Problem Sheet 5: Financial Volatility

Exercise 1

NYSE.XLS contains data on ΔY = the percentage change in stock prices each month from 1952 through 1995 on the New York Stock Exchange (NYSE). For those interested in precise details, the data are value-weighted stock returns exclusive of dividends deflated using the consumer price index. Note that this data is already in differenced form but deviations from the mean have not been taken, i.e. it is ΔY not Y or Δy.

a) Make a time series plot of this data and comment on any patterns you observe.
b) Comment on the univariate time series properties of ΔY. What does its autocorrelation function look like? If you build an AR(p) model using this data what is p? Is ΔY stationary? Are stock returns on the NYSE predictable (i.e. can past stock returns help you to predict current values)?
c) Assume that the original series, Y, follows a random walk such that an AR(0) model for ΔY is appropriate (possibly with an intercept). Calculate the volatility of this variable as described on pages 212-213 of the textbook.
d) Plot the volatility of this series. Does it appear that volatility clustering is present?
e) Construct an AR(p) model for the volatility series and discuss its properties. Can past values of volatility on the stock market help you to predict current volatility?

Exercise 2

Using the NYSE Data from Exercise 1 (i.e. the percentage change in stock prices each month from 1952 through 1995).

a) Estimate ARCH(p) models for various values of p. Is there volatility clustering in this data (i.e. does an ARCH model beat a simpler model where there is constant volatility which means $\gamma_1=..=\gamma_p=0$) ? Which value of p is preferable?
b) For your preferred choice of p, make a time series plot of volatility (i.e. plot a graph of σ_t^2).
c) Repeat parts a) and b) using a GARCH(p,q). Does your graph of volatility look the same with ARCH and GARCH models?