Asset Allocation and Portfolio Management

A Master of Science Level Class Offered by the Statistics Department as Part of the FSRM Program

Instructor: Gordon Ritter, PhD

Prerequisites: Multivariable Calculus, Linear Algebra, Probability, and Statistics, all at the level of a full-year undergraduate course. Some minimal programming experience in one of the standard modern languages such as Python, C++, or Java.

Format: The class will be lecture-based with assigned readings, distributed class notes, homework assignments, and a final exam. Lectures will be once per week in the evening.

Course description: A practical, yet intellectually rigorous treatment of modern portfolio theory and portfolio optimization, with applications to portfolio management and asset allocation. Related topics from econometrics and statistics will be included when relevant. The course will begin with a brief review of utility theory, the capital asset pricing model, and mean-variance optimization. Then all of the following topics will be covered in detail: Ross' Arbitrage Pricing Theory, fundamental and statistical (PCA) implementations of APT (i.e. multi-factor models), applications of factor models such as covariance matrix estimation and volatility forecasting, risk measures including copulas, VaR and CVaR, portfolio optimization in the context of a factor model, the Moore-Penrose pseudoinverse, Black-Litterman optimization and applications to asset allocation problems, risk parity portfolios, portfolio optimization with transaction costs (and related microstructure theory), general convex optimization with constraints, execution algorithms, and computational considerations related to implementation of these ideas in practice. We will also discuss how to construct a proper strategy simulation (or "backtest"), and various biases that naïve simulation implementations suffer from, such as look-ahead bias and overfitting, and robust implementations that don't allow such biases.

Readings:
The primary reference for the course will be the instructor's notes, which will be typewritten and posted on the course website after each lecture. Other references which are not strictly required, but very useful, are listed below:

1) Active Portfolio Management by Grinold and Kahn - McGraw-Hill; 2 edition (October 26, 1999) - ISBN- 10: 0070248826
2) Modern Investment Management: an equilibrium approach - Bob Litterman and the Quantitative Resources Group - GSAM - Wiley Finance 2003 - ISBN-10: 0471124109
3) Quantitative Equity Investing: Techniques and Strategies Hardcover – March 1, 2010 by Frank J. Fabozzi, Sergio M. Focardi, Petter N. Kolm
4) Convex Optimization, by Boyd & Vandenberghe, Cambridge University Press and available online

Assessment: Homework will be assigned approximately once every other week, and will be graded by a Teaching Assistant. There will be assigned readings associated with each lecture. There will also be a midterm exam in class, and a final exam (in-class or take-home, TBD) during finals week. The students' grades will be based 50% on the homework, and 50% on the exams.