Portfolio Risk Optimization

Agenda of this Video...

1. What is a Portfolio?
2. Portfolio vs Fund
3. Real Life Use Cases of Portfolio Risk Management
4. Why do we need portfolio analysis?
5. Some terminologies
6. Creating a Portfolio of stocks Facebook, Amazon, Apple, Netflix and Google (Also known as FAANG for short) in Python Step by Step.
   a. Getting the data.
   b. Computing Return metrics.
   c. Computing Risk metrics.
   d. Compute an Optimal Portfolio.
7. Task For you..

What is Portfolio?

Portfolio is a collection of investment options (stocks, bonds, crypto etc) for an investor.

Examples….
Portfolio-1 [APPLE STOCK = 20 %, MICROSOFT STOCK = 80 %]

Portfolio-2 [APPLE STOCK = 10 %, AMAZON STOCK = 10% MICROSOFT STOCK = 80 %]

Portfolio-3 [AMAZON STOCK = 40 %, MICROSOFT STOCK = 60 %]

Portfolio-4 [APPLE STOCK = 50 %, MICROSOFT STOCK = 50 %]

Portfolio vs Fund

Portfolio = Collection of Funds or Investments owned by an individual

Fund = Fund is a Pool of investment which is management of Professional Fund Manager

A professional Fund manager directly invests in a share or a bond but an individual investor just purchases units of funds.

Real Life use cases of Portfolio Risk Management

1. One of main use case of portfolio risk analysis or portfolio optimization is for individuals who invest regularly in the marker and who would like to know what would be the best combination of funds to put his/her money into.
2. There are some dedicated firms which just provide this service of optimization of portfolios for their clients. They have designated people specializing in the field of doing portfolio analysis. They are usually known as “Portfolio Fund Manager”.

Why Portfolio analysis?

There are large number of financial instruments to invest money into.

Now, an individual has to choose the best among them which will yield the best returns with some risk.

It is not an easy job. We cannot just choose some assets randomly without accessing them properly as market fluctuations happens and things doesn't go always as planned.

Some terminologies

1. Ticker / Stock Symbol
2. Diversification in Portfolio
3. Active vs Passive Investments
4. Portfolio weights / Strategies
    a. Equal
    b. Market Cap
    c. Optimized
5. Stock Price data
6. Individual Stock Returns vs Portfolio Return

Portfolio for FAANG

Getting the data

Let us first decide the duration of the data.

We will consider the duration as last 6 years.

So, to collect the stock data for FAANG for the last 6 years we will use ***pandas_datareader.***

Computing Return Metrics

Now, that we have a price data for each of the symbols, we can now compute some return metrics for our portfolio. There can be many types of risk metric, let us look at some of them..

1. Average Return (Single Number for the portfolio).
2. Cumulative Return (a number which shows how return evolved through time).
3. Annualized return (For making the comparison easier).

Computing Risk Metric (Portfolio Standard Deviation)

Given two stocks in the portfolio, then the portfolio standard deviation can be written as..

$$\sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \rho_{1,2} \sigma_1 \sigma_2}$$

$$\sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 Cov_{1,2}}$$

Alternative Expression for Portfolio Standard Deviation

The formula for portfolio volatility is:

$$\sigma_{Portfolio} = \sqrt{w_T \cdot \Sigma \cdot w}$$

- $\sigma_{Portfolio}$: Portfolio volatility
- Σ: Covariance matrix of returns
- w: Portfolio weights (w_T is transposed portfolio weights)
- $\cdot$ The dot-multiplication operator

Risk adjusted Return Metrics

1. Sharpe Ratio: It is a single number which takes into account both the return and the risk. It just takes the difference of the annualized return and the risk free return and then divides that with standard deviation.
2. Sortino Ratio: It overcomes one problem of the sharpe ratio. Sharpe ratio takes into consideration the volatility in the form of standard deviation for both the positive and negative return. But it is only the negative returns which the investor should be worried about.

Task for you..

Build an optimal portfolio for the stocks “AMAZON”, “APPLE”, “WALMART” and “MICROSOFT”

Building an optimal portfolio essentially means coming up with the optimal weights for each instruments in the portfolio.

Thank you