

## CSC425 Time Series Analysis and Forecasting 2014/15 Fall quarter

### Instructor

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**Office Hours:** Thursday at 3:30-5:00pm (in my office or through Online Rooms at d2l.depaul.edu)

**Course Web page:** <http://d2l.depaul.edu>

### Summary of Course

The course presents statistical methods for time series analysis and forecasting with a focus on financial data analysis. The course will place great emphasis on applications. The course topics include linear time series analysis, stationarity and autocorrelation functions, autoregressive and moving average models, and their generalizations, conditional heteroschedastic (ARCH/GARCH) models to describe markets volatility. Alternative models for financial markets volatility will be discussed. If time permits, we'll discuss non-linear models, and non-parametric tests to address non-linearity problems in financial time series. Students will have the option to use the statistical packages SAS or R for the analysis and modeling of time series.

### Prerequisites

CSC423 or consent of instructor.

### Grading Policy

The final grade has the following components:

*Homework and Programming assignments (45%).* There will be four or five assignments. Assignments will be posted on Thursday and be due a week later on Friday at midnight. Late assignments will not be accepted later than three days from the due date. Notice that a 25% point penalty will be applied for late submissions. **Extensions may only be granted for exceptional reasons, and must be requested BY EMAIL before the due date.**

*Group project (25%).* Final project due at the end of the quarter. Details will be provided later in class.

*Final (30%).* In-class exam is scheduled on Thursday November 20th (week 11). Details about the exam will be provided during the course. **Online students must schedule their final exam** using the Proctored Exam link at the D2L website during the time frame specified by your instructor. Students living within the Chicago land area are expected to take their exams at a DePaul University campus. Time slots vary by campus and day. They can also take the exam with the other in-class students at the official exam time. Online students living outside the Chicago land area (*remote*) will have their exams administered by a qualified proctor. You will need to find an acceptable proctor in your area before you register for your exam. Detailed information about online exams is at <http://blogs.cti.depaul.edu/colwiki/Wiki%20Pages/How%20Do%20I%20Take%20My%20Exams.aspx>

Students receiving more than 90% of possible points are guaranteed at least an A-, more than 80% at least a B-, more than 70% at least a C-, and more than 60% at least a D.

### Textbooks and Printed Resources

**Required Text:** An Introduction to Analysis of Financial Data with R" by Ruey Tsay, Publisher: Wiley, October 29, 2012, ISBN-10: 0470890819

Note that this is a new textbook that replaces the previous textbook from the same author. The newer book is shorter and covers the topics discussed in csc425, including additional examples and case studies.

Students may choose to buy the “longer” book *Analysis of Financial Time Series*, 3rd ed., by Ruey S. Tsay. John Wiley & Sons (2010), ISBN: 0-470-414359 (for students interested in learning additional techniques that we don’t have time to cover in a 10 week course).

**Optional Text:**

*SAS for forecasting time series*, 2nd ed., by John C. Brocklebank and David A. Dickey. SAS Institute Inc. & John Wiley & Sons (2005). ISBN: 0-471-39566-8

Introductory notes on SAS and R will be posted on the course website.

**Statistical software:**

Students have the option to use either SAS or R. Two or three lab sessions (recorded for online students) will be scheduled during the quarter.

Both SAS 9.3 and R are available in the CDM labs, and SAS is available in all DePaul labs. If you prefer to install the software on your own machine:

- R is freely available at <http://cran.rstudio.com/>.
- The MS Windows-version of SAS 9.3 installer (with installation directions) is now available on Campus Connection at <http://campusconnect.depaul.edu> under Self Service -> Student Resources -> Student Software -> Windows -> SAS -> Installer -> 9.3

The pdf file found there contains installation instructions. Note: SAS 9.3 system requirements can be found at <http://support.sas.com/documentation/installcenter/93/index.html>

**Information for all students**

Students are encouraged to contact the instructor for any question related to the course. You can see me in my office (room 716 of CDM building) during contact hours, or by appointment at other times.

