HE 3022 – Econometric Modelling and Forecasting

Semester 2, 2019-2020

Course Aims

This course will introduce you to a wide range of methods and models used in forecasting in business and economics. You will be familiar with the processes of forecasting, qualitative and quantitative forecasting methods, data analysis and selection of the appropriate forecasting models and implementation of forecasting. You will also know how to use and apply R-statistical packages to implement the models using real data. Prior knowledge of R software is not required for the course.

Intended Learning Outcomes

By the end of this course, you will be able to:

1. Show good knowledge of the qualitative and quantitative forecasting processes;
2. Identify patterns in time series data;
3. Estimate and interpret bivariate and multivariate regression models for forecasting;
4. Decompose different components of time series data;
5. Apply a variety of smoothing methods;
6. Identify and interpret univariate models;
7. Apply the forecasting methods and processes to real-world data from business and economics.
8. Use the appropriate R-statistical packages to implement the forecasting models.

Lecture Schedule (The schedule may be revised during the semester)

Teaching Week No.	**Topics**	**Readings**
1	Introduction to R Introduction to Forecasting (Getting Started)	HA 'Using R" & Ch. 1 (2nd edition)
1-2	Forecasting toolboxes-time series graphics Times series patterns Seasonal plots Scatter plots Lag plots Autocorrelation White noise	HA Chapter 2 (2nd edition)
2-3	Forecaster's toolboxes Simple forecasting methods Transformation and adjustments Evaluating forecast accuracy Residual diagnostics Prediction intervals Forecast package in R	HA Chapter 3 (2nd edition)
4-5	Forecasting using linear regression Review of linear regression Evaluating the regression model Forecasting with regression	HA Chapter 5 (2nd edition)

	Forecasting using multiple regression Review of multiple regression Some useful predictors Selecting predictors Residual diagnostics Matrix formulation Non-linear regression Correlation, causation and forecasting	
6	Time series decomposition Time series components Moving averages Classical decomposition X-11 decomposition SEATS decomposition STL decomposition Forecasting with decomposition	HA Chapter 6 (2nd edition)
7-8	Exponential Smoothing Simple exponential smoothing Trend methods Holt-Winters' Seasonal method Taxonomy of exponential smoothing Innovations of state space model Forecasting with ETS models	HA Chapter 7 (2nd edition)
8-9	ARIMA models Stationarity and differencing Backshift notation Autoregressive models Moving average models Non-seasonal ARIMA models Estimation and order selection ARIMA modelling in R Forecasting Seasonal ARIMA models ARIMA vs ETS	HA Chapter 8 (2nd edition)
10	Dynamic regression models Estimation Regression with ARIMA errors in R Forecasting Dynamic harmonic regressions Lagged predictors	HA Chapter 9 (2nd edition)
11-12	Selected Advanced Topics Advanced Seasonality Vector Autoregressions Neural Network models Bootrapping and bagging Forecast Combinations Prediction intervals for aggregates	HA Chap 11 HA Chap 12 Sections 12.4 & 12.5

Main Text

(HA) Hyndman, R., and Athanasopoulus, Forecasting: Principles and Practice (second edition) at http://otexts.org/fpp2/index.html.

References (To be updated during the semester)
Introduction to R

- Try R Code School (http://tryr.codeschool.com/)
- DataCamp Introduction to R (https://www.datacamp.com/courses/free-introduction-to-r)
- R tutorial (Clarkson University) (http://www.cyclismo.org/tutorial/R/)
- Coursera R Programming (https://www.coursera.org/learn/r-programming)
- Google search for commands and errors

Reference for R

- Kickstarting R (https://cran.r-project.org/doc/contrib/Lemon-kickstart/index.html)

Time series analysis in R

- Using R for Time Series Analysis (http://a-little-book-of-r-for-time-series.readthedocs.io/en/latest/src/timeseries.html)

Course Assessment	
Course Work • Attendance and turning point exercises • Assignments Notes: *Turning point* exercises are treated as quizzes. Please inform me immediately if you have problems/issues with *Turning point* and your devices. If the problems with your devices cannot be resolved, I am sorry that I cannot accept answers on pieces of papers after the exercises because the answers are shown right after the questions. It is not fair to those who have answered using Turningpoint. You will receive a grade of B for either wrong answers or defective devices. Correct answers will receive an A. At the end of the semester your lowest mark for the turningpoint exercises will be removed You will be excused only from Turning point exercises and class participation if you have a medical certificate (MC) ***officially*** submitted to HSS. **Final Exam**	 20 20 60

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Announcement: There will be no class 28 January 2020.