

THE UNIVERSITY OF CHICAGO
Graduate School of Business
Business 41202, Spring Quarter 2008, Mr. Ruey S. Tsay

Homework Assignment #4

Note:

1. **Due Date:** Campus and Evening classes: May 6, 2008.
 2. All tests use the 5% significance level for type-I error.
 3. For daily series, use ten (10) lags in all ACF or ARCH-effect tests. For monthly series, use twelve (12) lags.
 4. The purpose of this assignment is to analyze the volatility series of daily and monthly asset returns.
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1. The file “d-catvw0007.txt” contains the daily simple returns of Caterpillar stock (CAT) and the value-weighted (VW) composite index from 2000 to 2007. The file consists of date, CAT return, and VW returns in three columns. The returns include dividends. Convert the simple returns into log returns. This problem focuses on the CAT stock returns.
 - The $Q(m)$ statistics show that the log return series of CAT stock has no serial correlations so that the mean equation is simply a constant. Is there any ARCH effect in the log returns of CAT stock?
 - Specify and fit an ARCH model to the log returns of CAT stock. Write down the fitted model.
 - Fit a GARCH(1,1) model for the log return of CAT stock using Gaussian distribution for the innovations. Perform model checking, and write down the fitted model.
 - Fit the GARCH(1,1) model again using the Student-t distribution for the innovations. Write down the fitted model.
 - Among the three fitted volatility models, choose one that appears to be the best. Why?
 2. Consider the daily log returns of the VW index in Problem 1.
 - Is there any serial correlation in the log returns of VW index?

- Is there any ARCH effect in the log return series of VW index?
 - Fit an IGARCH(1,1) model for the log return series of the index using Student-t distribution for the innovations.
 - Compute 1- to 4-step ahead forecasts for the daily log return and its volatility based on the fitted model. [Note: volatility not variance.]
3. Again, consider the daily log returns of CAT stock in Problem 1.
- Fit a GARCH(1,1)-M model for the series with Student-t distribution. Write down the fitted model.
 - Is the ARCH-in-mean parameter significant at the 5% level?
 - Fit a GJR(1,1) model with Gaussian innovations to the log return series. Perform model checking and write down the fitted model.
 - Is the “leverage” parameter significant?
4. The data file “m-ge4007.txt” contains the date and monthly simple returns of General Electrics (GE) stock from 1940 to 2007. Transform the simple returns into log returns.
- Is there any serial correlation in the monthly log returns of GE stock?
 - Fit a GARCH(1,1) model to the monthly percentage log returns of GE stock using generalized error distribution for the innovations. Write down the fitted model.
 - Use the fitted model to calculate 1-step to 5-step ahead forecasts for the log returns series and its volatility.
5. The file “d-exszus.txt” contains the daily exchange rate of Swiss Francs to one U.S. Dollar from January 1980 to April 22, 2008. Compute the log returns of the exchange rate.
- Is there any serial correlation in the log return series?
 - Is there any ARCH effect in the log return series?
 - Fit an IGARCH(1,1) model to the log return series using Gaussian innovations. Perform model checking and write down the fitted model. [Note: This is the model used in RiskMetrics to compute VaR.]
 - Use the model to produce 1-step to 4-step ahead forecasts for the log return series and its volatility.

Reading assignments: Chapter 3 of the textbook.