Homework Assignment 3

Note:

• You may discuss problems with other students, but must hand in your OWN solutions.
• You may use any software to do the empirical analysis even though I use R in the demonstration, especially the MTS package.
• The assignment is due in one week once assigned.
• Due on May 4, 2015 (before class).

1. The data file hw3p1.txt contains 300 observations generated from the VMA(1) model

\[ z_t = a_t - \begin{bmatrix} 0.2 & 0.3 \\ -0.6 & 1.1 \end{bmatrix} a_{t-1}, \]

where \( \{a_t\} \) is a sequence of iid bivariate \( N(0, I_2) \) random vectors.

• Show that the data support the specification of a VMA(1) model.
• Fit a VMA(1) model. Perform model checking and write down the fitted model.
• Use to fitted model to perform 1-step to 2-step ahead forecasts at the forecast origin \( t = 300 \).
• Fit a VAR model to the data. Perform model checking and write down the fitted model.
• Compare the VMA(1) and the VAR model you specified. Draw your conclusions.

2. Again, consider the data set in Problem 1. Perform estimation via the conditional maximum likelihood method first. Then, perform estimation via the exact maximum likelihood method. Compare the two fitted models and draw your conclusions.

3. Consider the monthly log returns of CRSP decile portfolios 1, 2, and 5 from January 1961 to September 2011.

• Specify a VMA model for the 3-dimensional log returns.
• Estimate the specified model via the conditional maximum likelihood method. Refine the model if necessary by removing insignificant estimates with \( t \)-ratio 1.645. Is the model adequate? Write down the fitted model.
• Use the fitted model to obtain forecasts for October and November of 2011.

4. Consider the quarterly U.S. Federal government debt held by (a) foreign and international investors and (b) by the Federal Reserve Banks, in billions of dollars, from 1970.I to 2012.III. Let \( z_t \) be the quarterly growth rate series of the debt, i.e., the first difference of the log debt.
• Specify a VMA model for the growth rate series.
• Fit the specified VMA model and perform model checking.
• Write down the fitted model.
• Use the model to obtain 1-step and 2-step ahead forecasts of the growth rate series at
  the forecast origin 2012.III.

**Reading assignment**: Chapter 3 of the textbook.