

ADVANCED ECONOMETRICS (EC312)

Course duration: 54 hours lecture and class time (Over three weeks)

LSE Teaching Department: Department of Economics

Lead Faculty: Dr Marcia Schafgans and Dr Tatiana Komarova

Pre-requisites: Students should have taken EC212 Introduction to Econometrics or an equivalent undergraduate course in econometrics. With EC312 being considerably more advanced technically than EC212, a good working knowledge of multivariate calculus and linear algebra will be required as well.

Course Objective:

This course will present an advanced treatment of econometric principles for cross-sectional, panel and time-series data sets. While concentrating on linear models, some non-linear cases will also be discussed, notably limited dependent variable models and generalised methods of moments. The course will focus on modern econometric techniques, addressing both technical derivations and practical applications. Applications in the areas of microeconomics, macroeconomics and finance will be considered.

Main Text:

Greene, W.H., *Econometric Analysis*, (7th edition), Pearson, 2011

OR

Verbeek, M., *A Guide to Modern Econometrics*, (4th edition), Wiley, 2012.

Further Useful References:

Johnston, J. and J. Dinardo, *Econometric Methods*, (4th edition), McGraw-Hill, 1997.

Assessment:

Mid course examination 50%, final examination 50%.



Contacts:

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Topics:

- **Module 1:** Main Regression. Topics to include: Principles of Estimation (Ordinary Least Squares, Generalized Least Squares and Maximum Likelihood Estimation with Micro-Econometric applications); Principles of Testing (t- and F-test; Wald, Likelihood Ratio, Lagrange Multiplier Testing Principles). Time Series: Basic Time Series Processes; Stationarity and Nonstationarity - Unit roots and Cointegration
- **Module 2:** Estimation Methodology. Topics to include: Endogeneity in linear regression models; Instruments; 2SLS estimator; Simultaneous equations. Motivation, definition and asymptotic properties of GMM estimator; Efficient GMM estimation; Over-identifying restrictions. Introduction to Panel Data Models: Fixed effect and random effect models. Arellano-Bond estimator in dynamic panel data models. Introduction to Quantile estimation.

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PART A: MAIN REGRESSION

Non-required readings indicated with ()*

A.1 Multiple Linear Regression Model

Linear Regression Model and Classical (Gauss Markov) Assumptions. Estimators (OLS, Method of Moments, MLE). Geometric Aspect of OLS estimators and Intuition. Goodness of Fit. Finite Sample Properties of the OLS estimators. Hypothesis Testing (Exact): t-test and F-test. Testing for functional form and structural break. Asymptotic Properties of the OLS estimators. Partitioned Regression Model and the FWL Theorem.

- Verbeek, Ch. 2-3
- Greene, Ch. 2-3, 4.1-4.5.1, 4.7.1, 5.1-5.5

A.2 Generalized Linear Regression Model (Non-Spherical Disturbances)

Heteroskedasticity (Serial Correlation). Consequences for OLS estimator. Efficient Estimation (GLS). Heteroskedasticity and GLS: Weighted Least Squares. Feasible GLS

Inefficient OLS (Robust). Testing for presence of heteroskedasticity. Brief note: Time Series – Serial correlation. Serial Correlation: Clustering.

- Verbeek, Ch. 4
- Greene, Ch. 9, Ch. 20.1-20.3, 20.5, 20.7-20.9

A.3 Maximum Likelihood Estimation, Trinity of Classical Testing (W, LM, LR)

With applications in Limited Dependent Variable models

Binary Choice and Count Data

Maximum Likelihood Estimator. MLE Properties (Asymptotic). MLE Examples. Trinity of Classical Tests (Wald, Likelihood Ratio, Lagrange Multiplier).

- Verbeek, Ch. 6.1-6.3 and 7.1, 7.3
- Greene, Ch. 14.1-14.4, 14.6-14.6.4, 14.9.1, 17.2-17.3.4, 17.3.7, 18.4.1
- (*) Mroz, T. (1987): "The sensitivity of an empirical model of married women's hours of work to economic and statistical assumptions," *Econometrica*, 55, 765--799.
- (*) Cincera, M. (1997): "Patents, R&D and Technological Spillovers at the Firm Level," *Journal of Applied Econometrics*, 12, 265--280.

