MFE 409: Financial Risk Management
Problem set 4

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due 4/28 before midnight

You should work with your assigned group but should write up your answer individually. Give the name of your group members in your writeup and submit it on BruinLearn before April 28 at midnight.

1 Choosing a VaR technique

Download the excel file which contains the time series of gains for a strategy from 1/2/2014 to 12/19/2017.

1. *Historical method*
   (a) For each day in 2015-2017, compute historical VaR and exponential weighted 1-day 99%-VaR (with $\lambda = 0.995$).
   (b) Backtest the measures for VaR you obtained in question 1. How many exceptions did the two measures produce? What do you conclude?
   (c) For each day in the sample, compute the 95% confidence intervals of the historical VaR and the exponential weighted VaR you obtained in question 1, using both parametric (for the historical VaR) and bootstrap methods (for the two measures). For the parametric method, assume the gains are normally distributed.
2. *Model-building approach*
   (a) Compute volatility using the EWMA with $\lambda = 0.96$. Compute the corresponding measure of VaR.
   (b) Use maximum likelihood estimation to estimate a GARCH model for volatility. Compute the corresponding measure of VaR.
   (c) Compare the results from the two approaches.
3. *A mixed approach*
   (a) For each day in the sample, compute the volatility of the portfolio in the previous month. Normalize gains with estimated volatility. Compare the distribution of the normalized gain with the original ones.

(b) Develop an approach to measure VaR which takes advantage of your response to the previous question. Implement it and compare its exceptions with the previous approaches. *Optional: You can use the approach of extreme value theory.*

4. Combining your answers to the previous questions, write a proposal to the head of trading for measuring the risk of this trade in real time, justifying your choices.