Financial Econometrics I

Instructor:	Fu Ouyang (fu.ouyang@foxmail.com)
Lectures:	14:00-17:40, Friday in School of Finance (SoF) 306
Office hours:	10:30-12:00, Friday in SoF 528, or by appointment
Website:	www.ouyangfu.jimdo.com/teaching
Prerequisites:	Undergraduate finance, econometrics, calculus, linear algebra, probability and statistics

Course Description

As an introductory course at the master's level, this course introduces students to fundamentals of financial econometrics. Topics will cover the basic tools that finance researchers and analysts use to build empirical models and test financial economics theories, as well as evaluate policy effects and business practices. This course is application-oriented and the mathematics will be kept at a moderate level. Emphasis centers on intuitive understanding of key concepts and techniques in financial econometrics and providing a solid foundation for empirical work and carrying out research projects in various fields such as time series analysis, asset pricing, portfolio management, risk management, securities regulation, among others. The main purpose of this course is to teach students "workhorses" of empirical studies in finance and sharpen their quantitative skills. This course will also introduce students to the use of the R programming language. As a powerful software environment for data analysis, statistical computing and graphics, R's popularity among a wide variety of professionals in the financial industry (e.g., quantitative analysts, consultants, portfolio managers, etc) has increased substantially during recent years.

Course Objectives

By the end of this course you should be able to:

- Define and explain common terms and concepts used in financial econometrics.
- Understand the mechanics of basic econometric estimators and hypothesis testing.
- Diagnose estimation problems and explain how they may affect the inference.

- Choose the most appropriate econometric model for a given problem and data set.
- Conduct empirical analysis using R, interpret the program output, and effectively communicate the results.

Textbook and References[1]

- (Required) Jianqing Fan and Qiwei Yao (2017), "The Elements of Financial Econometrics", 1st edition, Cambridge University Press.
- (Optional) Jianqing Fan and Qiwei Yao (2003), "Nonlinear Time Series: Nonparametric and Parametric Methods", 1st edition, Springer.
- (Optional) Walter Enders (2014), "Applied Econometric Time Series", 4th edition, Wiley.
- (Optional) Peter J. Brockwell and Richard A. Davis (2009), "Time Series: Theory and Methods", 2nd edition, Springer.
- (Optional) Peter J. Brockwell and Richard A. Davis (2016), "Introduction to Time Series and Forecasting", 3rd edition, Springer.

Statistical Computation

The computation in this class should be carried out using R, which has its free and open source software environment available for Windows, Mac OS, and Linux. You can download and install the latest version of R[2] from the R Project for Statistical Computing. I will use R for most of the empirical examples I present in this class. The data and codes for these examples will be made available on course website, so you can replicate the results. There are numerous (free) references for R available online. For starters, I personally recommend "R Programming for Data Science" by Roger Peng. An online course associated with this book is available on Coursera.

Problem Sets

There will be 7 problem sets distributed out during the course. They will be posted on the course website. Problem sets should be turned in at the beginning of class on the day that they are due. Late homework will not be accepted and there will be no extensions.

[1] You can purchase these books at www.amazon.cn.

[2] If you prefer a Matlab-like, integrated development environment (IDE), you can download and install RStudio after you have R installed.

Working problems is an effective way of learning the theoretical aspects of econometric methods. Most problem sets will include at least one empirical problem in which you will be asked to conduct some analyses on a data set. These data sets will be made available on the course website and most of them will be in CSV format. You are encouraged to work on the problems together (no more than 3 people), but everyone should turn in his or her own original work. Please place the names of the other students in your work group on the top of your assignment. Read homework instruction carefully before you start working on each homework.

Final Project

There will be a final project on which you are encouraged to work with your homework partner(s). The project can be thought of as a "comprehensive" problem set, for which you will be given a data set and a series of research questions. The project is designed so that you are required to apply the techniques learned in lectures to analyze the given data set. The project will be released during the last week of this class, and you will have two weeks to write up a research report summarizing your answers to the research questions. You should submit your report by the due date (TBD). No late submission is acceptable. Similar to the problem set, you are allowed to work on the project in groups, i.e., you can discuss how to answer the questions with your group members. However, this is not a group project, which means that you must answer all the questions in your own words and hand in your report (with names of your group members on it) separately.

Grading

Your course grade will depend on your performance on the problem sets and final project in the following way:

$$\text{Grade} = \text{Problem Sets } 70\% + \text{Final Project } 30\%$$

Course Structure and Outline[3]

This class consists of two sections, *lectures* and *office hours*. The lectures will introduce new materials and develop the key concepts of the course. I will lecture using slides, which will be posted on the course website. The slides for particular lectures should be available for downloading at least 24 hours before the day I lecture on this topic in class. I recommend that you bring a copy to class. If I make major changes to the slides, either during or after class, I will post updated versions of them and send you notifications.

[3]The course outline is tentative and subject to future adjustment.

Office hours are intended to help you get answers to questions about concepts from the lectures, the problem sets and, later in the course, about final projects. The attendance is totally optional. You are encouraged to stop by my office during office hours with questions to ask or send them to me in advance and schedule a short discussion session.

The course outline is summarized in the following table:

WEEK	TOPIC	READING
	Part 1: Time Series Analysis in Financial Econometrics	
Week 1	Course syllabus, asset returns and related statistical models, efficient market hypothesis and related tests.	Chapter 1
Week 2	Linear time series models (1): review of asymptotic statistics, stationarity, ARMA models, and their estimation.	Chapter 2
Week 3	Linear time series models (2): model diagnostics, identification, and selection, nonstationarity.	Chapter 2
Week 4	Linear time series models (3): deterministic and stochastic trends, forecasting.	Chapter 2
Week 5	Heteroscedastic volatility models (1): ARCH and GARCH models.	Chapter 3
Week 6	Heteroscedastic volatility models (2): ARMA-GARCH models, extended GARCH, stochastic volatility models.	Chapter 3
Week 7	Multivariate time series analysis (1): stationarity and autocorrelation matrices, vector autoregressive models.	Chapter 4
Week 8	Multivariate time series analysis (2): causality, impulse reponse functions, unit root, and cointegration.	Chapter 4