

SYLLABUS

FIN 525: Empirical Methods in Finance

Spring 2023

MW, 9:30 AM – 10:45 AM in McClelland Room 132

MW, 12:30 PM – 1:45 PM in McClelland Room 118

Instructor Information

Instructor: Mihai Ion

Instructor contact: mihaiion@email.arizona.edu

Instructor office hours: MW from 11:00AM – 12:00 PM (room 315H)

Teaching Assistant: Yuan Gao

Teaching Assistant contact: ggao@email.arizona.edu

Teaching Assistant office hours: by appointment (email her)

Course Description

The objective of this course is to familiarize the students with the databases and various statistical methods needed to undertake practitioner-type research in finance (manage large amounts of data, do empirical analysis of financial data, interpret statistical results, and present their analysis). The students are assumed to have a basic knowledge of Finance and Statistics/Econometrics. The course is empirically oriented and is geared towards students who are interested in a career in financial industry or finance research in general. Students will be introduced to the Python programming language, which will be used to conduct all our data analysis.

Course Prerequisites or Co-requisites

FIN 521 (Investment Analysis) or equivalent

Course Format and Teaching Methods

Lectures will be held in person. All lecture notes will be posted in D2L under the “Lectures and Data” link. Each lecture will be posted under two formats different formats: an HTML or PDF file containing all the code, results, and explanations from the lecture, and a Jupyter Notebook file that is missing the code. You are encouraged to use this Jupyter Notebook to type along the code with me as we go through the lecture. Instructions on how to open Jupyter Notebooks will be provided on the first day of class. All computations will be performed using the Python programming language. No prior knowledge of Python is assumed.

Course Objectives

The topics covered in this course were chosen with the objective of developing an understanding of sound empirical-analysis practices. These topics fall into several broad categories:

- Python programming fundamentals
- Data processing
- Descriptive statistics
- Linear regression
- Advanced linear regression topics
- Algorithmic trading

Please see “Schedule of Topics and Activities” section below for more detail on the topics covered in this course.

Expected Learning Outcomes

After completion of this course, students should be able to:

- Download financial data from the WRDS database, the St. Louis FRED, Yahoo Finance, and Kenneth French's database.
- Understand and explain the concept of hypothesis testing
- Interpret regression coefficients, t-statistics and p-values
- Use Python programming to:
 - Load and merge (combine) datasets
 - Create new variables, manipulate dates and calculate lags and leads
 - Produce summary statistics of financial data
 - Perform linear regression analysis for time-series, cross-sectional and panel data
 - Produce regression estimates that are robust to outliers, heteroskedasticity, correlated residuals and unobserved fixed effects
 - Understand the concepts of endogeneity and spurious correlation as well as the tools commonly used to address these issues
 - Calculate portfolio stock returns from firm-level returns
 - Estimate stock return alphas and betas
 - Test for cross-sectional and time-series predictability in stock returns

Course Communications

Announcements will be made through D2L. If you have questions outside of class times and office hours, please email the instructor or the TA and we will try to get back to you within 24 hours during weekdays or the following Monday for questions asked over the weekend.

Required Texts and Materials

There is no required textbook for this class. You may find the following textbooks useful:

- Python for finance ("Python for Finance: Analyze Big Financial Data", by Yves Hilpisch)
 - https://www.amazon.com/gp/product/1492024333/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1
- Python in general ("Learn Python 3 the Hard Way", by Zed Shaw)
 - https://www.amazon.com/gp/product/0134692888/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1

You will need a working computer and an internet connection to participate in the lectures and a laptop for your exam. For assignments and the exam, you will be asked to perform computation-intensive tasks that cannot be performed by hand, with a financial calculator or even with Excel. For this purpose, we will learn how to use the Python programming language throughout the course. It is your responsibility to make sure that, during the exam, you have access to a working installation of Python, Jupyter Notebook, and all Python packages used in class. You will also need these tools for your assignments, since you will be asked to submit your solutions in the form of a Jupyter Notebook that you upload to D2L.

Schedule of Topics and Activities

This schedule is preliminary and subject to change. You will be notified when important changes have been made.

