FSRM565: FINANCIAL TIME SERIES ANALYSIS 16:958:565

SPRING 2021, THURSDAY 6:40-9:30 PM, ONLINE

1. COURSE INFORMATION

- Instructor: Han Xiao
- Office: Hill Center 451
- Office Hour: **Wednesday 2:00–3:00pm** or by appointment
- Email: hxiao@stat.rutgers.edu (**Only** emails sent to this account are guaranteed for replies in time!)
- TA: Zebang Li
- TA Email: zl326@stat.rutgers.edu
- TA Office Hour: **Monday 10:00am–12:00pm** or by appointment
- Prerequisite. First graduate level courses in mathematical statistics and applied regression. This course will cover a great deal of materials at a rapid pace and will require some programming kills (`R`, or other software of your choice, such as `SAS` or `Python`). Students who have had difficulty in previous mathematical statistics courses or programming may find that this course requires a considerable amount of time and effort, and should plan accordingly.
- Text: 01. *Analysis of Financial Time Series*, by Ruey S. Tsay. Wiley, 2010, 3rd. Full text available at `https://ebookcentral.proquest.com/lib/rutgers-ebooks/reader.action?docID=565117`. Access from campus or login via Rutgers account. The book website is:
`https://faculty.chicagobooth.edu/ruey-s-tsay/research/analysis-of-financial-time-series-3rd-editi`
  02. *Time Series Analysis and Its Applications*, by Robert H. Shumway and David S. Stoffer. Springer, 2017, 4th. Full text available through Springer Link
`https://link-springer-com.proxy.libraries.rutgers.edu/book/10.1007/978-3-319-52452-8`.
You need to access the Springer Link through Rutgers library and log in using your NetID. The book website is `https://www.stat.pitt.edu/stoffer/tsa4/`
  03. *Multivariate Time Series Analysis*, by Ruey S. Tsay. Wiley, 2014. Full text available at `http://ebookcentral.proquest.com/lib/rutgers-ebooks/reader.action?docID=1562422`. Access from campus or login via Rutgers account. The book website is:
`https://faculty.chicagobooth.edu/ruey-s-tsay/research/multivariate-time-series-analysis-with-r-an`
- Software: R. Free software available at `http://www.r-project.org/`. If you go to `Manuals` on the left panel of the website, you will find a good introduction *An Introduction to R*. A more advanced reference is *Modern Applied Statistics with S*, by Venables and Ripley. Springer, 2002, 4ed.
- Course website: Canvas
- Course work: eleven homework assignments, project, midterm and final exams.
- Grades: homework (20%), midterm (30%), final (30%) , project (20%).

2. Syllabus (tentative)

Week #	Date	Topic	Due
1	Jan 21	Introduction and stationarity	
2	Jan 28	Classical decomposition models	HW1
3	Feb 04	Linear state space models and Kalman filters	HW2
4	Feb 11	ARIMA models: models and simulations	HW3
5	Feb 18	ARIMA models: prediction	HW4
6	Feb 25	ARIMA models: inference and diagnostics	HW5
7	Mar 04	Time series regression and lagged regression / Intervention Analysis	HW6 Proposal
8	Mar 11	Midterm	
9	Mar 25	Nonlinear time series analysis	HW7
10	Apr 01	Conditional heteroscedastic models	HW8
11	Apr 08	Value at Risk	HW9 Intermediate report
12	Apr 15	Multivariate time series: basics	HW10
13	Apr 22	Multivariate time series: factor models and vector autoregressive models	HW11
14	Apr 29	Project Presentation	HW12
15	TBA	Final	

3. Homework

- Homework will be assigned and collected weekly. The lowest grade will be dropped. **So late homework will NOT be accepted. DO NOT COPY from other sources.**
- All homework assignment should be written on standard 8.5 by 11 paper and then scanned or photographed into PDF. Computer generated output without detailed explanations and remarks will not receive any credit. You may type out your answers, but make sure to use different fonts to distinguish your own writings from the computer output. .
- Data analysis is an integral part of the course. The main software package is R. Instructions for using the package will be given and briefly discussed, assuming you have taken the *Regression Analysis* course with R. If you do not have previous exposure to R (or S+), please be aware that you may need to devote considerable time and effort to get started. R is a free software. You may use any other software package of your choice, but no instructions or help will be given from TA or me.

4. Project Guideline

Project is to be carried out by a team of two investigators. Imagine that the upper management is contemplating to disband your team and this is your last chance to show how useful you are, in order to save your job. You can choose to do (but not limited to) one of the following things: (i) finding an interesting dataset, raising and answering meaningful questions, (ii) reading a journal/conference paper and reproducing its numerical results, (iii) propose new methodological/algorithmic/theoretical ideas.

Your **project proposal** needs to include what you plan to do, why it is important to the business, what kind of data you are going to use and a list of possible methodologies you plan to use. Your **intermediate report** needs to include data description, preliminary analysis, the methodologies you are using, and the results you expect to get. The presentation is limited to 10 minutes to your upper management who will decide if you still have a job tomorrow. Your **final report** should contain a report of what you have done, with summaries for a very busy boss who missed your presentation, and with details for an expert consultant who will read all the details of your report and give an expert opinion to the upper management.

Important dates: proposal due on **Mar 04**, intermediate report due on **Apr 08**, final report due on **TBA**. Please submit **hard** copies for the proposal and intermediate report, and the following for the final report **by email** and **on Canvas**: (i) a **PDF** file of the final report, (ii) data set used for the project, which can be directly read by R, and (iii) R code (please make sure that by running the code, all the results in the report can be reproduced).