

**Econ 624 (Section 0101)**  
**Econometrics I**  
**Part I**

**Instructor:**

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**TA:**

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**Discussion Section:**

Thurs. 5:30 - 7:15 pm, Tydings Hall, Room 2108

**Lecture:**

Tues./ Thurs. 12:30 - 1:45 pm, Tydings Hall, Room 1132

**Prerequisite:**

Students are presumed to have had at least a one-semester course in mathematical statistics at the level of R.V.Hogg, A.Craig, and J.W.McKean, *Introduction to Mathematical Statistics* (6<sup>th</sup> Edition) as well as knowledge of the material covered in Econ 623, including basic knowledge of asymptotic theory. Students are also assumed to have a strong background in linear algebra and in the solution of difference equations.

### **Academic Integrity:**

Academic integrity is a foundation for learning. The University has approved a Code of Academic Integrity available on the web at <http://www.president.umd.edu/policies/iii100a.html>. The Code prohibits students from cheating in exams, plagiarizing, submitting the same paper for credit in two courses without authorization, buying papers, submitting fraudulent documents, and forging signatures.

### **Students with Disability**

A student, who has a documented disability and who wishes to receive accommodation or services from the University's Disabilities Support Service (DSS), must first complete a registration process which involves meeting with one of the senior staff members at DSS and providing the appropriate documentation. An appointment with DSS can be scheduled by calling (301) 314-7682.

### **Course Evaluations**

Students are encouraged to submit course evaluations through CourseEvalUM ([www.courseevalum.umd.edu](http://www.courseevalum.umd.edu)).

### **Principle Texts:**

Greene, W.H. (2007). *Econometric Analysis*, 6th Edition. Prentice Hall.  
(ISBN-10: 0135132452) (G)

Hamilton, J.D. (1994). *Time Series Analysis*. Princeton University Press.  
(ISBN-10: 0691042896) (H)

### **Additional References in Econometrics and Statistics:**

Aoki, M. (1987). *State Space Modeling of Time Series*, New York: Springer-Verlag.

Anderson, T. W. (1971). *The Statistical Analysis of Time Series*, New York: Wiley.

Box, G. E. P. and G. M. Jenkins (1976). *Time Series Analysis: Forecasting and Control*, (2nd Edition), San Francisco: Holden Day.

Brillinger, D. R. (1981). *Time Series: Data Analysis and Theory*, (2nd Edition), San Francisco: Holden Day.

Brockwell, P. J. and R. A. Davis (1993). *Time Series: Theory and Methods*, (2nd Edition) New York: Springer-Verlag. (BD)

Efron, B. and R. J. Tibshirani (1993). *An Introduction to the Bootstrap*, New York: Chapman & Hall. (ET)

Fishman, G. (1969). *Spectral Methods in Econometrics*, Cambridge: Harvard University Press.

Fuller, W. A. (1976). *Introduction to Statistical Time Series*, New York: Wiley.

Granger, C. W. T. and P. Newbold (1987). *Forecasting Economic Time Series*, (2nd Edition), New York: Academic Press.

Grenander, U. and M. Rosenblatt (1957). *Statistical Analysis of Stationary Time Series*, New York: Wiley.

Hannan, E. J. (1970). *Multiple Time Series*, New York: Wiley.

Hannan, E. J. and M. Deistler (1988). *Statistical Theory of Linear Systems*, New York: Wiley.

Harvey, A. C. (1993). *Time Series Models*, (2nd Edition), Cambridge: MIT Press.

J. Johnston and J. DiNardo (1997). *Econometric Methods*, 4th Edition. McGraw Hill, (JD)

G. G. Judge, et al. (1985). *The Theory and Practice of Econometrics*, 2nd Edition. Wiley (JGHLL)

Koenker, R. (2005). *Quantile Regression*, New York: Cambridge University Press. (K)

Lutkepohl, H. (1993). *Introduction to Multiple Time Series Analysis*, (2nd Edition), New York: Springer-Verlag.

