SECOND SEMESTER 2020-21

Course Handout Part II

Date: 17/03/2021

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.	: MPBA G512
Course Title	: TIME SERIES ANALYSIS AND FORECASTING
Instructor-in-Charge	: Rishi Kumar

1. Course Description:

This course will introduce you to the theory and application of time series analysis. The content will be focused on the estimation and testing of the time series models so that you can apply theoretical concepts to practical problems and find empirics based insights to them.

2. Scope and Objective of the Course:

Time series techniques are being extensively applied in diverse fields. The easy availability of time series data and statistical software have made it possible to draw empirical findings using the time series modelling and estimation. Hence, it becomes important to gain understanding of the subject and its practical application.

The course with an aim to provide basic theoretical understanding of time series analysis, will cover the univariate time series modelling and forecasting which is important for understanding more advanced topics. Further, the course includes regression with time series data. The vector error correction and vector autoregressive models will also be covered along with time-varying volatility and ARCH Models. The emphasis will also be on teaching the application of theoretical concepts on actual data with the regular hands on sessions using R.

3. Text Books:

T1. Brooks, C. (2014). Introductory Econometrics for Finance. Cambridge university press. 3rd Edition.

T2. Enders, W. (2010). *Applied Econometric Time Series*. Wiley India Pvt. Ltd.

T3. R. Carter Hill, William E. Griffiths and Guay C. Lim (2018) Principles of Econometrics, 5th Edition, Wiley.

Reference books:

R1. Tsay, Ruey S. (2015), Analysis of Financial Time Series. Wiley India Pvt. Ltd.

R2. Cowpertwait, P. S., & Metcalfe, A. V. (2009). Introductory Time Series with R. Springer Science & Business Media.

R3. Kleiber, C., & Zeileis, A. (2008). Applied Econometrics with R. Springer Science & Business Media.

R4. Jeffrey M. Wooldridge (2013), Introductory Econometrics: A Modern Approach, 5th Edition, Thomson, South-Western.

4. Course Plan:

S. No.	Lec. No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1	1	Introduction to time series analysis and forecasting	Introduction: Scope and Coverage	Class Notes
2	2-8	Univariate time series modelling and forecasting	Moving average processes; Autoregressive processes; The partial autocorrelation function; ARMA processes; Building ARMA models: the Box–Jenkins approach.	T1: Ch-6; T2: Ch-2 and Class Notes
3	9-12	Hand on session with R: Univariate time series modelling and forecasting		
4	13-20	Regression with Time-Series Data: Stationary Variables	Modeling Dynamic Relationships; Autocorrelations; Stationarity and Weak Dependence; Forecasting; Testing for Granger Causality; Testing for Serially Correlated Errors; Lagrange Multiplier Test; Durbin–Watson Test; Finite Distributed Lags; Infinite Distributed Lags.	T3: Ch-9 and Class Notes
5	21-23	Hand on session with R: Regression with Time-Series Data (Stationary Variables)		
6	24-28	Regression with Time-Series Data: Non-stationary Variables	Stationary and Nonstationary Variables; Trend Stationary Variables; The First-Order Autoregressive Model; Random Walk Models; Consequences of Stochastic Trends; Unit Root Tests for Stationarity; Dickey–Fuller Tests; Order	T1: Ch-8; T2: Ch-4; T3: Ch-12 and Class Notes

			of Integration; Cointegration; The Error Correction Model.	
7	29-30	Hand on session with R: Regression with Time-Series Data (Non-stationary Variables)		
8	31-34	Vector Error Correction and Vector Autoregressive Models	VEC and VAR Models; Estimating a Vector Error Correction Model; Estimating a VAR Model; Impulse Responses and Variance Decompositions.	T1: Ch-7; T2: Ch-5 & 6; T3: Ch-13 and Class Notes
9	35-36	Hand on session with R: Vector Error Correction and Vector Autoregressive Models		
10	37-40	Time-Varying Volatility and ARCH Models	The ARCH Model; Time-Varying Volatility; Testing, Estimating, and Forecasting; The GARCH Model.	T1: Ch-9; T2: Ch-3; T3: Ch-14 and Class Notes
11	41-42	Hand on session with R: Time-Varying Volatility and ARCH Models		

5. Learning Outcomes:
Topic 1: Introduction to time series analysis and forecasting

In this topic students will be introduced to the subject and given an overview of the course. On completion of the module, students will be able to appreciate the scope and importance of time series analysis and forecasting.

Topic 2: Univariate time series modelling and forecasting

Under this topic, the concepts of moving average and autoregressive processes will be introduced along with ARMA processes and models. The discussion will focus on partial autocorrelation function and Box–Jenkins approach. This module will help grasp the basics of time series which will help students understand more complex and advanced concepts.

Topic 3: Regression with Time-Series Data: Stationary Variables

This module will be focussed on modelling dynamic relations. The students will be introduced to the very important concept of stationarity and weak dependence. The commonly used granger causality will also be explained. We will also learn techniques to test for serially correlated errors and also modelling them. .

Topic 4: Regression with Time-Series Data: Non-stationary Variables

In this module, we will investigate the nature of nonstationary variables, examine the consequences of using them in regression analysis, introduce tests for stationarity, and learn how to model regression relationships that involve nonstationary variables.

Topic 5: Vector Error Correction and Vector Autoregressive Models

In this module, students will learn to explore the causal relationship between pairs of time series variables. In doing so, we shall be extending our study of time-series data to take account of their dynamic properties and interactions. In particular, we will discuss the vector error correction (VEC) and vector autoregressive (VAR) models. We will learn how to estimate a VEC model when there is cointegration between I(1) variables, and how to estimate a VAR model when there is no cointegration

Topic 6: Time-Varying Volatility and ARCH Models

In this part of the course, we are concerned with stationary series, but with conditional variances that change over time. The model we focus on is called the autoregressive conditional heteroskedastic (ARCH) model. The particular aims are to discuss the modeling of dynamic variances using the ARCH class of models of volatility, the estimation of these models, and their use in forecasting.

6. **Evaluation Scheme:**

S.No.	Components	Duration	Weight age (%)	Date, Time & Venue	Nature of Component
1	Assignment-I	-	10	To be announced	OB
2	Mid-Semester Exam	90 min.	30	23/10/2021 3.30 - 5.00PM	OB
3	Assignment-II	-	10	To be announced	OB
4	Assignment-III	-	10	To be announced	OB
5	Comprehensive Exam.	3 hrs.	40	28/12/2021 (AN)	OB

7. **Chamber consultation hour**: To be announced in the class.

8. **Notices**: All notices regarding the course will be put on CMS or the **Economics and Finance or LTC Notice Boards.**

9. Make-up Policy: Make-up will be granted only on genuine grounds and if prior permission is taken through official email only. Request for make up after the test/exam would not be entertained at all.

10. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

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Instructor-in-charge

MPBA G512

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