Bayesian Macroeconometrics **Gerzensee Ph.D. Course, June 2019**

Exercises for Lecture 6

Exercise 1: Some Questions

Q1. Why is the Kalman filter needed to compute the likelihood function of a log-linearized DSGE model?

Q2. What are the key steps in a filtering algorithm? Characterize the various conditional distributions of states and observations that are computed by the filter.

Q3 How would you elicit a prior distribution for DSGE model parameters?

Q4. Why is an algorithm such as the Metropolis-Hastings algorithm needed to sample from the posterior distribution of a DSGE model?

Q5. Describe the steps of the Metropolis-Hastings algorithm.

Q6. Does the MH algorithm generate a sequence of independent draws θ^i from the posterior distribution $p(\theta|Y)$?

Q7. Suppose $\theta = [\theta_1, \theta_2]'$ and you have used the MH algorithm to generate a sequence of draws θ^i, $i = 1, \ldots, N$. How do you approximate the mean and the standard deviation of the marginal posterior $p(\theta_1|Y)$? How would you approximate the 5th and 95th percentile of the posterior distribution?

Q8. Why do practitioners often drop the first 20-50% of draws generated by an MH algorithm?

Q9. TRUE or FALSE. The more persistent the Markov chain, the more accurate the Monte Carlo approximation of posterior moments computed from the output of this chain. Explain your answer.

Q10. What is a *random walk* MH algorithm?

Q11. Suppose you are using the MH algorithm to approximate the posterior distribution of DSGE model parameters. Describe how you could/would choose the proposal density $q(\cdot)$. What is the rationale for this choice?

Q12. Suppose you find that the acceptance rate of your MH algorithm is close to zero. Would you increase or decrease the variance of the proposal distribution $q(\cdot)$ to raise the acceptance rate? Explain your reasoning.

Exercise 2: DSGE Model Estimation using RWMH Algorithm

Replicate the Bayesian estimation of the small-scale DSGE model in Chapters 4.1 and 4.2 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 look for

- the specification of the prior distribution
- the solution of the DSGE model;
- the evaluation of the likelihood function;
- the random-walk Metropolis-Hastings algorithm;

(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 (change the proposal distribution; run the algorithm repeatedly). You can be creative here. Write a summary of your findings.