**COURSE CONTENT**

**Course Coordinator**  
Joseph Dennis 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 per week)

**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, 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. No prior knowledge of R software is required for the  
course.

**Intended Learning Outcomes (ILO)**
By the end of this course, you (as a student) would 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 regression models for forecasting;
4. Decompose and forecast 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.
9. Work, manage time and negotiate content or solutions in a team.

**Course Content**
1. Forecasting toolboxes-time series graphics
2. Forecaster’s toolboxes
3. Forecast using judgement, Linear regression and multiple regression
4. Time series decomposition
5. Exponential Smoothing
6. ARIMA models
7. Dynamic regression models
Assessment (includes both continuous and summative assessment)

1. CA 1 : 10%
2. CA 2 : 10%
3. CA 3 : 30%
4. Final Examination : 50%

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 Instructor

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Office Location</th>
<th>Phone</th>
<th>Email</th>
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<tbody>
<tr>
<td>Joseph D. ALBA</td>
<td>SHHK 04-80</td>
<td>67906234</td>
<td><a href="mailto:ajoalba@ntu.edu.sg">ajoalba@ntu.edu.sg</a></td>
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Planned Weekly Schedule

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<td>1.1 Introduction to R</td>
<td>1, 8</td>
<td>HA “Using R” &amp; Ch. 1 (2nd edition)</td>
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<td></td>
<td>1.2 Introduction to Forecasting (Getting Started)</td>
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<td>2</td>
<td>2. Time series graphics</td>
<td>1, 2, 8</td>
<td>HA Chapter 2 (2nd edition)</td>
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<td></td>
<td>2.1 Times series patterns</td>
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<td>2.2 Seasonal plots</td>
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<td>2.3 Scatter plots</td>
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<td>2.4 Lag plots</td>
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<td>2.5 Autocorrelation</td>
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<tr>
<td>Chapter</td>
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<td>Subtopics</td>
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| 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 | 1, 2, 6, 7 | HA Chapter 3 (2nd ed) |
| 4-5     | 4. Forecasting using regression | 4.1 Review of linear regression  
4.2 Evaluating the regression model  
4.3 Forecasting with regression  
4.4 Review of multiple regression  
4.5 Some useful predictors  
4.6 Selecting predictors  
4.7 Residual diagnostics  
4.8 Non-linear regression  
4.9 Correlation, causation and forecasting | 1, 2, 3, 5, 7, 8 | HA Chapter 5 (2nd edition) |
| 6       | 5 Time series decomposition | 5.1 Time series components  
5.2 Moving averages  
5.3 Classical decomposition  
5.4 X-11 decomposition  
5.5 SEATS decomposition  
5.6 STL decomposition  
5.7 Forecasting with decomposition | 1, 2, 4, 7, 8 | HA Chapter 6 (2nd edition) |
| 7-8     | 6 Exponential Smoothing | 6.1 Simple exponential smoothing  
6.2 Trend methods  
6.3 Holt-Winters’ Seasonal method  
6.4 Taxonomy of exponential smoothing  
6.5 Innovations of state space model  
6.6 Forecasting with ETS models | 1, 2, 4, 5, 6, 7, 8 | HA Chapter 7 (2nd edition) |
| 9-10    | 7 ARIMA models | 7.1 Stationarity and differencing  
7.2 Backshift notation  
7.3 Autoregressive models  
7.4 Moving average models  
7.5 Non-seasonal ARIMA models  
7.6 Estimation and order | 1, 2, 6, 7, 8 | HA Chapter 8 (2nd edition) |
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<td>ARIMA modelling in R</td>
<td>Section 12.4 (2nd edition)</td>
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<td>7.8</td>
<td>Forecasting</td>
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<td>7.9</td>
<td>Seasonal ARIMA models</td>
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<td>7.10</td>
<td>ARIMA vs ETS</td>
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<td>7.11</td>
<td>Forecast Combinations</td>
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<td>8.1</td>
<td>Dynamic regression models</td>
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<td>8.2</td>
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<td>Regression with ARIMA errors in R</td>
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<td>Stochastic and deterministic trends</td>
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<td>8.6</td>
<td>Dynamic harmonic regressions</td>
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<td>8.7</td>
<td>Lagged predictors</td>
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<td>11</td>
<td>Student presentations of their projects (Project reports are due Monday of this week. Students to provide slides of their presentations).</td>
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<td>12</td>
<td>Slides will be provided</td>
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<td>13</td>
<td>Student presentations of their projects (Students to submit slides of their presentations).</td>
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<tr>
<td>14</td>
<td>Slides will be provided</td>
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