ECON7350: Applied Econometrics for Macroeconomics and Finance

Tutorial 8: Modelling Volatility - I

At the end of this tutorial you should be able to:

- use R to infer the presence of heteroscedasticity using the Breusch-Pagan test;
- construct an adequate set of models with possible GARCH errors;
- use R to estimate volatilities based on models with GARCH errors.

Problems

Consider the daily share prices of Commonwealth Bank (CWB) for the period 5 September 1996—30 August 2006 ($T = 2605$) in the data file `cwb.csv`. Let $\{y_t\}$ denote the process of share prices.

1. Plot the *log share prices* ($\ln y_t$) and comment on the possible features of the DGP.

2. Plot the *returns* ($r_t = \ln y_t - \ln y_{t-1}$) and comment on the possible features of the DGP.
3. Assuming homoscedasticity, identify an adequate set of models ARMA models for r_t.
4. Generate estimated squared residuals for the set of models chosen in Question 3. Plot the squared residuals along with the sample ACFs. Interpret your findings.
5. Test if the errors in your set of models contain ARCH or GARCH effects.
6. Expand the adequate set of models to specifications with heteroscedasticity. To this end, only consider conditional variances modelled with ARCH/GARCH residuals. Hint: Use the `rugarch` package with `ugarchspec` and `ugarchfit` functions.
7. Estimate each model in the set identified in Question 6 and plot the estimated volatilities ($\hat{h}_t$). Interpret the results.