Econ 512 Lab 2 Part II
GARCH

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Due: May 9, 2002.

1 Exercises

1. Modification of Tsay (2001), chapter 3, exercise 8. For this exercise, use the data in the file m-gmsp5099.dat which contains the monthly log returns, in percentages, of General Motors and S&P 500 index from 1950 to 1999. The GM returns are in column 1.

   (a) Build a GARCH(p, q) model with normal errors for the log returns on GM stock. The model should have the form

   $$\begin{aligned} y_t &= c + \varepsilon_t \\ \varepsilon_t &\sim \text{GARCH}(p, q) \end{aligned}$$

   Justify your final model with the usual diagnostics and write down the final fitted model.

   (b) Build a GARCH-M model with normal errors for the log returns on GM stock. Justify your final model with the usual diagnostics and write down the final fitted model.

   (c) Build a GARCH model where the errors follow a Student-t distribution with 6 degrees of freedom. Check the model and write down the fitted model.

   (d) Build a GARCH model where the errors follow a Student-t distribution and the degrees of freedom are estimated. Write down the fitted model. Let v be the degrees of freedom on the Student-t distribution. Test the hypothesis that $v = 6$ against the alternative that $v \neq 6$ using a likelihood ratio statistic and a 5% significance level. What do you conclude?

   (e) Build an EGARCH model (without leverage effects) for the log returns of GM stock. Justify your final model with the usual diagnostics and write down the final fitted model.

(f) Compare all the volatility models obtained for the log returns of GM stock. Is there any significant difference? Why?

(g) Compute $h-$ step ahead volatility prediction for $h = 1, \ldots, 6$ for all the models. Briefly compare the volatility predictions.

2. Modification of Tsay (2001), chapter 3, exercise 9. For this exercise, use the data in the file m-gmsp5099.dat which contains the monthly log returns, in percentages, of General Motors and S&P 500 index from 1950 to 1999. The GM returns are in column 1.

(a) Build a GARCH model with normal errors for the monthly log returns of S&P 500 index. Check your final model with the usual diagnostics and write down the final fitted model.

(b) Is there a summer effect on the volatility of the index return? Use the GARCH model built in part (a) to answer this question. How would you account for seasonality in the conditional variance equation?

(c) Are lagged returns of GM stock useful in modeling the index volatility? Use the GARCH model built in part (a) as a baseline for comparison.