Optofolio Optimizer Case Study on the Egyptian Market

Feb 1, 2021

A. EXECUTIVE SUMMARY

Using Optofolio technology we generated an efficient frontier of optimal portfolios for consecutive six months periods starting January 2015 and ending January 2021. From each efficient frontier, we picked four portfolios representing different degrees of risk and calculated their performance. In addition, we created an additional portfolio (inspired from Nassim Taleb's Barbell portfolio) consisting of 80% fixed income and 20% our maximum risk portfolio. Below graph summarizes the performance of the different portfolios compared to EGX 30 and pure fixed income portfolio.

The low and mid risk portfolios generated the highest 6-year returns with a compounded annual returns of about 18.2% and 17.2% respectively. This is significantly higher than EGX30 compounded annual return of about 3.1% and the 12% fixed income annual return. Both portfolios also had max drawdown values of 3.6%, 13.8% respectively, which are significantly less than EGX30 maximum drawdown value of 37.9%. In addition, these portfolios have better performance than existing mutual funds offered in the market by major institutions such as Banque Misr, CIB and EFG.

It is worth mentioning that the portfolios presented in this report are just a sample intending to show the potential of Optofolio technology which can be further leveraged to generate better performing portfolios. A simple example would be to dynamically switch

between different portfolios with different risk profiles based on the historical trend; the asset manager can also control the portfolio switching based on the overall market future expectations and fund constraints. A more complex example would be to use monte carlo simulation to test the portfolios on thousands of possible future scenarios.

B. Background & Motivation

In the last 10 years, historical returns of the Egyptian Stock Market were far below the required returns from an investment with such a high level of risk. As an example, from January 2015 to January 2021, the popular index EGX30 compounded annual return was about 3.1% which is far below returns of fixed income products.

Optofolio Optimizer was developed to produce optimal portfolios for different risk profiles given any set of available assets. We used Optofolio Optimizer to generate multiple portfolios from stocks listed in the Egyptian Stock Exchange as well as a fixed income product with a 12% annual interest rate.In this document, we present the technical approach we used to generate and test the portfolios, as well as the performance results of the generated portfolios.

We provided the following constraints to the Optofolio Optimizer to make sure the generated portfolios meet the following criteria:
- No stock is allowed to exceed 15% of the overall portfolio value.
- Sum of the percentages of stocks belonging to the same sector is not allowed to exceed 40% of the overall portfolio value.
- Selected stocks must have a median turnover of more than 1,000,000 EGP over the last 6 months.
- Stock investments are always positive in value, so no shorting of stocks is used.

C. Technical Approach

Data Preprocessing and Postprocessing

Before running the optimization algorithm, the following modifications were made to the existing stock data:
- Missing stock prices were replaced with the first price prior to the first data point in a given stock, and an average of the two closest prices otherwise.
- Stock prices were converted to daily return values using day-on-day change in price.
- Fixed income is considered an additional asset with a constant 12% annualized return which is converted into a daily return value similar to other assets.

After performing the optimization, investments in the portfolio that do not reach a minimum of 1% of the portfolio value are removed if any. Portfolio is then rebalanced on the remainder of the assets that can be increased, given the existing constraints.

Available Data & Re-optimization frequency

First, we ran Optofolio optimization algorithms on historical data available from 2010 till end of December 2014 to generate a set of optimal portfolios with different risk appetites and measured their performance for the next 6 months starting from 1st of January 2015 (the first validation period). For each subsequent 6 months period, the portfolios are **re-optimized** with new prices data up to the next validation period; for example, for the second 6 months validation period starting from July 1st 2015, the data used by Optofolio Optimizer includes all available data upto the 30ths of June 2015. To summarize, we repeated the process of generating and measuring the performance of optimal portfolios for 12 times for the 12 six months period spanning years from 2015 till 2020.

