Risk Measures

(Insert Sharpe Ratio equation here)

The Sharpe ratio is one of the fundamental risk/return measures used in finance. It describes how much excess return you are receiving for each extra unit of volatility. A slight problem with the ratio is that using monthly data over a particular time period is supposed to be acceptable due to an assumption that asset returns are normally distributed (which may not always be the case). However, the portfolio return is assumed to be normally distributed and the Sharpe ratio is still generally regarded as perhaps the best risk-adjusted measure of return. A higher Sharpe ratio is better because it means more expected return per extra unit of risk. The Sharpe ratio is expected to be higher for the standard MVO portfolio because MVO’s objective function tries to specifically minimize the traditional measure for portfolio variance.

(Insert Modified Sharpe ratio Equation here)

The Modified Sharpe ratio is a risk measure created here. It is similar to the Sharpe ratio expect is has a different measure of variance. It uses the objective function of the Inflation-hedged portfolio equation as its variance. This way, the measure also accounts for the risk posed by a high inflation rate. It should be noted that similar to the Sharpe ratio, the modified Sharpe ratio is expected to be higher for the inflation-hedged portfolio because the objective function attempts to specifically minimize the measure of variance used. It is useful to look at both of the two measures when assessing the risk-adjusted return of the portfolio and the value of the model over a particular time period.

(Insert Weighted Portfolio Inflation Beta equation here)

As shown above, the Weighted Portfolio Inflation Beta(WPIB) is computed by summing the products of the asset allocation weights and their corresponding inflation betas. It is an interesting value to look at because it shows insights into the difference between standard MVO and our model. For the most part, the WPIB is higher for our model representing an allocation skewed towards assets with high inflation betas. Perhaps surprisingly, this is not always the case and sometime standard MVO boasts a high WPIB than our model. This can be explained by looking at the form or our model.

The return constraint of our model incorporates the expected return of the assets. The expected return used is the usual expected return perturbed by the (asset inflation beta) \times (expected inflation rate). This means that assets with higher inflation betas will generally have higher expected returns and in order to meet the return constraint there must be a large allocation in these assets.

Looking at the objective function of our model shows a different picture. Because it is trying to minimize the objective function and the coefficients of the weights are inflation betas, the objective function has a preference to an allocation in assets with lower inflation betas. Note that this corresponds to the variance term but the intuition for the covariance term is a little different. In this case, the objective function has a preference to reduce the covariance term by investing in assets with a small product of inflation betas. This means that some of the assets invested in are likely to have negative inflation betas. While this makes sense in the current iteration of the model, due to it being balanced by the return constraint, there is room for modification here. Changing the Beta terms to be 1/Beta is one idea and more ideas are discussed in the improvements section.

Note that the WPIB is not displayed in association with any of the graphs because it is not a true risk measure but rather is used behind the scenes to better understand the chosen allocation.

These results demonstrate the true nature of our model and its strategy. It attempts to hedge against inflation risk by actively investing in assets that move with inflation so in the case of inflation shocks or rising inflation rates, the portfolio will remain stable or even increase while other portfolios may decrease in value .This is only true if the minimum return constraint is high enough as setting it too low can lead to a higher WPIB for the standard MVO portfolio.