ECON 4304: Time Series Econometrics and Business Forecasting

HKUST Department of Economics

2025-26 Spring Term

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Course Description

This course introduces econometric methods and their applications in time series analysis and forecasting. Topics include multiple regression using time series data, tests for structural break, theories and applications of ARMA models for forecasting, modeling time-varying volatility using ARCH/GARCH models, unit root testing for non-stationary time series data, estimation of dynamic causal effects using vector autoregression and cointegration, forecasting with mixed frequencies using MIDAS and dynamic factors.

Prerequisites

Econ 3334 or equivalent

Course Intended Learning Outcomes (CILOs) and Mapped PILOs

Upon successful completion of the course, students will be able to:

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

Assessment Scheme

Assessment Tasks	Contribution to Final Grade (%)	Due Dates/Exam Dates
Assignments	20%	Feb 21, Mar 11, Apr 8
In-class Exam 1*	26%	Mar 16 (Mon)
In-class Exam 2*	26%	Apr 13 (Mon)
In-class Exam 3*	28%	May 8 (Fri)

*You need to bring your laptop (with R and Rstudio installed) to the classroom and log in to the CANVAS course website to take the exams. Absence from exams without valid reasons (illness/family emergencies) and documentary proof will result in zero marks.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped CILOs	Explanation
Assignments	CILOs 3, 4	The assignments evaluate students' ability to conduct time series analysis to solve economic and financial problems.
Exam	CILOs 1, 2, 3	The exam assesses students' understanding of time series econometrics discussed in the lectures.

Learning Resources

There is no required textbook. We use lecture slides and code examples for teaching. All teaching files are downloadable from the course CANVAS website (https://canvas.ust.hk).

The following books (in Library Reserve) help enhance your learning of the content in the lecture slides.

- Chris Brooks (**CB**) (2019): "Introductory Econometrics for Finance." 4th Edition, Cambridge University Press.
- Stock, James and Mark Watson (2019) "Introduction to Econometrics." 4th Edition, Pearson.

The course uses R to demonstrate time series analysis. It 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.

Final Grade Rubrics

Grade	Short Description	Elaboration
A	Excellent Performance	Demonstrate a deep understanding of the time series econometrics covered in the course. Exhibits exceptional skills in utilizing the taught techniques to solve related economic and financial problems. Excels in the assignments and exams.
B	Good Performance	Shows a solid grasp of the time series econometrics covered in the course. Demonstrates good skills in utilizing them to solve related economic and financial problems. Performs well in the assignments and exams.
C	Satisfactory Performance	Demonstrate an adequate understanding of the time series econometrics covered in the course. Demonstrates fair skills in utilizing them to solve related economic and financial problems. Performs fairly in the assignments and exams.
D	Marginal Pass	Students show limited understanding of course materials, inconsistent use of tools, and incomplete performance in assignments and exams.
F	Fail	Students display a lack of understanding of course materials, inadequate use of tools, and unsuccessful completion of assignments, and exams.

Course Outline

1. Introduction (Week 1, CB Ch.2)

2: Review of Linear Regression Using Time Series Data (Weeks 1-2, CB Ch.3-4)

3: Review of Regression Diagnostics: A Time Series Perspective (Weeks 2-3, CB Ch.5)

- Tests for Structural Break

4. Univariate Time Series Models (Weeks 3-6, CB Ch.6)

- Stationarity, Autocorrelation/Partial Autocorrelation, Forecast
- Autoregressive (AR), Moving Average (MA), ARMA Models
- Application to US Core Inflation

5. Volatility Models (Weeks 6-7, CB Ch.9)

- Autoregressive Conditional Heteroskedasticity (ARCH/GARCH) Models
- Applications for ARCH/GARCH Models

6. Multivariate Time Series Models: Vector Autoregression (VAR) (Weeks 7-9, CB Ch.7)

- Structural VAR, Reduced-form VAR, Recursive VAR Models
- Applications for VAR Models

7: Non-stationary Time Series: Time Trend and Stochastic Trend (Weeks 9-10, CB Ch.8)

- Unit root tests

8. Multivariate Time Series: Modeling the Long-Run Relationship (Weeks 10-12, CB Ch.8)

- Cointegration and Vector Error Correction Models (VECM)
- Applications for VECM Models

9. Forecasting with Mixed Frequencies of Data (Weeks 12-13)

- The MIDAS Approach

10. Forecasting with a Large Number of Predictors (Weeks 12-13)

- The Dynamic Factor Modelling Approach

Course AI Policy

The use of Generative AI is encouraged for learning only but not permitted for all the assessment tasks.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST - Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.