

Forecasting Techniques for a Practitioner

Area: Production and quantitative Methods

To be offered in term: Term 5

Instructors: Apratim Guha [AG] and Tathagata Bandyopadhyay [TB]

Course Credit: 1 Credit

No. of Sessions: 20

References:

1. Forecasting, Time Series, and Regression: An Applied Approach (Forecasting, Time Series, & Regression), 4th Edition, by Anne B. Koehler, Bruce Bowerman and Richard O'Connell. Brooks/Cole. [KBO]
2. Time Series Forecasting by Chris Chatfield, Chapman and Hall, London [CC]
3. Forecasting Applications & Methods by Francis X. Diebold, Cengage Learning India Private Limited [FXD]
4. Forecasting: Principles and Practice by Rob J. Hyndman. Downloadable from <http://robjhyndman.com/uwafiles/fpp-notes.pdf> [RJH]
5. Introductory Time Series with R by Paul S. P. Cowpertwait and Andrew V. Metcalfe. Springer Verlag. [CM]

Course Objectives:

This course primarily focuses on the applications of univariate time series analysis in economics and finance. The objective of the course is to give participants a hands-on experience of real-life applications through analysis of interesting data sets. So that at the end of the course the participants may feel confident about modeling time series data mainly for forecasting purpose. The theoretical concepts like covariance stationary process, stationary ARMA processes, some specific unit root processes e.g. ARIMA models and its variations, and models with conditional heteroskedasticity (ARCH and GARCH) will be explained through analysis of data. Forecasting the demand of new product is often a problem for an organization. An interesting HBR case will be used to explain such a forecasting process. The course ends with the presentation of projects.

Prerequisites

There is no prerequisite but a prior interest in the subject would definitely help.

Data Analysis

Throughout the course we will use the **R** programming language for data analysis. Prior knowledge of R could be useful but not a requirement.

Evaluation:

Quizzes: 40%

Assignments: 20%

Final project: 40%

Session-wise Outline:

Sessions	Topics	Reading
Session 1	Basic issues of forecasting techniques, forecasting models and measures of accuracy	Material to be provided in class.
Session 2	Review of basic linear regression analysis using a data set. Departure from the linear regression model assumptions in time series regression models.	FXD Section 2.5. KBO Ch. 5
Session 3	Components of a time series, Models of time series and methods of isolating the components from the time series data	KBO Sections 6.1, 6.3-6.4. FXD Chs.5-6.
Session 4	Simple exponential smoothing and forecasting by the Holt-Winters procedure: Discussion of the procedures using a data set.	RJH Ch. 3 CC Section 4.3. Dataset to be provided in class. KBO Chs. 7-8
Session 5	Modeling and forecasting trend and seasonal components	FXD Chs.5-6. RJH Ch. 4
Session 6	Implementation of methods discussed in Session 5 using a data set	Dataset to be provided in class.
Sessions 7-8	Ideas of serial correlation: autocovariance and autocorrelations functions. The correlogram. Tests for presence of serial correlation in regression models. Implementation in R.	KBO Section 9.2 FXD Ch. 7 RJH Section 2.5
Session 9	Modelling serial correlation: AR and MA processes. The partial autocorrelation function. Visual determination the orders of AR and MA processes.	KBO Sections 9.3-9.4 FXD Ch. 8
Session 10	Ideas of Stationarity and Invertibility. Investigating stationarity through plots.	KBO Section 12.1. FXD Ch. 8 RJH Ch. 6

Session 11	Modeling non-stationarity: unit roots. Tests for Unit Roots. Implementation in R.	FXD Ch. 13
Session 12	ARMA and ARIMA processes.	FXD Ch. 8 and Ch. 13
Sessions 13-14	Estimation of AR, MA, ARMA and ARIMA processes. Order Selection. Discussion of the procedures using data. Fitting the models using R.	RJH Ch. 7. Dataset to be provided in class.
Session 15	Incorporating seasonality in the ARIMA models.	KBO Sections 11.1-11.2. FXD Ch. 10 and Ch. 13 RJH Ch. 8
Session 16	Incorporating covariates in the ARIMA models.	KBO Section 11.3. RJH Sections 10.1-10.3. FXD Ch. 11
Session 17	Dealing with heteroscedasticity. ARCH and GARCH models.	FXD Ch. 14.
Session 18	Forecasting the demand of a new product	HBS Case: Forecasting the adoption of E-books, May 3, 2005
Sessions 19-20	Project Presentation	-