

Macro Theory B

Final Assignment

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This is the final assignment for the “Macro Theory B” course.

1 The assignment

The point of departure for this assignment is the search and matching model for a stationary economy. We extend this model by introducing shocks to productivity, thus creating business cycles in the economy. The purpose of the problem set is then to code and analyze such an economy.

2 Productivity shocks

- The shocks to productivity are modeled as follows.
- Productivity y can take N values between y_l and y_h .
- There is a transition matrix $\Gamma(y, y')$ that states the probability of y' next period given y today.

3 assignment steps

1. Read the notes of the DMP model to familiarize yourself with the basic (stationary) model.
2. Read Shimer’s paper, “The Cyclical Behavior of Equilibrium Unemployment and Vacancies” in the *American Economic Review*, 2005 to familiarize yourself both with the model with fluctuations and with the ideas of productivity shocks. Notice that Shimer uses in most of his paper continuous time, so the Bellman equations look different. You do not need to spend time on this as you can stick to discrete time as we did in class.

3. Have a code that properly solves the static DMP problem. You can use the code that Dina wrote or you can write one for yourself.
4. Derive the two equilibrium conditions for the model with aggregate shocks:

$$\mathbb{E}_{x_{t+1}} S_{t+1} = \frac{c}{(1-\gamma)\beta q(\theta)}, \quad (1)$$

$$S_t = y - b + \beta \left\{ (1-\sigma) \mathbb{E}_{x_{t+1}} S_{t+1} - \frac{\theta_t \phi}{(1-\phi)} \frac{c}{\beta} \right\}. \quad (2)$$

5. Adapt the stationary code to solve for the economy with productivity shocks (as explained in class).
6. Use Shimer's parametrization (Table 2 on page 38 of his paper). Notice that since the process for productivity shock is continuous while the model is discrete you would need to discretize the productivity process. For this use the Tauchen method "function [Y,Yprob] = tauchen(N,mu,rho,sigma,m)" with $N = 30$, $mu = 0$, $m = 3$ and ρ, σ from Shimer's table.
7. At this point you would have a solution for the mode, which is a value of θ for each level of productivity.
8. Simulate a path of productivity levels for $T = 5000$ (notice that Shimer uses a time frequency of one quarter) by using an initial level of y in the middle of the grid Y that you derived from the Tauchen method.
9. Use the transition matrix $Yprob$ to determine the path of productivities (as explained in class).
10. Calculate the unemployment rate over the T periods by using the formula: $U_{t+1} = u_t(1 - \theta q(\theta)) + (1 - u_t)s$
11. Shimer reports that the log variance of unemployment is 0.19. Calculate the log variance of unemployment in the model. Shimer gets 0.009 so about 20 times smaller than the one in the data. For this step you would need to use an HP filter with a smoothing coefficient of 10,000. Do this by using the following command: "[hptrend,hpdevu]=hpfilter(logu,hpdegree);", where hptrend and hpdev are outputs (you are interested in hpdevu, which are the log deviations), logu is the log of the unemployment series, and hpdegree is 10,000. You would then need to use matlab's std function to get the standard deviation of the hpdevu series.

4 Submission instructions

- The assignment is due on Tuesday, August 4th.

- Please provide all the code used to solve the assignment, with instructions how to run the code if needed, plus results for all the endogenous variables that you solved for. Please also provide the steps to get the equilibrium of the economy with aggregate shocks (the two equations above).
- The quality of the code, including readability, comments, meaningful names and all the other aspects of quality code that were mentioned in class will be taken into consideration as part of the grading.
- The assignment should be submitted by email only to Dina Gat at dinagat@gmail.com
- The assignment can be submitted separately or in dyads.