AMSC/MATH 420 Project Two, Spring 2014
Modeling Portfolios: Monday Markov Models

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

This project explores whether there is benefit in building Markov models that treat the first trading day of the week differently from every other trading day. 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 that 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 $\mathbf{V}$. Also use one-year histories of daily return rates and uniform weights to calabrate a Markov model that uses one probability density for the return rates on the first trading day of each week, and another probability density for the return rates on all other trading days. Because the first trading day of each week is generally a Monday, we will call such models Monday Markov Models.

Find unbiased estimators for the "Monday" return rate means $\mathbf{m}_{\mathrm{M}}$ and covariances $\mathbf{V}_{\mathrm{M}}$, as well as the return rate means $\mathbf{m}_{\mathrm{O}}$ and covariances $\mathbf{V}_{\mathrm{O}}$ for the other trading days. Do you see a "Monday" effect for all assets or some assets? If so, describe it.

Modify the IID model from the lectures into a Markov model that draws return rates from a density $p_{\mathrm{M}}(\mathbf{R})$ with means $\mathbf{m}_{\mathrm{M}}$ and covariances $\mathbf{V}_{\mathrm{M}}$ on "Mondays", and from a density $p_{\mathrm{O}}(\mathbf{R})$ with means $\mathbf{m}_{\mathrm{O}}$ and covariances $\mathbf{V}_{\mathrm{O}}$ on other trading days.

There is a version of the central limit theorem that is more general than the one given in the lectures for IID models which holds for such Markov models. Present this Lindeberg central limit theorem and use it to build an objective function for the Monday Markov Model that is analogous to the one built in the lectures for the IID model depending upon a risk aversion coefficient χ.

Repeat the last homework assignment using both the IID objective function and the Monday Markov objective function 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. Describe and explain differences you do or do not find in the performance of the optimal portfolios computed from the IID model and the Monday Markov Model.