

Course Outline for Econometrics - Macroeconomic Policy and Financial Markets Program

Part I – Maite Cabeza

1. Review of statistics

Random variables and distribution. Expectations and moments. Estimators and estimates. Sample mean and sample variance. Sampling distributions. Finite sample properties of estimators. Asymptotic distribution theory. Convergence in probability. Law of Large numbers. Convergence in distribution. Central Limit Theorem. Asymptotic properties of estimators. Classical statistical inference. Key distributions for statistical inference.

2. An introduction to linear regression

Econometrics: definition and objectives. Descriptive econometrics versus causal econometrics. Experimental data and observational data. The nature of economic data. Regressions and causal inference. Conditional mean function. Linear regression model with stochastic regressors. The classical assumptions.

3. Estimation of the linear regression model

Least squares estimator (LS). Goodness of fit. Numerical properties of LS estimator. Influential observations and outliers. Statistical properties of LS estimator. Distribution of LS estimator. Finite sample properties. Gauss-Markow Theorem. Experimental approximation to LS sampling distribution. Applications.

4. Asymptotic Theory and the linear regression model

Key concepts and properties of asymptotic theory for econometrics. Slutsky's Theorem. Continuous Mapping Theorem. Transformation Theorem. Product Limit Normal Rule. Multivariate extension of the Central Limit Theorem. Asymptotic properties of LS. Consistent and asymptotically normal estimator. Applications.

5. Restrictions and hypothesis testing

Inference in the context of the classical linear regression model. Exact tests. Hypothesis testing with the t -statistic. Hypothesis testing with the F -statistic. Testing linear combinations of regression parameters. Restricted LS estimation. F -statistic via restricted and unrestricted LS. Testing for parameter stability. Confidence intervals and confidence regions. Large sample tests. Asymptotic-T. Wald-type tests. Applications.

Part II – Daniela Iorio

6. Additional Topics on OLS and Instrumental Variable (IV) Estimation

Heteroskedasticity and Robust Inference. Motivation for using an IV approach. Multiple instruments and Two-Stage Least Squares (2SLS). Asymptotic Normality. Asymptotic Efficiency. Applications.

Reference: Wooldridge Ch.4 and 5

7. Linear Unobserved Effects Panel Data Models

Motivation. Pooled OLS. Fixed Effects Methods. Random Effects Methods. First Differencing Methods. Comparison of the estimators.

Reference: Wooldridge Ch.10

8. Limited-Dependent and Qualitative Variables

Linear Probability Model. Logit and Probit Models (Maximum Likelihood Estimation; Marginal Effects and Testing). Multinomial Logit. Ordered Response Models. Applications

Reference: Wooldridge Ch.15

9. Discrete Response Models for Panel Data and Cluster Samples

Pooled Probit and Logit. Unobserved Effects Probit and Logit models. Applications.

Reference: Wooldridge Ch.15

10. Dynamic Unobserved Effects Panel Data Models

Applications to both linear and non linear models.

Textbook: J.M. Wooldridge, *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Cambridge.