Priestley, M. B. (1981). *Spectral Analysis and Time Series*, New York: Academic Press.

Reinsel, G. C. (1993). *Elements of Multivariate Time Series Analysis*, New York: Springer-Verlag.

Sargan, J.D. (1988). *Lectures on Advanced Econometric Theory*. Basil Blackwell.

Schmidt, P. (1976). *Econometrics*. Marcel Dekker. (S)

Whittle, P. (1984). *Prediction and Regulation*, (2nd Edition) Oxford: Blackwell.

White, H. (2000). *Asymptotic Theory for Econometrician*, Revised Edition. Academic Press.

#### **Handbooks:**

Z. Griliches and M. Intriligator, eds., *Handbook of Econometrics*, Vol. 1. North-Holland, 1983.

Z. Griliches and M. Intriligator, eds., *Handbook of Econometrics*, Vol. 2. North-Holland, 1984.

Z. Griliches and M. Intriligator, eds., *Handbook of Econometrics*, Vol. 3. North-Holland, 1986.

R. Engle and D. McFadden, eds., *Handbook of Econometrics*, Vol 4. Elsevier, 1994.

J. Heckman and E. Leamer, eds., *Handbook of Econometrics*, Vol 5, Elsevier, 2001.

### Some Useful References in Probability:

The following books are good references for the asymptotic theory presented in this course.

Billingsley, P. (1968). *Convergence of Probability Measures*, New York: Wiley. (B)

Hall, P. and C. C. Heyde (1980). *Martingale Limit Theory and Its Application*, New York: Academic Press.

Ibragimov, I. A. and Y. V. Linnik (1971). *Independent and Stationary Sequences of Random Variables*, Groningen: Wolters - Noordhoff.

Stout, W. F. (1974). *Almost Sure Convergence*, New York: Academic Press.

Pollard, D. (1984). *Convergence of Stochastic Processes*, New York: Springer-Verlag.

## **Course Outline and Reading List**

(R-required reading; S-suggested reading)

### **Reviews**

#### A. Asymptotic Theory

(S) Handout on “Basic Elements of Asymptotic Theory”

#### B. Hypothesis Testing

(S) Handout on “Basic Approaches to Testing Hypotheses”

#### C. Lag Operators and Difference Equations

(S) Handout on “Lag Operators and Difference Equations”

### **I. Topics in Stationary Time Series - Univariate Case**

A. Stationary Stochastic Processes

B. Dynamic Regression Models with Serial Correlation

C. Autoregressive Models

D. Order Selection for Stationary Autoregressive Models

- (R) ● H: Chapter 3.
- (S) ● BD: Chapters 1, 3, and 8

## II. Linear Systems

### A. Seemingly Unrelated Regressions Model

### B. Simultaneous Equations Model

1. Definitions, and Assumptions
2. Identification
3. OLS of Structural and Reduced Form Parameters, Indirect Least Squares
4. Limited Information and Full Information Instrumental Variable Estimation
5. The FIML Estimator and the Structure of Simultaneous Equation Estimators

- (R) ● G: Chapters 12-13.
- S: Chapters 4-5.
- Prucha, I. R. and H. H. Kelejian (1984). "The Structure of Simultaneous Equation Estimators: A Generalization Towards Non-normal Disturbances," *Econometrica*, 53, 721-736.
- (R) ● JD: Chapter 9, Sec 9.4-9.6
- JGHLL: Chapter 15
- T: 429-458, 489-525.

## III. Vector Autoregressions

1. Estimation and Inference in Stationary VAR
2. Testing for Granger Causality
3. Impulse Response Analysis

- (R) ● H: Chapter 11.

