TOOLS FOR APPLIED MACRO I 2017

PROBLEM SET IV

Instructions

Write up your results carefully and clearly and submit electronically in pdf format to pkn8@cornell.edu before April 7 together with any MatLab code used in the exercise. Use the naming convention APPLIED_MACRO_PS4_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.

1. MLE and DSGE models

Consider the following linearized New Keynesian model with consumption habits and price indexation

$$\begin{aligned}
\pi_t &= (1-\delta_\pi)\,\beta E_t\pi_{t+1} + \kappa(y_t - \overline{y}_t) + \delta_\pi\pi_{t-1} + u_t^\pi : u_t^\pi \sim N(0,\sigma_\pi^2) \\
y_t &= (1-\delta_y)\,E_t y_{t+1} - \frac{1}{\gamma}(r_t - E_t\pi_{t+1}) + \delta_y y_{t-1} + u_t^y : u_t^y \sim N(0,\sigma_y^2) \\
r_t &= \phi_\pi\pi_{t-1} + \phi_y y_{t-1} + \phi_r r_{t-1} + u_t^r : u_t^r \sim N(0,\sigma_r^2) \\
x_t &= \rho x_{t-1} + u_t^x : u_t^x \sim N(0,\sigma_x^2)
\end{aligned}$$

where π is inflation, y is (the log of) output, r the short interest rate and x (log of) potential output. The parameters δ_π and δ_y lie in the interval $(0,1)$.

(1) Write down the model in matrix form. What are the state variables and what are the "jump" variables?
(2) Download quarterly data on CPI inflation, GDP and the Federal Funds Rate for the same sample you used for Problem Set III. Make sure you use seasonally adjusted data. Demean inflation and interest rates. Detrend GDP using the HP-filter and an appropriate smoothing parameter. Plot the raw and demeaned/detrended data.
(3) Solve the model using the stable/unstable decoupling method discussed in class.
(4) Find the MLE of the parameter vector $\Theta = \{\delta_\pi, \delta_\pi, \beta, \kappa, \gamma, \phi_\pi, \phi_y, \phi_r, \rho, \sigma_\pi^2, \sigma_y^2, \sigma_r^2, \sigma_x^2\}$ using simulated annealing to maximize the likelihood function. (Hint: You need to make sure that parameter vectors that do not satisfy the conditions for a unique stable solution do not result in a code breakdown.)
(5) Plot impulse response function of the endogenous variables to all the shocks in the model. Compare with your estimate of the effect of a monetary policy shock from the SVAR exercise in Problem Set III.
(6) Use the Kalman filter to find a real time estimate of potential output.

Date: March 24, 2017.