

# CQF Value at Risk

## Exercises

1. Consider a position of £5 million in a single asset X with daily volatility of 1%. What are the annualised and 10-day standard deviations? Using the Normal factor calculate 99%/10day VaR in money terms.
2. Now, consider a portfolio of two assets X and Y, £100,000 investment each. The daily volatilities of both assets are 1% and correlation between their returns is  $\rho_{XY} = 0.3$ . Calculate 99%/5day Analytical VaR (in money terms) for this portfolio.
3. Assume that P&L of an investment portfolio is a random variable that follows Normal distribution  $X \sim N(\mu, \sigma^2)$ . Use the definition of *VaR as a percentile* to derive analytical expression for VaR calculation.
4. Assume ‘elliptical markets’: asset returns are Normally distributed or close. What percentage of returns are outside two standard deviations from the mean? Consider the left tail.

*Within that tail*, what is the mean of standardised returns – that is, what is an average tail loss? Provide analytical solutions for abstract  $\mu, \sigma$  using a simplifying assumption of Standard Normal Distribution.

PDF for Normal Distribution  $N(\mu, \sigma^2)$  is  $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ .

5. What are the two main numerical methods used for the Empirical VaR estimation? What are their drawbacks?