Problem Set 4 Macroeconometrics, Summer 2016
Distributed: 26 July 2016
Due: 2 August 2016

1. Consider the following VAR(2) in primitive form:

$$\Delta y_t = 2 - .03 i_t + .2\Delta y_{t-1} + .057 i_{t-1} + \mu_{\Delta yt}$$
$$i_t = 2 - .04\Delta y_t + .23\Delta y_{t-1} + .37 i_{t-1} + \mu_{it}$$

where,
$\Delta y_t$ is real GDP growth (the differenced log of real GDP)
$i_t$ is the level of the federal funds rate
$\mu_{\Delta yt}, \mu_{it}$ are white noise, mutually and serially uncorrelated with
$\text{var}(\mu_{\Delta yt}) = \sigma^2_{\Delta y} = 1.2$
$\text{var}(\mu_{it}) = \sigma^2_i = 1.7$

a. Re-write this VAR in standard form.

b. Calculate the variances and covariance of the reduced form residuals, assuming a Choleski decomposition (that is the name of the restriction we discussed in class--where we set the contemporaneous effect of one variable on another to 0).

c. What is the interpretation of the Choleski decomposition applied to this VAR?

2. Download the following three data series from FRED for 1947 through 2007:

Spot Oil Price: West Texas Intermediate (monthly)
GDP implicit price deflator (quarterly)
Real GDP (quarterly)

Convert the oil price series to quarterly data and then transform into a "relative" oil price series by deflating by the GDP implicit price deflator.

Convert the relative oil price series and the real GDP series into annualized growth rates.

a. Estimate a VAR(2) with the annualized data on real GDP and relative oil prices. (Use the common sample: 1947.1-2007.4). Choose the appropriate lag length based on the system AIC statistic.

b. Present the impulse responses and variance decomposition using the decomposition that assumes oil prices shocks are exogenous with respect to real GDP growth.

c. Interpret your findings.

3. Consider the following VAR(2) in *standard* form:

$$y_t = .2y_{t-1} + .057z_{t-1} + \mu_{yt}$$
$$z_t = .3z_{t-1} + \mu_{zt}$$

where

$\mu_{yt}$, $\mu_{zt}$ are *mutually and serially* uncorrelated white noise with

$$\text{var}(\mu_{yt}) = 1$$
$$\text{var}(\mu_{zt}) = 1$$

a. Derive the VMA representation of this VAR(2). This is equivalent to deriving the 4 impulse response functions. You can easily do this operation in EXCEL.

b. Derive the variance decompositions for this VAR(2) at horizons n = 1, 4, and 12.

4. Download the following monthly series:

- unemployment rate
- core CPI (CPI less food and energy)
- producer price index for commodities
- federal funds interest rate

Convert the core CPI and the PPI for commodities into annualized growth rates

Estimate a structural VAR(3) with 6 lags of each variable, impose the restrictions that are suggested by Bernanke and Blinder (1992). Report and interpret the impulse responses and variance decompositions. If there is a "price puzzle," include the annualized growth of the PPI in the VAR and re-compute the impulse responses and variance decompositions. Report and interpret the impulse responses and variance decompositions.