Econometrics II: ARIMA, VAR and cointegration

Academic Year: (2020 / 2021) **Review date: 09-07-2020**

Department assigned to the subject: Economics Department

Coordinating teacher: ESCRIBANO SAEZ, ALVARO

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Notions and methods acquired in Statistics and Econometrics I.

OBJECTIVES

This is an empirical macroeconomic course. The student will become familiar with univariate macroeconomic modeling, analyzing macroeconomic relationships using time series data.
The material taught in this course will lead the student to acquire the ability to use basic econometric programs (EVIEWS, GRETEL) for univariate time series data, for single and multiple equations (VAR models) stationary and non stationary (Cointegration). These abilities will give the student the capacity to construct empirical economic models and to test macroeconomic hypotheses based on econometric models. These models are commonly used in macroeconomics and finances, in particular those related to business cycles (booms and recessions), nonlinear models and determinants of economic growth.
Other skills that the student will acquire include familiarity with methods of analysis of the current state of the economy that are useful to interpret the movements of macroeconomic aggregates and of sectors in market economies.
Core Competencies:
- Possess knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas , often within a research context (CC1).

- Students can apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study (CC2).

- Students should be able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments (CC3) .

- That students can communicate their conclusions and the knowledge and rationale underpinning these, to specialist and non-specialist audiences in a clear and unambiguous (CC4).

- Students must possess the learning skills to enable them to continue studying in a way that will be largely self-directed or autonomous (CC5) .

Skills or General (SG No)

- Communication of complex economic arguments both through written and oral. (SG1).

- Communication of the findings and the body of knowledge and rationality that underpin it, specialists and non-specialists in a clear and unambiguous. (SG 2).

- Effective use of telecommunications technologies and in particular, the Internet, word processing, spreadsheets, databases and statistical packages. (SG 3).

- Identification, selection and access to various sources of information in both paper and electronic or other medium . (SG 4).

- Ability to integrate knowledge, handle complex issues and formulate judgments with incomplete or limited information, including knowing reflecting on social and ethical responsibilities linked to the application of their knowledge and judgment. (SG 5).

- Knowledge of a variety of programs for the organization, presentation and analysis of economic data.

(SG 6).

- Acquisition of sufficient learning skills for further study in an autonomous way (SG 7).

- Ability to make informed judgments about the design and the effects of economic policies in the field of industrial economy in different sectors. (SG 8).

- Extensive knowledge of the primary sources of information and economic data. (SG 9)

Learning outcomes acquired by the student with the subject (potential activities done by students)

You use the linear regression model as a tool to quantify the causal relationship between economic variables from the empirical evidence.

Acquire ability to understand the problems associated with the data and the appropriateness of quantitative methods in each case.

Develop capacity for a ceteris - paribus empirical analysis of a variety of economic problems and proposing suitable models making inferences about parameters.

Acquire critical analysis, taking into account the different modeling strategies and the consequences of failure of model assumptions.

Learn to analyze economic problems from statistical information.

Learn how to apply econometric techniques to empirical modeling of the behavior of individual economic agents (households or individuals and companies) .

Learn how to access the data sources relevant to the object of study (business data , surveys of individuals and families , etc. .) .

You will know the limitations associated with the available data and the implications for the empirical analysis.

Understand the limitations of the classical regression model as empirical tool.

Learn how to develop strategies for modeling, data processing and empirical testing of economic hypotheses relevant.

Learn to analyze the dynamic relationships between economic variables, which are considered random from heterogeneous samples in each case essentially choosing the most appropriate model . Extraction of quantitative and qualitative findings on the nature of relationships.

DESCRIPTION OF CONTENTS: PROGRAMME

This course gives an overview of the basic concepts in time series econometrics, with a particular emphasis on the tools needed to undertake empirical analysis. The final objective is to be able to analyze the evolution of the economic variables (inflation, Gross Domestic Product, Money, interest rate¿), to understand the dynamic relationship between those variables, and to predict them. In macroeconomics context, this is very useful for policy makers; since it helps them take their decision based on better knowledge of how many macroeconomic variables affect each other at different horizons. We will focus on the following topics:

(1) Characteristics of economic time series data: Stochastic processes and time series, stationarity and ergodicity, simple autocorrelation function (ACF) and Partial autocorrelation function (PACF). [Brockwell P.J. and Davis Chapter I + Lecture notes].

(2) Univariate stationary models: Wold decomposition, ARMA processes, Causal models, invertible models, estimation and inference on the mean and the ACF, estimation and inference on the parameter estimates of ARMA models, white noise tests, model selection (information criteria), methodologies for the design of ARMA models, real data examples (interest rates, growth rate of GDP, temperature, etc.) [B&D chapters II, III & V + Lecture notes].

(3) Forecasting: Forecasts computing, forecast evaluation ¿ [B&D chapters II, III & V + Lecture notes].

