Portfolio Optimization and Backtesting

I have created this portfolio of 10 stocks which are traded in the US Markets, and I aim to invest $10,000 in this portfolio. The stocks are selected on the basis of the current global scenario, keeping in mind the uncertainty of trade wars, tariffs and other global conflicts. So I have tried my best to pick the most diversified portfolio I could, companies in sectors such as Energy, Aerospace, Gold ETFs, AI and Tech, Healthcare, Biotechnology, Pharma and Consumer Goods.

Impact of Trump's Policies

Ever since the start of his second term, he has made it very difficult for a lot of people to make money from the stock market. In this time of global slowdown and recession, Trump decides to start an all out trade war with the rest of the world. With the rollout of high tariffs on imports and new and unanticipated restrictions imposed on allies, it is really difficult to think of a profitable strategy.

Companies which rely heavily on imports from foreign countries in order to serve the people of the USA will face a lot of difficulties as compared to companies which have their manufacturing operations in the domestic USA beforehand. Also with increasing layoffs with the advancement of AI there is an overall economic downturn.

On the other hand this new advent of AI has made the markets overvalued, which led to the correction of the overvalued markets.

So we cannot bet on AI, as the future is uncertain. It cannot be said that the greater the amount of investment leads to better innovation anymore, as China is now leading the AI race and spending a very minuscule amount as compared to OpenAI, Deepmind, Meta and Alphabet.

My idea is that the companies in the Utilities sector, Healthcare and Energy will continue to perform well in the future, even if they decline till the next round of tariffs are imposed. Apart from that, to shield myself from the increased volatility we want to have a certain amount of Gold and then some Inverse ETFs to short the market. This way we can lower our exposure to risk.

I have made the following stock selection, the weights will be assigned later on the basis of the strategy and cannot be decided just yet.

1. Exxon Mobil Corp.	(XOM)	8. Johnson & Johnson	(JNJ)
2. AT&T	(T)	7. Vertex Pharmaceuticals Ltd.	(VRTX)
3. Northrop Grumman Inc.	(NOC)	9. Coca-Cola Company	(KO)
4. SPDR Gold Trust	(GLD)	10. Philip Morris International Ltd.	(PM)
5. International Business Machines	(IBM)		
6. Procter and Gamble	(PG)		

Here I will use Mean Variance Optimization to allocate weights to the portfolio and then calculate the Sharpe Ratio, Drawdown and Overall Returns. I will also calculate the costs of transactions which come into play while re-balancing the weights. For a simple understanding and less transaction costs, we will rebalance the portfolio every 45 Days.

Why 45 Days?

This way we can reduce the number of transactions, reduce the turnover and then still be able to capture the momentum changes in the market, so that we act on it.

Mean Variance Optimization

It provides a mathematical framework to construct portfolios that either maximize expected return for a given level of risk or minimize risk for a given level of expected return. The core idea is diversification: combining assets to balance risk and reward efficiently.
In simple words, this strategy helps us to reduce the risk while giving us the maximum amount of returns for a certain investment.

We need to calculate the following:

Expected Return:

The average return an asset is anticipated to generate in the future, this is done by looking at the average daily return of the investment and then annualising it.

Variance (Risk):

Measures the volatility of an asset's returns, i.e. how much does the return fluctuate or change. If the returns change wildly then this increases risk. It is always better to have lesser volatility in returns as it gives better chances of assured returns.

Covariance:

Indicates how two assets move relative to each other (diversification potential), i.e. how do the stocks in our portfolio move with respect to each other. If the covariance is high then the stocks are closely related, maybe of the same industry or same sector, whatever impacts one will surely impact the other as well, this increases risk. So we need a portfolio with stocks with low covariance

The covariance of a stock with itself is nothing but its own variance of returns.

For Exxon Mobil Corp. (XOM) the variance of returns is high - 0.105, but still we invest in it.

Why?
Because it is the largest Energy company in the US. The shift from conventional black gold to the clean green is not easy and certainly not quick. The demand for energy will always rise, and whatever policy Trump may introduce the demand will always rise. Thus if tariffs are imposed then people will end up paying more for their gas, but will not stop using it.

