MGT 595: Applied Quantitative Finance

Instructor: Professor Tobias J. Moskowitz
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Class hours Th. 8:30-11:30am and 1:00-4:00pm in Classroom 4210
Office hours By appointment only.

Course Description

This course develops, examines, and applies models for portfolio decisions by investors and the pricing of securities in capital markets. While developing portfolio theory, we will study the extensive empirical work that characterizes movements in security prices, evaluates alternative investment and asset pricing models, and attempts to test those models and interpret the implications of those tests. This is a research oriented course with practical implementation of quantitative methods in finance, aimed at highly motivated and technically proficient MBA and undergraduate students.

This course is designed for students who want a more detailed and up-to-date treatment of academic asset pricing theory and empirical work and its application to the practice of quantitative finance. The course is especially appropriate for students contemplating analytical finance and quantitative money management, and provides many tools and concepts that are essential for a career in quantitative investments. The material is covered in a rigorous analytical manner, and students must be comfortable with some technical methodologies (i.e., calculus, linear and matrix algebra, and statistical theory). The course is meant to be challenging, but accessible. The expectation is that the average student spends 10-20 hours per week on the course, outside of class.

A good fundamental background in economics and especially statistics is required. The course is highly quantitative because the field is, and so relies heavily on analytical tools and economic theory developed throughout the course. Students should be comfortable with probability, statistics, and regression analysis. Students should also feel comfortable with the concepts of risk aversion, utility functions, and budget constraints. Use of a statistical package or programming language will be vital for the course, saving time and aiding in understanding the material. Many of the applications will move beyond simple spreadsheet packages such as Excel. A good statistical programming language such as Matlab, SAS,
Stata, Python is even more useful. I will supplement the course with programming help and the data assignments will be done in groups (more below).

**Course Requirements and Grading**

The requirements for the course are six problem sets (which include data analysis) and a final exam. The problem sets are to be done in groups of 1-3 people. Class participation is also used to determine grades.

Your course grade will be determined as follows:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Class Participation</td>
<td>5%</td>
</tr>
<tr>
<td>6 Problem Sets</td>
<td>50%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>45%</td>
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This course should not be taken pass/fail – to get anything out of it you need to do the work, and if you’re going to do that much work you might as well get a grade for it!

**Class participation** will be weighted heavily, as it is key to understanding the material in the course. Many topics and economic questions will not have a specific answer. Therefore, dialogue and debate are an important part of this course. Thus, students need to be prepared *before* class. I want classroom discussion to be open; this will help immensely.

**Problem sets** will be due most weeks and are to be done in groups of 1-3 people*. The problem sets will consist mostly of data analysis and replication of studies with some extensions of the data analysis in those studies and some conceptual questions concerning the interpretation of the analysis. The goal is to generate a set of quantitative tools and programs throughout the course that are applied in practice. The problem sets cumulatively develop these tools by adding on to previous analysis so that extensive models are developed by the end of the course and similar routines are applied to multiple contexts.

**TA and Review Sessions**

- The TA for the course is **Jun Wu**, a Ph.D. student in Finance.

- The TA will hold a Matlab tutorial session the first week of class – students are **strongly** encouraged to attend (you’ll thank me later).

- The TA will hold weekly office hours. The TA’s objective is to help you with data and statistics questions primarily for the upcoming problem set each week, but also to go over any lingering questions from the previous problem set if time permits.

- You should feel free to contact the TA with any and all questions. You can reach the TA by e-mail at the following address:

  jun.wu@yale.edu
Readings for the Course

- **Texts**
  Required texts:

  1. NONE.

- **Other Readings**
  Almost all of the readings for the course will be posted on the course webpage with links to the articles. Some of the articles are challenging. However, I will assign certain portions of these articles that I feel are relevant to the topics discussed in class, and will not hold you responsible for the most difficult and advanced material. In addition, I have included some optional readings, which will be discussed briefly in class. For anything that I’m not allowed to post online (due to copyright issues) I will print out and bring to class. You are responsible for *any and everything* covered in class and maybe even some stuff not covered in class.

- **Class Notes and Handouts**
  Lecture notes will be handed out a week or more in advance and posted on the course website, too. You should either take notes electronically in class or print out the lecture notes ahead of time and take notes during class on the hard copies, so that you can follow the lecture as we discuss the various topics. However, much of the material will be presented in discussion format in class.

Feedback, Questions, and Concerns

This course is conceptually and analytically challenging, and will require a large time commitment from students (10-20 hours per week). If you have any concerns about the course, please let me know. The best way to catch me is to e-mail me to set up an appointment.
Course Outline

* indicates required reading.

† indicates lecture note obtained from website or hard copy in class.

Bold indicates article to be discussed in class.

NOTE: All articles for the class are either contained in the course packet or are posted on the web page for the class. Most are posted on the web page to save you (a lot of) money!

Before the course begins: (Students should know this material before entering the class)

0 Preliminaries: Background and Statistics (not to be covered in class, but you NEED TO KNOW)

† Lecture 0: Stock returns, portfolio mathematics, return distributions, and the Market Model

Lecture Topics covered in class:

1. Portfolio Theory and Practice (1/26)
   † Course Outline and Introduction.
   † Lecture 1: Portfolio Theory, the CAPM, and Practice
   ** Jorion, Phillipe, “Portfolio Optimization in Practice.”

2. Evaluating Portfolios: Cross-Sectional Tests (2/2)
   • Problem Set#1 DUE.
   † Lecture 2: Cross-Sectional and Time-Series Asset Pricing Tests

   • Problem Set#2 DUE.
   † (continue) Lecture 2: Cross-Sectional and Time-Series Asset Pricing Tests
4. Market Efficiency, Inefficiency, and Limits to Arbitrage (2/16)

- **Problem Set#3 DUE.**
- † Lecture 3: Market Efficiency/Inefficiency
- * Bodie, Kane, and Marcus ch. 12 (good review of the issues).
- * Shleifer, Andre, *Inefficient Markets*, ch.1

5. Value Investing (2/23)

- **Problem Set#4 DUE.**
- † Lecture 4: Value

6. Momentum Investing (3/1)
7. Quality and Defensive Investing (3/8)

- **Problem Set#6 DUE.**

† Lecture 6: Quality and Defensive