The best way to contact me is through email at [rsettimi@cdm.depaul.edu](mailto:rsettimi@cdm.depaul.edu). Most emails will be answered within 24 hours. You can also call me at 312 362-5556, or skype (skype.com) with me (skype ID: raffasw)

**All students are expected:**

- To read this document in full!
- To attend all classes (online students are expected to watch each lecture). If you miss a class, it is your responsibility to watch the lecture recording and to get copies of the notes or documents handed out in class. All lecture recordings are linked to the course website at <http://d2l.depaul.edu>
- To participate actively to class discussions and activities and to work on the in-class problems and exercises that are designed to improve students’ understanding of the class topics.
- To be familiar with all the course documents and notes posted at the course website.
- To read all the sections in the textbook relevant to the lecture before coming to class. The reading assignments are listed in the schedule included in this syllabus. Lecture notes are meant to complement the course textbook NOT TO REPLACE IT.
- To strictly adhere to the University Academic Integrity Policy, that is published in the Student Handbook or at the Academic Integrity site at DePaul University (<http://academicintegrity.depaul.edu>).

Violations of the University Academic Integrity Policy include (but are not limited to): (a) using or providing unauthorized assistance or materials on course assignments; (b) possessing unauthorized materials during an examination; (c) submitting as one’s own any material that is copied from published or unpublished sources such as the Internet, print, computer files without proper acknowledgement that it is someone else’s; (d) submitting as one’s own work a report, examination, paper, computer file, lab report or other assignment which has been prepared by someone else. If you are unsure about what constitutes unauthorized help on an exam or assignment, or what information requires citation and/or attribution, please ask your instructor. If proven, violations may result in the failure of the assignment, failure of the course, and/or additional disciplinary actions.

*Tutors:* Unfortunately there aren't tutors for this course. The tutors' schedule is at:

<http://www.cdm.depaul.edu/advising/Pages/TutoringProgram.aspx>

Remember that I am your "best tutor", and you should not hesitate to contact me and to come and see me for any question regarding the assignments.

#### For online students

Recordings of each lecture will be available a few hours after the "live" class, and can be found at the course website <https://d2l.depaul.edu>. Online students are expected to watch the lectures every week and to keep up with the course information posted on the course website.

Students are encouraged to contact the instructor through email at [rsettimi@cdm.depaul.edu](mailto:rsettimi@cdm.depaul.edu), phone (312 3625556) or skype (skype id: raffasw). Most emails will be answered within 24 hours.

#### Tentative schedule and reading assignments

The following schedule is tentative. The reading assignments are from the course textbook "An Introduction to analysis of financial data with R" by R. Tsay.

Week	Topic	Reading assignment
1	Review of some statistical concepts: exploratory data analysis, correlation and regression analysis. Introduction to financial time series and their properties, distribution of returns. Introduction to SAS and R. <i>Lab session</i>	Chapter 1: Sections 1.1 - 1.7
2	Distribution of returns and empirical properties. Stationarity, correlation and autocorrelation function. White noise series and introduction to linear time series.	Chapter 1: Section 1.7 - 1.8 Chapter 2: Sections 2.1, 2.2, 2.3.
3	Linear Time series: Simple autoregressive models and moving average models.	Chapter 2: sections 2.4, 2.5. Chapter 3: section 3.1
4	Simple ARMA models. Estimation and identification of correct ARMA model. <i>Lab session</i>	Chapter 2: sections 2.6, 2.12
5	Unit root non stationarity and ARIMA models, Exponential smoothing.	Chapter 2: sections 2.7, 2.8. Chapter 3: section 3.2
6	Seasonal models (SARIMA). Conditional heteroschedastic models. Characteristics of volatility and ARCH effects.	Chapter 2: section 2.9. Chapter 4: sections 4.1 to 4.5
7	The GARCH model. Integrated GARCH, GARCH-M and E-GARCH models to analyze market volatility	Chapter 4: sections 4.6 to 4.12. Chapter 5: section 5.1
8	More advanced GARCH models	Chapter 4: sections 4.6 to 4.12.
9	Regression models with time series errors. Adding covariates to time series models.	Chapter 2: section 2.10 Chapter 3: section 3.3 Chapter 4: section 4.15
10	Analysis of High-frequency data. Discussion of challenges and solutions. Review for final exam	Chapter 6
11	Final exam	