Econ. 556b Spring 1999 Chris Sims

# Metropolis Sampling Exercise

Using the same model and data as for the previous exercise, with the base settings for all the parameters as a starting point, use Metropolis Markov Chain Monte Carlo sampling to create draws from the joint posterior, under a flat prior, of the variance parameters in that exercise: $\sigma_\varepsilon$, and the variance matrix $\Omega$ of $\zeta_t$ in (2) of that exercise. Because of the requirement of symmetry and positive definiteness of the $\Omega$, it is best to parameterize it as $\Omega = W'W$, with W upper triangular. Then all the upper triangle of $W$ can be left unrestricted, though to avoid redundancy in the parameterization you should treat the likelihood as zero when any diagonal element of $W$ is zero. The initial prior variance is to be held fixed as you do this. We are switching from assuming $\Omega$ is a scalar multiple of the initial prior variance to a parameterization in which $\Omega$ is given a free form.

You will be making Metropolis draws from a 7-dimensional distribution. Use an i.i.d. normal p.d.f. as the jump p.d.f., making the standard error of each parameter in the jump distribution .15 times the level of that parameter in the base specification of the previous exercise. With each setting of the variance parameters, of course, you evaluate the likelihood with the Kalman filter, and use the likelihood values to determine jump probabilities according to the Metropolis rule. You can adjust the jump p.d.f. if it looks to you to be too tight or too spread out. You will probably want to make 10,000 draws or so, though you should not make that many until you have made your code is working with much smaller runs.

Assess convergence by examining time series of draws of some of the parameters—they should not be trending in the latter part of your draws. If you can't get convergence in a modest amount of computer time (a run of 10-20 minutes, say), give up. We don't want to tie up lots of computers on this exercise.

Find the mean and covariance matrix of your sample of draws.

Make a few draws from your artificial sample and display Kalman smoothed and Kalman filtered estimates with error bands for them as we did on the last exercise. Has this more elaborate procedure changed the substance of our conclusions?