

Financial Time Series

Assignment #6

Notes

This assignment is concerned with Value at Risk and Expected Shortfall. Assume that the tail probability of interest is 1% and the portfolio consists of two stocks, namely Amazon (AMZN) and Merck (MRK). The sample period is from January 2, 2004 to May 19, 2017. Download the AMZN data from <http://www.math.ttu.edu/~atrindad/tsdata>, under the name `Amazon.csv`. The MRK data can be downloaded from Yahoo Google via the `quantmod` package (adjusted closing prices). For all Questions, assume that you hold both stocks valued at \$1 million each (long position).

Questions

1. (Amazon stock: Econometric risk measures). Consider the Amazon stock only.
 - (a) Calculate the VaR of your position for the next trading day using the RiskMetrics method on May 19, 2017. You must estimate the corresponding IGARCH(1,1) model. What is the associated expected shortfall? Also, what is the VaR for the next 10 trading days?
 - (b) Build a GARCH(1,1) model for the log return series with Gaussian innovations. What is the VaR based on the fitted model for the next trading day? What is the corresponding expected shortfall?
 - (c) Build a GARCH(1,1) model with Student-t innovations for the log return series. What is the VaR for the next trading day based on the fitted model? What is the corresponding expected shortfall?
 - (d) Use the empirical method to estimate VaR and expected shortfall for the next trading day.

2. (Amazon stock: EVT risk measures). Consider the Amazon stock only.
 - (a) Using blocks of size 21, fit a generalized extreme value distribution to the appropriate return series (long position). Write down the estimates and their standard errors.
 - (b) Compute the 1% VaR of your financial position based on the fitted parameters. What is the 1% VaR of your financial position for the next 10 trading days?
3. (Amazon stock: GPD risk measures). Consider the Amazon stock only.
 - (a) Fit a generalized Pareto distribution to the appropriate return series (long position) with threshold 2.0%. Write down the estimates and their standard errors.
 - (b) Based on the fitted model, what is the 1% VaR of your position? What is the associated expected shortfall?
 - (c) Repeat the analysis using threshold 3.0%. Are the results sensitive to the choice of thresholds? Why?
4. (Amazon stock: Overview of all risk measures). Consider the Amazon stock only. Tabulate and compare all the various 1% VaR values for 1 day ahead based on Questions 1 to 3.
5. (Amazon & Merck stock: Portfolio risk). Consider a portfolio with weights $(w, 1 - w)$ consisting, respectively, of the Amazon & Merck stocks. We wish to calculate the VaR for the portfolio using the Riskmetrics approach under different scenarios: (i) $w = 1$ (done in Question 1(a)); (ii) $w = 0.5$; (iii) $w = 0$. Which of the 3 scenarios results in the lowest risk?