EXERCISE ON FORECASTS AND ERROR BANDS

Get current data on US real GDP and take its log. We'll call this time series y.

This exercise will be a lot easier if you use the R code available on the course web site, though of course it can also be done with Matlab or Python or any general coding language. Most of the exercise can be done with `rfvar3()` and `fcastBand`. The last two parts require some original programming, even if you use R.

The tasks listed below say you should repeat them for the model estimated with a prior and for the model estimated without a prior. This is required, though, only for 2 and 3. Except for 2, there may well be not much difference. You should check whether there is much difference for one or two of the other items, so we can discuss the difference or lack thereof in class.

(1) Estimate a 5th order autoregression, with constant term, for y. Do this two ways, once by OLS (i.e. conditioning on the initial observation) and once with a Minnesota prior using only the co-persistence and unit root dummy observations, weighted as $\lambda = 5$, $\mu = 2$, as in the default arguments to the `rfvar3()` function in the R VAR tools.

(2) Form forecasts of y, based on initial conditions from 1947:I through 1948:I and running through the end of the sample, using both estimates, and plot both forecasts and the actual data on the same graph.

(3) Make 1000 draws from the posterior distribution (under normality assumptions) for the coefficients (including the constant). Make these draws for both estimates (i.e. with and without the dummy observations). Use the draws to calculate 90% and 68% error bands and the median forecast for the forecasts over the sample based on the sample initial conditions. Plot these on two separate graphs.

(4) Using the same pair of 1000-draw MCMC samples, plot the error bands and median forecast from the end of the sample through 2070. Also do this without adding current shocks over the forecast period — i.e. showing only uncertainty in the mean forecast path that arises from uncertainty abaout the model parameters, not uncertainty about future shocks.

(5) Again using the same two sets of MCMC draws, display the central forecast and error bands for the projections of end-of-sample eigenvectors corresponding to each of the first three eigenvalues of the forecast draws covariance matrix.

(6) Estimate the model as a fourth-order AR in first differences and make 1000 draws from the posterior on the coefficients on that model. Use these draws to generate 1000 draws from the posterior for the *levels* of y from the end of the sample to 2070. This will require, using the R toolkit, using the output (not the plots) from `fcastBand()` and cumulating to convert difference forecasts into levels. Plot the median and 68% and 90% bands for these forecasts.

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