COURSE CONTENT

Course Coordinator  Joseph D. Alba

Course Code  HE3022

Course Title  Econometric Modelling and Forecasting

Pre-requisites  HE2005 Principles of Econometrics; or at least an A grade in HE2004 Introductory Econometrics*

No of AUs  3

Contact Hours  39 hours (3 hours seminar)

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 (ILO)
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.

Assessment
Assignments, class participation and turning point exercises : 20%
Forecasting Project : 20%

Final Examination : 60%
Total : 100%
Reading and References

Main Text

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)

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

Time series analysis in R

Course Instructors

<table>
<thead>
<tr>
<th>Instructor</th>
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<tbody>
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<tr>
<td>Teaching Week No.</td>
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| 1                | 1.1 Introduction to R
1.2 Introduction to Forecasting (Getting Started)                 | HA “Using R” & Ch. 1 (2nd edition)            |
| 2                | 2. Forecasting toolboxes-time series graphics
2. 1 Times series patterns
2. 2 Seasonal plots
2. 3 Scatter plots
2. 4 Lag plots
2. 5 Autocorrelation
2. 6 White noise | HA Chapter 2 (2nd edition)                                           |
| 3                | 3. Forecaster’s toolboxes
3.1 Simple forecasting methods
3.2 Transformation and adjustments
3.3 Evaluating forecast accuracy
3.4 Residual diagnostics
3.5 Prediction intervals
3.6 Forecast package in R | HA Chapter 3 (2nd ed)                                                |
| 4                | 4. Forecast using judgement
4.1 Limitations
4.2 Key principles
4.3 The Delphi method
4.4 Forecasting by analogy
4.5 Scenario forecasting
4.6 New product forecasting
4.7 Judgmental forecasting | HA Chap 4 (2nd edition)                                               |
| 4-5              | 5. Forecasting using linear regression
5.1 Review of linear regression
5.2 Evaluating the regression model
5.3 Forecasting with regression
5.4 Statistical inference
5.5 Non-linear functional forms
5.6 Regression with time series data | HA Chapter 5 (2nd edition)                                           |
| 5-6              | Forecasting using multiple regression
5.7 Review of multiple regression
5.8 Some useful predictors
5.9 Selecting predictors
5.10 Residual diagnostics
5.11 Matrix formulation
5.12 Non-linear regression
5.13 Correlation, causation and forecasting | HA Chapter 5 (2nd edition)                                           |
|    | 6 Time series decomposition  
6.1 Time series components  
6.2 Moving averages  
6.3 Classical decomposition  
6.4 X-11 decomposition  
6.5 SEATS decomposition  
6.6 STL decomposition  
6.7 Forecasting with decomposition | HA Chapter 6 (2nd edition) |
|----|--------------------------------------------------------------------------------|
|  7 | 7 Exponential Smoothing  
7.1 Simple exponential smoothing  
7.2 Trend methods  
7.3 Holt-Winters’ Seasonal method  
7.4 Taxonomy of exponential smoothing  
7.5 Innovations of state space model  
7.6 Forecasting with ETS models | HA Chapter 7 (2nd edition) |
| 8-9 | 8 ARIMA models  
8.1 Stationarity and differencing  
8.2 Backshift notation  
8.3 Autoregressive models  
8.4 Moving average models  
8.5 Non-seasonal ARIMA models  
8.6 Estimation and order selection  
8.7 ARIMA modelling in R  
8.8 Forecasting  
8.9 Seasonal ARIMA models  
8.10 ARIMA vs ETS | HA Chapter 8 (2nd edition) |
| 10-12 | 9 Dynamic regression models  
9.1 Estimation  
9.2 Regression with ARIMA errors in R  
9.3 Forecasting  
9.4 Stochastic and deterministic trends  
9.5 Dynamic harmonic regressions  
9.6 Lagged predictors | HA Chapter 9 (2nd edition) |