Problem statement

One of the main roles of financial advisors is the construction of investment portfolios for their clients (investors) according to their individual needs and objectives of the investors. Many times, it is about maximising wealth with as less risk-taking as possible, particularly for risk-averse investors. From an Operational Research perspective, we may consider this as a constrained problem of maximizing return on investment. The aim is to create a suitable portfolio of assets that achieves the specific objectives of the investor.

Imagine that you are a financial analyst working at Hymans Robertson LLP. The Investment Manager has asked you to construct an efficient portfolio of equity assets (stocks) for a client. The initial information given to you is the following:

The client has £300,000 in capital to invest in a portfolio and wants to get the highest return possible with the lowest risk over a period of 6 months.

Because the investor is risk-averse, the Investment Manager has asked you:

- To not invest more than 15% of the capital in one single stock.

- To collect 20 years of historical data of the closing monthly stock price to calculate the expected return and volatility.

- To build a portfolio with a minimum of 10 and a maximum of 20 stocks.

Task

You need to construct a diversified efficient portfolio taking into consideration the above constraints.

This task was also assigned to other Junior Analysts like you. At the last meeting, the Investment Manager announced that the Junior Analyst or team of two Junior Analysts that presents the best report will get a promotion.

As the Investment Manager needs to make sure you did a good job, you are required to submit two reports, a client report and a business report. They must satisfying the following guidelines:

1) The business report will only be read by the Investment Manager. It must be at most 10 pages long, excluding appendices, with detailed explanations of the calculations performed and the thinking underlying your analysis. You must also explain the limitations of your modelling approach and any caveats that apply to your results and recommendations.

2) The client report will be given to the client. The information in this report must be convincing enough for the client to pick your portfolio. You do not need to include any technical details.

Suggested approaches

- The closing data of each stock can be downloaded for free [here](). Instructions on how to download historical data are given [here]().

- You can take standard deviation of returns as a measure of risk of the asset class and/or portfolios or you can also use other risk-measures.

- Assume the return distributions are normal (or any other with suitable justifications) with the mean and standard deviation obtained earlier.

- You can assume there are no taxes and transaction costs involved.

- You may need to look at the concepts of Modern Portfolio Theory in the context of portfolio optimisation. For instance, if you opt to use the Modern Portfolio Theory, you will be looking for the highest Sharpe ratio.

- You may need to look at the concepts of efficient frontier, efficient portfolio, and optimal portfolio in the context of portfolio optimisation.

Hints

- You may make reasonable assumptions about risk-free rates, if needed.

- You should think about the benefits of diversification that arise from correlations. This is important because choosing a suitable combination stocks can reduce the risk of the portfolio substantially.

- You can take a look at the following source:

[Portfolio Optimization]()