TIME SERIES ANALYSIS I

Instructor: *Dean FANTAZZINI*

- **Course Objectives**: The goal of this course is to introduce basic time series models and to provide tools for empirical work with economic and financial time series data. It starts by introducing univariate stationary ARMA models, progresses to non-stationary models, periodic models and ends by discussing multivariate models. Applied aspect of time series analysis is emphasized in the course.

- **Prerequisites**: Students should be familiar with basic concepts of econometrics including probability theory, linear algebra, OLS, GLS and maximum likelihood. Students need to have a knowledge of a statistical software (e.g. Eviews, GAUSS, R, etc.) before start working on the empirical research paper. We will use Eviews throughout the lectures as it is one of the most commonly used econometric software.

- **Textbooks**:
  - James D. Hamilton (1994), *Time Series Analysis*, Princeton University Press
  - Fumio Hayashi, (2000), *Econometrics*, Princeton University Press
  - Сергей Айвазян (2001), *Основы эконометрики*, Юнити, Том 2
  - Ruey Tsay (2002), *Analysis of Financial Time Series*, Wiley
  - P. Franses and R. Paap (2004), *Periodic Time Series Models*, Oxford University Press

- **Method of Grading**: Each student should take a final exam which considers both theoretical and applied aspects.

Course Outline

1. Review of Stationary ARMA Processes
- 1.1 Moving Average process
- 1.2 Auto-Regressive processes
- 1.3 ARMA processes
- 1.4 Estimation of ARMA processes

2. Review of Non-stationary processes
- 2.1 Trend Stationary processes
- 2.2 Integrated processes
- 2.3 Forecasting
- 2.4 Unit-Root Testing
- 2.5 Box & Jenkins Methodology

3. Periodic models
- 3.1 Why Periodic models?
- 3.2 Representation of Univariate periodic time series models
- 3.3 Model selection and parameters estimation

4. Multivariate stationary models: VAR models
- 4.1 Definitions and Basic Concepts
- 4.2 VAR models and estimation
- 4.3 Granger causality test
- 4.4 Impulse response functions
- 4.5 Empirical applications: American and Danish quarterly economic data.

5. VEC models
- 5.1 Concept of Cointegration and Error-Correction Models
- 5.2 Representations of Cointegrated Systems
- 5.3 Estimation
- 5.4 Model Specification and Evaluation.
- 5.5 Empirical applications: Estimating the Phillips Curve for Italy.

6. Nonlinear VEC models
- 6.1 Threshold Vector Error Correction (TVEC) Models
- 6.2 Testing for Threshold cointegration
- 6.3 Empirical Applications with R: SETAR, TVAR, and TVEC Models
- 6.4 Non-Stationary Periodic Model: VEC representation.
- 6.5 Empirical applications with Eviews: Non-Stationary Periodic Models.

References

1. Stationary processes: Review of ARMA Processes

- Айвазян[2], paragraphs 3.2-3.3, 3.4.1-3.4.3
- Hamilton, chapters 3, 5
- Hayashi, chapter 6
- Tsay, chapter 2

2. Non-stationary processes

- Айвазян[2], paragraphs 3.5.1
- Hamilton, chapters 15-17
- Hayashi, chapter 9
- Tsay, chapter 2

3. Periodic models

- Franses and Paap, chapters 1-3

4. Multivariate stationary models: VAR models

- Hamilton, chapters 11
- Hayashi, chapter 6
- Tsay, chapter 8

5. VEC models

- Hamilton, chapter 19-20
- Hayashi, chapter 9-10
- Tsay, Chapter 8

6. Nonlinear VEC models

- Franses and Paap, chapters 4-5
- Selected readings announced during lectures