POLICY EVALUATION - ASSIGNMENT

Deadline: November 30th, 10 am

Answer the questions and report the results and the related comments in a document.
The answers shoud be clear, concise and (possibly) correct.

Load in Gretl the dataset oil data.gdt containing monthly time series of the percent change in global crude oil production ($\Delta prod_t$), an index of real economic activity (rea_t), and the real price of oil (rpo_t) from 1973:1 to 2007:12. The rea_t and rpo_t series are expressed in logs.

1. Plot the time series and explore the correlogram of rea_t. Test the null hypothesis that the series is I(1) using an ADF test. Select the lag order for the ADF test, starting from a maximum lag order k = 12, using the BIC criterion. Report the ADF regression, the test results and motivate your choice for the deterministic component in the ADF regression.

2. Perform an ADF test on the first difference of rea_t, i.e. $\Delta rea_t = rea_t - rea_{t-1}$, and motivate your choice for the deterministic component in the ADF regression. What can you conclude on the order of integration of rea_t?

3. Select the best $ARMA(p, q)$ specification for the series Δrea_t according to the Bayesian Information Criterion (BIC), where $p = 0 \dots 4$ and $q = 0 \dots 4$. Use conditional maximum likelihood to estimate ARMA models and set the tolerance parameter to 0.0001 using the command *"bhhh_toler 0.0001"*. Report the results. Then, plot the residuals and their ACF. Do they look like a white noise?

4. Estimate a reduced form VAR:
$$\Theta(L)\, y_t = \delta + e_t$$
where $y_t = [\Delta prod_t; rea_t; rpo_t]'$. Select the number of lags, starting from a maximum lag order k = 12, and motivate your choice using the BIC criterion. Plot the VAR inverse roots (*Graphs* → *VAR inverse roots*) as well as the residuals from the 3 VAR equations. What can you conclude about the stationarity of the VAR?

5. Consider the mapping $e_t = Cu_t$ between reduced-form residuals e_t and structural shocks u_t, where:
$$\begin{pmatrix} e_t^{\Delta prod} \\ e_t^{rea} \\ e_t^{rpo} \end{pmatrix} = \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix} \begin{pmatrix} u_t^{oil\, supply\, shock} \\ u_t^{agg\, demand\, shock} \\ u_t^{oil-specific\, demand\, shock} \end{pmatrix}$$

   Consider the following assumptions:

   (a) Crude oil supply shocks (referred to as *oil-supply shocks*) are defined as unpredictable innovations to global oil production. Crude oil supply is assumed not to respond to aggregate and oil-specific demand shocks within the same month.

(b) Innovations to global real economic activity depend on crude oil supply shocks and on shocks to the global demand for industrial commodities (referred to as *aggregate-demand shocks*). Shocks that are specific to the oil market do not affect global real economic activity immediately, but with a delay of at least a month.

(c) Innovations to the real price of oil depend oil supply shocks, aggregate demand shocks and shocks in the demand for oil (referred to as *oil-specific demand shocks*). Based on the information above, suggest an identication strategy in terms of restrictions to the C matrix coefficients.

6. Report estimates of matrix C using a VAR with 24 lags (i.e. 2 years) and plot the responses of rea_t and rpo_t to the following shocks for a 25-period horizon and comment the results:

   (a) a negative shock to oil supply;

   (b) a positive shock to aggregate demand;

   (c) a positive shock to oil-market specific demand.

7. Plot the Historical Decomposition for the real price of oil (variable rpo_t) using the SVAR specification of point 5 and briefly comment the results.