

Economics 273 (Part 2)  
Advanced Econometrics I  
MWF 9:00-10:50  
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## Course Outline

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Economics 363  
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This course has two goals. The first is to provide students with a working knowledge of asymptotic statistical methods. The second is to apply these statistical concepts to study the large-sample properties of all commonly used econometric models. The first half of the course focuses on deriving the large-sample properties of estimators defined as the solution to an optimization problem under a variety of assumptions for the true data generation process. These large-sample results are applied to the maximum likelihood and nonlinear least squares estimators. Extensions of this framework to the case of nonlinear instrumental variables estimators, including the generalized method of moments estimator, are then presented. Various asymptotic testing procedures are derived for these modeling frameworks.

The remainder of the course is devoted to several recent extensions of these methods. The first is simulation estimation. Simulated maximum likelihood and simulated method of moments estimators will be presented and their large-sample properties discussed. The basics of non-parametric econometric techniques, specifically kernel density and regression methods will then be presented.

**Students are expected to read the assigned papers before each lecture.**

### Useful Reference Books:

A.W. Van Der Vaart, *Asymptotic Statistics*, Cambridge University Press, 1998 (AS).

Takeshi, Amemiya, *Advanced Econometrics*, Harvard University Press, 1985 (AE).

Christian Gourieroux and Alain Monfort, *Simulation-Based Econometric Methods*, 1996, (SBEM).

Gallant, A.R. *Nonlinear Statistical Models*, 1987, (NSM).

Halbert White, *Asymptotic Theory for Econometricians*, Academic Press, 1984 (ATE).

Charles F. Manski, *Analog Estimation Methods in Econometrics*, Chapman and Hall, 1988 (AEME).

Bernard W. Silverman, *Density Estimation for Statistics and Data Analysis*, Chapman and Hall, 1986 (DE).

Peter Bickel, Chris Klaassen, Ya'acov Ritov and Jon Wellner, *Efficient and Adaptive Estimation for Semiparametric Models*, Johns Hopkins, 1993, (BKRW).

Gallant, A.R. (1997) *An Introduction to Econometric Theory*, Princeton University Press, Princeton, New Jersey. [A very readable introduction to measure theory for economists.]

## **HOMEWORK**

There will be 3 theoretical problems sets.

## **GRADING**

Homeworks	33 percent
Final Exam	67 percent (Take Home)

## **COURSE OUTLINE**

### **1. Asymptotics for Nonlinear Least Squares Estimators (2 Lectures)**

- (a) Classical Assumptions**
- (b) Violation of Classical Assumptions: Autocorrelation, Heteroscedasticity**
- (c) Feasible Generalized Least Squares**
- (d) Hypothesis and Specification Testing**

Jennrich, M. (1969) Asymptotic Properties of Nonlinear Least Squares Estimators, *Annals of Mathematical Statistics*, 20, 633-643.

While, H. (1980) Nonlinear Regression on Cross-Section Data, *Econometrica*, 48(3), 721-746.

White, H. and Domowitz, Ian (1984) Nonlinear Regression with Dependent Observations, *Econometrica*, 52, 143-161.

White, H. (1980) Using Least Squares to Approximate Unknown Regression Functions, *International Economic Review*, 21(1), 149-170.

### **2. Asymptotics for Quasi-Maximum Likelihood Estimation (2 Lectures)**

- (a) Classical Assumptions**
- (b) Misspecified Models**
- (c) Hypothesis and Specification Testing**

White, H. (1982) Maximum Likelihood Estimation of Misspecified Models, *Econometrica*, 50, 1-25.

Tauchen, G.E. (1985) Diagnostic Testing and Evaluation of Maximum Likelihood Models, *Journal of Econometrics*, 30, 415-443.

### **3. Asymptotics for M-Estimators with Differential Objective Functions (2 lectures)**

- (a) Stochastic Equicontinuity**
- (b) Empirical Process Methods**

Andrews, D.W.K. (1987) Consistency in Nonlinear Econometric Models: A Generic Uniform Law of Large Numbers, *Econometrica*, 55(6), 1465-1471.