Date	Topic	Due
Wednesday, January 11, 2023	lecture01: Overview and setup	
Monday, January 16, 2023	NO CLASS - MLK Day	
	Part 1: Python Fundamentals	
Wednesday, January 18, 2023	lecture02: Code Execution. Variables. Types.	
Monday, January 23, 2023	lecture03: Data Structures. Intro to the "dot" notation.	
Wednesday, January 25, 2023	lecture04: Conditional Statements. Iteration.	
Monday, January 30, 2023	lecture05: Functions. Packages.	
Wednesday, February 1, 2023	lecture06: Assignment 1 Lab	A1 (Feb 3)
	Part 2: Data Processing	
Monday, February 6, 2023	lecture07: The Pandas Package and DataFrames	
Wednesday, February 8, 2023	lecture08: Data Input/Output (I/O)	
Monday, February 13, 2023	lecture09: Data Filtering	
Wednesday, February 15, 2023	lecture10: Data Cleaning	
Monday, February 20, 2023	lecture11: Merging, Reshaping	
Wednesday, February 22, 2023	lecture12: Dates, Lags, Sorting	
Monday, February 27, 2023	lecture13: Assignment 2 Lab	
	Part 3: Data Visualization and Descriptive Statistics	
Wednesday, March 1, 2023	lecture14: Data Visualization. Unconditional Statistics	A2 (Mar 3)
March 4-12, 2022	NO CLASS - Spring Recess	
Monday, March 13, 2023	lecture15: Conditional Stats - groupby, apply, transform	
Wednesday, March 15, 2023	lecture16: Conditional Stats - applications	
Monday, March 20, 2023	lecture17: Assignment 3 Lab	
	Part 4: Linear Regression	
Wednesday, March 22, 2023	lecture18: Introduction 1 (point estimates, t-statistics, p-values)	A3 (Mar 24)
Monday, March 27, 2023	lecture19: Introduction 2 (predictions, interactions, non-linearity)	
Wednesday, March 29, 2023	lecture20: Panel Regression Intro	
Monday, April 3, 2023	lecture21: Robust Panel Regression	
Wednesday, April 5, 2023	lecture22: Robust Time-Series Regression	
Monday, April 10, 2023	lecture23: Regression Recap Lab	
Wednesday, April 12, 2023	lecture24: Assignment 4 Lab	A4 (Apr 14)
	Part 5: Algorithmic Trading / Paper replication	
Monday, April 17, 2023	lecture 25: Paper Review and Data Cleaning	
Wednesday, April 19, 2023	lecture26: Sorting Variables and Descriptive Statistics	
Monday, April 24, 2023	lecture27: Calculating Raw Portfolio Returns	
Wednesday, April 26, 2023	lecture28: Portfolio Performance	
Monday, May 1, 2023	lecture29: Assignment 5 Lab	
Wednesday, May 3, 2023	lecture30: Review Session for Exam	A5 (May 5)
Thursday, May 11, 2023	Final Exam: 10:30am to 12:30pm in class (McClelland 132)	

Assessments

Your final grade will be calculated as follows:

- Assignments: $5 \times 12\% = 60\%$ of final grade
- Final Exam: 40% of final grade

Assignments and Groups

You will be asked to form groups of three people to work on the assignments. Each group will submit a single solution for each assignment. **Please email your TA at ggao@email.arizona.edu to let her know who your group members are, no later than Friday, January 20th.** If we do not receive an email from you by then, you will be assigned to a group randomly.

Final Examination or Project

The final exam will be in class (room 132) on Thursday, May 11, 2023 from 10:30AM to 12:30PM. The exam will have a similar format to your assignments: you will be provided with a Jupyter Notebook containing the exam questions, and space for you to include your solutions to those questions. You will then post your solution back on D2L as a Jupyter Notebook. Unlike the assignments, the final exam is solved individually, not as a group.

Grading Scale and Policies

Letter grades will be assigned as follows:

- A → Final grade of 90% or more, or final grade ranks in the top 35% of the class
- B → Final grade of 80% or more, or final grade ranks in top 85% of the class
- C → Final grade of 70% or more, or final grade ranks in the top 95% of the class
- D or F → Final grade below 70%. Evaluated on a case-by-case basis depending on the effort the student put in the course

WRDS Login Information

I have created a “Class Account” for the Wharton Research Data Services (WRDS) database. We will use the information available on WRDS to perform a significant portion of the data analysis for this class. To access the database, go to <https://wrds-www.wharton.upenn.edu/login/> and use:

- **Username:** ua_fin525
- **Password:** python_class

Nondiscrimination and Anti-harassment Policy

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please see: <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

University Policies

All university policies related to a syllabus are available at: <https://academicaffairs.arizona.edu/syllabus-policies>.

Subject to Change Notice

Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor of this course.