## Portfolio Generation and Selection

For each validation period, previous data is used to generate a Pareto frontier of the most efficient portfolios given the risk and return objectives. A typical pareto frontier is shown below:
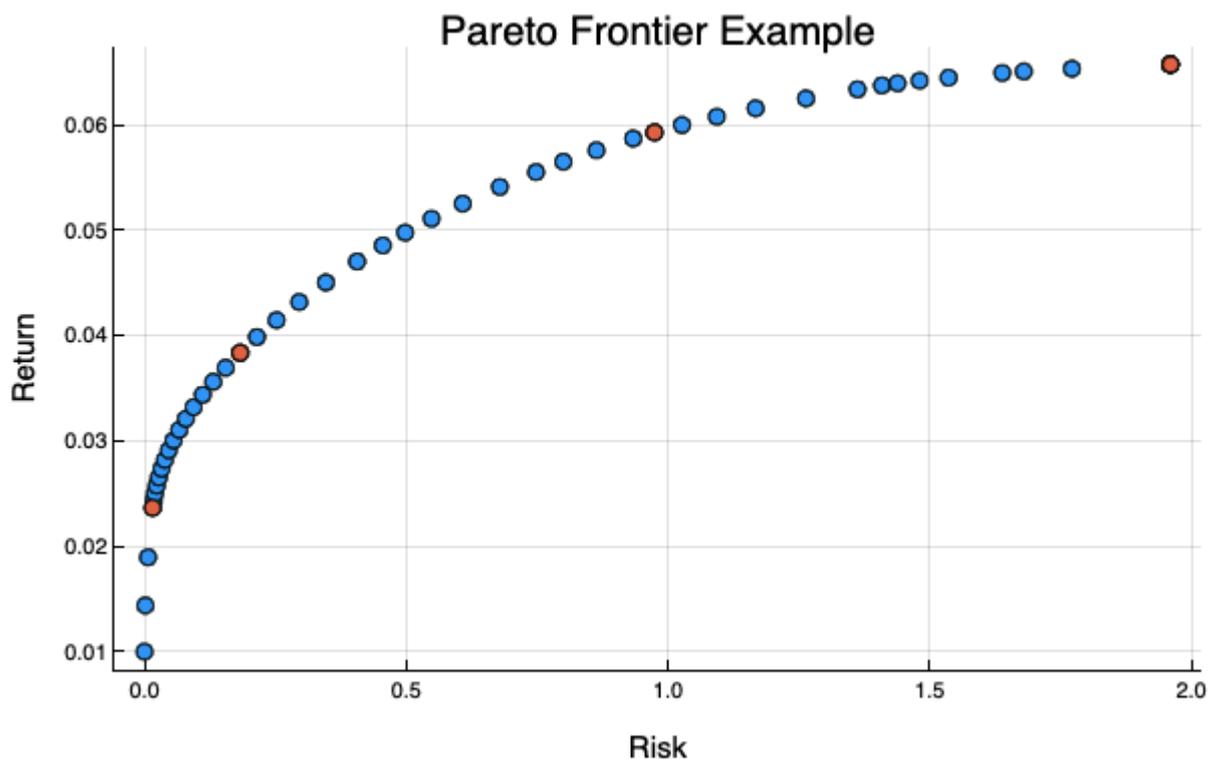
A similar frontier with a number of portfolios is produced for each validation round. The frontier contains portfolios that have an increasing risk appetite, from left to right. We chose to select certain portfolios in the Pareto frontier that correspond to low, medium, high and maximum risk.
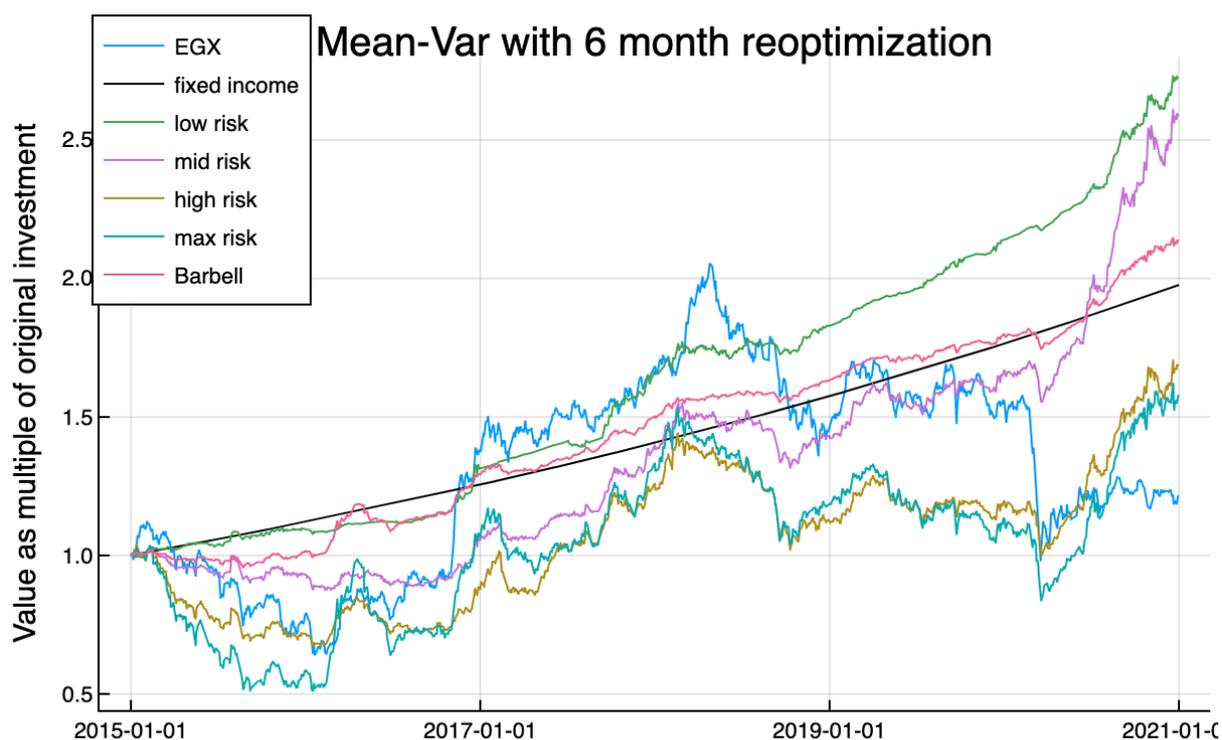
The four selected portfolios are shown as red circles in the above graph. That position is fixed for all the experiments and it corresponds to 10%, 40%, 70% and 100% of the maximum possible risk. This variation can be used as a basis for selecting different portfolios given current expectations for market trends.

