

ECON 147 Homework 5

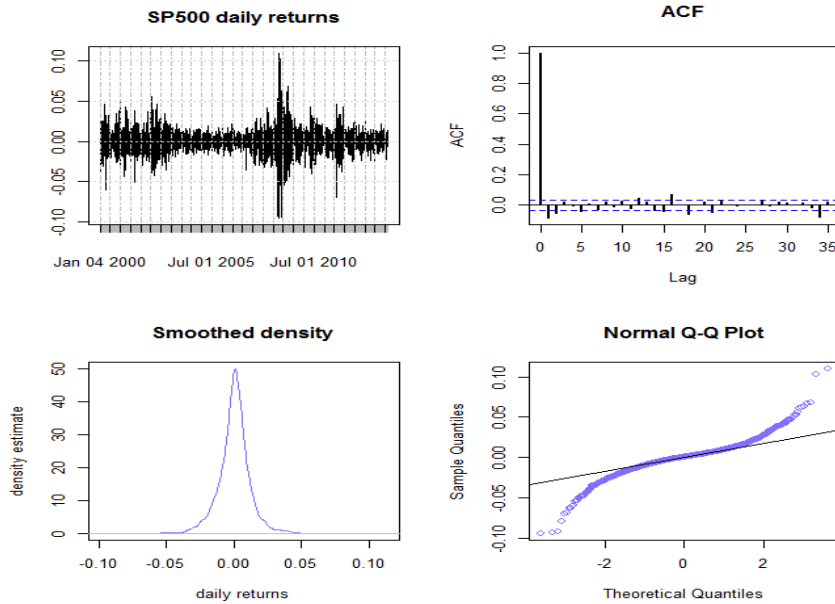
Due: 12:30 pm, May 30th

Reading and Program Downloads

- Please read the course material on the course website.
- For R exercises, the R code (econ147lab5_Hint.r) will be helpful. Make sure you understand the output rather than just following the hint.

Review Questions

- The followings are descriptive statistics of daily cc returns on S&P 500 index (Jan 3, 2000 - Feb 21, 2014: T=3,555).



- Describe the stylized facts on the return series based on the above information.
- (ARCH(1) Model)** Assuming that we use the following model:

$$\begin{aligned} r_t &= \sigma_t e_t, \quad e_t \sim iid N(0, 1), \quad t = 1, \dots, T \\ \sigma_t^2 &= \omega + \alpha_1 r_{t-1}^2, \quad \omega > 0 \text{ and } \alpha_1 \geq 0. \end{aligned}$$

Show that this model can generate the stylized facts you explained in (a).

- (GARCH(1,1) Model)** Now we turn to the following model:

$$\begin{aligned} r_t &= \sigma_t e_t, \quad e_t \sim iid N(0, 1), \quad t = 1, \dots, T \\ \sigma_t^2 &= \omega + \alpha_1 r_{t-1}^2 + \beta_1 \sigma_{t-1}^2, \quad \omega > 0, \alpha_1 \geq 0 \text{ and } \beta_1 \geq 0. \end{aligned}$$

Show that this model can be interpreted as ARMA (1,1) model for squared returns.

R Exercises

The following questions require R. On the course website is the R script files `econ147lab5_Hint.r`. The file contains hints for completing this R exercises. Copy and paste all statistical results and graphs into a MS Word document (or your favorite word processor) while you work, and add any comments and answer all questions in this document. Start MS Word and open a blank document. You will save all of your work in this document.

In this lab, you will analyze continuously compounded monthly return data on the S&P 500 index (`^GSPC`) and Microsoft stock (`MSFT`). I encourage you to go to finance.yahoo.com and research these assets. The script file `econ147lab5_Hint.r` walks you through all of the computations for the lab. You will also need to install several packages.

1. Do the following exercises.
 - (a) Make time plots of the return data from 2000-01-03 to 2014-02-21. Comment on any stylized fact on returns suggested by the plots.
 - (b) For each return series, make a four panel plot containing a return plot, acf, density plot and normal QQ-plot. Do the return series look normally distributed?
 - (c) Testing normality of each return distribution using Jarque-Bera test statistics.
 - (d) Now estimate GARCH(1,1) model parameters (as in Review Questions) and report the estimated values of $\alpha_1 + \beta_1$. How do you interpret these results?
 - (e) Plot the real cc returns and the fitted cc returns for MSFT and GSPC respectively. Comment on what you find.
 - (f) For parameter α_1 and β_1 compute 95% and (asymptotic) confidence intervals.
 - (g) Test $H_0 : \alpha_1 = 0$ with 95% confidence level for each returns. Do the test $H_0 : \beta_1 = 0.9$ as well.