GDN course: Homework assignment #1

Part A – ARMA estimation

Download 2 time series[1] with yearly frequency[2] of macroeconomic data of your chosen country. The time span ought to be as long as possible, but avoid periods with some dramatic shifts. Next, estimate the chosen time series with an ARMA model by using the **Box-Jenkins methodology**:

Step 1: visual inspections of data → data transformations → stationarity

Plot original time series and decide what kind of transformation to use in order to achieve stationarity. Usually one considers converting data into real terms, taking natural logarithm, differencing, or detrending time series. Describe the chosen transformation.

Step 2: identification of ARMA process

Plot the sample ACF, PACF and consult the Q-statistics (use the TSP command BJIDENT). Based on these plots choose the proper number of lags of the ARMA model[3]. If the choice of the proper number of lags seems impossible, it suggests your data is most likely non-stationary and you should go back to the step 1 and consider some other or additional transformation or different choice of the time span.

Step 3: estimation of the chosen ARMA process

To estimate the ARMA process use the TSP command BJEST.

Step 4: diagnose of residuals

Plot the sample ACF, PACF, and Q-statistics of the residuals of the model. The residuals should be a white noise. Otherwise something is wrong either with the identification (go back to step 1) or with the data transformation (go back to step 2).

What are your conclusions?

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[1] Time series should represent differing macroeconomic variables like GDP and consumption and not almost identical time series as GDP and GNP.
[2] For short time spans a higher frequency will be needed.
[3] If your plots suggest several potential ARMA models, use the parsimonious one.

Part B – Conditional Heteroskedasticity

1. Download daily data of exchange rates of your country's national currency to the US Dollar[4]. If your country has a short history of its national currency or no series for its currency could be found at all, choose a different country. Pick time periods of 'reasonable' behavior of the time series (no dramatic shifts).

2. If it seems necessary, you can apply logarithmic transformation and/or detrending. Try to avoid differencing. Alternatively you can use logarithm and differencing together to get returns of your time series.

3. Estimate your time series of exchange rates by an AR(P) model using **Box-Jenkins methodology**. Follow step 2 and 3 in the procedure described in part A. For determination of P use the TSP command BJIDENT and to estimate use the TSP command BJEST.

4. Test the residuals for conditional heteroskedasticity using the **LM** and **Ljung-Box tests**.

5. If you reject H_0 in any of the two tests, estimate the corresponding time series of exchange rates by an **AR(P)-GARCH(p,q) model**. Use GARCH command in TSP. For example an AR(1)-GARCH(1,1) model is estimated by a command: ARCH (NOMEAN,NAR=1,NMA=1) Y C Y(-1). Also look at the help examples.

6. Test the residuals for conditional heteroskedasticity.

What are your conclusions?

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[4] Some can be downloaded from http://www.federalreserve.gov/releases/h10/hist/