An example of the different portfolio components can be seen below:
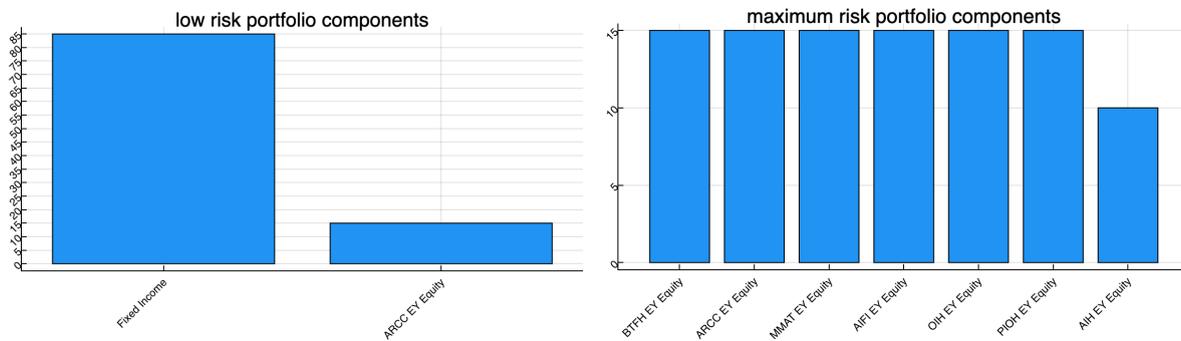
D. Results

In addition to the four portfolios described above (i.e. low, mid, high & max risk), we created an additional portfolio (inspired from Nassim Taleb's Barbell portfolio) consisting of 80% fixed income and 20% our maximum risk portfolio). Below graph summarizes the performance of the different portfolios compared to EGX 30 and a pure fixed income portfolio with 12% return.

Mean-Var with 6 month reoptimization

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It is worth mentioning that the portfolios presented in this report are just a sample intending to show the potential of Optofolio technology which can be further leveraged to generate better performing portfolios. A simple example would be to dynamically switch between different portfolios with different risk profiles based on the historical trend; the asset manager can also control the portfolio switching based on the overall market future

expectations and fund constraints. A more complex example would be to use monte carlo simulation to test the portfolios on thousands of possible future scenarios.

