FINM 25000 Assignment 1

HW Group A 6

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Question 1

*Table 1. Mean, Volatility and Sharpe Ratio of each asset*

Table

Description automatically generatedTable

Description automatically generated

SPY has the best (highest) Sharpe Ratio, while BWX has the worst (lowest) Sharpe Ratio.

Question 2

*Table 2. Correlation matrix*

Table

Description automatically generated

Background pattern

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*Figure 1. Heat map of correlation matrix*

The assets with most negative correlation are DBC and IEF, with a correlation coefficient of -0.41.

The assets with most positive correlation are PSP and EFA, with a correlation coefficient of 0.91.

Using Sharpe Ratio as a measure of performance, TIP with SR = 0.70 outperformed both domestic bonds (IEF) with SR = 0.40 and foreign bonds (BWX) with SR = 0.08.

Looking at the heat map, TIP seems to have relatively low correlation with all assets except domestic and foreign bonds. Therefore, TIP does seem to expand the investment opportunity set, and Harvard should consider them a separate asset.

Question 3

*Table 3. Weights of the tangency portfolio*

Table

Description automatically generated with medium confidence

For the tangency portfolio:

Mean = 0.34

Volatility = 0.26

Sharpe Ratio = 1.28

Question 4

*Table 4. Weights of the MV portfolio with target returns of 0.01*

Table

Description automatically generated

For the MV portfolio:

Mean = 0.01

Volatility = 0.0049

Sharpe Ratio = 2.05

The asset that has the most long is SPY, and the asset that has the most short is QAI. This portfolio also has heavy long positions in IEF, HYG and TIP. Since this is an MV portfolio that aims to minimise volatility, the long positions in IEF, HYG and TIP make sense, since all three are bonds and therefore tend to be relatively low-risk and low-volatility. Although SPY is a domestic equity asset and has higher volatility than the three bonds, it has significantly higher mean returns than the bonds and lower volatility than assets with similar mean returns, such as IYR and PSP. This would explain SPY’s heavy long position. On the other hand, QAI is heavily shorted since it has a relatively high correlation with all other assets (seen in the heat map) while having a low volatility, which means that its performance is relatively stable and the short position is a reliable counterweight against the other assets, which minimises volatility.

The long and short positions of the portfolios don’t necessarily line up with the Sharpe Ratios of the assets; that is, assets with high Sharpe Ratio values don’t necessarily have heavy long positions, and vice versa. For example, QAI, which has an extremely heavy short position, has a Sharpe Ratio higher than four other assets, while IYR, with the second highest Sharpe Ratio, also has a short position in the portfolio. On the other hand, IEF, which has the second highest long position in the portfolio, has a Sharpe Ratio even lower than QAI.

Question 5

For the equally weighted portfolio:

Weight of each asset = 0.0125

Mean = 0.01

Volatility = 0.014

Sharpe Ratio = 0.74

*Table 5. Weights of the risk-parity portfolio with target returns of 0.01*

Table

Description automatically generated

For the risk-parity portfolio:

Mean = 0.01

Volatility = 0.0127

Sharpe Ratio = 0.79

Using Sharpe Ratio to measure performance, the MV portfolio with a Sharpe Ratio of 2.05 significantly outperformed both the equally weighted portfolio and the risk-parity portfolio, with Sharpe Ratios of 0.74 and 0.79 respectively.

Question 6

*Table 6. Weights of the MV portfolio with target returns of 0.01, using data up to 2020*

Table

Description automatically generated

Sharpe Ratio using data through 2021: 2.25

Sharpe Ratio using data from 2022: -2.06

The raw data in 2022 had mostly negative excess returns, which means that 2022 was a bear market, leading to the negative Sharpe Ratio.