

## Application #4

### Optimizing Tail Risk

#### 1 Data

- On Chalk, download the file, “[dataAssets.mat](#)”.
- Be sure to save this data file into the current directory (or path) of Matlab.
- Use the command: “[load dataAssets](#)”. Upon running this command, you should see the variable, “[prices](#)” in your workspace.
- In the matrix of prices, each row corresponds to a day. The columns correspond, (in order,) to the [S&P 500](#) index, [USD](#) index, [crude oil](#) index, [HYG](#) index, and U.S. 10-yr [Treasury](#) index.

#### 2 Portfolio

1. Calculate (level) returns using the given price data.
2. Form an portfolio of data, equally split between the S&P 500 and the Oil Index.
3. Calculate the 5th quantile of the return history on this portfolio.

#### 3 Optimizing Tail Risk

Suppose we want to find the portfolio weight needed in S&P500, (with all remaining weight being in the Oil Index,) such that the 5th quantile of the return history is negative 3%.

1. Construct an in-line function that takes an argument, [w](#), and uses this to calculate the [difference](#) between the targeted 5th quantile and the quantile from this constructed portfolio with fraction [w](#) in the S&P500, and (1-w) in Oil.
2. Use the function [fzero](#) to optimize the weight such that this return quantile is acheived.

3. Create an in-line function that takes the absolute value of the difference between the targeted quantile and the estimated quantile from the portfolio history with weight `w`.
4. Use `fminunc` to optimize this quantile.
5. Compare your two answers from `fzero` and `fminunc`.