Northeastern University
Applied Financial Econometrics & Data Modeling – FINA 4350 Spring 2025
Sec 01: MWR 1335 - 1440, Hayden 012
Sec 02: WF 1145 – 1325, Hayden 012

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MAIN IDEA

The overarching theme of this course is the statistical properties of financial returns. We will learn how to describe financial (stock market) data, examine their properties, and construct appropriate models that will capture those properties. We'll work with time series data and learn several techniques that will help us model these data. We'll also cover core statistical ideas such as estimation and hypothesis testing in depth and learn to apply them in the context of our work.

COURSE MATERIALS

Textbook

There is no official textbook for this course (because it's not published). Here are a few references that you are welcome to try out if you feel like it.
A large portion of the topics we'll discuss will be based on the following online book. It uses R instead of Python so it may not be that useful for you as reference.

- *Eric Zivot's Introduction to Computational Finance and Financial Econometrics with R* *https://bookdown.org/compfinezbook/introcompfinr/*

A (kinda old) book that covers similar material is:

- *Statistics & Finance, David Ruppert*

The above author has another well-regarded (but more advanced) book:

- *Statistics & Data Analysis for Financial Engineering, 2nd Edition, Ruppert & Matteson*

If you want a more advanced material, you can refer to:

- *Kevin Sheppard's notes for Financial Econometrics course used at Oxford* *https://www.kevinsheppard.com/teaching/mfe/notes/*

For a more traditional econometric (economics instead of finance) focus, my favorite is:

- *Introductory Econometrics: A Modern Approach, 7th Edition, Jeffrey M. Wooldridge*

For detailed time series analysis in finance (requires a solid understanding of basic stats and also uses R):

- *Analysis of Financial Times Series, 3rd Edition, Ruey S. Tsay*

If you want to review some statistics material, the following is a good (and free) reference:
https://onlinestatbook.com

Software/Hardware

We will use Python for the computational aspect extensively. Since you've had at least one course where you were introduced to the language and got significant practice using it, I'll skip the basics. You will need for the Python work. Either Windows, Mac, or Linux system will do. You can work locally, with the Anaconda platform, for instance. You can also use a cloud platform like Google Colab, but some of the simulations we'll run might take longer.

CONTENT

Subject to change, here's a brief outline of what we'll cover:

- Financial Returns
- Random Variables & Distributions
- Matrices
- Time Series
- Returns Modeling
- Estimation & Hypothesis Testing
- Volatility Modeling
- Linear Models & OLS Estimation
- Logistic Regressions/Brownian Motion (time permitting)

COURSE GRADES

Assignments (20%):

- There will be (at least) 5 assignments distributed through the course

Midterm-I (20%):

- Note the date: Wednesday, Feb 05
- Will cover material to-date

Midterm-II (20%):

- Note the date: Wednesday, Mar 12
- Will cover material post Midterm-I

Final (40%):

- Date TBD (please do not book travel plans until registrar releases final schedule)
- Comprehensive

YOUR RESPONSIBILITIES

- Stay up to date with the material after each class. Although primarily quantitative in nature, this isn't a formula-based course.
- If there's anything not clear during the lecture, feel free to ask me then and there. Questions are welcome and in fact encouraged, whether it's conceptual or quantitative in nature.
- If you're reviewing and feel like you don't understand a concept, stop by my office and I'll be happy to go over it with you. You can also email me and if it's simple enough, I can explain it in the reply.

ACADEMIC HONESTY

Academic Integrity Policy

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship fosters an environment where students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and

undermines the achievements of the entire university.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in the code of student conduct or by the direction of instructors.

Definitions

Cheating: The university defines cheating as using or attempting to use unauthorized materials, information, or study aids in any academic exercise. When completing any academic assignment, a student shall rely on their own mastery of the subject.

Fabrication: The university defines fabrication as falsification, misrepresentation, or invention of any information, data, or citation in an academic exercise.

Plagiarism: The university defines plagiarism as using as one's own, the words, ideas, data, code, or other original academic material of another without providing proper citation or attribution. Plagiarism can apply to any assignment, either final or drafted copies, and it can occur either accidentally or deliberately. Claiming that one has "forgotten" to document ideas or material taken from another source does not exempt one from plagiarizing.

- Self-Plagiarism: The reuse of one's own words, ideas, or artistic expression (as in an essay) from preexisting material especially without acknowledgment of their earlier use.

Unauthorized Collaboration: The university defines unauthorized collaboration as instances when students submit individual academic works that are substantially similar to one another. While several students may have the same source material, any analysis, interpretation, or reporting of data required by an assignment must be each individual's independent work unless the instructor has explicitly granted permission for group work.

Facilitating Academic Dishonesty: The university defines facilitating academic dishonesty as intentionally or knowingly helping or contributing to the violation of any provision of this policy.

Participation in Academically Dishonest Activities: The university defines participation in academically dishonest activities as any action taken by a student with the intention of gaining an unfair advantage over other students.

Use of Supplemental Sources and Technology: Unauthorized use of aids, such as but not limited to notes, text, the Internet, artificial intelligence, chatbots, cell phones, etc. to complete any academic assignment.