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MATLAB Exercises

1. Use */Part1/moment_matching.m* to reproduce Figure 28 of FVRRS. Then answer the following questions:

   (a) What are the diagonal elements of the weight matrix W_T used to compute the estimators?

   (b) Change the vector $m_T(\cdot)$ in the construction of the estimator by changing the set of observables used to estimate the VAR. What happens to the sampling distribution of the estimator? Discuss and interpret your findings.

2. Use */Part2/likelihood_evaluation.m* to reproduce Figure 24 of FVRRS. Then answer the following questions:

   (a) For the case of $y_t = [\log(X_t/X_{t-1}), lsh_t, \pi_t]$ what are the log likelihood increments $\ln p(y_t|Y_{1:t-1})$ for $t = 10, 20, 30, 50$? What is the value for the log likelihood $p(Y_{1:T})$.

   (b) Change the code so that the filter uses the observables $y_t = [lsh_t, \pi_t, R_t]$. Generate plots for the true and filtered states ϕ_t, z_t, and λ_t. For period 25 report the true value of ϕ_t as well as the mean and credible intervals based on $p(s_t|Y_{1:t})$.

3. Use */Part3/MLE.m* to reproduce the figure in the MLE slides. Then do the following: Instead of evaluating the likelihood as function of ζ_p, change the code and evaluate the likelihood as function of one of the other parameters (your choice!). Note that you should change the range over which you evaluate the likelihood based on your choice of parameter and its true value. Then regenerate the figures.

4. Use */Part4/Candidate.m* and */Part4/MetropolisHastings.m* to reproduce Figure 32 and 33 of FVRRS.

5. Metropolis Hastings Sampler

(a) The Matlab program */Part 5/Metropolis.m* uses the RWMH algorithm to generate draws from a bimodal distribution. Read through the program code and run it with the default settings.

(b) To explore the performance of the Metropolis Algorithm, vary the parameters of the "posterior" distribution, μ_1, μ_2, Σ, and p. What happens to the accuracy of the numerical approximation?

(c) To explore the performance of the Metropolis Algorithm, vary the number of draws, the fraction of initial draws being discarded, and the variance-covariance matrix of the proposal density. What happens to the accuracy of the numerical approximation?

6. DSGE Model Estimation with MATLAB

(a) The Matlab programs in the directory */Part 6/* implement the estimation of the small-scale DSGE model in Chapter 4.2 of Herbst and Schorfheide (2015). Familiarize yourself with the structure of the programs by reading the readme files.

(b) Look for the program that computes the likelihood function with the Kalman filter. Compare the expressions in the code to the formulas in the lecture notes.

(c) Look for the program that implements the RW Metropolis algorithm. Compare the MATLAB implementation to the outline of the algorithm in the lecture notes.

(d) Run the MATLAB programs to replicate some of the results in the book and to generate additional results

- Obtain Recursive Averages and Posterior Marginal Distributions of parameters.
- Change the prior distribution and vary the proposal density used in the RWMH algorithm.
- Compute DSGE model forecasts.
- Compute the impulse response functions for a monetary policy shock. Graph the median response as well as 90% credible bands.
- Compute marginal likelihood values.
- Compute Variance Decompositions