**Time Series Econometrics and Business Forecasting**

**ECON 4304, Spring 2021**

**Department of Economics, HKUST**

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Office: Rm 6082, LSK Bldg        Office Hours: by appointment.

**TA:**        XU, Feiting        Email: fxuaf@connect.ust.hk

**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 Gretl and 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.  The regular classroom teaching will not start until further notice from the university. The planned classroom teaching schedule is as follows:

Monday and Wednesday 12:00 PM - 1:20 PM.

**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**.

**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]

**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.

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[1] Other editions of both books also work.

**Computer Software**

- Gretl is available at: http://gretl.sourceforge.net/

- 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 Matlab, Eviews, Stata, Python, etc (except Excel), to finish problem sets. However, they will not be taught 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. Students may work in groups, but each student must submit his/her own solution. **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 (tentative): Mar 15 (Monday), 12pm-1:00pm (class time).
The midterm will be open-book and cover all course materials before Mar 15. We will conduct the test online unless the University changes relevant policies. I will announce the details later.

**Final (55%):**    **Time and format to be announced**.
The final will be open-book and cover all course materials, include those covered in midterm. We will conduct the test online unless the University changes relevant policies. I will announce the details later.

**Class Attendance**: You should use your **official name** to join a 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 <u>one week</u> 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 Gretl and 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.1  | Mon | Topic 1: Introduction                                             | Ch.1       |
| 2  | Feb.3  | Wed | Topic 2: Review of linear regression                              | Ch.2       |
| 3  | Feb.8  | Mon |                                                                   | Ch.3       |
| 4  | Feb.10 | Wed | Topic 3: Review of regression diagnostics                         | Ch.4       |
| 5  | Feb.17 | Wed |                                                                   | Ch.4       |
| 6  | Feb.22 | Mon | Topic 4.1: Univariate time series models: autocorrelation         | Ch.5       |
| 7  | Feb.24 | Wed |                                                                   | Ch.5       |
| 8  | Mar.1  | Mon | Topic 4.2: Univariate time series models: information set         | Ch.5       |
| 9  | Mar.3  | Wed | Topic 4.3: Univariate time series models: MA                      | Ch.5       |
| 10 | Mar.8  | Mon | Topic 4.4: Univariate time series models: AR, ARMA                | Ch.5       |
| 11 | Mar.10 | Wed | Topic 4.5: Univariate time series models: model selection         | Ch.5       |
| 12 | Mar.15 | Mon | **Mid-term exam** (the same as class time)                        |            |
| 13 | Mar.17 | Wed | Topic 5: Multivariate time series models: VAR                     | Ch.6       |
| 14 | Mar.22 | Mon |                                                                   | Ch.6       |
| 15 | Mar.24 | Wed |                                                                   | Ch.6       |
| 16 | Mar.29 | Mon |                                                                   | Ch.6       |
| 17 | Apr.7  | Wed | Topic 6: Multivariate time series models: cointegration           | Ch.7       |
| 18 | Apr.12 | Mon |                                                                   | Ch.7       |
| 19 | Apr.14 | Wed |                                                                   | Ch.7       |
| 20 | Apr.19 | Mon |                                                                   | Ch.7       |
| 21 | Apr.21 | Wed | Topic 7.1: Volatility models: introduction                        | Ch.8       |
| 22 | Apr.26 | Mon | Topic 7.2: Volatility models: ARCH/GARCH                          | Ch.8       |
| 23 | Apr.28 | Wed |                                                                   | Ch.8       |
| 24 | May.3  | Mon | Topic 7.3: Volatility models: applications                        | Ch.8       |
| 25 | May.5  | Wed | Topic 8: A guide for empirical study                              | Ch.13      |

**Remark**: no class on Feb 15 (Public Holiday), Mar 31, Apr 5 (Midterm break).