

# FINM3405 Derivatives and risk management

## Tutorial Sheet 12: VaR and ES

October 19, 2024

**Question 1.** Explain in words what VaR and ES are measuring, what are the potential shortfalls of VaR, and why ES may be advantageous over VaR.

**Question 2.** How may VaR and ES be inaccurate when quantifying a share portfolio's market risk under the assumption of normally distributed returns? How might one get around this problem?

**Question 3.** Suppose returns are normally distributed. You hold a \$10m portfolio whose mean daily return is  $\mu = 0.08\%$  and whose standard deviation (volatility) in daily returns is  $\sigma = 1.5\%$ . What is the daily  $\alpha = 2.5\%$  (sometimes also referred to as the 97.5%) VaR and ES of your portfolio? Also calculate the daily VaR and ES for confidence levels of 95% and 99% (so  $\alpha = 5\%$  and  $\alpha = 1\%$ ). Plot the normal PDF modelling the distribution in the daily changes in your portfolio value (profits/losses) as well as the VaR and ES.

**Question 4.** Continue to assume returns are normally distributed. You hold a portfolio of  $Q_1 = 100$  units invested in share 1 whose current price is  $P_1 = 50$ , and  $Q_2 = 150$  units invested in share 2 whose current price  $P_2 = 35$ . Suppose the daily expected returns are zero and the daily standard deviations in returns are  $\sigma_1 = 1\%$  and  $\sigma_2 = 1.3\%$ . Calculate the individual 99% daily VaRs, the portfolio's worst case daily 99% VaR, and the gains from diversification if the correlation in returns is  $\rho = 0.5$ . Plot the normal PDF modelling the distribution in the daily changes in your portfolio value (profits/losses) as well as the VaR and ES, and the worst case VaR.