ADVANCED ECONOMETRICS

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TEXT: Greene, William, Econometric Analysis, 5th ed., Prentice Hall, 2003. (GR*)
4th and 5th edition keyed to course outline. (Either Edition can be used)

REFERENCE BOOKS:

Amemiya, T., Advanced Econometrics, Cambridge: Harvard University, 1985.
Davidson, R. And J. G. MacKinnon, Estimation and Inference in Econometrics, New York: Oxford Press, 1993.
Enders, W., Applied Econometric Time Series, New York: Wiley, 1995.
Griliches, Z. and M. D. Intriligator, Handbook of Econometrics, 4 vols., Amsterdam: North Holland, 1983.
Hamilton, J. D., Time Series Analysis, Princeton: Princeton, 1994.
Hayashi, Fumio, Econometrics, Princeton: Princton, 2000.
Kendall, M. and A. Stuart, The Advanced Theory of Statistics, 3 vols., New York: Oxford Press, various years.
Kennedy, Peter, A Guide to Econometrics, Cambridge: MIT Press, various years.
Maddala, G. S., Introduction to Econometrics, New York: Macmillan, 1992.
Mittelhammer, R.C., G. G. Judge, D. J. Miller, Econometric Foundations, Cambridge:Cambridge, 2000.
Rao, C. R., Linear Statistical Inference and Its Application, New York: Wiley, 1965.
Rudd, Paul, An Introduction to Classical Econometric Theory, New York: Oxford, 2000.
Schmidt, P., Econometrics, New York: Marcel Dekker, 1976.
Theil, H., Principles of Econometrics, New York: Wiley, 1971.
Wooldridge, J., Econometric Analysis of Cross Section and Panel Data, MIT Press, 1999.

COURSE OUTLINE:

I. Matrix theory, statistical theory and regression models
   A. Matrices, vectors and elementary operations
      REF: GR (4th:CH 2; 5th: Appendix A)
      1. Definitions
      2. Operations
      3. Properties of operations
      4. Partitioned matrices
      5. Quadratic forms and their classification
      6. Kronnecker products
      7. Latent roots and characteristic vectors
      8. Vector and matrix differentiation with applications to constrained and unconstrained optimization theory
      9.

B. Statistics REF: GR (**4th** :CH 3,4; **5th** : Appendix B & C)
   1. Univariate distributions
   2. Multivariate distributions
   3. Maximum likelihood estimation
   4. Asymptotic distribution theory

C. The generalized regression model
   REF: GR (**4th**: CH 6, 7, 8, 9, 11, 12, 13, 17.2, 17.3 ;
   5th : 2,3,4,5,6,7,10,11,12,19.2,3,4))
   1. The model
   2. Estimators of the coefficients
   3. Forecasting GR (**4th**: 7.11, 13.9 and **5th**: 6.6 and 12.11)
   4. Some important special cases
      a. No autocorrelation or heteroskedasticity
      b. Heteroskedasticity
      c. Autocorrelation
   5. Seemingly unrelated regression: GR (**4th**:15.4 and **5th**: 14.2)
   6. ARCH and GARCH models: GR (**4th**: 12.1, 18.5 and **5th** :11.8)
   7. Stochastic regressors GR(**4th**: 9.4 and **5th**: 4.5)
   8. Instrumental variables GR (**4th**: 9.5; **5th**: 5.4 and 15.5). Additional reference Angrist, J.D. and A.B. Krueger, "Instrumental Variables and the Search for Identification: from Supply and Demand to Natural Experiements," Journal of Economic Perspectives, 15 (2001), 69-85.
   9. Hausman Test GR(**4th**: 9.5 and **5th**: 5.5)
   10. Models for Panel Data: Cross sectional and time series (Panel Data (GR 4th: 14; 5th : 13) and Wooldridge (1999))
   11. Generalized Method of Moments (GMM) and IV revisited. (Newey notes)
   12. Alternative Estimators and Specifications
      a. Specifications: Parametric, Semiparametric, nonparametric
      b. Estimators: LAD, OLS, L_p, MLE, QMLE, M-estimation, partially adaptive, kernel estimation
   13. Some variations on the basic model
      b. Hedonic regression models (GR **4th**: Problem 8.6)
      c. Poisson regression models (GR **4th** : Example 3.6 and **5th**: 21.9)