#### IV. Econometric Models of Time-Varying Volatility

- A. Autoregressive Conditional Heteroskedasticity (ARCH)
- B. Generalized Autoregressive Conditional Heteroskedasticity (GARCH)
- C. Other Extensions of the ARCH model
- D. Stochastic Volatility Model

- (R) ● Bollerslev, T. (1986). "Generalized Autoregressive Conditional Heteroskedasticity," *Journal of Econometrics*, 31, 307-327.
- Bollerslev, T., R. Y. Chou and K. F. Kroner (1992). "ARCH Modelling in Finance: A Review of the Theory and Empirical Evidence," *Journal of Econometrics*, 52, 5-59.
- Engle, R. F. (1982). "Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation," *Econometrica*, 50, 987-1007.
- Engle, R. F. and T. Bollerslev (1986). "Modelling the Persistence of Conditional Variances," *Econometric Reviews*, 5, 1-50.
- Kim, S.; N. Shephard, and S. Chib (1998). "Stochastic Volatility: Likelihood Inference and Comparison with ARCH Models," *Review of Economic Studies*, 65, pp. 361-393.
- Chib S., F. Nardari, and N. Shephard (2002). "Markov Chain Monte Carlo Methods for Stochastic Volatility Models," *Journal of Econometrics*, 108, pp. 281-316.
- (S) ● Jacquier, E., N. G. Polson and P. E. Rossi (1994). "Bayesian Analysis of Stochastic Volatility Models," *Journal of Business and Economic Statistics*, 12, pp. 371-89.
- Lumsdaine, R. L. (1995). "Asymptotic Properties of the Quasi-Maximum Likelihood Estimator in GARCH (1,1) and IGARCH (1, 1) Models," *Econometrica* (forthcoming).
- Nelson, D. B. (1990). "Stationarity and Persistence in the GARCH (1,1) Model," *Econometric Theory*, 6, 318-334.
- Nelson, D. B. (1991). "Conditional Heteroskedasticity in Asset Returns: A New Approach," *Econometrica*, 59, 347-370.
- Weiss, A. (1986). "Asymptotic Theory for ARCH Models: Estimation and Testing," *Econometric Theory*, 2, 107-131.

## V. Selected Topics on Bootstrap Methods and Higher Order Asymptotic Approximation

- (R) ● Handbook of Econometrics, Vol IV, Chapter 39 by Peter Hall
- (S) ● ET: Chapters 1-6, 9-10, 16
  - Phillips, P.C.B. (1983). "Exact Small Sample Theory in the Simultaneous Equations Model." In *Handbook of Econometrics*, Vol. 1, North-Holland, pp. 450-516.
  - Rothenberg, Thomas (1984). "Approximating the Distributions of Econometric Estimators and Test Statistics." In *Handbook of Econometrics*, Vol. 2, North-Holland, pp. 882-935.
  - Hall, P. and J. Horowitz (1996). "Bootstrap Critical Values for Tests Based on Generalized-Methods-of-Moments Estimators," *Econometrica*, 64, 891-916.

### **Grading Policy for Part I for Econ 624:**

- Half of your final grade in Econ 624 will be based on your performance in Part I of this course. There are two requirements for Part I, and they are weighted as follows:

Homework	15%
Midterm Exam	35%

(Note that the weights are given as a percentage of your final course grade, so that the total weight for Part I adds up to 50% and not 100%.)

- Homework problems will consist of theoretical problems and of empirical (computer) problems. Homework problems are handed out on Tuesdays and are due two Mondays after they are handed out. No credit will be given for homework that is late. (Problem sets should be handed in to the TA in person if at all possible. Problem sets that are slipped under the door or placed in mail boxes are not considered handed in until they are found!) The computer may be down for certain periods. Therefore, it is essential that computer assignments are started early. No extension of the deadlines for the assignments will be granted, unless the computer was down for at least 100 hours in the two-week assignment period.
- No make-up midterm exam will be given except in cases of illness (supported by a doctor's note), religious observance, participation in University activities at the request of the University authorities, or compelling circumstances beyond the student's control. If possible, the student should inform me (or the Economics Department) of his or her situation before the exam.