MACROECONOMETRICS 1 - PhD course

Instructor: *Dean FANTAZZINI*

- **Course Objectives**: This course introduces graduate students to a set of econometrics models used in macroeconomic time series modelling, financial economics and monetary economics. It starts by briefly reviewing large sample theory, and then move to single-equation and multi-equation Generalized Method of Moments (GMM). The second part of the course is devoted to Vector Error Correction (VEC) models and nonlinear VEC models, while the third part to unit root tests with structural breaks, panel unit root tests and panel cointegration tests. Applied aspect of macroeconometric modelling is emphasized in the course.

- **Prerequisites**: Students should be familiar with basic concepts of econometrics including probability theory, linear algebra, OLS, and Maximum Likelihood, as well as with basic concepts of time series analysis including ARIMA models, VAR models and linear systems of simultaneous equations. Students need to have a knowledge of a statistical software (e.g. Eviews, R, GAUSS, MATLAB or Stata) before working on the empirical research paper.

- **Textbooks**:

  - Cryer J.D. and K.S. Chan (2008), *Time Series Analysis: With Applications in R*, Springer, 2nd edition
  - Gregoriou G. and R. Pascalau, Ed., (2011), *Nonlinear Financial Econometrics: Markov Switching Models, Persistence and Nonlinear Cointegration*, Palgrave Macmillan
  - Hamilton J. D. (1994), *Time Series Analysis*, Princeton University Press
  - Hayashi F. (2000), *Econometrics*, Princeton University Press
  - Lutkepohl H. and M. Kratzig (2004), *Applied Time Series Econometrics*, Cambridge University Press.
  - Tsay R. (2010), *Analysis of Financial Time Series*, Wiley, 3rd edition
  - Zivot, E. and J. Wang (2005), *Modeling Financial Time Series with S-PLUS*, Springer

- **Method of Grading**: The course grades will be based on a written exam (50%) and on an empirical research paper which considers both the theoretical and applied aspects discussed in the class (50%).

Course Outline

1. Review of Large Sample Theory
- 1.1 Review of Limit Theorems for Sequences of Random Variables
- 1.2 Fundamental Concepts in Time-Series Analysis
- 1.3 Example: Large-Sample Distribution of the OLS Estimator

2. Single-Equation GMM
- 2.1 Endogeneity Bias: examples
- 2.2 Generalized Method of Moments
- 2.3 Large-Sample Properties of GMM
- 2.4 Testing Overidentifying Restrictions
- 2.5 Implications of Conditional Homoskedasticity

3. Multiple-Equation GMM
- 3.1 The Multiple-Equation Model
- 3.2 Large-Sample Theory
- 3.3 Single-Equation versus Multiple-Equation Estimation
- 3.4 Special Cases of Multiple-Equation GMM: FIVE, 3SLS, and SUR
- 3.5 Incorporating Serial Correlation in GMM

4. VEC models
- 4.1 Concept of Cointegration and Error-Correction Models
- 4.2 Representations of Cointegrated Systems
- 4.3 Estimation
- 4.4 Model Specification and Evaluation.
- 4.5 Structural VECM
- 4.6 Empirical applications

5. Introduction to Nonlinear models
- 4.1 Tests for Nonlinearity
- 4.2 Threshold Models and Tests for Threshold Nonlinearity
- 4.3 Model Diagnostics and Forecasting with Threshold models
- 4.4 Smooth Transition Autoregressive Models (STAR) models
- 4.5 Testing Linearity Against STAR Models
- 4.6 Estimation, Forecasting and Software for Nonlinear Models

6. Nonlinear VEC models
- 6.1 Threshold Vector Error Correction (TVEC) Models
- 6.2 Testing for Threshold cointegration
- 6.3 Other Nonlinear VEC models: Markov-Switching VEC Models (MS-VECMs), Nonlinear-ECM-Rational Polynomial (NECM-RP) and Switching Transition Error Correction Models (STECMs)
- 6.4 Empirical Applications

7. Additional recent topics: Unit root tests and Cointegration tests with structural breaks, Panel unit root tests and Panel cointegration tests
- 7.1 Unit root tests with structural breaks
- 7.2 Cointegration tests with structural breaks
- 7.3 Panel unit root tests
- 7.4 Panel cointegration tests and estimation methods

References

1. Review of Large Sample Theory

- Hayashi, chapter 2

2. Single-Equation GMM

- Hayashi, chapter 3

3. Multiple-Equation GMM

- Hayashi, chapters 4, 6

4. VEC models

- Hamilton, chapter 19-20
- Hayashi, chapter 9-10
- Lütkepohl, chapter 6-8
- Lütkepohl and Krätzig, chapter 3
- Tsay, paragraphs 8.5-8.6

5. Introduction to Nonlinear models

- Cryer and Chan, chapter 15
- Zivot and Wang, chapter 18
- Tsay, chapter 4.
- Lutkepohl and Kratzig, chapter 6

6. Nonlinear VEC models

- Gregoriou and Pascalau (Ed.), chapters 7,9
- Selected readings announced during lectures

7. Additional recent topics: Unit root tests with structural breaks, Panel unit root tests and Panel cointegration tests

- Selected readings announced during lectures