# FRE-GY 6713 Fall 2018 Front Matter and Syllabus – Professor Philips

**Class timings:** 10:00 AM to 12:20 PM on Fridays in RH 214.

**Office Hours:** 10:00 AM to 12:30 PM on Wednesdays (in the FRE department) and 9:45 AM to 10:00 AM and 12:30 pm to 1 PM on Mondays and Fridays (in the classroom ahead of and after my Valuation Theory and Quantitative Portfolio Management classes)

**e-mail:** tp55@nyu.edu

**Objectives:** To study quantitative portfolio management in sufficient depth to allow one to immediately apply its lessons to the management of equity and fixed income portfolios, and to get a glimpse of the many links between portfolio management and other fields.

**Class Structure:** Each 2 hr. 20 minute class will be broken up into three segments. We will start by going over any difficulties that students are having with the material, and then have two lectures, with a short break in between. A guest speaker from Bloomberg will come to one of our classes to train us on the use of PORT, and to get students started on their Bloomberg project.

**Preparatory work:** I will provide materials that should be read ahead of each class, and you will get extra credit for completing a short feedback from that lets me know what parts of the lecture you had difficulty with.

**Homework, Project and Exams:** At the end of each class I will hand out a homework assignment, which must be turned in the following week. There will be a midterm and final exam, and a Bloomberg project. We will use Bloomberg's PORT portfolio optimizer (accessible from the Bloomberg terminals in the Bloomberg lab) to better understand large scale risk models and portfolio optimization. This will nicely complement the material we develop in class, and will provide a useful introduction to the many issues that need to be addressed when solving realistic portfolio optimization problems.

**Grades:** 40% Homework, 15% Midterm exam, 30% Final exam, 15% Bloomberg project

**Textbook:** Luenberger. *Investment Science*, 2nd Edition, Oxford University Press.

I will provide a collection of papers, but you can additionally purchase the following book if you want: Andrew Ang (2014). *Asset Management: A Systematic Approach to Factor Investing*, Oxford University Press (hard-copy $90.25 from Amazon, somewhat less expensive Kindle and eBook versions are available)

**Software:** Anaconda Python (3.6.5) (https://www.anaconda.com/distribution/), but Matlab, R, Julia (and even Excel!) are perfectly viable. Use what you are most comfortable using.

**Prerequisites:** Matriculation into a graduate program sponsored by the Department of Finance & Risk Engineering, or permission of the Department & FRE-GY 6083 (Quantitative Methods in Finance). I will assume an undergraduate level knowledge of probability, calculus, and linear algebra.

**Moses Center Statement of Disability**

If you are student with a disability who is requesting accommodations, please contact New York University's Moses Center for Students with Disabilities (CSD) at 212-998-4980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 3rd floor.

**NYU School of Engineering Policies and Procedures on Academic Misconduct**

A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School of Engineering are expected to exhibit those qualities in their academic work. It is through the process of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School's rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School's Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:

1. Cheating: intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person's work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.
2. Fabrication: including but not limited to, falsifying experimental data and/or citations.
3. Plagiarism: intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.
4. Unauthorized collaboration: working together on work that was meant to be done individually.
5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission has been received from the course instructor(s) or research adviser involved.
6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.

# FRE-GY 6713 Fall 2018 Front Matter and Syllabus – Professor Philips

1. **Module 1: Portfolio Optimization**
    a. Review of probability and linear algebra
    b. Mean-variance optimization and its limitations
    c. Constraints and their impact on performance: the transfer coefficient
    d. The CAPM and the single factor model
    e. The Zero-Beta CAPM and the Betting Against Beta Factor
    f. Multi factor models and the Arbitrage Pricing Theory
    g. Robust optimization – problems, solutions and implications
    h. The efficient frontier and its implications
    i. Log-optimal investing

2. **Module 2: Risk Budgeting**
    a. Risk budgeting vs. portfolio optimization
    b. Robust risk budgeting using expected shortfall
    c. Euler equations and marginal contributions to risk: the $x\ \sigma\ \rho$ decomposition
    d. Risk Parity
    e. The Treynor–Black model
    f. The Black–Litterman model
    g. Wilcox's Discretionary Wealth Model

3. **Module 3: Fixed Income Concepts and Bond Portfolio Management**
    a. Types of bonds – fixed rate, floating rate, mortgages, structured securities
    b. Duration, Key rate durations, Convexity, Spreads and DTS
    c. Discount factors and continuously compounded rates
    d. Modeling yield curves parsimoniously
    e. Spread duration and spread risk; setting credit limits
    f. Index tracking for global portfolios
    g. Immunization and duration targeting

## Midterm Exam

4. **Module 4: Bloomberg Lab**
    a. Multi-asset risk modeling
    b. Large-scale portfolio optimization
    c. Backtesting the risk and performance of optimized portfolios
    d. Bloomberg optimization project

5. **Module 5: Modeling and Estimating Expected Returns**
    a. Equilibrium Theories vs. Financial Models
    b. Time series models of expected returns
    c. Estimating expected returns for fixed income: yields, defaults, optionality
    d. Estimating expected returns for equities: EBO equation, CAPE, factor models

6. **Module 6: Measuring and Managing Risk**
    a. Measures of risk – Volatility, VaR, Expected Shortfall,
    b. Coherent measures of risk
    c. Application of risk measures: setting credit limits, modeling country default risk
    d. Stress Tests and Stress Expected Shortfalls
    e. Estimating variances and correlations – GARCH, DCC, Shrinkage

f. Standard errors of risk estimates
g. Ordinary least squares and a robust alternative – Theil-Sen regression
h. Robust estimators of first and second moments – Median, Hodges-Lehman mean, Rn and Qn, Theil-Sen correlation estimates

7. **Module 7: Measuring and Monitoring Portfolio Performance and Tying it all Together**
   a. Measures of performance – Excess Return, Sharpe Ratio, Information Ratio, Treynor Ratio, M squared, Omega Ratio, Sortino Ratio, Stutzer's measure, drawdowns
   b. Monitoring portfolio and factor performance using Statistical Process Control
   c. Tying it all together - implications for active portfolio management