

Risk Management: Assignment 3

Financial Engineering

Equity Portfolio VaR/ES and Counterparty Risk

Instructions

- **Delivery:** Friday 18:00 p.m. the 28th of March to financial.engineering.polimi@gmail.com, with subject "RM: Assignment 3, Group #";
- Deliver
 - a **short** pdf document with the results. List the errors you've found.
 - the code written in Python using your preferred IDE;
- Fill the gaps where appropriate and correct the errors (in case of incoherences between this document and the code, follow this document);
- Comment (in detail) the code and use explicative variable names.

Case study 1

At the end of the 31st of January 2020 the risk management team of Polimi AM, due to different rules on four portfolios, has to compute risk measures (significance level 95%) as follows (the trading days of the different stocks are not the same, add previous day value in case of missing share price):

1. Portfolio1 with equal weights on BMW, BNP Paribas, Danone, Nokia and Total. Compute daily VaR and ES with a 4y estimation via gaussian parametric approach. The notional of the portfolio is €25m;
2. Portfolio2 with Adidas (25K shares), Allianz (20K shares), ASML (20K shares) and Deutsche Boerse (10K shares). Compute daily VaR and ES with a 3y estimation via a historical simulation approach and a bootstrap method with 300 simulations;
3. Portfolio3 with equal weights in Airbus, BBVA, BMW, Eni, ING and Schneider. Compute daily VaR and ES with a 4y estimation via a weighted historical simulation approach with $\lambda = 0.95$. Also the notional of this portfolio is €25m;
4. Portfolio4 with equal weights in the last 20 companies in the provided csv file (consider Inditex instead of Prosus due to missing data). Compute 10 days VaR and ES with a 3y estimation gaussian parametric PCA approach varying the number of principal components used. Comment the results;

Finally, for portfolios 2, 3 and 4 the risk manager checks results order of magnitude via a plausibility check.

Case study 2

At the end of the 31st of January 2023 consider a portfolio formed by stocks of Anheuser-Busch for €5,509,000 and the same number of put options with expiry on the 5th of April 2023, with strike €53 and implied volatility equal to 18.5%. The market price a 3% dividend yield for Anheuser-Busch. To price the option use the bootstrap data from the Risk Management: Assignment 0.

Questions

1. Using a 2y historical simulation for the underlying, compute a 10days/99% VaR via a Monte-Carlo and a delta normal approaches (only delta term);
2. Can you improve the delta normal VaR? How?

Case study 3

On the 31st of January 2023 at 10:45 C.E.T. Polimi Bank buys from ISP a 5y Cliquet option for a

€50m notional. Option yearly payoff (annual bond) at payment date is: $[S(t_{i-1}) - S(t_i)] +$
The option is on an equity stock with no dividends, trading at €2.5 and with constant volatility 25%.
For ISP default probabilities use the results from the third laboratory.

Questions

1. What should be the correct price?
2. At what price ISP would try to sell it?