Below subsection shows the portfolios generated based on available data upto the 31st of January 2021.
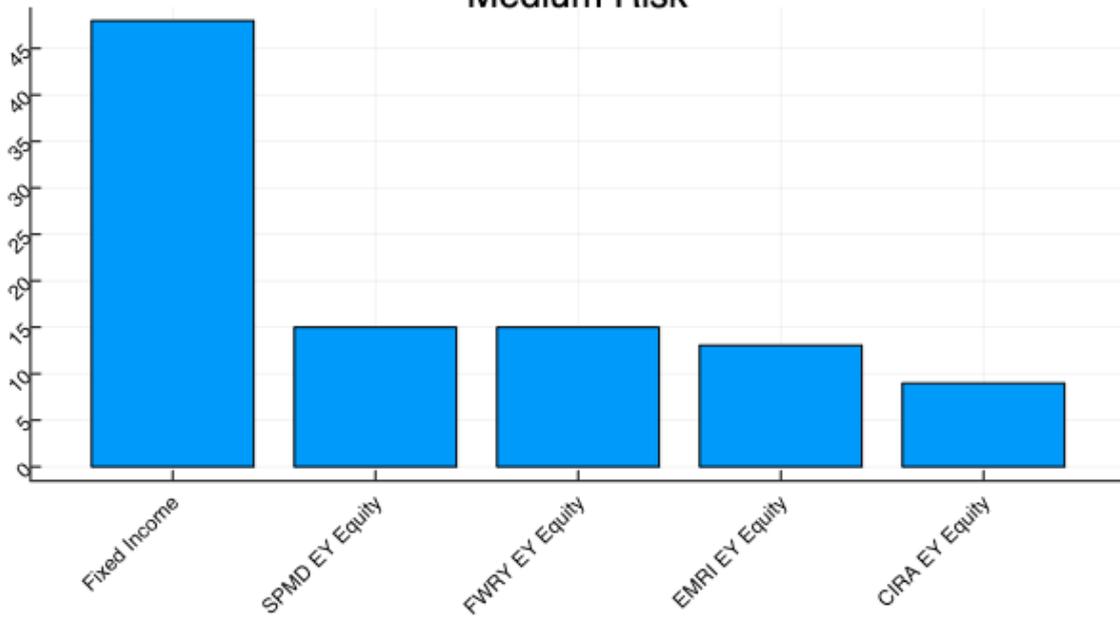
Current Portfolios

