Economics 424A: Computational Finance and Financial Econometrics
June 20 to Aug 1, 2023

Instructor: Yu-chin Chen
Class Time and Location: T/Th 5:30-8:30PM online
Course Office Hours: W 5:30 to 6:30PM (use link on Canvas) & by appointment
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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.

This course is an elective for the *Undergraduate Certificate in Economic Theory and Quantitative Methods* and one of the core courses for the *Certificate in Quantitative Managerial Economics*. It is also included in the *Advanced Undergraduate Economic Theory and Quantitative Methods Courses* list for the *Bachelor of Science* degree in Economics. A condensed (3 credit) version of ECON 424 is given in CFRM 462. Students entering the *Professional MS in Computational Finance and Risk Management* program or the *Computational Finance Certificate* program will benefit from being familiar with this ECON 424/CFRM 462 course material.

Note for the Summer Intensive Course:

This already intensive course is crammed in six and a half weeks; we intend to cover all the topics as the regular quarter course. **Your commitment is thus essential for success**. Most of the material will follow the free online version of this course, available on Coursera (Links to an external site.) from 2013-2015. You can access the archived videos here (Links to an external site.) Feel free to use it as a resource but **know that this summer course won't be identical to the Coursera version.**

Course Objectives

- Understand basic financial theories of asset risk-return trade-off 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 ~~and excel~~.
- Applications to foreign exchange and other markets in group projects.

Online Format

It is difficult for most people to concentrate continuously for three-hours of lectures, especially via Zoom. As such, the course will adopt a hybrid approach. You will be asked to work out some recorded material on your own, and class time will involve, in addition to interactive lectures, Q&A sessions and group discussions.

Course Textbooks:

- (Required) ***An Introduction to Computational Finance and Financial Econometrics with R***, by Eric Zivot, manuscript in preparation for publication by CRC Press. Updated: June, 2021. **(EZ)**
- (Required) ***Statistics and Data Analysis for Financial Engineering with R Examples***, by David Ruppert and David 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 for spreadsheet modeling. 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 (Links to an external site.). There are versions available for the PC, Mac, and various forms of LINIX. The CSSCR lab, on the 1th floor of Savery Hall, has R on most of the PCs. I highly recommend using RStudio (www.rstudio.org (Links to an external site.)) as a free integrated development environment for R.

We will be using several user-created packages (libraries of R functions) specifically designed for the analysis of financial time series data. R packages are maintained on the web and can be automatically downloaded from within R. The R package *IntroCompFinR* is the companion package for the (EZ) textbook used in this class and is available on R-Forge here (Links to an external site.). 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. Group work is strongly encouraged but **you need to submit individual write-ups, in your own words**, as well as the names of your group-mates. 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. Due dates are on Canvas (generally by the end of every Tuesday, except for July 4th.)

- 5 Quizzes (40%)

There are five quizzes for the course. Each quiz will take about 30 minutes to complete and counts towards 8% of your grade. They are designed to make sure you stay up-to-date on the material

so are therefore cumulative. The dates are on Canvas (i.e. every Thursday). No makeups will be given without prior approval.

- Participation (5%)

Class participation benefits everyone: it helps me gauge the level of understanding in the classroom. It can also benefit other students by clearing up confusing points. Participation includes asking and answering questions, participating in classroom discussions, and contributing to HW/lab sessions. The lab sessions are designed to help you apply concepts learned in lectures. You will be guided through examples to help you with completing assignments at home. Since we will work through problems collectively, participation is especially important.

- Group Presentation & Individual Write-Up (20%)

There will be a final group project that you will present on August 1st with your groupmates. Topics will be assigned later in the course for you to sign up. In addition to the online presentation, you will submit an **individual** short write-up to 1) summarize the overall presentation; 2) provide more details on your individual part. The write-up is due by the end of Thursday, August 3rd.

Group Work for Assignments

Working in groups is highly encouraged. Study groups are encouraged for assignments and for quiz preparation. This class is multi-dimensional, covering theory, application, code-reading…etc., so having others in the class to discuss will be very helpful, as students often learn these different components at different paces. However, **please submit individual assignments IN YOUR OWN WORDS and keep in mind that all exams/quizzes will be based on individual evaluations.**

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 conduct.