(4) Regression with autocorrelation: Consequences of the presence of autocorrelated errors, robust inference through HAC standard errors, endogeneity problems (lagged dependent variable), instrumental Variables solution (Two Step Least Squares). [Wooldridge Chapter 12 & 15].

(5) Nonlinear models (TAR, STAR) and ARCH, GARCH models, Estimation, Predictions, extensions of GARCH models. [Hamilton Chapter 21+ Teräsvirta et al. (2010) +Lecture notes].

(6) Vectors Autoregressive Models (VAR): VAR models, structural form, reduced form, identifiability conditions, Granger-Causality analysis, Impulse response function (IRF). [Enders (2004) + Lecture notes].

(7) Non-stationary processes: Non-stationary processes about a trend (vs. integrated processes, unit root Dickey-Fuller test, forecasting with non-stationary models, structural changes, permanent and transitory shocks. [Stock and Watson Chapter 14, Wooldridge Chapter 18 + Lecture notes].

(8) Cointegration: Spurious regressions, Cointegration, Error-Correction models¿ [Stock and Watson Chapter 14, Wooldridge Chapter 18 + Zivot (notes)+ Lecture notes].

LEARNING ACTIVITIES AND METHODOLOGY

The teaching method will be the following:
(1) Magistral classes, where the concepts will be developed in detail and the properties of macroeconomics models of time series will be covered. To facilitate understanding and learning of this material by the student, the students will have access to the class material (slides etc.) via the internet. They will also receive an ample list of complementary materials that will permit them to understand and go deeper into issues covered in class, and into some related issues of interest that may not have been covered in class.
(2) Discussion of the exercises done by the student, covering the estimation and specification of classic models in the literature, previously covered in class, such as the various exercises of estimation and forecasting with time series in various economies and different time periods.
(3) Comments on current economic issues to which the student can use the knowledge acquired in the course to deepen their understanding.
(4) Practical classes in reduced groups where the students will learn to make arguments and reason in public, to use the necessary econometric programs (above all E-Views) to do estimation and testing of macroeconomic models of time-series. This will be done by the use of both algebraic and empirical exercises in class, with an emphasis on the applied nature of this course.
(5) Complete an empirical project by the end of the course that demonstrates that the student understands how to apply with rigor and economic reasoning the econometric techniques studied. The project should be well written and have the basic structure of a short scientific article: Introduction, literature review, model and estimation, description of the data used and their quality, empirical results, evaluation of the model and hypothesis tests, conclusions & future extensions. Every student should give a formal oral presentation (in Power Point) of their empirical project in front of all students of the class and the professor.

In order to emphasize application of theory to real data, students have to do several empirical projects which involve the use of the online database (accessible via the website of the library of the University of Carlos III de Madrid) and the statistical package EViews.

During the classes, students will have the opportunity to learn how to use the online database and the statistical package EViews.

Several theoretical problem sets (exercises) will be solved during the course.

Students will also have homeworks (exercises) to solve.

The homeworks and empirical projects will be evaluated.

ASSESSMENT SYSTEM

Continuous evaluation (100%):
The weekly assignments and class participation (20%), the oral defense of the empirical project carried out by the student (20%) and the written empirical project (60%).

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- Brockwell P.J. and Davis R.A. Introduction to Time Series and Forecasting, 2nd ed., Springer., 2002

- Enders W. Applied Econometric Time Series, 2nd ed., Wiley, 2004

- Enders W. Applied Econometric Time Series, 4nd ed., Wiley, 2015

- Hamilton, J Time Series Analysis, Princeton University Press, 1994

- Hendry D.F (2015). Introductory Macro-econometrics: A New Approach. , A New Approach. Timberlake Consultants Ltd. London SE26 5BN, UK. http://www.timberlake.co.uk/intromacroeconometrics, 2015

- Mills T.C. The Econometric Modelling of Financial Time Series, 2nd ed., Cambridge University Press, 1999

- Stock, J. and Watson, M. Introduction to Econometrics, Addison-Wesley, 2003

- Terásvirta T., D. Tjostheim and C.W.J. Granger Modelling Nonlinear Economic Time Series, Oxford University Press, 2010

- Wooldridge, J.M Introductory Econometrics: A Modern Approach, 2nd ed., Thomson South-Western, 2003

ADDITIONAL BIBLIOGRAPHY

- Brockwell P.J. and Davis R.A. Introduction to Time Series and Forecasting, 2nd ed., Springer, 2002

- Enders W. Applied Econometric Time Series, 4th ed., Wiley. , 2015

- Escribano A. (2004) Nonlinear Error Correction: The Case of Money Demand in the UK (1878-2000), Macroeconomic Dynamics. 2004, 8, 76-116., 2004

- Escribano A., Peña J.I. and Villaplana P. (2011) Modeling Electricity Prices: International Evidence, Oxford Bulletin of Economics and Statistics V. 73, 622-650., 2011

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