FNCE 5321: Financial Risk Modeling II

Spring 2017

Practice Exam

Multiple Choice Questions

1. Consider arbitrary portfolios A and B, and their combined portfolio C, which of the following relationships always holds for VaRs of A, B, and C?

   A) $VaR_A + VaR_B = VaR_C$

   B) $VaR_A + VaR_B \geq VaR_C$

   C) $VaR_A + VaR_B \leq VaR_C$

   D) None of the above

2. For which of the following purposes is a long time horizon advisable when computing the VaR?

   A) in order to provide a more accurate measurement of the VaR

   B) for capital adequacy purposes

   C) for backtesting purposes

   D) for portfolio of derivatives

3. A bank is backtesting its daily 5% VaR. What is the expected number of daily violations for the bank over the last year?

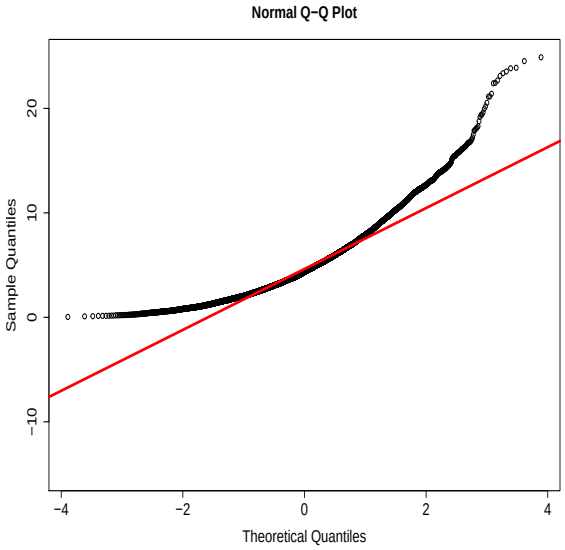
   A) 0

   B) 5

   C) 13

   D) 50

Figure 1



4. Figure 1 shows the QQ-plot of randomly simulated observations from a Chi-squred distributed variable. Which of the following is correct?

   I. The Chi-squared distribution has fatter left tails
   II. The Chi-squared distribution has thinner left tails
   III. The Chi-squared distribution has fatter right tails
   IV. The Chi-squared distribution has thinner right tails

   A) I and III
   B) I and IV
   C) II and III
   D) II and IV

5. You make QQ-plots of the following variables against the standard normal distribution. Which of the following deviates the most from the straight line in the QQ-plot?

   A) A normally distributed variable with standard deviation equal to 1%

B) A normally distributed variable with standard deviation equal to 5%

C) A t distributed variable with the degree of freedom equal to 5

D) A t distributed variable with the degree of freedom equal to 10

6. Which of the following statements regarding the leverage effect is not correct?

A) The leverage effect refers to the stylized fact that equity and bond markets tend to comove more negatively in economic recessions

B) The non-linear GARCH model can account for the leverage effect

C) The leverage effect refers to the stylized fact that negative equity returns often causes higher future volatility

D) A decrease in equity price mechanically increases the financial leverage of firms, which makes their equity riskier

7. A bank is backtesting its daily 5% VaR. Which of the following hit sequences most likely fails the independence test?

A) 0, 1, 0, 0, 0, 0, 0, 0, 0, 0

B) 0, 1, 0, 0, 0, 0, 0, 0, 1, 0

C) 0, 1, 1, 0, 0, 0, 0, 0, 0, 0

D) 0, 1, 1, 1, 0, 0, 0, 0, 0, 0

8. Which of the following statements is not true regarding the RiskMetrics model and the GARCH model?

A) The RiskMetrics model does not have a well-defined long-run or unconditional variance

B) The GARCH model does have a well-defined long-run or unconditional variance

C) For the RiskMetrics model, multi-horizon VaRs are equal to single-period VaR multiplied by the square root of the horizon

D) For the GARCH model, multi-horizon VaRs are equal to single-period VaR multiplied by the square root of the horizon

Analytical Questions

1. (a) Describe the Filtered Historical Simulation approach to estimate VaR.

   (b) What is the theoretical advantage of Filtered Historical Simulation approach relative to the parametric GARCH approach?

2. At the end of day on Black Monday (October 19th 1987), you would like to estimate the term structure of VaRs and expected shortfalls on the S&P 500 index for the next 300 days. The first thing you did is to fit a GARCH(1,1) model to the past two years of data to obtain the one-step ahead volatility forecast (denoted by σ_{t+1}), and the parameters ω, α, and β of the GARCH(1,1) model.

   Describe the steps you would take to estimate the term structure of VaRs and expected shortfalls using the Monte Carlo Simulation method, in which you use standard normal shocks and you update future volatility usiing the GARCH(1,1) model.

3. An insurance company is backtesting its VaR methodology using data from March 6th 2017 to March 24th 2017 (i.e. a total of 15 daily observations).

   The estimated daily 5% VaRs during this period are correspondingly 0.0316, 0.0304, 0.0292, 0.0366, 0.0354, 0.0371, 0.0441, 0.0424, 0.0419, 0.0402, 0.0538, 0.0531, 0.0643, 0.0713, 0.0758.

   The daily equity returns of the insurance company over this period are correspondingly -0.00406, -0.00153, -0.03036, 0.00446, 0.02047, -0.03473, 0.00618, 0.01403, 0.00213, -0.04828, 0.01737, -0.04826, 0.04274, 0.03946, -0.03894.

   (a) What is the hit sequence for this 15 observations?

   (b) You would like to conduct the unconditional coverage test. Calculate the likelihood for the null hypothesis and the alternative hypothesis.

   (c) Calculate the likelihood ratio statistic for the unconditional coverage test. Would you reject the null hypothesis? (Hint: The 95% quantile of χ^2_1 is 3.84)