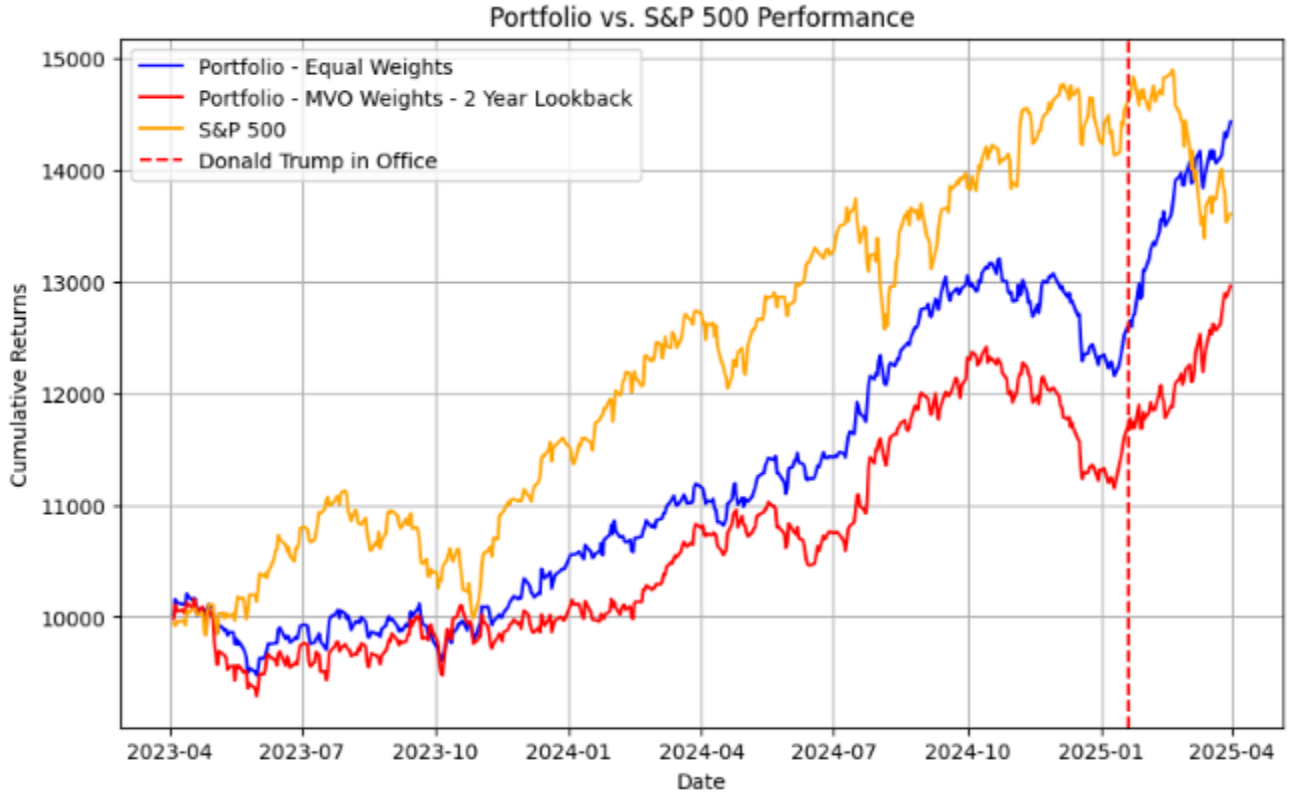
Optimal Weights

1. Exxon Mobil Corp.	0.3	8. Johnson & Johnson	0.05
2. AT&T	0.05	7. Vertex Pharmaceuticals Ltd.	0.05
3. Northrop Grumman Inc.	0.28	9. Coca-Cola Company	0.05
4. SPDR Gold Trust	0.05	10. Philip Morris International Ltd.	0.07
5. International Business Machines	0.05		
6. Procter and Gamble	0.05		

