Department of Economics	ECON 672
University of Michigan	Winter 2008

Econometric Analysis II

Lectures:	Tue. and Thu., 1:00pm – 2:30pm, 1202 SEB
Instructor:	Yoonseok Lee (365C Lorch Hall, 615-0177, yoolee@umich.edu)
Office Hours:	Tue. 2:40pm – 4:00pm or by appointment
GSI:	Bill Lincoln (107 Lorch Hall, wlincoln@umich.edu) (Office Hours: Wed. 10:00am – 12:00pm, Lorch 351F)
Discussion Session:	Mon. 6:00pm–7:00pm, 173 LORCH

Course Description

This is a graduate level course in econometrics and designed for first-year economics Ph.D. students. The pre-requisite is Econ 671 or its equivalent. Knowledge of linear algebra and graduate level of probability/statistics is essential. The main goal is to provide a broad overview of basic modern econometrics tools. Selected current research topics will be also covered depending on time and interest.

The class web page is available at http://ctools.umich.edu. Announcements, problem sets and additional reading materials will be posted there, so make sure to visit the site frequently. Hard copies of these materials will *not* be distributed.

If you believe you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities to help us determine appropriate accommodations. I will treat any information you provide as private and confidential.

Course Requirements

The main requirement of this course is weekly-based problem sets (30%), the midterm exam (30%) and the final exam (40%). The due date of each problem set will be announced when it is posted; no late submissions will be accepted. In each problem set, computer-based exercises are integrated as an essential part of the course. Students are only allowed to use matrix-based programming software such as MATLAB or GAUSS.

(Note that STATA cannot be used unless otherwise noted.) The GSI will only support MATLAB. Students can form study groups and collaborate with other students to work on problem sets. You have to, however, write up and submit your own solutions.

The exams are scheduled as follows (in the normal classroom space):

Midterm: 1:00pm – 2:30pm, Tuesday, March 4 (in class)
Final Exam: 4:00pm – 6:00pm, Thursday, April 17

All exams are closed-book. The final exam will cover materials taught throughout the course, though more emphasis will be put on topics discussed after the midterm.

References

The recommended references for this course are:

[A] Amemiya, T. (1985). *Advanced Econometrics*, Harvard University Press.

[B] The lecture note by Bruce Hansen (University of Wisconsin-Madison): It is available at `http://www.ssc.wisc.edu/~bhansen/notes/notes.htm`.

[DM] Davidson, R. and J.G. McKinnon. (2004). *Econometric Theory and Methods*, Oxford University Press.

[G]* Green, W. (2008). *Econometric Analysis*, 6th ed., Prentice Hall.

[H]* Hayashi, F. (2000). *Econometrics*, Princeton University Press.

[JD] Johnston, J. and J. DiNardo (1996). *Econometric Analysis*, 4th ed., McGraw-Hill.

[K] Kennedy, P. (2003). *A Guide to Econometrics*, 5th ed., MIT Press.

[W] Wooldridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*, MIT Press.

Note that each textbook has different approach in econometrics but the coverages are very comparable; so you can choose any one or two based on your taste. [A] is a classic and covers most of the topics in more theoretical point of view. [H] has very nice treatment in GMM theories and time series; it tries to interpret all econometric models in the framework of GMM. [B] is a good companion to this textbook. [G] and [DM] summarize the linear regression part in a very organized and classical way; so you can find my lectures have a similar structure of these textbooks especially for linear regression theories. [W] has more microeconometric point of view including panel structures but it requires basic knowledge in econometric theories to read better. [JD] is less technical and it is not sufficient for Econ Ph.D.; but it is easy to read and good to get a quick overview. [K] explains the main econometric concepts intuitively using few equations, so it is good to read before you study the technical details. I also recommend the series of *Handbook of Econometrics*, Elsevier.

