assume that the economy is in its stochastic steady state at date $s = 0$, and that households have perfect foresight over the sequence of endowments $\{Y_s\}$. The real rate r remains constant at its steady state value.

Write a program that computes the transition dynamics for aggregate wealth A_t and consumption C_t. Specifically, do the following:

1. Compute the steady state of the economy using your code from problem set 1. Store the marginal value of wealth $\partial V^{\text{ss}}/\partial a_-$ and the ergodic distribution D^{ss} at the steady state.

2. Suppose the economy has returned to its stochastic steady state at $s = T = 300$. Initialize $\partial V_T/\partial a_- = \partial V^{\text{ss}}/\partial a_-$. Then iterate backward on $\partial V_s/\partial a_-$ using the function `backward_step` from problem set 1, and keep track of the policy functions c_s and a_s at each point of the transition.

   Hint: At each point of the iteration, you will need to pass $\partial V_{s+1}/\partial a_-$ along with the current value of Y_s (and all constant parameters) as arguments to the function `backward_step`, and will obtain outputs c_s, a_s and $\partial V_s/\partial a_-$.

3. Initialize the cross-sectional distribution $D_0 = D^{\text{ss}}$. Then iterate forward on D_s using `forward_step` from problem set 1.

   Hint: At each point of the iteration, you will first need to use Young's method to discretize the savings policy a_s that you obtained during the backward iteration. Then you will need to pass the discretized savings policy at date s along with D_s as arguments to the function `forward_step`, and will obtain D_{s+1} as output.

4. Use the sequence of policy functions $\{c_s, a_s\}$ together with the sequence of distributions $\{D_s\}$ to compute aggregate wealth $\{A_s\}$ and aggregate consumption $\{C_s\}$ along the transition path.

5. Plot the consumption and wealth response for the first 50 periods of the transition path.

6. Play around with the truncation horizon T. Is the computed transition path robust to the truncation?

7. Repeat the exercise for the news-shock case where

$$Y_s = \begin{cases} Y^{\text{ss}} & s < 10 \\ Y^{\text{ss}} + (\rho_\eta)^{s-10}\sigma_\eta & s \geq 10. \end{cases}$$

2 Calibrating Hugget (1993) with government debt

Consider the Hugget economy with government debt and $\underline{a} = 0$. Let $B/Y = 1.4 \times 4$ and $G/Y = 0.18$. Find and report the value of β (round to 4 digits) such that the market clearing interest rate r equals $0.01/4$. Set all other parameters as in the calibration from the first problem set.