Time Series Econometrics and Business Forecasting

ECON 4304, Spring 2022

Department of Economics, HKUST

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Course Description:

This course will introduce students to econometric techniques and their applications in economic time series analysis. We will first review key concepts in multiple regression using time series data. We then introduce the test for structural change. We will walk through both the theory and applications of ARMA models for forecasting, estimation of dynamic causal effects using vector autoregression, unit root and cointegration, conditional heteroskedasticity through the lens of (G)ARCH models. Emphasis will be put on special features of economic time series data and the associated statistical tools. The free software R will be used for data analysis.

Prerequisites: Econ 3334 or consent of instructor.

Lectures: The lectures will initially be conducted through the online mode via Zoom. You need to join the Zoom meeting through Canvas during the class time. We expect to hold the regular classroom and mixed-mode teaching in late February if the pandemic situation improves. The planned classroom teaching schedule is as follows:

Monday 04:30PM - 05:50PM; Friday 12:00PM - 01:20PM. (Rm 2304, Lift 17-18)

Tutorial Sessions: TA: Feiting XU <fxuaf@connect.ust.hk>

The tutorial is **not** weekly. The TA will make an announcement through Canvas when there is a tutorial session. Initially, the tutorial will be conducted via Zoom. There is no tutorial during the first week. The planned time and face-to-face tutorial location will be as follows:

Friday 04:30PM - 05:20PM. (Rm 4502, Lift 25-26)

Textbook: The course material will be mainly based on lecture notes and slides. The following books will also serve to help you to enhance your learning of the content in the lecture notes and slides.

***** Stock, James and Mark Watson (2019) "*Introduction to Econometrics*." 4th Edition, Pearson.

***** Chris Brooks (2014): "Introductory Econometrics for Finance." 3rd Edition, Cambridge University Press.[1]

[1] Other editions of both books also work.

Course Web Site: http://canvas.ust.hk

Slides, problem sets and other materials will be posted on Canvas. You should check the course website at least **twice a week** for important announcement such as the homework information.

Computer Software

- Data analysis will be mainly demonstrated using the free software R.
  - R is available at: https://www.r-project.org/. You may install R first. Then install Rstudio (https://rstudio.com/), which is an easy interface to use R.
- You may also use other software such as Eviews, Stata, gretl, Python, Matlab, etc (except Excel), to finish data-related problem sets. However, I will focus on R in my teaching. I will not teach or provide technical assistance for other software in this course.

Course Requirements:

Homework (15%): There will be 5 graded problem sets (3 points each) and some ungraded practice quizzes, assigned during the semester. These problem sets/quizzes focus on computational and analytical exercises. Each student must submit his/her **own answers** in their **own writing** individually. **Students must submit their solutions through Canvas**. Main solution files must be in Microsoft Word or PDF format. Data files must be read by Microsoft Excel. The due dates will be specified in each assignment. **Email or mail submissions will not be accepted.** Late submission including uploading failure will not be accepted without justification. If the submission occurs after the answer is posted, it will receive zero point.

Midterm (30%): **Date and time: Mar 14 (Monday), during class time**.
The midterm will be cover all course materials before Mar 15. A formula sheet will be provided. We will conduct the test either online or physically depending on the University policies.

Final (55%): **Time and format to be announced**.
The final will cover all course materials, include those covered in midterm. We expect to conduct the test physically on campus unless the University changes relevant policies.

Class Attendance: We will not take record of attendance but you are strongly encouraged to attend every lecture. During the online class, you should use your **official name** to join the Zoom meeting. Any distracting behaviors, such as posting lecture-unrelated content, will not be tolerated. A student violating the rule will be removed from the Zoom meeting and receive significant deduction of points from his/her final grade

Exam Policy:

- There will be no make-up exams for the midterm. If you miss the midterm, you will receive zero for that exam. The only exception is a verifiable medical reason, in which case the weight of the midterm

will be moved to the final exam. If you miss the final exam, you will receive an "F"(fail) for the course. The only exception is that you successfully apply a make-up exam formally through the school. In such a case, I will allow you to do a make-up exam.

- There is zero tolerance of cheating in the exam. The case of cheating will be reported to both the department and the school level. We will check your **school ID cards** during exams.

- For the online exams, you must comply with all the rules that will be separately sent out before the exam. Some basic rules:

  - You will need a mobile device and a computer with a webcam.
  - It is your responsibility to find a private place where you have reliable internet connection to do the online exams.
  - You will be required to **record your computer's screen** throughout the exams.
  - You will be required to scan your written exam as PDF files and upload them to Canvas in the designated time.
  - Time zone, unstable internet or other technical difficulties other than Canvas/Zoom server failures, are NOT excuses for failure of complying with the rules.
  - I reserve the right to orally question you about your answers.
  - In case of disputes over any suspicious activities, I may void your exam entirely without re-examination.

Re-grading Policy: Contact your TA regarding any grading issue within one week from the time the grade is released.

Academic Integrity and Honesty: Students are required to comply with the university policy on academic integrity as detailed at http://ugadmin.ust.hk/integrity/student-1.html

Course Intended Learning Outcomes: Upon completion of the course, you will be able to:

1. Understand key concepts in time series econometrics and acquire basic analytical skills in time series analysis.
2. Construct an appropriate time series regression model to analyze a given economic data set, and then conduct statistical inference and interpret the results.
3. Use the statistical software R to conduct time series analysis and forecast.

4. Collect data set to conduct empirical analysis, and provide answers to economic questions.

5. Present your understanding of certain economic problems verbally and in writing, and use empirical results to justify your explanation.

Tentative Schedule:

	Date	Day	Topic	Book by CB
1	Feb.4	Fri	Topic 1: Introduction	Ch.1
2	Feb.7	Mon	Topic 2: Review of linear regression	Ch.2
3	Feb.11	Fri		Ch.3
4	Feb.14	Mon	Topic 3: Review of regression diagnostics	Ch.4
5	Feb.18	Fri		Ch.4
6	Feb.21	Mon	Topic 4.1: Univariate time series models: autocorrelation	Ch.5
7	Feb.25	Fri		Ch.5
8	Feb.28	Mon	Topic 4.2: Univariate time series models: information set	Ch.5
9	Mar.4	Fri	Topic 4.3: Univariate time series models: MA	Ch.5
10	Mar.7	Mon	Topic 4.4: Univariate time series models: AR, ARMA	Ch.5
11	Mar.11	Fri	Topic 4.5: Univariate time series models: model selection	Ch.5
12	Mar.14	Mon	**Mid-term exam** (the same as class time)	
13	Mar.18	Fri	Topic 5: Multivariate time series models: VAR	Ch.6
14	Mar.21	Mon		Ch.6
15	Mar.25	Fri		Ch.6
16	Mar.28	Mon		Ch.6
17	Apr.1	Fri	Topic 6: Multivariate time series models: cointegration	Ch.7
18	Apr.4	Mon		Ch.7
19	Apr.8	Fri		Ch.7
20	Apr.11	Mon		Ch.7
21	Apr.22	Fri	Topic 7.1: Volatility models: introduction	Ch.8
22	Apr.25	Mon	Topic 7.2: Volatility models: ARCH/GARCH	Ch.8
23	Apr.29	Fri	Topic 7.3: Volatility models: applications	Ch.8
24	May.6	Fri	Topic 7.3: Volatility models: applications	Ch.8

Remark: no class on Apr 15, Apr 18 (Midterm break), May 2, May 9 (Public Holiday).