FANG refers to Amazon (AMZN), Netflix (NFLX) and Google/Alphabet(GOOG).

Together with Apple (AAPL) and Microsoft (MSFT), they stand for the lion's share of technology

stocks (44:7% of Nasdaq). Stocks of these technology big names outperform SP500, but they are

also, subject to larger draw down and volatility. The goal of this project is to construct a portfolio

of big tech stocks to balance their growth prospect and risk exposure.

Some of these instructions are intentionally vague and open ended, they may not have universal

correct answers.

(a) Download daily shock prices data for AAPL, AMZN, GOOG, MSFT, and NFLX in

the last 10 years for Wharton Research Data Services or Yahoo Finance. Download SP500

daily value for the same period of time. Prepare the data so that it can be analyzed by R. Calculate and plot the log return for stock prices and the SP500. Comment on what

happened for these stock prices and the index during this period of time. Can you find any

special events and what have happened for these stock prices during these special events?

(b) Construct portfolios of stocks using the following two strategies. Assume that the initial

investment in each stock is $1000 at the beginning of the time period.

\_ Value. Assume that returns of stock prices are mean-reverting around their long-run

mean return. Therefore, stocks whose return is lower than its long-run mean is expected

to have higher return in the future; meanwhile stocks whose return is higher than its

long-run mean is expected to have lower return later. Therefore, if we believe this

assumption, we should buy low and sell high.

\_ Momentum. Assume that returns of stock prices have momentum feature, i.e., stocks

which start to have \abnormal" return may continue this pattern for a period of time.

Therefore, we need to buy stocks with high abnormal return and sell stocks with low

abnormal return.

Design two portfolios following above strategies. For these two different strategies, portfolios

are rebalanced at the same frequency, either daily or monthly. (In the construction of these

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two portfolios, we need to estimate their long-run mean return. We cannot use future

returns to calculate the long-run mean.)

Compute the 99% VaR and 97:5% Expected Shortfall for these two portfolios, using both

normal models and historical approach. Compare performance of these two portfolios and

the SP500 index.

(c) We can use autocorrelations of stock returns to identify whether they are Value stocks or

Momentum stocks. Improve the portfolio construction in part (b) using the autocorrelations

on a rolling window. Stocks with negative autocorrelations are likely to be Value stocks;

Stocks with positive autocorrelations may be Momentum stocks. You can then use the

autocorrelation on the current time window to determine the investment style for the next

period.

Compute the 99% VaR and 97:5% Expected Shortfall for this portfolio, using both normal

models and historical approach. Compare its performance with the two portfolios and the

SP500 index in part (b).

(d) Use the weight of the six technology stocks in Nasdaq to create a mini-index. Analyze the

dependence between this mini-index with SP500 using copulas of different types. Among

the copulas we learned in class, which copula best \_t the observation?

(e) These technology stocks sometimes experience large drawdown, for example, Facebook data

scandal or the recent tech stock downturn in October. Find such an event of the mini-index

constructed in part (d). Analyze its return level and return period. (Remember you need

sufficient long historical data to do this.)