

# **Financial Economics Spring 2023, Online Asynchronous**

**Instructor:** Zachary Kessler

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**Office Hours:** Fridays, 11:00 a.m. – 12:00 p.m. on Zoom

## **Course Description:**

Financial markets are perhaps one of the most important but least understood aspects of the economy. While references to visiting the moon and claims of tricks some undisclosed “they” do not want you to know about, most are unaware of the massive amount of scholarly work describing these often obscure markets operate. This class then has two main goals. First, this course seeks to provide an academically grounded outline of the field of financial economics. Second, given recent technological advances, this class will utilize commonly employed AI, ML, and statistical methods to explore the above academic foundation in a computational manner. In this way, the course offers both important theoretical understanding as well as practical applications.

As this is a 400 level course, it will be presumed you have taken the necessary Principle courses as well as Intermediate Micro and an initial course in monetary economics (for GMU this is ECON 311). Additionally, this course will lean heavily on coding capabilities so some preliminary exposure to a coding language (Python, R, etc.) would be of benefit, though resources and lessons will be provided if this would be your first exposure. All other methods required will be taught in the course.

## **Required Texts:**

Financial Economics; Frank J. Fabozzi, Edwin H. Neave, and Guofo Zhou (Hereby denoted as FE. Further, I encourage rental rather than purchase)

Throughout the semester there will be various other readings assigned that will be more focused on methods or relevant examples. These will all be free.

## **Grades:**

Homework: 20%

Major Projects: 45%

Discussion/Participation: 10%

Final Project: 25%

*Homework:* Each week there will be a single exercise that is posted. Generally, through the course of the assignment multiple steps will be necessary. This exercise will be grounded in the topics covered during the week and require some practical coding to address. These are graded on completion with comments provided by me. The homework will be posted at the start of the week, Monday at 12:00 a.m., and close the following Sunday at 11:59 p.m.

*Major Projects:* At the end of some collection of content, I will post a prompt. These prompts are generally related to present events that combine the themes of that particular unit alongside practical methodologies. A project will require a written paper paired with empirical tests drawn from the models we have used in class. A project will entail a 6-page double-spaced write-up that employs the formal methods and theories we have discussed in that unit. There will be 3, each worth 15% of the total 45% listed, through the course of the semester. As in the real world such projects are often complex, multifaceted, and require careful planning. Likewise in the real world, your ability to collaborate may be critical to your success. Therefore, in this course if you so choose, you may opt to work on a project as a team of no more than 5 people. To be clear, this is a CHOICE. It is OPTIONAL. You are more than welcome to work on your own for these projects as that may put you in position for success as well.

To ensure fairness between projects completed by a team and those by an individual, any project submitted by a team will be subject to stricter scrutiny than those from individuals. Plan accordingly. If you are working in a team, you must notify me of who is in your team within 24 hours of the assignment being issued.

*Discussion Forum/Participation:* Each week's assignment will have multiple approaches (as coding often can) to reach the answer grounded in the theoretical approach. In this way, there are multiple paths to the correct conclusion. Additionally, AI/ML and finance can be (and ideally are) collaborative processes. This class seeks to foster such a place. If you are stuck or wish to understand a particular piece of code or exercise better, beyond emailing me, you may also post to these discussion pages. Further, if you have helpful tips, resources, or packages, you are encouraged to offer them here as well. Participating in these discussions and assisting your classmates in cultivating this collaborative environment is encouraged and, as should be obvious from the grading distribution, rewarded.

*Final Project:* In place of a final exam, everyone will complete a project with a topic of their own choosing that pertains to the variety of areas discussed in the class. The focus of this project will be your proposal of a relevant real-world situation and to then apply the methods we have used in class to this matter. This project will be submitted as a 12-page double-spaced paper. The project must employ some form of the statistical modeling we employ through the course.

Rubrics will be supplied for all written projects.

## **Class Schedule:**

*January 23<sup>rd</sup>:*

FE Chapter 1-2

## Coding Bootcamp (Python/R/Stata)

*January 30<sup>th</sup>:*

FE Chapters 3-4

Getting to Know Your Data: Manipulation, Filtering, and Charts

*February 6<sup>th</sup>:*

FE Chapters 5-6

Some Initial Statistical Modeling: Time Series

Financial Project 1 assigned

*February 13<sup>th</sup>:*

FE Chapters 7-8

Introduction to Machine Learning: The Types of ML

Financial Project 1 due

*February 20<sup>th</sup>:*

FE Chapters 9-10

Initial Applications of ML to Finance

*February 27<sup>th</sup>:*

FE Chapters 11-12

ML Packages: Building from Scratch versus Presets

*March 6<sup>th</sup>:*

FE Chapters 13-14

Using ML to Forecast Asset Prices

*March 13<sup>th</sup>:* SPRING BREAK

*March 20<sup>th</sup>:*

FE Chapters 15-16

An Introduction to RL

Financial Project 2 assigned

*March 27<sup>th</sup>:*

FE Chapters 17

Building RL Systems for Finance

Financial Project 2 due

*April 3<sup>rd</sup>:*

FE Chapters 18-19  
Gaussian Process for Finance

*April 10<sup>th</sup>:*

FE Chapter 20-21  
Using Text Data for Financial AI

*April 17<sup>th</sup>:*

FE Chapter 22-23  
A Smattering of Other Techniques  
Financial Project 3 assigned

*April 24<sup>th</sup>:*

FE Chapter 24  
Issues with AI Systems in Finance  
Financial Project 3 due

*May 1<sup>st</sup>:*

FE Chapter 25-26  
(No Coding Content)

*May 17<sup>th</sup>:* FINAL PROJECT DUE AT MIDNIGHT

### **Late Work Policy:**

Late homework submissions will not be accepted as they are for a completion grade. In other words, you can quite literally submit a blank document and still receive credit. However, you will obviously not receive any comments. Late financial projects will only be permitted under extenuating circumstances. You must notify as soon as possible with a valid excuse to move the due date for these projects.

### **GMU Honor Code:**

Students are expected to follow GMU's Honor Code in every aspect of the course. No cheating or plagiarism will be tolerated for any assignments. Any individual caught using such methods will be reported to the necessary parties and will immediately receive a zero for the assignment.

## **Statement on Accommodations:**

Any student with a disability who desires academic accommodations, please let me know and reach out to GMU Disability services via email at [ods@gmu.edu](mailto:ods@gmu.edu) or on the phone, 703-993-2474. Any arrangements to be made will be done so through this office.

## **Statement on Inclusivity**

This class will cultivate an inclusive environment supporting a broad variety of experiences and backgrounds. These differences are to be acknowledged, celebrated, and provide insight on any topics discussed.

## **Student Privacy**

During the course of this class, no student's personal information will be disclosed to anyone. For more information on your rights to privacy in this class under FERPA, please visit this link: <https://registrar.gmu.edu/ferpa/>.

## **Other Student Resources**

Keep Learning, Learning Services ([learningservices.gmu.edu/keeplearning/](http://learningservices.gmu.edu/keeplearning/))

University Libraries ([library.gmu.edu](http://library.gmu.edu))

Writing Center ([writingcenter.gmu.edu](http://writingcenter.gmu.edu))

Counseling and Psychological Services ([caps.gmu.edu](http://caps.gmu.edu))