

Exercises for Lecture 9**Exercise 1: Some Questions**

- Q1.** What is the difference between the bootstrap particle filter and the conditionally-optimal particle filter?
- Q2.** Can the conditionally-optimal particle filter be implemented in a nonlinear DSGE model?
- Q3.** Why is the resampling step needed in the particle filter?
- Q4.** TRUE or FALSE: the smaller the measurement error in the state-space representation, the more accurate the particle filter approximation. Explain.
- Q5.** How do outliers in your sample affect the accuracy of particle filter approximations?
- Q6.** Is the particle filter approximation of the likelihood function unbiased? When does unbiasedness become helpful?

Exercise 2: Particle Filtering

Replicate the use of the bootstrap particle filter and the conditionally-optimal particle filter for the small-scale DSGE model in Chapter 8.6 of Herbst and Schorfheide (2015). To get you started, you can find some MATLAB code on the companion website for the book.

- (i) Take a close look at the structure of the code and compare the description of the filter in the book with the implementation in the code.
- (ii) Modify the code a bit to conduct two interesting experiments of your choice. These experiments could be related to the robustness of the empirical results (you can change the model, change the sample); or they could be related to the performance of the algorithm. You can be creative here. Write a summary of your findings.