FRE 6713 - Advanced Portfolio Syllabus (3-credit course)

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1 Course Goals

This course is an introduction to quantitative portfolio theory, practice, optimization, and management. It addresses investor choice, market opportunities, and optimal portfolio selection. It examines security covariance and return models, performance analysis, and return attribution. It ptrovides also an introduction to some basic methods for robust portfolio construction. The course will also include a computational component in which students will construct optimal portfolios, track their behavior, and analyze their performance.

2 Pedagogy

This course will be taught in a hybrid manner including lectures and Socratic method discussions. Each week, there will be assigned readings. Students must do the readings before class and will be ofen call on students frequently to explain and discss concepts from the readings. Students' answers will count toward their grade in terms of class participation.

3 Books

The following books are recommended, but not required:

- Francis and Kim, *Modern Portfolio Theory,* Wiley, 2013. ISBN: 111837052X.
- Grinold and Kahn, *Active Portfolio Management, 2e*, McGraw Hill, 1999. ISBN:0070248826.
- Hubert, *Essential mathematics for Market Risk Management, 2e*, Wiley, 2012. ISBN 9781119979524

4 Assessment

Grades will be based on a combination of in classe quizzes, exams, homeworks, projects, attendance, and class participation.

1. **Attendance and Participation.** Attendance is mandatory. The class will be interactive. Students are required to participate and answer questions on the reading assignments.
2. **Quizzes.** There will be about four to five in class 15-minute quizzes.
3. **Homework.** There will beabout four to five homework assignments in which students will write programs for portfolio management Matlab, R or Python.
4. **Exams.** There will be a 3-hour in class midterm exam or a midterm individual project) and an final project.
5. **Project.** Students will form groups of three or less, and each group will be required to manage a hypothetical portfolio for the duration of the course. Management of the portfolio in accordance with methods taught in class will count toward students' grades.

Weights: The final weighting will be

Attendance and Participation	10%
Quizzes	15%
Homeworks	20%
Mid-term Exam or Project	25%
Final Project	30%
Total	100%

5 Topics to be covered

One-Period Utility Analysis.	Orientation. Basic ideas of investor preferences. Utility of wealth. Basic assumptions about utility. Certainty-equivalent wealth. Absolute and Relative Risk Aversion.
Computational Tools.	Review of linear and matrix algebra, matrix calculus.
Optimization Review.	Basic unconstrained optimization. Nonlinear optimization. Convex Constrained Optimization. Equality and Inequality Constraints. Kuhn-Tucker conditions.
The Opportunity Set.	What the market makes available to the investor. Portfolio expected return and risk. Portfolio weights. Attainable regions of risk-return space. Risk reduction. Diversifiable and non-diversifiable risk. The Markowitz bullet.
Efficient Frontiers.	The budget-constrained effcient frontier. Selling short: motivation, mechanics, benefits, risks. Efficient frontier with short sales allowed. Efficient frontier with a riskless security. Separation theorems.
CAPM ,APT, Return Models.	Equilibrium models. Underlying Assumptions. Intuition. Price of risk. Price of time. The security market line. Derivation of the CAPM. Correlation structure of security returns. Covariance models. The constant correlation model. Single index and Multi-Index models.
Robust Allocation	Robustification of Expected Returns and Risk Matrices. Worst Case Optimization. Matrix Calibration. Black-Litterman Allocation.
Active Portfolios.	Active and excess return. Active weights. Information ratio. Information coeffcient. The fundamental law of active management. Gambling examples. Additivity of IRs.
Bond Portfolios.	Active and Passive Bond portfolio management. Matching of liabilities and incoming cash flows. Sensitivity to interest rate risk. Duration. Portfolio construction to mitigate interest rate risk sensitivity.
Dynamic Portfolio Allocation.	Risk Sensitive Asset Allocation. Maximum Principle, HJB Equation, Feedback using Riccati Equation.
Analysis.	Dynamic Portfolio Allocation. Performance Measurement. Effects of cash flows. Internal Rate of Return. Performance Attribution.