The following books are popular choices for particular topics:

[HT] Hamilton, J.D. (1994). *Time Series*, Princeton University Press. (Time Series)

[HS] Hsiao, C. (2003). *Analysis of Panel Data*, 2nd ed., Cambridge University Press. (Panel Models)

[PU] Pagan, A. and A. Ullah (1999). *Nonparametric Econometrics*, Cambridge University Press. (Nonparametric Models)

[WH] White, H. (2001). *Asymptotic Theory for Econometricians*, rev. ed., Academic Press. (Asymptotic Theory)

Course Outline

I. Univariate Linear Models

1. Review of linear algebra [JD Appendix; G Appendix; B Appendix]

    (a) Matrix as a linear transformation; Eigenvalues and eigenvectors; Projection; Spectral decomposition; Matrix inequality; Kronecker product and vec operator; Basic matrix differentiation

2. Classical linear regression models and the least squares [A 1,2; H 1,2; G 2-5,16; DM 2-5; B 2-5; WH]

    (a) Regression models and conditional expectation

    (b) Geometry of OLS estimation: least squares, decomposition of squaring, reparametrization, partitioned regression

    (c) Finite sample properties of OLS estimator: finite sample properties, omitting relevant variables vs. adding redundant variables, multicollinearity, optimality, testing linear hypothesis, prediction

    (d) Asymptotic properties of OLS estimator: review of asymptotic theory, consistency, asymptotic normality, testing (non)linear hypothesis, asymptotics of ML estimator

3. General linear regressions (GLS) [H 1,2; G 8,19; DM 7,13; B 5,10]

    (a) GLS and FGLS estimation

    (b) Statistical properties of GLS estimator: finite sample properties, optimality, asymptotic properties, equivalence of OLS and GLS

(c) Heteroskedasticity: estimation with heteroskedasticity, testing heteroskedasticity
(d) Autocorrelation: introduction of time series, estimation with AR(1) error, estimation with MA(1) error, testing serial correlation

4. Instrumental variables (IV) estimation [H 3; G 12; DM 8; B 9]
   (a) Endogeneity: errors in variables, simultaneity
   (b) IV estimation and 2SLS estimation
   (c) Statistical properties of 2SLS estimator and Hausman test
   (d) Identification Failure: irrelevant and weak IV's

II. Extremum estimators and Nonlinear Models

1. Extremum estimators [H 7; W 12]
   (a) M-estimators: MLE, NLS
   (b) Generalized Method of Moments (GMM) estimators: nonlinear GMM, IV, M-estimators
   (c) Classical Minimum Distance (CMD) estimators
2. Consistency of extremum estimators [H 3,7; W 12; A 4]
   (a) Consistency (a general result)
   (b) Identification: MLE, NLS, GMM
3. Asymptotic normality of extremum estimators [H 3,7; W 12; A 4]
   (a) Asymptotic Normality (a general result)
   (b) Examples: MLE, QMLE, NLS, GMM
   (c) Optimal weight matrices and continuously updated GMM
   (d) HAC Estimator
4. Hypothesis testing [H 3,7; W 12; A 4]
   (a) General nonlinear null hypothesis
   (b) J test (or over-identification test) in GMM
   (c) Model selection
5. Examples of nonlinear models [H 8; G 23,24; W 15,16,(17,18)]
   (a) Binary choice models: Logit, Probit, random utility models

   (b) Censored regressions: censoring vs. truncation, Tobit, sample selection models and Heckman's two-step estimation (Heckit), treatment effects

6. Numerical optimization [H 7.5; G Appendix E]

III. Multivariate Linear Models

1. Multivariate regression models [H 4,8; W 7]
   (a) Multivariate least squares
   (b) Statistical properties of the Multivariate LS estimators
   (c) Hypothesis testing
2. Seemingly Unrelated Regressions (SUR) [H 4,8; W 7]
   (a) System GLS
   (b) Relation between SUR and SELS
3. Panel models [H 5; W 10]
   (a) Fixed effects (FE) models: incidental parameter problem, FD and WG estimation
   (b) Random effects (RE) models: GLS estimation, relation between the GLS and the WG estimators, choosing between FE and RE models (Hausman test)
4. Simultaneous equation models (SEM) [G 13; W 9; H 4,8]
   (a) Specification: structural form (SF) vs. reduced form (RF) equations
   (b) Identification: order condition, rank condition
   (c) Estimation: ILS, 2SLS, 3SLS, FIML, LIML