Centre for International Trade and Development

School of International Studies

Course : MA level

Course Title: Topics in Financial Econometrics

Course Code: IE 527

Course Type: Optional

Course Teacher: Prof. Mandira Sarma and Dr. Suman Das

Credits: 4

Contact Hours: 4 hours per week

Course Objectives: The objective of the course is to expose students to econometric methods used in empirical finance. The focus will be on econometrics of financial markets.

Learning Outcomes: Upon completion of this course, students will be able to

- analyze financial time series data
- critically review empirical works that use financial time series
- conduct empirical research on issues of financial markets.

Course Pre-requisites: The course assumes prior knowledge in probability, statistics and econometrics. Familiarity with econometric software will be essential as assignments will have to be carried out using standard packages such as Stata, Eviews, R etc.

Evaluation: Grading will be based on a set of assignments, exams and a term paper.

Course Content (Modules marked '*'are of advanced nature and will be done subject to students' interest and availability of time)**:**

I. Financial Markets and Financial time series: Basic concepts

a. Introduction to financial markets; overview of some theoretical models of financial markets (Capital Asset Pricing Model, Efficient market hypothesis, random walk model, Multifactor Pricing Model); Definitions of asset returns, distributional properties and stylized facts of asset returns; Definitions of market risk

Suggested Readings: Ruey S. Tsay (Chap 1); Campbell, Lo and MacKinlay (Chap 1)

b. Introduction to basic concepts of time series analysis – Stochastic process. Time Series as a discrete stochastic process. Characteristics of a Stochastic process (mean, standard deviation, autocovariation, autocorrelation, partial autocorrelation). Stationary and non-stationary stochastic process. Concept of ergodicity and Wold's decomposition theorem.

Suggested Readings: Hamilton - Chapter 3; Mills and Markellos - Chap 2

II. Modelling Financial Time Series

1. **Modelling Univariate stationary asset returns** – Autoregressive Models AR(p), Moving Average Models MA(q), Autoregressive Moving Average Models ARMA(p,q). Stationarity and Invertibility Conditions. Properties of these models in terms of autocorrelation and partial autocorrelation functions. Yull-Walker equations. Estimation of the parameters of AR(p), MA(q) and ARMA(p,q) process. Box-Jenkins Framework of model building - identification, estimation and diagnostic checks. AIC, SBC Criteria and Portmanteau Statistic.

   Suggested Readings: Hamilton – Chap 3,4,5; Ruey S. Tsay (Chap 2); Mills and Markellos (Chap 2);

2. **Univariate non-stationary asset returns**– Series with deterministic time trend and Unit Root processes. Comparing Trend-Stationary and Unit Root Processes. Unit Root tests – Dickey-Fuller test, Augmented Dickey-Fuller and Philips Perron tests.

   Suggested Readings: Hamilton – Chap 15, 16, 17; Mills and Markellos (Chap 3); Ruey S. Tsay (Chap 2)

3. **Modelling Multivariate Financial Time Series** –
   a. Weak Stationarity; Cross-Correlation matrices; Vector models for asset returns – Vector Autoregressive Models, Granger Causality, Impulse response Analysis and Orthogonalized Impulse Response Analysis;
   b. Unit Root non-stationarity and co-integration, Cointegrated Vector Autoregressive Models; Error Correction Models

      Suggested Readings: Hamilton – Chap 10, 11; Ruey S. Tsay (Chap 8); Mills and Markellos (Chap 8 and 9)

4. **Modelling asset returns volatility** –

   a. Features of volatility in financial time series; ARCH, GARCH, EGARCH and other variations of conditional heteroscadasticity models.
      Suggested Readings: Ruey S. Tsay (Chap3); Mills and Markellos (Chap 5); Hamilton (Chap 21).

   b. Multivariate GARCH models; Constant-Correlation and Time-Varying Correlation Models ; The Dynamic Conditional Correlations (DCC) model. Suggested Readings: Ruey S. Tsay (Chap 10); Mills and Markellos (Chap 8)

III. Extreme Values, Quantile Estimation and Value at Risk (VaR) *

1. VaR as a quantile risk measure of asset portfolios; econometric approaches to VaR estimation
2. Extreme value theory (EVT) – review of EVT, Fisher Tippette Theorem; generalized extreme value distribution; empirical estimation of extreme values of financial time series; application of EVT in VaR estimation
   Suggested readings: Ruey S. Tsay (Chap 7); Mills and Markellos (Chap 7)

Reading List (Essential)

1. R. S. Tsay, 2005, *Analysis of Financial Time Series*, Wiley Series in Probability and Statistics, 2nd edition (RT)
2. J. Y. Campbell, A. W. Lo, and A. C. MacKinlay, 1997, *The Econometrics of Financial Markets,* Princeton University Press (CLM)

3. T. C. Mills and R. N. Markellos, *The Econometric Modelling of Financial Time Series,* 2008, Cambridge University Press, 3rd edition (TM) – An earlier Edition of this book is by Terrance Mills which can also be used.
4. J. D. Hamilton, 1994, *Time Series Analysis*, Princeton University Press (JH)

Reading List (Optional)

5. Chris Brooks, 2002, *Introductory econometrics for finance* , Cambridge University Press
6. Christian Gourieroux and Joann Jasiak, 2001, *Financial Econometrics: Problems, Models, and Methods,* Princeton University Press
7. Peijie Wang, 2008, *Financial econometrics,* Taylor & Francis
8. Walter Enders, 2004, *Applied Econometric Time Series,* John Wiley and Sons