Newey, W.K. (1991) Uniform Convergence in Probability and Stochastic Equicontinuity, *Econometrica*, 59, 1161-1167.

Newey, W.K. and McFadden, D. (1994) Large Sample Estimation and Hypothesis Testing, *Handbook of Econometrics, volume 4*, Elsevier Science B.V., Amsterdam, 2111-2245.

#### **4. Asymptotics for M-Estimators with Non-Differentiable Objective Functions (1 Lecture)**

**(a) Least Absolute Deviations**

**(b) Quantile Regression Estimators**

Bassett, G.S. and Koenker, R. (1978) Asymptotic Theory of Least Absolute Error Regression, *Journal of the American Statistical Association*, 73, 667-677.

Koenker, R. and Bassett, G. (1978) Regression Quantiles, *Econometrica*, 46, 33-50.

#### **5. Non-Standards Methods for Performing Hypothesis Tests (2 Lectures)**

**(a) Bootstrapping**

**(b) Standard-errors for two-step estimation methods**

Hall, P. (1992) *The Bootstrap and Edgeworth Expansion*, Springer-Verlag: New York, pp. 1-37.

Efron, B. and Tibshirani, R. (1993), *An Introduction to the Bootstrap*, Chapman & Hall: New York, pp. 10-177.

Pagan, A.R. (1984) Econometric Issues in the Analysis of Regressions with Generated Regressors, *International Economic Review*, 25, 221-247.

#### **6. Asymptotic Theory for Generalized Method of Moments Estimators (3 Lectures)**

**(a) Consistency and Asymptotic Normality for Arbitrary Weighting Matrix**

**(b) Nonlinear 2SLS and 3SLS**

**(b) Optimal Weighting Matrix**

**(c) Estimating Optimal Weighting Matrix**

Amemiya, T. (1974) The Nonlinear Two-Stage Least-Squares Estimator, *Journal of Econometrics*, 2, 105-110.

Amemiya, T. (1977) The Maximum Likelihood and Nonlinear Three-Stage Least Squares Estimator in the General Nonlinear Simultaneous Equations Model, *Econometrica*, 45, 955-968.

Hansen, L.P. (1982) Large Sample Properties of Generalized Method of Moments Estimators, *Econometrica*, 50, 1029-1054.

Newey, W.K. (1985) Generalized Method of Moments Specification Testing, *Journal of Econometrics*, 29, 229-256.

Andrews, D.W.K. (1991) Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimation, *Econometrica*, 59, 817-858.

#### **7. Simulation Estimation and Related Asymptotic Theory (3 Lectures)**

**(a) Method of Simulated Moments**

**(b) Method of Simulated Scores**

**(c) Simulated Maximum Likelihood**  
**(d) Indirect Inference**

McFadden, D. (1989) A Method of Simulated Moments for Estimation of Multinomial Discrete Response Models, *Econometrica*, 57, 995-1026.

Pakes, A. and Pollard, D. (1989) Simulation and the Asymptotics of Optimization Estimators, *Econometrica*, 57, 1027-1057.

McFadden, D. and Ruud, P. (1994) Estimation by Simulation, *Review of Economics and Statistics*, 76, 591-608.

Smith, A. (1993) Estimating Nonlinear Time Series Models Using Simulated Vector Autoregressions, *Journal of Applied Econometrics*, 8, 63-84.

Gourieroux, C., Monfort, A. and Renault, E. (1993) Indirect Inference, *Journal of Applied Econometrics*, 8, 85-118.

Lee, L.-F., (1995) Asymptotic Bias in Simulated Maximum Likelihood Estimation of Discrete Choice Models, *Econometric Theory*, v11, n3, 437-483.

Lee, L.-F., (1992) On Efficiency of Methods of Simulated Moments and Maximum Simulated Likelihood Estimation of Discrete Response Models, *Econometric Theory*, v8 n4, 518-552.