

THE UNIVERSITY OF CHICAGO
Booth School of Business
Business 41202-01/81, Spring Quarter 2017, Mr. Ruey S. Tsay

Analysis of Financial Time Series
COURSE INFORMATION

Course web:

<http://faculty.chicagobooth.edu/ruey.tsay/teaching/bs41202/sp2017/>

Booth Honor Code: This course requires students to follow closely the Chicago Booth Honor Code and Standards of Scholarship in examinations and homework assignments. The Honor Code requires students to sign the following pledge, “I pledge my honor that I have not violated the Honor Code during this examination,” on every examination.

Course Objectives:

- To learn basic knowledge of financial time series, including high-frequency data and big finance data
- To study simple models and methods for analyzing financial data (both for mean and volatility evolutions). In particular, various approaches to volatility modeling are discussed.
- To investigate dependence between asset returns, including Kendall tau, Spearman’s rho, and tail dependence
- To assess market risk and credit risk, and to study methods for calculating Value at Risk (VaR) and expected shortfall.
- To understand proper use and limits of econometric methods in business and finance.
- To gain experience in handling financial data and big finance data.

Textbook: *Analysis of Financial Time Series* by Ruey S. Tsay (John Wiley, 2010), 3rd Ed., ISBN 0-470-41435-9.

Some References: (optional)

- *The Econometrics of Financial Markets* by Campbell, Lo, and MacKinlay, 1997, Princeton University Press: New Jersey.
- *Options, Futures, and Other Derivatives*, 8th Ed. by J.C. Hull, 2012, Prentice-Hall: Upper Saddle River, New Jersey.
- *Modeling Financial Time Series with S-plus* by E. Zivot and J. Wang, 2005, 2nd Ed., Springer: New York. (2nd printing).

- *An Introduction to Analysis of Financial Data with R* by Ruey S. Tsay, (John Wiley, 2013), ISBN 0-470-89081-3.
- *Statistics and Data Analysis for Financial Engineering* by D. Ruppert and D.S. Matteson, 2nd ed., Springer, 2015. ISBN1-4939-2613-8.

Web: All data sets of the textbook are posted on Web at <http://faculty.chicagobooth.edu/ruey.tsay/teaching/fts3/>

Handouts and assignments are posted on Web at

<http://faculty.chicagobooth.edu/ruey.tsay/teaching/bs41202/sp2017/>

(or click on the course name on my teaching web page)

Students are encouraged to check the course web site regularly for information concerning the course.

Office hour:

Wednesday: 4:00 pm to 5:00 pm or by appointment.

My phone number (773)702-6750, My office: HPC 455

Fax number: 773-702-0458

E-mail: ruey.tsay@chicagobooth.edu

(the easiest way to contact me)

Teaching Assistant: Mr. Jae Hyen Chung

The easiest way to contact Jae is via email below:

E-mail: jchung4@chicagobooth.edu

TA will hold weekly review sessions. **For campus session, review starts from Week 2.** Evening session starts from Week 1 (to install R, if needed). TA will also help you with software packages and answer your questions.

Review Sessions:

1. BS41201-01: Tuesdays 11:45 am to 12:15 pm, HCC04
2. BS41202-81: Tuesdays 5:20 pm to 5:50 pm, GC 308 (except 4/4 and 6/6 at GC 206).

Grading:

In-class Exam (30%), Final Exam (35%), in-class discussion (5%), and homework assignments (30%).

Computing and software:

Data analysis is an integral part of the course. The software package used is R, which is free and easy to use. Multiple packages will be used, including quantmod, fBasics, fGarch, rugarch, and evir. Instructions to install R are available on course web page.

Instructions for using R commands will be given and discussed. **No prior knowledge of the packages is required.**

Students may use other packages if they prefer.

Special notes:

- R is free at <http://www.r-project.org> (with many packages useful for the course).
- There are six HW assignments. The best five scores are used to compute the final grade of homework assignment.
- Homework is due **before** class on the due day. **No e-mail submission is accepted.**
- No late homework assignments will be accepted; I plan to post solutions on the Web promptly.
- Students may discuss homework assignments, but **every student must hand in his or her own solutions.**
- In-class exam: Week 6, open book. (Campus class: May 3, Evening class: May 2)
- Final exam in the exam week as scheduled.

Course Outline: **All topics include data analysis and applications.**

1. Returns and their empirical characteristics; data analysis with R including accessing financial and economic data via Internet.
2. Measuring dependence between returns: correlation, Kendall tau, Spearman's rho and tail dependence.
3. Linear time series models and their applications, including pros and cons of various models.
4. Volatility modeling via conditional heteroscedastic models
5. Nonlinear models, neural networks and their applications (brief)
6. High-frequency data analysis, realized volatility, and market micro-structure (including big data issue)
7. Continuous-time diffusion models and Ito's Lemma (brief)
8. Value at Risk (VaR), stress test, peak over the threshold (extreme value theory), expected shortfall, and quantiles.
9. Multivariate models, factor models, and their applications, if time permits.
10. Multivariate analysis of financial returns, including pair trading, if time permits.
11. Principal volatility component analysis, if time permits.

Pre-class reading: See course web handout: Note