SYLLABUS

FIN 525: Empirical Methods in Finance

Spring 2022

Monday, Wednesday, 9:30 AM – 10:45 AM in McClelland Room 129

Also via Zoom (see D2L "Zoom" tab for meeting links)

Instructor Information

Instructor: Mihai Ion

Instructor contact: mihaiion@email.arizona.edu

Instructor office hours: MW from 11:00AM – 12:00 PM (a separate Zoom link will be posted on D2L)

Teaching Assistant: Yuan Gao

Teaching Assistant contact: ggao@email.arizona.edu

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 of 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. However, they will also be available "live" online via Zoom and the recordings will be subsequently posted under the "Zoom" tab on the course D2L page. Your D2L calendar should show you the Zoom link we will use for each class session. If you choose to participate via Zoom, to protect your privacy, you may keep your microphone and camera turned off for the duration of the entire class, and you may change your name to "anonymous" or a pseudonym.

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 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
Wednesday, January 12, 2022	lecture01: Overview and setup
Monday, January 17, 2022	NO CLASS - MLK Day
	Part 1: Python Fundamentals
Wednesday, January 19, 2022	lecture02: Code Execution. Variables. Types.
Monday, January 24, 2022	lecture03: Data Structures. Intro to the "dot" notation.
Wednesday, January 26, 2022	lecture04: Conditional Statements. Iteration.
Monday, January 31, 2022	lecture05: Functions. Packages.
Wednesday, February 2, 2022	lecture06: Assignment 1 Lab
	Part 2: Data Processing
Monday, February 7, 2022	lecture07: The Pandas Package and DataFrames
Wednesday, February 9, 2022	lecture08: Data Input/Output (I/O)
Monday, February 14, 2022	lecture09: Data Filtering
Wednesday, February 16, 2022	lecture10: Data Cleaning
Monday, February 21, 2022	lecture11: Merging, Reshaping
Wednesday, February 23, 2022	lecture12: Dates, Lags, Sorting
Monday, February 28, 2022	lecture13: Assignment 2 Lab
	Part 3: Data Visualization and Descriptive Statistics
Wednesday, March 2, 2022	lecture14: Data Visualization. Unconditional Statistics
March 5-13, 2022	NO CLASS - Spring Recess
Monday, March 14, 2022	lecture15: Conditional Stats - groupby, apply, transform
Wednesday, March 16, 2022	lecture16: Conditional Stats - applications
Monday, March 21, 2022	lecture17: Assignment 3 Lab
	Part 4: Linear Regression
Wednesday, March 23, 2022	lecture18: Introduction 1 (point estimates, t-statistics, p-values)
Monday, March 28, 2022	lecture19: Introduction 2 (predictions, interactions, non-linearity)
Wednesday, March 30, 2022	lecture20: Panel Regression Intro
Monday, April 4, 2022	lecture21: Robust Panel Regression
Wednesday, April 6, 2022	lecture22: Robust Time-Series Regression
Monday, April 11, 2022	lecture23: Rogression Recap Lab
Wednesday, April 13, 2022	lecture24: Assignment 4 Lab
	Part 5: Algorithmic Trading / Paper replication
Monday, April 18, 2022	lecture 25: Paper Review and Data Cleaning
Wednesday, April 20, 2022	lecture26: Sorting Variables and Descriptive Statistics
Monday, April 25, 2022	lecture27: Calculating Raw Portfolio Returns
Wednesday, April 27, 2022	lecture28: Portfolio Performance
Monday, May 2, 2022	lecture29: Assignment 5 Lab
Wednesday, May 4, 2022	lecture30: Review Session for Exam
Thursday, May 12, 2022	Final Exam: 10:30am to 12:30pm in class

Assessments

Your final grade will be calculated as follows:

- Assignments: 5 x 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 21st.** 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 on Thursday, May 12, 2022 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 80% 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**: fin525_eller
- **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.

Graduate Student Resources

Please consider including a link to the University of Arizona's Basic Needs Resources page: http://basicneeds.arizona.edu/index.html