MASTER in ECONOMIC DEVELOPMENT (UC3M)

Syllabus 2024/25
ECONOMETRICS I
(Introduction to Time Series Econometrics)

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Goals: The objective of the course is to understand the temporal evolution of the most relevant economic variables (inflation, interest rates, GDP, exchange rate, prices of financial assets, etc.) and learn to analyze the causal dynamic relationships existing between these variables for the purpose of making forecasts, contrasting different theories and carrying out economic policy analysis.

Course organization: It is organized in 11 sessions. Each session will be divided into a theoretical part and a practical part with the aim that the student can develop an empirical mini-project during the course.

Syllabus:

Topic I: *Characteristics of time series economic data.*
Stochastic processes, time series. Stationarity and ergodicity. Autocorrelation function (ACF). Partial Autocorrelation Function (PAC).

Applications: Graphic analysis of the most relevant economic series with different transformations.

Topic II: *Stationary univariate models*.
Wold decomposition. ARMA processes. Causal models, invertible models. Estimation and inference of the mean and the FAC. Estimation and inference of the parameters of the ARMA models. White noise tests. Model selection (information criteria).

Applications: Wold decomposition in practice. ARMA model simulation.

Topic III: *Forecasting*.
Predictions building. Evaluation of forecasts. Combination of forecasts.

Applications: Prediction of the growth rates of the main macroeconomic aggregates.

Topic IV: *Regression with autocorrelated data*.
Consequence of the existence of self-correlated errors. Robust inference via HAC standard error estimation. Autocorrelation tests. Endogeneity problems (lagged dependent variable), solution via estimation by Instrumental Variables (two-stage least squares).

Applications: Regressions with macroeconomic variables.

Topic V: *Univariate Econometric Dynamic Models.*
Distributed lags models (ADL). Short- and long-term multipliers. Calculation of the average and medium delays. Partial adjustment models. Estimation and inference with and without autocorrelation in errors.

Applications: Dynamic models of different macroeconomic variables.

Topic VI: *Multi-equation Dynamic Models*.
VAR models. Conditions of identifiability. Causality analysis in the Granger sense. Estimation and inference. Impulse response function.

Applications: **Causality between interest rates and economic growth (Topic of the empirical project)**.

Topic VII: *Nonstationary processes*.
Stationary processes around a trend (TS) versus integrated processes (DS). Dickey-Fuller unit root tests. Estimation of trends and cycles. Permanent shocks and transitory shocks. Forecasting with non-stationary models. Structural changes.

Applications: Non-stationarity of the macroeconomic and financial series. Testing the financial market efficiency hypothesis.

Topic VIII: *Regression with nonstationary variables*.
Spurious regression. Cointegration. Error correction models. Estimation and Inference in two steps. Permanent and transitory components.

Applications: The Present Discounted Value model. The law of the single price (PPP).

Teaching Methodology: The formal aspects are minimized, giving priority to the intuitive discussion of the concepts and the management of real databases, with the objective that the student reaches a practical domain of econometrics with time series data. The practical implementation of the course is done through the econometric program E-Views (or the free software GRETL) and free access economic series.

Course Grading: Final Exam of the first part of the course (50%) + Mini-Empirical Project (50%) corresponding to the second part of the course. This year's empirical project aims to analyse a VAR model (replication of a VAR model with three variables and updated data). It consists of a maximum of 5 sheets (or 10 slides) where the student will have to show capacity for analysis and synthesis, critical reasoning and a sound use of quantitative tools.

Bibliography:

- Brockwell, P. & R. Davis (2002), Introduction to Time Series and Forecasting (second edition). Springer-Verlag.
- Diebold, F. (2001), Elements of Forecasting (second edition). South-Western.
- Enders, W. (2003), Applied Econometric Times Series (second edition). John Wiley.
- Koop, G. (2005), Analysis of Economic Data (second edition), Wiley.
- Mills, T.C. (1999), The Econometric Modelling of Financial Time Series. Cambridge University Press.
- Patterson, K. (2000), An Introduction to Applied Econometrics: A time series approach. Palgrave Publishers.
- Stock, J. & M. Watson (2003), Introduction to Econometrics. Addison-Wesley.
- Wooldridge, J. (2002), Econometrics: A Modern Approach (second edition). South-Western.

- + **Lecture notes**