

**INTERNATIONAL MANAGEMENT INSTITUTE, BHUBANESWAR**

**POST GRADUATE DIPLOMA IN MANAGEMENT**

**FN: 610-FINANCIAL ECONOMETRICS USING R**

**CREDIT: 3 credits**

**SESSION DURATION: 60 Minutes**

**TERM: IV**

**YEAR: 2020-2021**

**BATCH: 2019-21**

**FACULTY:** Dr. Santanu Das

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**Office hours:** 9.30 am to 5.30 pm

**Consulting hours:** Can be decided based on prior appointment.

**Course Introduction:** This course aims at introducing the methods of econometrics and their application to economic and financial data. This course focuses on the empirical techniques which are mostly used in the analysis of financial markets and how they are applied to actual real-world data in standard computer packages like R. This course will cover the topics like classic linear regression model (with assumptions), univariate time series models and multivariate time series models like Vector Autoregressive models and Cointegration techniques.

**Learning Outcomes:** The specific learning outcomes of the course are:

- To acquaint students with the fundamentals of financial econometrics (**LO1** Subject Knowledge)
- To acquaint students with various econometric tools and techniques and linking it to various economic and financial problems (**LO2** Concept Application)
- To increase the students' ability to apply econometric techniques to economic and financial data (**LO3** Economic & Financial Application)
- To expose participants to practical orientation of building econometric models using R (**LO4** Software based analytical skills)

**Course Pedagogy:** The course will have a judicious mix of lectures and lab (*R* based) exercises.

**Course Readings**

**Books:**

Tsay, R.S., 2005. *Analysis of financial time series* (Vol. 543). John Wiley & Sons. Third edition.

**Additional readings:**

Gujarati, D.N., 2009. *Basic econometrics*. Tata McGraw-Hill Education. Fifth edition.

**Course Evaluation criteria:**

The approach of assessment would be to test the candidate's:

(a) ability to use statistical techniques to formulate, estimate and draw inferences from simple statistical techniques; (b) understanding of the way in which those results can be given interpretations; and (c)

ability to communicate with other statisticians, and with non-specialists, in a comprehensible and effective manner.

Components	Learning Outcomes	Weightage (%)
Mid Term Exam	LO1 LO2	20%
Quizzes (Unannounced)	LO1 LO2	10%
Project Presentation (In a group of 2 each. Topics to be decided by 4 <sup>th</sup> session) Students will be required to write a report at the end of the term and submit. It must contain detailed literature study, model development, sample description, analysis and conclusion along with the <b>Turnitin Report (Maximum similarity allowed is 15%)</b>	LO1 LO2 LO3 LO4	10% (Mid Term) 20% (End Term) 10% (Report)
End Term Exam	LO1 LO2 LO3 LO4	30%
Total		100%

### Suggested list of topics

- Time series modelling of T-bills of emerging markets
- Parametric VaR modelling of stocks
- Volatility modelling and forecasting of major stock indices of the world using GARCH based models
- Cointegration analysis of stocks in developed and emerging markets
- Understanding short term relationship between two financial assets using VAR model

### Plagiarism

We are committed to upholding the highest standards of academic integrity and honesty. Plagiarism is the use of or presentation of ideas, works that are not one's own and which are not common knowledge, without granting credit to the originator. You may refer the already available content just for your reference and to get the basic ideas. Only 20% of such content is acceptable, above that comes under the definition of Plagiarism which is unacceptable in IMI and will be treated seriously. All such cases will be referred to the appropriate body of the Institute for suitable disciplinary action.

**Session Plan:** This may be given in tabular form or without gridlines. However, must cover the following details:

Session No.	Topic	Learning Outcomes	Readings

1-2	<b>Understanding the R environment</b> <ul style="list-style-type: none"> <li>▪ Creating directory</li> <li>▪ Basic mathematical operations</li> <li>▪ Importing data</li> <li>▪ Creating variables</li> <li>▪ Extracting columns and rows from a file</li> <li>▪ Saving output</li> </ul>	LO1	Classroom discussion
3-6	<b>Introduction to Financial Data</b> <ul style="list-style-type: none"> <li>▪ One period and multiperiod returns</li> <li>▪ Distributional Properties of returns (Joint, marginal and conditional)</li> <li>▪ Moments of a random variable – Mean, Variance, Skewness and Kurtosis, Performing t-tests for sample moments</li> </ul>	LO1, LO2	Tsay, Chapter 2
7-10	<b>Visualizing Financial Data</b> <ul style="list-style-type: none"> <li>▪ Understanding normality of data</li> <li>▪ Jarque-Bera test, QQ Plot</li> <li>▪ Histogram</li> <li>▪ Kernel Density function</li> <li>▪ Stationarity of data (Strong and Weak)</li> <li>▪ Testing for Unit Root (ADF test)</li> </ul>	LO2	Tsay, Chapter 1 & 2
11-16	<b>Linear Models</b> <ul style="list-style-type: none"> <li>▪ Concepts of autocorrelation, white noise, random walk</li> <li>▪ AR (p), MA(q) and ARMA (p,q) modelling</li> <li>▪ Testing for serial correlation</li> <li>▪ Selecting models using ACF, PACF and EACF graphs, AIC and BIC Criterion</li> </ul>	LO2, LO4	Tsay, Chapter 1 & 2
<b>2 SESSIONS</b>	<b>MID-TERM PROJECT PRESENTATION</b>		
17-22	<b>Univariate Volatility Modelling</b> <ul style="list-style-type: none"> <li>▪ Meaning of volatility and its measurements</li> <li>▪ Heteroscedasticity in data</li> <li>▪ Testing for ARCH effects</li> <li>▪ ARCH (p) and GARCH (p,q) models</li> <li>▪ Forecasting using GARCH models</li> <li>▪ DCC-GARCH Models</li> </ul>	LO2, LO3, LO4	Tsay, Chapter 3
23-26	<b>Multivariate Volatility Modelling</b> <ul style="list-style-type: none"> <li>▪ Vector Autoregression</li> </ul>	LO3, LO4	Tsay, Chapter 8

	<ul style="list-style-type: none"> <li>▪ Cointegration (Johansen Cointegration test)</li> <li>▪ VECM</li> </ul>		
27-30	<b>Risk Measures</b> <ul style="list-style-type: none"> <li>• Value at Risk (VaR)</li> <li>• Expected Shortfall (CVaR)</li> <li>• Extreme Value Theory (EVT)</li> </ul>	LO3, LO4	Tsay, Chapter 7
31-33	<b>Project Presentation</b>		