TOOLS FOR APPLIED MACRO 2017

PROBLEM SET III

Instructions

Write up your results carefully and clearly and submit electronically in pdf format to pkn8@cornell.edu before Friday March 17 together with any MatLab code used in the exercise. Use the naming convention APPLIED_MACRO_PS3_2017_YOURNAME.zip Use notation as indicated in the questions. A well-written exercise should be understandable to a reader who have not read the questions.

Question 1

For the US, find quarterly data for CPI inflation (π_t), GDP growth ($\Delta y_t \equiv \ln y_t = \ln y_{t-1}$ gives growth in per cent), the Federal Funds Rate (r_t). Use entire post WWII data except post-2007 financial crisis data. Make sure that you use **seasonally adjusted** time series. (Google "FRED St Louis" if you do not know where to look for data.)

(1) Plot the data.

(2) Consider the *reduced form* $VAR(p)$

$$\begin{bmatrix} r_t \\ \Delta y_t \\ \pi_t \end{bmatrix} = \mathbf{c} + \Phi_1 \begin{bmatrix} r_{t-1} \\ \Delta y_{t-1} \\ \pi_{t-1} \end{bmatrix} + ... + \Phi_p \begin{bmatrix} r_{t-p} \\ \Delta y_{t-p} \\ \pi_{t-p} \end{bmatrix} + \varepsilon_t : \varepsilon_t \sim N(0, \Omega)$$

Use $p = 4$ and conditional maximum likelihood to find estimates of $c, \Phi_1, \Phi_2, ...\Phi_p$ and Ω.

(3) Identify the structural form

$$A_0 \begin{bmatrix} r_t \\ \Delta y_t \\ \pi_t \end{bmatrix} = \mathbf{c} + A_1 \begin{bmatrix} r_{t-1} \\ \Delta y_{t-1} \\ \pi_{t-1} \end{bmatrix} + ... + A_p \begin{bmatrix} r_{t-p} \\ \Delta y_{t-p} \\ \pi_{t-p} \end{bmatrix} + \mathbf{u}_t : \mathbf{u}_t \sim N(0, I)$$

by assuming that interest rates do not respond contemporaneously to GDP growth or inflation and that GDP growth do not respond contemporaneously to inflation.

(4) Compute impulse response functions for all variables to all shocks. Do the IRFs make economic sense? Why or why not?

(5) Perform variance decompositions and discuss the result.

(6) Decompose the actual time series of $r_t, \Delta y_t$ and π_t into components due to initial conditions in period 1 and orthogonal shocks that have occurred between period 1 and period t. Plot and discuss relationship with answers to Q1.5.

(7) Check sensitivity to sample period by recomputing the IRFs after re-estimating the model using only post 1985 data. What do you find?

(8) Check sensitivity to lag order by redoing steps 2-4 using a lag order p determined by statistical criteria (i.e. you can use your results from Problem Set II) as well as setting $p = 1$.

Date: March 10, 2017.

Question 2

(1) Consider the reduced form bivariate $VAR(p)$

$$\begin{bmatrix} r_t \\ \Delta y_t \end{bmatrix} = \mathbf{c} + \Phi_1 \begin{bmatrix} r_{t-1} \\ \Delta y_{t-1} \end{bmatrix} + ... + \Phi_p \begin{bmatrix} r_{t-p} \\ \Delta y_{t-p} \end{bmatrix} + \varepsilon_t : \varepsilon_t \sim N(0, \Omega).$$

Use conditional maximum likelihood to find estimates of $\Phi_1, \Phi_2, ...\Phi_p$ and Ω. Use lag order $p = 1$. (Use the entire sample.)

(2) Identify the structural form

$$A_0 \begin{bmatrix} r_t \\ \Delta y_t \end{bmatrix} = \mathbf{c} + A_1 \begin{bmatrix} r_{t-1} \\ \Delta y_{t-1} \end{bmatrix} + ... + A_p \begin{bmatrix} r_{t-p} \\ \Delta y_{t-p} \end{bmatrix} + \mathbf{u}_t : \mathbf{u}_t \sim N(0, I)$$

by assuming that shocks to interest rates do not affect the *level* of GDP in the long run.

(3) Compute and plot impulse response functions for all variables to all shocks. Verify that the identifying assumptions hold by also computing and plotting cumulative impulse responses.

(4) Check robustness of the impulse responses by also estimating a VAR(4) using the same identifying assumption.