Finally, If we were to invest today, running Optofolio Optimizer up to January 2021 the following portfolios are generated
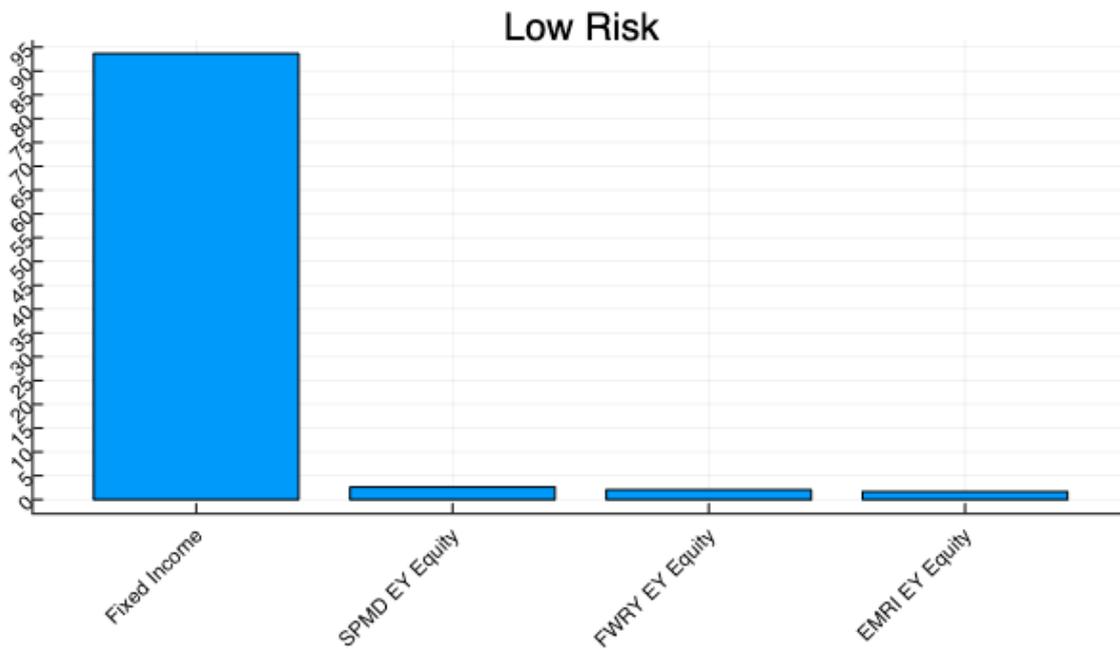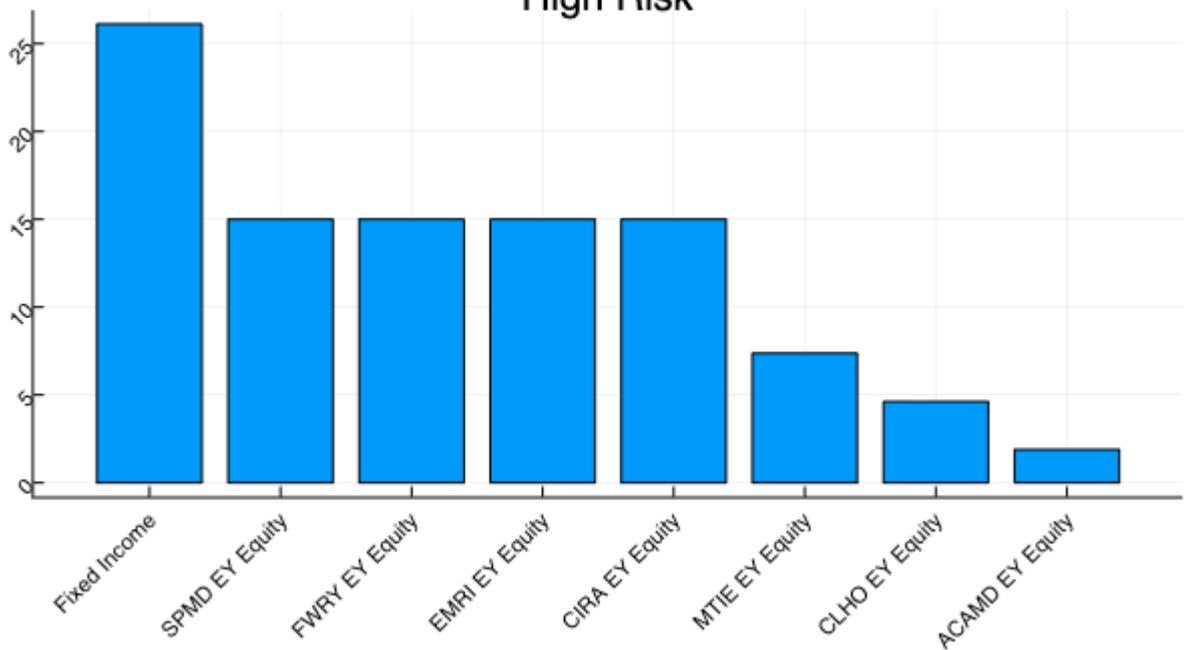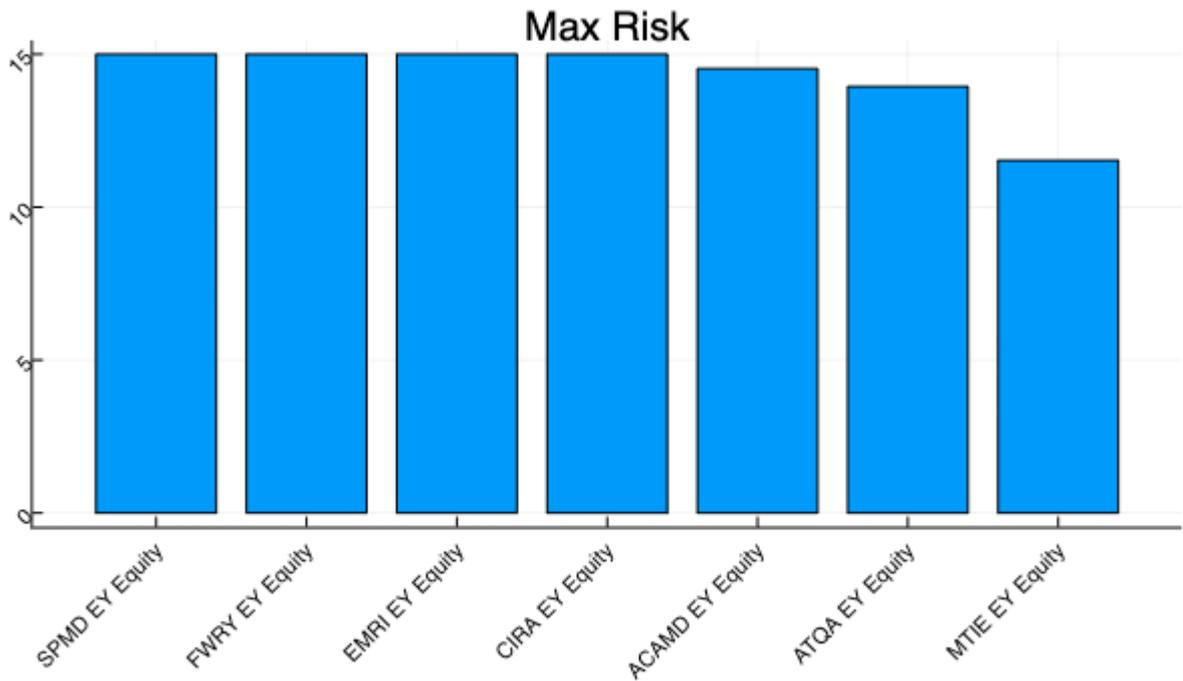

