AMSC/MATH 420 Project Two, Spring 2014
Modeling Portfolios: Graphical Validation of IID Models

presentation due Friday, 2 May, 2014
report due Monday, 12 May, 2014

This project explores how to use graphical tests to guide the choice of the risk aversion coefficient. Consider the following groups of assets:

(A) this will be the Group A from the first project;
(B) this will be the Group B from the first project of one of the team members and will be decided after the team is assigned.

For each of the years ending December 31 of the years 2008-2013 use one-year histories of daily return rates and uniform weights to calabrate $\mathbf{m}$ and $\mathbf{V}$.

For each asset i and each year consider the scatter-plots of $\{(r_i(d), r_i(d+c))\}_{d=1}^{D-c}$ in $\mathbb{R}^2$ for various $c > 0$. Recall that for an IID model the values of $r_i(d)$ and $r_i(d+c)$ would be independent. In that case the scatter-plots would be a sampling from the density over the plane that is the product of the density $q_i(r)$ along each axis. Devise a measure of how far a scatter-plot is from one generated by independent events. Use this measure to determine a correlation time c for each asset each year. The smaller this c, the better an IID model.

For each asset i and each year consider the points $\{(d, r_i(d))\}_{d=1}^{D}$ in $\mathbb{R}^2$. Recall that for an IID model this distribution should be uniform in d. Devise a measure of how nonuniform this distribution is in d. For each year order the assets from most uniform to least uniform according to this measure. For each year plot the points $\{(d, r_i(d))\}_{d=1}^{D}$ for the most uniform and the least uniform asset.

Devise at least four measures of how each market history is consistent with an IID model based on what you did above. For example, you can average the measures you devised above, or take their maximum, or anything else that makes sense.

Repeat the last homework assignment with $\chi = 0$, .25, .5, .75, 1, 1.25, 1.5, 1.75 and 2. Determine which value of χ yields the best performing portfolios in the subsequent year. Use scatter plots to seek correlations between these best χ and the measures that you devised above. Identify the two measures that have the strongest correlation and find a linear function of those measures that best fits these χ.