



Universidad Carlos III de Madrid, Economics Department
Academic Year 2011-2012, First Semester

SYLLABUS: STATISTICS

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Office hours:

Tuesday from 3pm to 5pm in my office at **15.2.09** or by appointment (email).

Teaching Assistant:

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Course Description:

This course gives an overview of the important concepts in probability and statistics, with a particular emphasis on the tools needed to develop estimation and inference techniques in econometrics.

Program

(1) *Probability*: Set theory (sample space, events, operations with sets), Probability theory (sigma algebra, axioms of probability, calculus of probability), Conditional probability and independence (Bayes Rule, independence, Mutually independence).

(2) *Random variables*: Density functions, cumulative distribution function, transformations, Expectation operator, moments, prediction, moment generating function (characteristic function), Cumulant generating function, important examples of models for Random variables.

(3) *Random vectors*: Cumulative distribution function, Expectation operator, Moment generating and characteristic function, Marginal distributions, Conditional distribution, Independence, Inequalities, Transformations, important examples of models for Random vectors (Multivariate normal).

(4) *Sampling and Sampling distributions*:

(5) *Point Estimation*: Finite Sample Properties for Point Estimators, Point Estimation Methods (Method of Moments Estimator, Maximum Likelihood Estimator).

(6) Hypothesis Testing: Introduction, Power function (power and size of a test), Most powerful tests (Neyman-Pearson Lemma), Unbiased Uniformly Most Powerful (UUMP) tests, P-value, Methods for constructing tests statistics (Likelihood Ratio test, Wald test, Lagrange Multiplier test), Asymptotic distributions of Likelihood Ratio test, Wald test and Lagrange Multiplier test.

Reference list:

- **Ash, R. (2000)**, *Probability and Measure Theory*, 2nd Edition. Academic Press.
- Bierens, H. (2004), *Introduction to the Mathematical and Statistical Foundations of Econometrics*. Cambridge.
- Casella, R. and J. Berger (2002), *Statistical Inference*, 2nd Edition. Duxbury.
- Cramer, H. (1946), *Mathematical Methods of Statistics*. Princeton.
- **Fuller, W. (1996)**, *Introduction to Statistical Time Series*, 2nd Edition. Wiley.
- **Jacod, J. and P. Protter (2003)**, *Probability Essentials*. 2nd Edition, Springer.
- Mittelhammer, R. (1992), *Mathematical Statistics for Economics and Business*. Springer-Verlag.
- Mood, A., F. Graybill. and D. Boes (1974), *Introduction to the Theory of Statistics*. McGraw Hill.
- Rohatgi, V. (1984), *Statistical Inference*. Dover.
- Serfling, R. (1980), *Approximation Theorems of Mathematical Statistics*. Wiley.
- Sen, P. and J. Singer (1993), *Large Sample Methods in Statistics*. Chapman.

Evaluation:

(1) The final grade is based on the final exam (**85%**) and the homeworks (**15%**).

(2) Every two weeks, my TA will solve some problem sets.

The exam will be based on those problem sets + classes + homeworks + ...