FRE-GY 7121 I,
Statistical Arbitrage

Fall 2021
Daniel Totouom-Tangho
Wednesday 7:00pm-9:41pm

To contact professor: dtt226@nyu.edu

Course Prerequisites

- Strong interest in working with mathematical finance and its business applications. Basic understanding of financial markets and related concepts.
- Working knowledge of stochastic processes, times series models and statistics.
- Proficiency in either of the languages such as R, Java, Python, C or C++ is will recommended for applications of strategies to data at low, intermediate and high frequency.

Course Description

- Statistical arbitrage refers to strategies that combine many relatively independent positive expected value trades so that profit, while not guaranteed, becomes very likely.
- This course prepares students to research and practice in this area by providing the tools and techniques to generate and evaluate individual trading strategies, combine them into a coherent portfolio, manage the resulting risks, and monitor for excess deviations from expected performance.
- It introduces theoretical concepts such as cointegration, risk capital allocation, proper backtesting, and factor analysis, as well as practical considerations such as data mining, automated systems, and trade execution.

Course Objectives

- Build an automated trading system with quantitative methods and/or machine learning techniques.
- Understand practical aspects of strategies implementation including the statistical estimation of the parameters, back-testing and performance assessment.

Course Structure

- This course will be delivered through a series of lectures, followed by a question and answer session and a discussion. Some weeks, problem solving sessions will be incorporated.

Course Requirements

Students will be expected to attend classes, to read materials ahead of course meetings and also be prepared to discuss assignments in class. There will be weekly homework assignments and a final project with presentation.

Grading of Assignments

The grade for this course will be determined according to the following formula:

Assignments/Activities	% of Final Grade
Class participation	10%
Homework	30%
Final Project	60%

Letter Grades

Letter grades for the entire course will be assigned as follows:

Letter Grade	Points	Percent
A	4.00	Example: 92.5% and higher
A-	3.67	Example: 90.0 – 92.49%
B+	3.33	Example: 87.5% - 89.99%
B	3.00	Example: 82.5% - 87.49%
B-	2.67	Example: 80% - 82.49%
C+	2.33	Example: 77.5% - 79.99%
C	2.00	Example: 70.0% - 77.49%
F	.00	Example: 69.99% and lower

Course Schedule

Indicative program:
- Introduction and history.
  - Differences and similarities between stat arb and technical analysis.

- Volatility Signature, Frequency Arbitrage
- Proper ratio construction and dynamic rebalancing.
- Pairs trading. Co-integration.
- Selective topics
  - Hidden Markov Chain approach
    - ✔ Implication on dimensionality reduction and regime classification
  - PCA Methods
  - Applications of machine learning.
  - Automated systems.
    - ✔ Trade execution.
    - ✔ Advantages and disadvantages of various frequencies.
- Strategy deploying and monitoring.
  - Idea generation.
  - Constructing an optimal strategy conditional on a given set of indicators
- Back testing.
  - Data mining.
  - Data error detection.
  - Survivorship bias.
  - Mean reversion and momentum.

Course Materials

Readings

- Reading materials ahead of course meetings helps students participate actively in class. Additional readings may be posted in NYU Classes for better understanding of topics.

Recommended Textbooks & Materials

- A set of notes will be distributed through NYU classes before the Semester starts.
- In addition, the textbooks below are optional for this course:
  - Statistical Arbitrage: Algorithmic Trading Insights and Technics, Andrew Pole
  - Pairs Trading: Quantitative Methods and Analysis, Ganapathy Vidyamurthy
  - An Introduction to Statistical Learning: with Applications in R, Gareth James.

Resources

- **Access your course materials**: NYU Classes (nyu.edu/its/classes)
- **Databases, journal articles, and more**: Bern Dibner Library (library.nyu.edu) NYU Virtual Business Library (guides.nyu.edu/vbl)
- **Obtain 24/7 technology assistance:** Tandon IT Help Desk (soehelpdesk@nyu.edu, 646.997.3123) NYU IT Service Desk (AskIT@nyu.edu, 212-998-3333)

Policies

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 have 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.

Disability Disclosure Statement

Academic accommodations are available for students with disabilities. Please contact the **Moses Center for Students with Disabilities** (212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

Inclusion Statement

The NYU Tandon School values an inclusive and equitable environment for all our students. I hope to foster a sense of community in this class and consider it a place where individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities will be treated with respect. It is my intent that all students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. If this standard is not being upheld, please feel free to speak with me.