Math 420, Spring 2020
Sixth Team Homework

due Thursday, 23 April, 2020

In the following exercises consider the risky assets in groups (A) (B) and (C) of your final project. Consider one-year histories of daily share price data for each asset over the years ending December 31 of 2015-2019. There are 20 quarters within this five year period.

Use adjusted closing prices to compute the return for each trading day over the five years 2015-2019. For each of the five years ending December 31 of 2015-2019 compute $\mathbf{m}$ and $\mathbf{V}$ for the assests in group (A), groups (A) and (B) combined, and groups (A), (B), and (C) combined using one-year histories with uniform weights. Use the U.S. T-Bill rate available at the beginning of each year as the safe investment for the data from that year. Assume that the credit line for each year is three points higher than the U.S. T-Bill rate.

Exercise 1. For each of the five years plot a graph that shows

- the points (m_i, σ_i) associated with each asset,
- the frontier hyperbola associated with each of the three pairs $(\mathbf{m}, \mathbf{V})$,
- the long frontier associated with each of the three pairs $(\mathbf{m}, \mathbf{V})$,
- the points $(\mu_{\text{si}}, \sigma_{\text{si}})$ and $(\mu_{\text{cl}}, \sigma_{\text{cl}})$ on the frontier hyperbola associated with each of the three pairs $(\mathbf{m}, \mathbf{V})$,
- the efficient frontier associated with each of the three pairs $(\mathbf{m}, \mathbf{V})$,
- the point $(\mu_{\text{si}}, \sigma_{\text{si}})$ on the long frontier associated with each of the three pairs $(\mathbf{m}, \mathbf{V})$,
- the efficient long frontier associated with each of the three pairs $(\mathbf{m}, \mathbf{V})$.

Exercise 2. For each of the five years and each of the three pairs $(\mathbf{m}, \mathbf{V})$ compute

- the allocation $\mathbf{f}_{\text{si}}$ for the tangent portfolio on the frontier hyperbola associated with the safe investment,
- the allocation $\mathbf{f}_{\text{cl}}$ for the tangent portfolio on the frontier hyperbola associated with the credit line,
- the allocation $\mathbf{f}_{\text{ls}}$ for the tangent portfolio on the long frontier associated with the safe investment.

Apply the metrics ω^{m}, ω^{v}, ω^{KS}, ω^{ar}, and ω^{ac} to the portfolios with allocations $\mathbf{f}_{\text{si}}$ $\mathbf{f}_{\text{cl}}$, and $\mathbf{f}_{\text{ls}}$ for each of the five years and each of the three pairs $(\mathbf{m}, \mathbf{V})$. For each portfolios plot these five metrics as a function of quarters. There should be nine plots, one for each portfolio.