Case Study 2023-2024

During the first half of 2023, there were a number of bank failures in the U.S., notably SVB and also collapse of Credit Suisse headquarters in Switzerland.

Please work on the following steps to build your own portfolio and monitor its risk.

(1) **Data Preparation**: Obtain the historical data including equities, bonds, etc. Construct your optimal portfolio.

Definition: Value-at-Risk (VaR) is the maximum loss over a target horizon such that the probability that the actual loss is larger is equal to $1-\alpha$.

(2) **VaR Estimation** [2][3] :

a. Based on your portfolio, estimate the 1-day Value-at-Risk (VaR) values at confidence levels: 95% and 99% using the normal distribution

Notice that, due to our rolling data window, σ^2 *changes over time, sometimes dramatically so. This implies that newer observations are more valuable than older observations in our data window. One common approach is called the Exponentially Weighted Moving Average VaR (EWMA VaR).*

b. Repeat step (2.a) compute the VaR values by weighting newer data more heavily than older data.

Unlike the normal distribution or t distribution methods, historical VaR simulation is a non-parametric method. It does not assume a particular distribution of the asset P&L.

c. Recalculate your VaR values using historical simulations.

d. Backtest your estimation

(3) **Liquidity Risk:**

a. How to evaluate and measure the liquidity risk of your portfolio?

b. Scenario Test: How does the rate shock impact your portfolio?

Reference:

[1] MATLAB Datafeed Toolbox™: https://www.mathworks.com/products/datafeed.html

[2] MATLAB Risk Management Toolbox: https://www.mathworks.com/products/risk-management.html

[3] Value-at-Risk Estimation and Backtesting: https://www.mathworks.com/help/risk/value-at-risk-estimation-and-backtesting.html

[4] Nieppola, O., Backtesting Value-at-Risk Models. Helsinki School of Business. 2009.