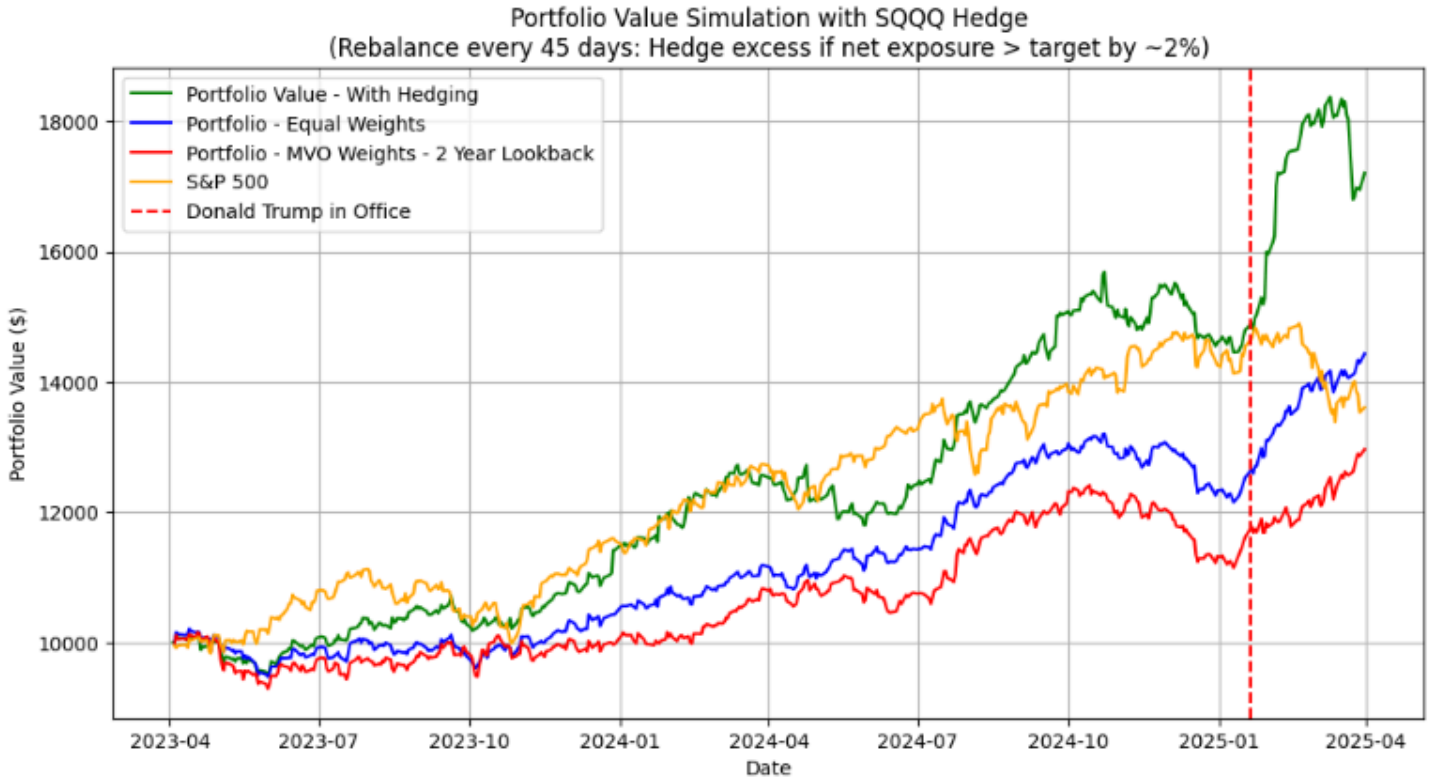
The weights are assigned in such a way that there are bounds, minimum weight must be 5% and the maximum should be 30%.

Results

This is without re-balancing. The optimal weights are not performing well. (To improve that increase the lookback period to 6 years in the MVO, than the 2 years in this case)



With re-balancing we achieve the following results.



Rebalancing Strategy

The basic idea is that we will look back at the portfolio every 45 days, and check if the weights of any of the stocks have increased by more than 2% of the total investment value at that time, then we will sell off that much to retain the original weights. From the cash we get from selling our positions, we buy an Inverse ETF, as it is a good way to short the market, so we reduce our risks and get good returns even when the market is not performing well.

It can be clearly seen from the above graph that our Hedging Rebalancing has proved to be very effective. In times of a bullish market, it gives comparable returns to the initial strategy, but in times of bear markets it outperforms quite well. In times of shock as well we can reduce our losses with this strategy, like the recent crash of this last Friday which was the worst session in the market since 2020.

Sharpe Ratio: 2.063

Drawdown: -8.59%

Returns: 36.02%

(Annualised data)

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