EC 831: Empirical Methods in Macroeconomics

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Reduced form VAR with Gibbs Sampling

We want to estimate the following model:

$$y_t = a_0 + \sum_{j=1}^{p} A_j y_{t-j} + \varepsilon_t$$

$t = 1, 2, ..., T$, y_t, a_0, ε_t: M x 1,and A_j: M x M
$\varepsilon_t \sim N(0, \Sigma)$

Here $M = 3$ and $p = 2$

The data are in the file `data_baseline.mat`. It is a matlab matrix file.

It contains the following variables:
1) unrate (Unemployment rate)
2) pi (Inflation)
3) tbill3m (3 month T-bill interest rate)
dates (vector of dates 1954:Q4 to 2013:Q3)

We want to estimate the VAR with Gibbs Sampler. Here I outline the specific steps that we will take to setup the prior and estimate the model.

Independent-Wishart Priors:

We will use the "training sample" method to choose the prior parameters. This involves using the first 10 years (or so) of the sample to help pick the priors.

1) Format the data in line with following equation in the notes

$$y = Z\beta + \varepsilon \tag{1}$$

2) Run OLS on equation (1) using data from 1955:Q2 to 1964:Q2 (37 observations) to get $\widehat{\beta}_{OLS}$ and $\widehat{\sigma}^2_{OLS}$.
Order the variables as specified in the previous page so it is easy to compare the results.

Note the first two observations are dropped because we have two lags, but those two observations are still used in Z.

3) Setup the priors in the following way.

$$\beta \sim N(\underline{\beta}, \underline{V}_{\beta})$$

$$\Sigma^{-1} \sim W(\underline{S}^{-1}, \underline{\nu})$$

where

$$\begin{aligned} \underline{\beta} &= \widehat{\beta}_{OLS} \\ \underline{V}_{\beta} &= 4var(\widehat{\beta}_{OLS}) \\ \underline{\nu} &= 3 \\ \underline{S} &= \widehat{\varepsilon}_{\tilde{T},OLS}\widehat{\varepsilon}'_{\tilde{T},OLS} \quad \text{(This is M x M)} \end{aligned}$$

$\tilde{T}$ is # of observations in the training sample.

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4) Run the Gibbs Sampler for data from 1965:Q1 to 2013:Q3 (195 observations). Again, 1964:Q3 and 1964:Q4 are "dropped" because of two lags.

5) Check convergence using techniques discussed in class.

6) Run OLS on same data from 1965:Q1 to 2013:Q3 (195 observations).

7) Plot trace plots for Gibbs Sampler draws from all the elements of β (21 parameters) and Σ (6 parameters). On each trace plot, also draw a horizontal line equal to the corresponding OLS estimate.

8) Repeat Gibbs Sampler for diffuse priors and redo the trace plots.

$$
\begin{aligned}
\underline{\beta} &= \widehat{\beta}_{OLS} \\
\underline{V}_{\beta} &= \infty \\
\underline{\nu} &= 0 \\
\underline{S} &= 0
\end{aligned}
$$

Optional

Calculate the marginal likelihood for the VAR for the two different priors

Use Laplace approx, Modified harmonic mean estimator & Chib method