Package Name: BFAVAR
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Default Proc Name: BFAVAR
Default Menu Text: Bayesian Factor Augmented VAR
Interface: Dialog and command line

Description

This add-in allows you to perform the estimation of Factor-Augmented Vector Regression (FAVAR) models by using a one-step Bayesian Gibbs sampling likelihood approach (see more details in Bernanke, Boivin, and Eliasz 2004).

To illustrate the main idea of this add-in, consider the following transition equation (VAR model):

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \Phi(L) \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + v_t,$$

where $\Phi(L)$ is a lag polynomial of finite order d. The error term v_t is mean zero with covariance matrix Q. Y_t is (m x 1) vector of observable economic variables and F_t is (k x 1) vector of unobserved factors.

It is assumed that the informational time series X_t are related to the unobservable factors F_t and the observable factors Y_t by state space form

$$\begin{bmatrix} X_t \\ Y_t \end{bmatrix} = \begin{bmatrix} \Lambda^f & \Lambda^y \\ 0 & I \end{bmatrix} \begin{bmatrix} F_t \\ Y_t \end{bmatrix} + \begin{bmatrix} e_t \\ 0 \end{bmatrix}$$

where Λ^f and Λ^y are matrix of factor loadings and error terms e_t are mean zero and will assumed uncorrelated with diagonal covariance matrix R. The error vectors e_t and v_t are assumed to be distributed according to $e_t \sim N(0, R)$ and $v_t \sim N(0, R)$, with e_t and v_t independent.

The package estimates FAVAR model by a one-step likelihood based Bayesian Gibbs sampling approach. Unlike to 2 step principal component approach, the joint likelihood estimation only requires that the first k variables are selected to be the slow-moving variables (the upper k x m block of Λ^y to be zero) and the upper k x k block of Λ^f to be an identity matrix. The identification of structural shocks in the transition equation is recursive (cholesky) where all factors respond with a lag to change in the variable (e.g., federal fund rate) ordered last in Y_t.

BFAVAR package takes a Bayesian perspective, treating the model's parameters $\theta = (\Lambda^f, \Lambda^y, R, vec(\Phi), Q)$ as random variables. Bayesian estimation by multi-move Gibbs sampling procees by alternately sampling the parameters θ and unobserved factors F_t. The Gibbs sampling approach takes the following steps:

1. Choose set of starting values for parameter θ, say θ^0
2. Conditional on θ^0 and data $\tilde{X}_T = \left\| \begin{bmatrix} X_1 \\ Y_1 \end{bmatrix}, \begin{bmatrix} X_2 \\ Y_3 \end{bmatrix} \ldots, \begin{bmatrix} X_T \\ Y_T \end{bmatrix} \right\|$, draw a set of values for $\tilde{F}_T = \left\| \begin{bmatrix} F_1 \\ Y_1 \end{bmatrix}, \begin{bmatrix} F_2 \\ Y_3 \end{bmatrix} \ldots, \begin{bmatrix} F_T \\ Y_T \end{bmatrix} \right\|_t$, say $\tilde{F}_T^1$ from the conditonal distribution $p = (\tilde{F}_T | \tilde{X}_T, \theta^0)$.

3. Conditional on the sampled values of $\tilde{F}_T$ and $\tilde{X}_T$, draw a set of values of the parameters θ, say θ^1, from the conditional distribution $p = (\theta|\tilde{X}_T, \tilde{F}_T^1)$

The final 2 steps are repeated until the empirical distribution of $\tilde{F}_T^s$ and θ^s converge.

On the observation equations we impose a diffuse conjugate Normal –Inverse Gamma prior,

$$\Lambda_i|R_{ii} \sim N(0, R_{ii}M_0^{-1}) \, , R_{ii} \sim IG(3, 0.001)$$

where M_0^{-1} denotes prior variance parameter on the coefficients of the i –th equation, Λ_i. We set $M_0 = I$.

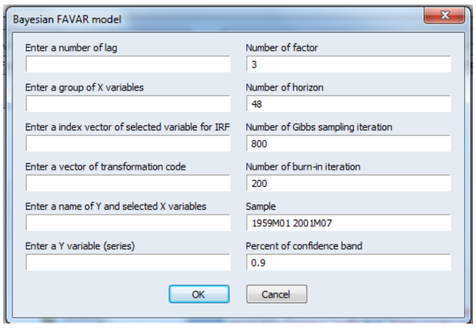
On the transition equations (VAR) we impose a diffuse conjugate Normal – Wishart prior,

$$vec(\Phi)|Q \sim N(0, Q \otimes \Omega_0) \, , Q \sim iW(Q_0, k + m + 2)$$

Following Kadiyala and Karlsson (1997), we set the diagonal elements of Q_0 to the residual variances of the corresponding d-lag univariate autoregressions, $\hat{\sigma}_i^2$. To match prior variances of the Minnesota prior we construct diagonal elements of the Ω_0 so that the prior variances of parameter on p lagged j’th variable in i'th equation equals $\sigma_i^2/p\sigma_j^2$.

Dialog

Upon running the add-in from the menus, a dialog will appear:



The first box lets you specify a number of lags while the second box specify the group of informational time series variables (X_t) from which the unobservable factors F_t is estimated. On the next box enter a index of selected macroeconomic variables for impulse response analysis. Please carefully choose an index number of Y and X from balanced panel (remember: with state space form, Y is ordered last, so after Y, $\text{index}_{\text{new}}$(X)= $\text{index}_{\text{old}}$(X) – 1)

On the next box (4th) enter a vector of transformation code of Y and selected macroeconomic variables X: 1=no transformation; 4=logarithm; 5=first difference of logarithm. On the next (5th) box just put names of Y_t and selected macroeconomic variables X. It should be text object which contain columns of names. On the next box (6th) enter Y_t variable. It should be series, not group. Other boxes specifies some optional inputs.

References:

Bernanke, B. S., J. Boivin and P. Eliasz (2005), “Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach”, Quarterly Journal of Economics 120.1: 387-422

Bernanke, B. S., J. Boivin and P. Eliasz (2004), “Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach”, NBER working paper No. 10220

Kadiyala, K. R. and Karlsson, S. (1997), ‘Numerical methods for estimation and inference in Bayesian Var-Models’, Journal of Applied Econometrics 12, 99–132.

Command line:

Syntax: bfavar(options) lags x(group of data) xir (index of selected variables) tcode(transformation code) name(Y and selected X variable) @ endogenous variables(Y)

E.g. bfavar 13 xdata xir code yx_name @ ffr

Options:

argument	***explanations***
factor	number of factor
horizon	number of steps for impulse response function
rep	number of Gibbs sampling iteration
burn	number of burn-in iteration
sample	sample size
ci	percent of confidence band

E.g. bfavar(factor=3, horizon=48, rep=1000, burn=200, ci=0.90) 13 xdata xir code yx_name @ ffr