MFE 409: Financial Risk Management
Problem set 1

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due 4/6 before midnight

You should work with your group but should write up your answer individually. Give the name of your group members in your writeup and submit it on CCLE before Monday April 6 at midnight.

1 VaR for an exponential distribution

1. Assume an asset value in 10 days follows an exponential distribution with mean W_0. Derive a formula for the value-at-risk for confidence c and reference level W_0 for the asset. Apply with $W_0 = 100$ and $c = 99\%$.

2. Now assume you are short this asset. Compute your value-at-risk for confidence c and apply with the same numerical values.

3. Comment on the similarity or difference between the results in the two questions.

4. Repeat the previous questions with expected shortfall.

2 VaR for mixtures

You have to allocate $1bn in the stock market. You are discussing with your partner regarding the volatility of returns. She has a view that, in line with historical averages, the volatility of returns will be of σ_1=10% in the next year. However, you believe that volatility will be higher, in the orders of σ_2=15% for the next year. After discussing with your partner, you agree in the following way: stocks returns follow a normal distribution with mean μ and σ_1 with probability π and normal distribution with mean μ and σ_2 with probability $1 - \pi$. For now assume that $\mu = 7\%$ and $\pi = 0.6$.

1. Compute the 1-year 99% VaR with your view, with your partner view, and with the common view. Compare results and provide a very brief explanation as if you were presenting to your manager.

2. To understand the role of π, plot a chart with π between 0 and 1 on the horizontal axiswhich and the corresponding VaR on the vertical axis. Comment on your results.

3. *More challenging.* After presenting your common view to your manager, you are challenged with an alternative view about volatility: σ is time-varying. The volatility trader suggests that a sensible model for sigma is a gamma distribution. Explain in as many details as possible (either derive of formula or use a computer program) how to compute the VaR of your portfolio when returns have a normal distribution conditional on σ and σ is distributed according to a Gamma distribution.