Math 420, Spring 2017
First Project: Histories and Weights

presentation Tuesday, 14 March, 2017
report due Thursday, 16 March, 2017

This project explores the sensitivity of the frontier to the choice of history and weights. Consider the following groups of assets.

(A) VITSX, VFIUX, VGSLX.
(B) from the "Projects" webpage.
(C) Google, Exxon-Mobil, Johnson & Johnson.

(1) Identify the funds in (A) and (B) and describe their holdings. (This information should inform some of your subsequent answers.)

(2) For each of the years ending December 31 of 2003-2016 calibrate $\mathbf{m}$ and $\mathbf{V}$ for the risky assets in group (A), in groups (A) and (B) combined, and in groups (A), (B), and (C) combined using:
   (a) half-year histories with uniform weights,
   (b) one-year histories with uniform weights,
   (c) two-year histories with uniform weights,
   (d) two-year histories with the second year weighted twice as much as the first year.

(3) For each $\mathbf{m}$ and $\mathbf{V}$ computed in part 2 compute the minimum volatility portfolio allocation $\mathbf{f}_{\text{mv}}$. Present these in twelve tables (four for group (A), four for groups (A) and (B) combined, and four for groups (A), (B), and (C) combined) that lists years and the allocations for each asset rounded to the nearest thousandth. Determine if each of these portfolios is long or solvent. How do the different calibrations effect $\mathbf{f}_{\text{mv}}$? Comment on the implications of what you find.

(4) Assume that the safe investment for each year is the U.S. T-Bill rate available at the beginning of that year. Assume that the credit-line for each year is three points higher than the U.S. T-Bill rate. For each $\mathbf{m}$ and $\mathbf{V}$ computed in part 2 compute the tangency portfolio allocations $\mathbf{f}_{\text{st}}$ and $\mathbf{f}_{\text{ct}}$ whenever they exist. Present these in twelve tables as was done in part 3. Identify when each of these portfolios exists and when it does determine if it is long or solvent. How do the different calibrations effect $\mathbf{f}_{\text{st}}$ and $\mathbf{f}_{\text{ct}}$? Comment on the implications of what you find.

(5) For each year and each calibration graph in the $\sigma\mu$-plane the three frontiers associated with the appropriate $\mathbf{m}$ and $\mathbf{V}$ computed in part 2 and the three efficient frontiers associated with the tangency portfolios found in part 4. How do the different calibrations effect the frontiers? In which years would you have the most confidence in the calibation? Comment on the implications of what you see.

(6) In a similar manner, for each year graph the efficient long frontiers, for the risky assets in group (A), groups (A) and (B) combined, and groups (A), (B), and (C) combined, with a safe investment of U.S. T-Bills. Comment on the implications of what you see.

(7) Present one table that for each year gives the metrics

$$\omega^{\nu}_{st} = \frac{\nu_{\text{as}}}{\nu_{\text{st}}}\,, \qquad \omega^{\nu}_{ct} = \frac{\nu_{\text{as}}}{\nu_{\text{ct}}}\,,$$

for each of the twelve efficient frontiers graphed in part 5. Comment on the implications of what you find.