A.4 Time Series, Non-Stationarity, Co-integration

Stationary and Non-stationary Series. AR, MA, and ARMA processes. Unit roots. (Augmented) Dickey Fuller test. Integrated Series. Trend Stationary and Difference Stationary Series. Cointegration.

- Verbeek, Ch. 8.1 - 8.7, 8.10, Ch. 9.1-9.7
- Greene, Ch. Ch. 21, 20.10
- Johnston & Dinardo: Ch 2, 2.4-2.5, Ch 7, 7.1-7.3, 7.6, Ch 8
- (*) Lettau, M. and S Ludvigson (2001): "Consumption, Aggregat

PART B: ESTIMATION METHODOLOGY AND TOPICS IN MICROECONOMETRICS

Non-required readings indicated with ()*

B.1 Endogeneity in linear regression models.

Properties of the OLS Estimator under Endogeneity. Causes of Endogeneity: Omission of Relevant Explanatory Variables; Measurement Error in Explanatory Variables; Simultaneity; Lagged Dependent Variable as a Regressor and Serially Correlated Errors

- Verbeek, Ch. 5.2
- Greene, Ch. 5.6.1
- (*) Card, D. (1999). The Causal Effect of Education on Earnings. *Handbook of Labor Economics* 3A, 1801-1863, Amsterdam: Elsevier.
- (*) Card, D. (2001). "Estimating the Returns to Schooling: Progress on Some Persistent Econometric Problems," *Econometrica*, Vol. 69, No. 5 (September, 2001), 1127-1160.
- (*) Griliches, Z. (1977). "Estimating the returns to schooling: Some econometric problems," *Econometrica*, Vol. 45, No. 1, 1-22.

B.2 Instrumental Variables Approach.

Instrumental Variables. Instrumental Variables (IV) Estimator. Finite-sample and Asymptotic Properties of the IV Estimator. Choice of Instruments.

- Verbeek, Ch. 5.3-5.4
- Greene, Ch. 5.4, 5.6

- (*) Angrist, J.D. (1990). "Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records," *American Economic Review*, 80, 313-336.
- (*) Angrist, J.D. and A.B. Krueger (1991). "Does Compulsory School Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics*, 56, 979-1014.
- **Two-Stage Least Squares (2SLS) Estimator and Generalized IV estimator. Hausman Test.**
- Verbeek, Ch. 5.5
- Greene, Ch. 5.5

B.3 Generalized Method of Moments

Overidentification. Generalized Method of Moments (GMM) Estimator. Rational Expectations Model. Asymptotic Properties of GMM Estimator. Efficient GMM Estimator. Test of Overidentifying Restrictions.

- Verbeek, Ch. 5.6-5.7
- Greene, Ch. 18
- (*) Hansen, L.P. and J.K. Singleton (1991). "Generalized Instrumental Variables Estimation of Nonlinear Rational Expectations Models," *Econometrica*, Vol. 50, No. 5, 1269-1286.

B.4 Introduction to Panel Data.

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Fixed Effects, Random Effects. Within Estimator, Between Estimator, Pooled OLS Estimator, GLS Estimator. Dynamic Panel Data Models. Arellano-Bond Estimator.

- Verbeek, Ch. 10.1-10.2
- Greene, Ch. 13

B.5 Introduction to Quantile Regression.

Review of Quantiles. Population Quantiles, Sample Quantiles. Conditional Quantile Function. Quantile Regression Estimator.

- Koenker, R., and G. Bassett (1978). "Regression Quantiles," *Econometrica*, Vol. 46, No. 1, 33-50.
- (*) Koenker, R. (2005). *Quantile Regression*, Econometric Society Monographs
- (*) Buchinsky, M. (1998). "Recent Advances in Quantile Regression Models: A Practical Guideline for Empirical Research", *The Journal of Human Resources*, Vol. 33, No. 1, 88-126.

Credit Transfer: If you are hoping to earn credit by taking this course, please ensure that you confirm it is eligible for credit transfer well in advance of the start date. Please discuss this directly with your home institution or Study Abroad Advisor.

As a guide, our LSE Summer School courses are typically eligible for three credits within the US system and 7.5 ECTS in Europe. Different institutions and countries can, and will, vary. You will receive a digital transcript and a printed certificate following your successful completion of the course in order to make arrangements for transfer of credit.

If you have any queries, please direct them to summer.school@lse.ac.uk