

ECONOMETRICS II

MSc in ECONOMIC ANALYSIS
Universidad Carlos III de Madrid

Second Semester 2020/21

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SYLLABUS

1. Inference on linear reduced form models. Causality and identification. Least Squares Estimates. Asymptotic inference. Restricted estimation. Measurement error. Control variables. Hypothesis Testing.
2. Inference on structural linear equations. Two Stage Least Squares Estimates. Specification Tests: Endogeneity, Overidentifying restrictions, Functional form, Heteroskedasticity.
3. Inference on systems of reduced form equations. Inference on a multivariate linear system based on OLS; GLS and FGLS; Seemingly unrelated systems of equations; the linear panel data model. The generalized method of moments: 2SLS, 3SLS. Testing overidentifying restrictions. Optimal instruments.
4. Inference on linear structural equations systems. Identification in a linear system. Estimation after identification. Identification with cross-equation and covariance restrictions. Models nonlinear in the endogenous variables.
5. Inference in the presence of unobserved heterogeneity. Random Effects Methods. Fixed Effects Methods. First Differencing Methods. Comparison of Estimators.
6. Inference with autocorrelated data. Basic concepts: Stationarity and weak dependence. Basic models: Martingale difference, linear processes, autoregressions. Laws of large numbers and central limit theorems. Autocorrelation and Heteroskedasticity-robust inference. Testing for serial correlation. GLS and IV estimates.
7. Inference on parameters in non-linear models. Examples: Non-linear regression, maximum likelihood, quantile regression, minimum distance. M and Z estimators.

Asymptotic properties under classical assumptions. Asymptotics under minimal assumptions. Numerical optimization methods: Newton-Raphson and Gauss-Newton. One step estimators.

8. Generalized method of moments. Identification via moment restrictions. GMM estimates. Asymptotic inferences. Tests of overidentifying restrictions.

9. Maximum likelihood. Consistency and asymptotic normality. Asymptotic inference. Examples: binary regression, TOBIT models and count data models.

10. Quantile linear regression. Consistency and asymptotic normality. Asymptotic inference. Causality analysis using quantile regression.

11. Inference on non-parametric models. Kernel estimates of density and regression functions. Local polynomial regression. Discontinuous regression. Asymptotic inference.

12. Semi-parametric models. Varying coefficient models, index models, adaptive estimation.

13. Specification testing. Goodness-of-fit tests for distribution functions. Model checks of regression functions and conditional model restrictions.

COURSE OUTLINE AND OBJECTIVES

This second course in Econometrics for the Economics Ph. D. program at University Carlos III de Madrid complements the Econometrics I course in three main directions after analyzing in detail inference for the linear model based on OLS and IV estimates.

First, inference for systems of equations with and without endogenous variables is discussed, extending many ideas described for single equation linear models and including panel data models with unobserved components.

Second, specific inference methods for dynamic models for time series data are presented.

Third, nonlinear models are studied and some particular examples of extremum estimates, including nonlinear GMM, and its application to nonlinear and limited dependent variable models is discussed.

Some select topics on nonparametric and semiparametric methods will be discussed at the end of the course.

Lecture notes are provided for each topic, together with a problem set including theoretical and applied exercises. Selected exercises will be worked out in classes and others should be handed in for grading. There is a mid-term exam that will account for 40% of the final grade together with the problem sets. This and the final exam will consist of problems and exercises similar to those of the problem sets.

The basic textbooks are Wooldridge (2002) and Hayashi (2000). Wooldridge (2000) and Stock and Watson (2010) are good introductions for many topics including dynamic models and Hansen (2020) covers some modern topics missing in more classical textbooks. Some other useful texts with additional examples and details are provided in the reading list and will be commented lectures. Further references for specialized topics are provided in a second list.

GRADING

Final Exam (60%) and Continuous Evaluation (40%) (Mid-term exam (35%) + Problem Sets (5%)).

BASIC TEXTBOOKS

1. Davidson, J. (2000). *Econometric Theory*. Blackwell.
2. Davidson, R. & MacKinnon, J.G. (1993). *Estimation and Inference in Econometrics*. Oxford University Press.
3. Gouriéroux, C. & Monfort, A. (1997). *Time Series and Dynamic Models* Cambridge University Press.
4. Greene, W.H. (1997). *Econometric Analysis*. Macmillan.
5. Hansen, B.E. (2020). *Econometrics*. U. Wisconsin.
<https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics.pdf>
6. Hayashi, F. (2000). *Econometrics*. Princeton University Press.
7. Stock, J.H. and M. Watson (2010). *Introduction to Econometrics*, 3e, Prentice Hall.
8. Wooldridge, J.M. (2000). *Introductory Econometrics. A Modern Approach*. South Western.
9. Wooldridge, J.M. (2002). *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

OTHER USEFUL TEXTBOOKS

1. Amemiya, T. (1985). *Advanced Econometric Theory*. Blackwell.
2. Arellano, M. (2003). *Panel Data Econometrics*. Oxford University Press.

3. Davidson, J. (1994). *Stochastic Limit Theory*. Oxford University Press.
4. Dhrymes, P.J. (1994). *Topics in Advanced Econometrics: Vol. II. Linear and Nonlinear Simultaneous Equations*. Springer Verlag.
5. Diebold, F. X. (2020). *Time Series Econometrics*. U Pennsylvania.
<https://www.sas.upenn.edu/~fdiebold/Teaching706/TimeSeriesEconometrics.pdf>
6. Gallant, A.R. (1986). *Nonlinear Statistical Models*. Wiley.
7. Gouriéroux, C. & Monfort, A. (1995). *Statistics and Econometric Models. Vol I & II*. Cambridge University Press.
8. Hamilton, J.D. (1994). *Time Series Analysis*. Princeton University Press.
9. Handbook of Econometrics (-2020) Elsevier.
<https://www.elsevier.com/books/book-series/handbook-of-econometrics>
10. Harvey, A.C. (1990). *The Econometric Analysis of Time Series*. Phillip Allan.
11. Hendry, D.F. (1995). *Dynamic Econometrics*. Oxford University Press.
12. Intriligator, M.D., Bodhin, R.G. & Hsiao, C. (1996). *Econometric Models, Techniques and Applications*, 2nd edition. Prentice Hall.
13. Judge, G.G., Griffiths, W.E., Hill, H., Lütkepohl R.C. & Lee, T.C. (1985). *The Theory and Practice of Econometrics*. Wiley.
14. Maddala, G.S. (1983). *Limited-dependent and Qualitative Variables in Econometrics*. Cambridge University Press.
15. Mittelhammer, R.C., Judge, G.G. & Miller, D.J. (2000). *Econometric Foundations*. Cambridge University Press.
16. Ruud, P.A. (2000). *Classical Econometric Theory*. Oxford University Press.
17. White, H. (1986). *Asymptotic Theory for Econometricians*. Academic Press.