**Tutorial Activity 09**

**Week 10**

**Stochastic Volatility Model**

Consider the daily stock prices of CIMB (1023.KL) from January 3, 2011 to October 07, 2016. You may download the prices using **getSymbols** command in **quantmod** package. The prices may also be available in the file **cimb.csv** through the **write.csv** command. Let be the demeaned percentage log returns.

Install **rugarch,** **forecast, sos,** and **stochvol** packages into your computer. The R commands are given in **Tut10-SV.R** script file.

1. Compute the demeaned returns of CIMB stock prices.
2. Using **svsample()** command of **stochvol** package estimate the stochastic volatility model for the full sample period. Plot the median (50% quantile) of latent volatility series. R command lines are as follows:

**result1 <- svsample(ret, draws = 20000, burnin = 1000, priormu = c(-10, 1), priorphi = c(20, 1.1), priorsigma = 0.1, thinlatent=1)**

1. Using **svsample()** command of **stochvol** package estimate the stochastic volatility model for the sample from the 1400th observation to 2668th observation so that we drop the outlier from the sample. Note that we also drop last 100 observations for forecasting exercise. R command lines are as follows:

**result2 <- svsample(ret[1400:2668], priormu = c(-10, 1), draws = 20000, burnin = 1000, priorphi = c(20, 1.1), priorsigma = 0.1, thinlatent=10)**

1. Estimate ARMA(1,1)-EGARCH(1,1) model assuming Student t distribution. Generate the volatility series (conditional standard deviation series) from the estimated model. Use the sample from 1400th observation to 2668th observation.
2. Plot in the same graph with different colours: (i) the median (50% quantile) of latent volatility series from stochastic volatility model and (ii) conditional standard deviation series from the EGARCH model estimated in part (d).
3. Obtain 100 step ahead volatility forecasts using the estimated SV model and AR(1)-EGARCH(1,1) model.
4. Obtain the forecast evaluation measures for the return and volatility series. Identify which model (SV or EGARCH) provides better out-of-sample volatility forecasting accuracy? Use as “actual” (ex-post) series.