

## Economics 424A: Computational Finance and Financial Econometrics Winter 2025

**Instructor:** Yu-chin Chen

**Class Time and Location:** MW 3:30-5:20pm in Savery 166

**Course Office Hours:** T 1:30-2:30PM & by appointment

**Email:** yuchin@uw.edu

**Website:** UW Canvas

### Course Description

This course is an introduction to computational finance and financial econometrics - *data science applied to finance*. It covers tools and concepts in computer programming and data analysis in R, econometrics (statistical analysis), financial economics, microeconomics, mathematical optimization, and probability models. This is a very hands-on course: the emphasis will be on applying economic models of asset returns to econometric analyses using real data. This involves: (1) exploratory data analysis; (2) specification of models to explain the data; (3) estimation and evaluation of models; (4) testing the economic implications of the model; (5) forecasting from the model. The modeling process requires the use of economic theory, matrix algebra, optimization techniques, probability models, statistical analysis, and statistical software.

Note: for up-to-date requirements for the *Undergraduate Certificate in Economic Theory and Quantitative Methods*, the *Certificate in Quantitative Managerial Economics*, and the *Bachelor of Science* degree in Economics, please consult the Economics Advisor's office (econadv@uw.edu).

### Format for the Course:

This is a demanding course as the objectives are multiple. **You will need to work out parts of each lecture note and sample codes on your own and in small groups, in preparation for the homework projects.** Class time will involve, in addition to interactive lectures, Q&A sessions and group discussions. Your attendance and contribution to group work are essential.

Detailed schedule and reading assignments will be posted on Canvas.

### Course Objectives

- Understand basic financial theories of risk-return tradeoff and portfolio optimization analysis.
- Apply econometric concepts of distributions, standard errors/confidence intervals, resampling methods, Monte Carlo simulations, and hypothesis testing to finance.
- Learn how to obtain, import, and analyze financial data.
- Learn how to perform statistical analysis using R.
- Applications in group projects.

### Course Textbooks:

- *An Introduction to Computational Finance and Financial Econometrics with R*, by

Eric Zivot, <https://bookdown.org/compfinezbook/introcompfinr> **(EZ)**

- ***Statistics and Data Analysis for Financial Engineering with R Examples***, by D. Ruppert and D. Matteson, Springer. The UW library has access to the e-book through SpringerLink **(Ruppert)**
- Additional supplementary material will be posted on **Canvas**

### **Software:**

This course will use *R* for data analysis and statistical modeling, with occasional use for Microsoft Excel. *R* is a free open-source statistical modeling and graphical analysis language built upon the *S* language developed at Bell Labs and is available on many computers throughout the UW campus. It can be downloaded from [www.r-project.org](http://www.r-project.org). There are versions available for the PC, Mac, and various forms of LINUX. The CSSCR lab on the 1st floor of Savery Hall has *R* on most of the PCs. We will also be using RStudio ([www.rstudio.org](http://www.rstudio.org)), a free integrated development environment for *R*.

We will be using several packages (libraries of *R* functions) specifically designed for analyzing financial time series data. *R* packages are maintained on the web and can be downloaded from within *R*. The *R* package ***IntroCompFinR*** is the companion package for the (EZ) textbook used in this class and is available on Canvas. This package contains data for all of the examples in the book as well as useful functions for data, portfolio, and risk analysis.

### **Grading:**

#### ***- 5 Homework Assignments (35%)***

There will be five homework assignments for the course. For some, you will be assigned a group to facilitate collaboration. Depending on the assignment, your submissions will be as a group or individually. Assignment grades will be based on a 10-point scale, 6 points to be awarded for completion. The remaining 4 points will be assigned based on the quality of the answers. There will also be extra credit options.

#### ***- 4 Quizzes (20%) and Final exam (20%)***

There are four quizzes for the course. Each quiz will take about 30 minutes to complete and counts towards 5% of your grade. They are designed to make sure you stay up to date with the material so are therefore cumulative. No makeups will be given. The final exam is scheduled for **March 20<sup>th</sup>**, 2:30-4:20pm

**If you cannot make an exam**, the following policy applies. If you miss a quiz, its weight will be added to the final exam. If you miss the final exam, you will need to take a make-up exam within the first week of the following quarter. This exam will be **significantly harder** than the exam at the end of this term, reflecting the fact that you have more time for preparation. Exceptions to this policy are granted in case of serious medical emergencies that concern either you or your family.

#### ***- Group Presentation & Write-Up (15%)***

There is a final group project that you will present during the last week of class with 3-4

groupmates. Topics will be assigned for you to sign up. Besides the **in-class** presentation, you will submit a more detailed write-up to help your classmates study as group project topics will be on the final exam.

**- Participation (10%)**

Participation points reflect contributions to in-classroom discussions (**including attendance for group work in class**) and to group HWs and the final project. For all the assignments that are submitted as a group, you will have the opportunity to evaluate the contributions of each group member.

**Group Work for Assignments**

This class is multi-dimensional, covering theory, application, code-reading, analyses...etc., so having others to discuss and learn from is invaluable. The course actively encourages group work. However, for individual assignments that are not assigned as a group, please submit individual assignments IN YOUR OWN WORDS.

Please use the **discussion board** for homework questions. Very often several students have the same questions, and with the discussion board, everyone can see the responses.

**Academic Conduct Policy**

The Economics Department supports the University policies regarding academic honesty and classroom behavior. Students of the course are expected to adhere to the Department's and the University of Washington's Policy on Academic Honesty that can be found at:

- <https://econ.washington.edu/policy-academic-conduct>
- <https://www.washington.edu/cssc/for-students/student-code-of-conduct/>

All students in the course will be required to sign an agreement to abide by these conducts.