Percentages = [93.66, 2.63, 2.05, 1.66]

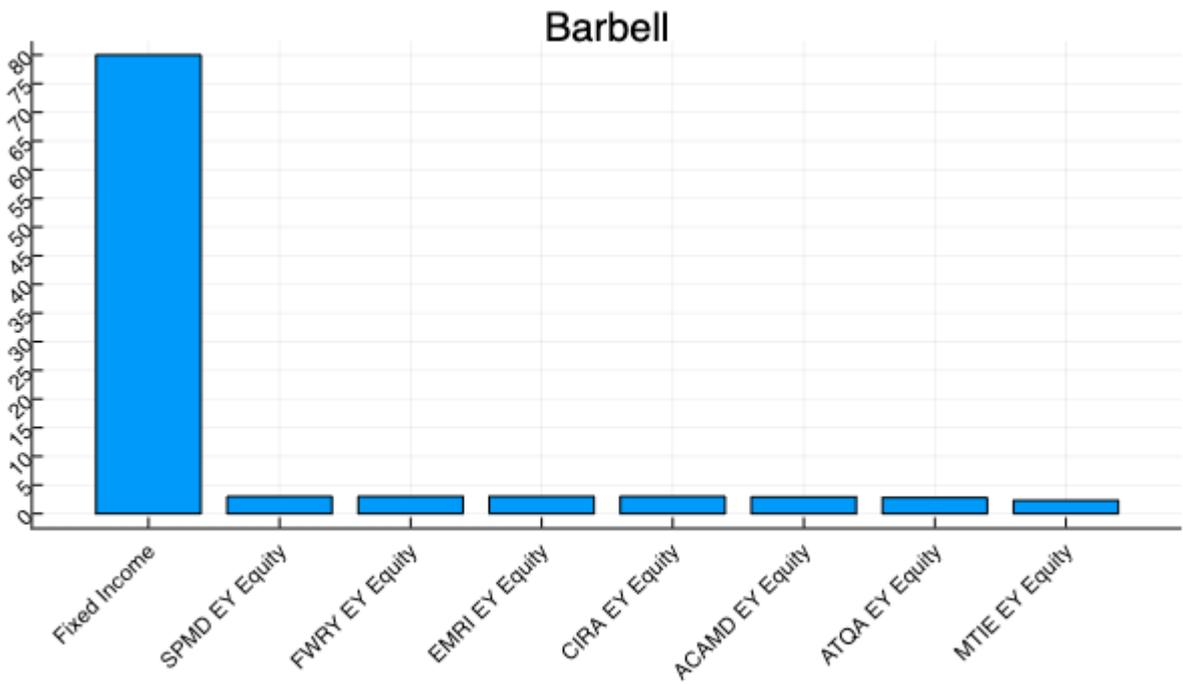## Medium Risk

Percentages = [47.98, 15, 15, 13.05, 8.97]

High Risk

Percentages = [26.11, 15, 15, 15, 15, 7.37, 4.62, 1.9]

OPT FOLIO
Portfolio Optimization with Insights

Percentages = [15, 15, 15, 15, 14.53, 13.94, 11.53]

Percentage = [80, 3, 3, 3, 3, 2.9, 2.8, 2.3]