City University of Hong Kong
Course Syllabus

offered by School of Data Science
with effect from Semester A 2019/20

Part I   Course Overview

Course Title: Time Series and Panel Data

Course Code: SDSC6012

Course Duration: One Semester

Credit Units: 3

Level: P6

Medium of Instruction: English

Medium of Assessment: English

Prerequisites:
(Course Code and Title)   Nil

Precursors:
(Course Code and Title)   Nil

Equivalent Courses:
(Course Code and Title)   Nil

Exclusive Courses:
(Course Code and Title)   Nil

Part II   Course Details

1.   **Abstract**

In macroeconomics and other areas of business, science, and engineering, a lot of data is available as time series or panel data sets. In this course, students will study the statistical tools that are used to analyse such data and apply them to real world data with the help of the statistical software R. The first part of the course starts by reviewing basic stochastic process and time series concepts. Then, ARMA models are introduced together with estimation methods for the models and properties of their forecasts. The GARCH model for modelling variation in error variances is also taught. The second part of the course introduces panel data, the statistical model for panel data, and three methods for estimating panel data models. Throughout the course, emphasis will be given to analysis of data using the taught methods with R software.

2.   **Course Intended Learning Outcomes (CILOs)**
(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	**Introduce** AR, MA, ARMA, ARCH GARCH models, and the models for panel data.	20%	✓		
2.	**Apply** time series models to analyse real data using R.	20%	✓	✓	✓
3.	**Understand** model selection criteria for time series models.	20%	✓		
4.	**Implement** the models for the panel data using R.	20%	✓	✓	
5.	Apply panel data models to analyse economic data.	20%	✓	✓	✓
		100%			

A1:   Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.
A2:   Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.
A3:   *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)
(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lectures	Learning through teaching is primarily based on lectures. Mini-lectures and small-group exercises will be used to facilitate conceptual understanding and applications of various statistical tools and techniques.	✓	✓	✓	✓	✓	26 hours/sem
Tutorial Exercises	The team-based exercises provide students with the opportunities to familiarize and apply the statistical tools learnt during the lectures through practical problem solving.		✓		✓	✓	13 hours/sem

4. Assessment Tasks/Activities (ATs)
(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: 50 %							
Test		✓	✓	✓	✓	25%	
Assignments	✓	✓	✓	✓		25%	
Examination: 50 % (duration: 2 hours)							
Examination	✓	✓	✓	✓	✓	50%	
						100%	

For a student to pass the course, at least 30% of the maximum mark for the examination should be obtained.

5. **Assessment Rubrics**
(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Test	Assess students' conceptual understanding of statistical methods for time series and panel data and how they can be programmed in R.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignments	Students' ability to write and employ existing codes in R to analyse real time series and panel data. Explanation and presentation of results are also assessed.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	Examination questions are designed to assess student's level of achievement of the intended learning outcomes, with emphasis placed on conceptual understanding and correct application, mostly through mathematical exposition, clear explanation, and numerical calculation, of the various statistical techniques for time series and panel data.	High	Significant	Moderate	Basic	Not even reaching marginal levels

The midterm, tutorial exercises and laboratory report will be numerically-marked, while examination will be numerically-marked and grades-awarded accordingly.

Part III   Other Information (more details can be provided separately in the teaching plan)

1.   Keyword Syllabus

(An indication of the key topics of the course).

- Autoregressive(AR), Moving average(MA), Autoregressive moving average (ARMA) models
- Properties of forecasts
- Modelling volatility using ARCH and GARCH
- Definition of panel data
- Pooled ordinary least squares (OLS) estimator
- Random effects estimator
- Fixed effects estimator
- Durbin-Wu-Hausman test

2.   Reading List
2.1   Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Pesaran, M. H. (2015). *Time series and panel data econometrics*. Oxford University Press.
2.	Brockwell, P. J., & Davis, R. A. (2016). *Introduction to time series and forecasting*. springer.

2.2   Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	Hsiao, C. (1986). *Analysis of Panel Data (Econometric Society Monograph)*. Cambridge University Press.