

Project: Value at Risk (VaR) and Expected Shortfall

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Objective

Estimate Value at Risk (VaR) and Expected Shortfall (ES) for a portfolio of synthetic returns. VaR provides a threshold return level such that losses beyond this level occur with a given small probability. Expected Shortfall complements VaR by capturing the average loss in the tail beyond the VaR cutoff.

Methodology

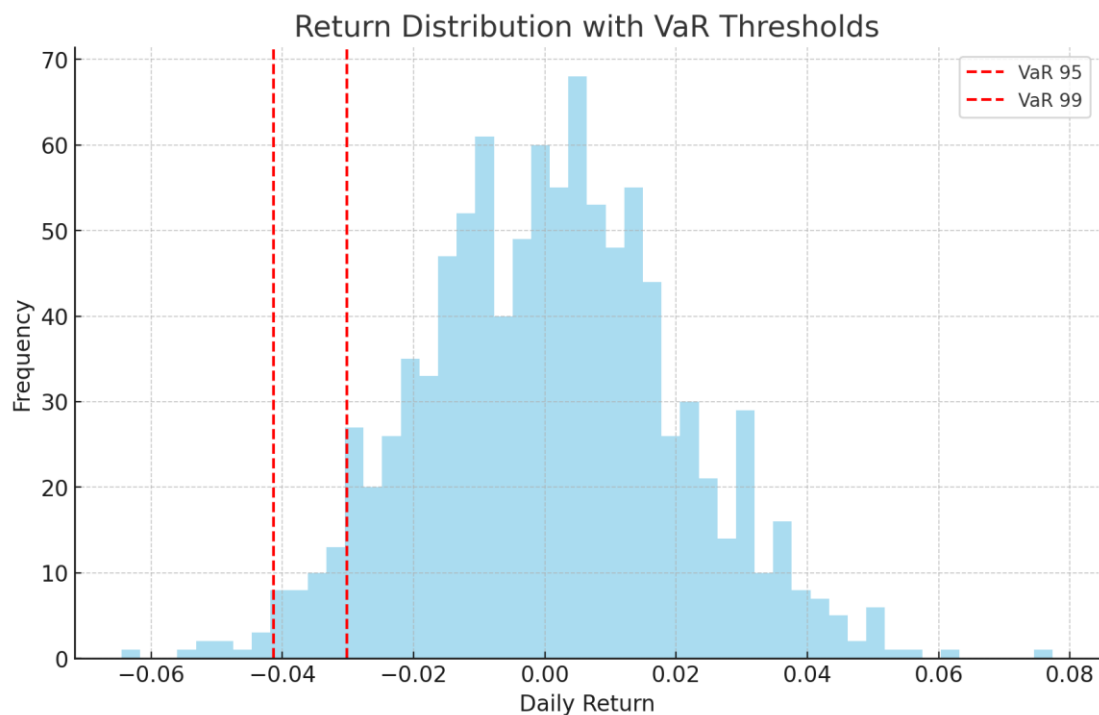
- Simulated 1,000 daily returns from a normal distribution.
- Calculated 95% and 99% quantiles for Historical VaR.
- Computed Expected Shortfall as the mean of returns below the VaR threshold.
- Produced histograms with VaR cutoffs and a rolling 95% VaR chart.

Results

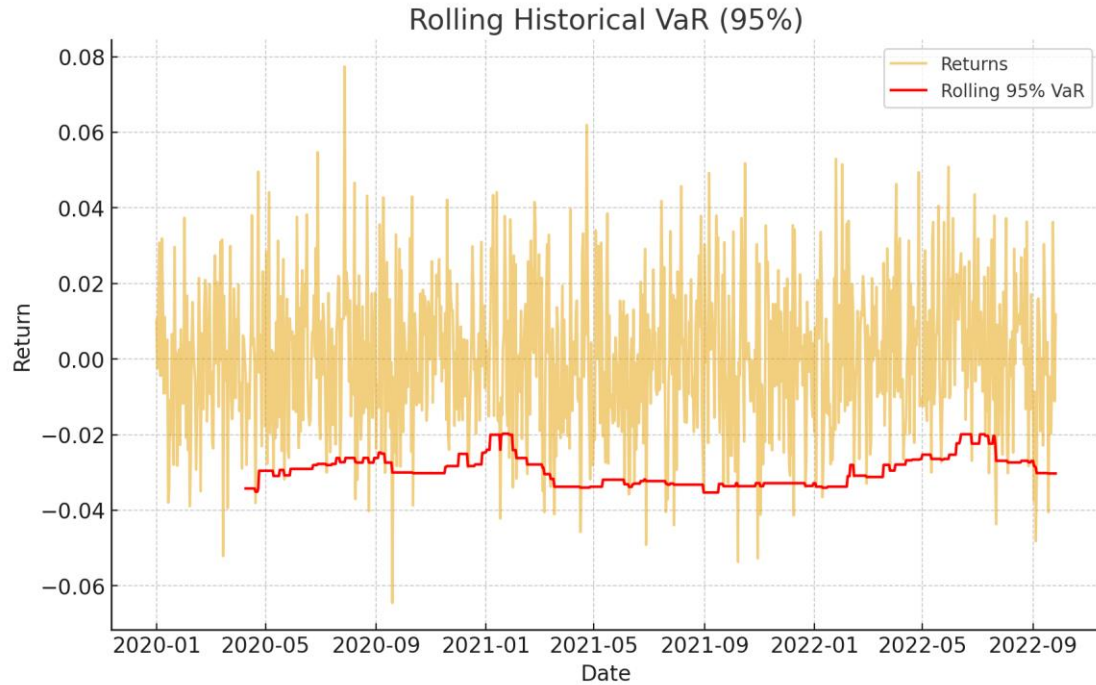
From synthetic returns:

- VaR 95% = -0.0302, ES 95% = -0.0382
- VaR 99% = -0.0413, ES 99% = -0.0496

Return distribution with VaR thresholds:



Rolling 95% Historical VaR:



Discussion & Notes

VaR provides a simple threshold-based risk metric but does not account for losses beyond that cutoff. Expected Shortfall improves on this by averaging tail losses, making it a coherent risk measure. Extensions include parametric VaR (assuming distributional form) and Monte Carlo VaR using simulated returns.