Appendix: A pedagogical note on adaptive and partially adaptive estimation

II Nonlinear models
   A. Introduction and estimation (GR **4th**: 5.5 and **5th**: 9)
   B. Computational methods (**5th**: Appendix E)
   C. Statistical inference (GR **4th**: 10.4 ; **5th** : 9.4 and 17.5)
   D. Some examples
      1. Production functions
      2. Models for the distribution of income
      3. Qualitative response models (GR **4th**: 19; **5th**: 21))
      4. Hazard models (GR **4th**: 20; **5th**: 22.5)
      5. Censored and/or truncated regression models (GR **4th**: 20.1, 2, 3; **5th**: 22.2, 22.3)
      6. Generalized method of moments (GR **4th**: 4.7, 11.5 and **5th**: 18)

III. Time series analysis GR (4th: 18; 5th: 20)
- A. Introduction
- B. Identification
- C. Estimation
- D. Forecasting
- E. Time series analysis and regression models
- F. Unit roots: some tests and implications
- G. Cointegration

IV Simultaneous Equation Model GR (4th: 16.1-16.8; 5th : 15)
- A. An introduction
- B. Representations of models
  1. Structural representation
  2. Reduced form representation
  3. Dynamic and static structural models
- C. Identification
  1. Identifiability relations
  2. Alternative methods of identification
     a. Necessary conditions (order conditions)
     b. Sufficient conditions (rank conditions)
  3. Tests of identification
- D. Estimation of reduced form parameters
- E. Estimation of structural parameters
  1. Review of notation
  2. Single equation techniques
  3. System techniques
- F. Forecasting

V. Dynamic models (class notes) GR (5th: 19)
- A. An introduction and an example
- B. Matrix representation of dynamic structural models
- C. Dynamic Models -- a special case
- D. An application of transfer functions

VI. Another representation of dynamic structural models: VAR (class notes) GR (5th: 19)
- A. Introduction
- B. Multivariate autoregressive moving average models
- C. Dynamic structural models
- D. Vector autoregressive representations GR (5th: 19.6)
- E. Vector moving average representation
- F. Impulse response functions
- G. Statistical inference
- H. A review and an application

VII. Miscellaneous topics (time permitting)

A. Bootstrapping in econometrics (GR **4th:** 5.3, 5.4 ; **5th** : Appendix E.4)

B. Empirical Likelihood Estimation

Point Distribution

Approximate distribution summary:

1 exam	150
Homework	100
Quizzes	50
Term paper	100
Final exam	200

STATEMENT ON THE HONOR CODE AND STUDENT RIGHTS

While all students sign the honor code, there are still specific skills most students need to master over time in order to correctly cite sources, especially in this new age of internet; as well as deal with the stress and strain of college life without resorting to cheating. Please know that your professor will notice instances of cheating on exams or plagiarizing on papers. See http://www.byu.edu/honorcode for specific examples of intentional, inadvertent plagiarism, fabrication, and falsification.

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Economics 588
"Proposed" schedule*
Winter 2007

Class Times: TTH 3:00 - 4:15 pm; B060 JFSB

Date	Topic	Course Notes
January 9	Introduction and Matrices	I. A (1-4)
11	Matrices	I. A (5, 6)
16	Matrices	I. A (7, 8)
18	Statistics	I. B (1)
23	Statistics	I. B (1)
25	Statistics	I. B (2, 3)
30	Statistics	I. B (3, 4)
February *1	Regression	I. C (1, 2)
6	Regression	I. C (3, 4)
8	Regression	I. C (5, 6, 7)
13	Regression	I. C (8, appendix)
15	Nonlinear Models	II. A, B
22	Nonlinear Models	II. C, D
**27	Nonlinear Models	II. C, D
March 1	Nonlinear Models	II. D
6	Exam on I and II	See sample exam
8	Time Series	III. A, B, C,
13	Time Series	III. D
15	Time Series	III. D.
20	Time Series	III. E., F.
22	Simultaneous Equations	IV. A.,
**27	Simultaneous Equations	IV. B., C.
29	Simultaneous Equations	IV. D., E., F.
April 3	Dynamic Models	V. A, B
5	Dynamic Models	V. C, D
April 10	Dynamic Models	VI. A, B, C.
12	Dynamic Models	VI. D, E, F, G, H
**17	Miscellaneous and Review	

* W—withdraw deadline (last day to withdraw from a semester class for academic reasons) is February 12th. .

** A proposal for your paper is due February 27th, a rough draft is due on March 27nd, and a "final" copy of your paper is due April 17th.

The final exam is scheduled for April 21th (Saturday) from 2:30 p.m. to 5:30 p.m.

*** I would like to accelerate through the *Matrices* and some of the *Regression* topics to allow coverage of additional topics.

Econometric Projects

The purpose of the project is to provide an opportunity to formulate a model of interest, collect relevant data, estimate the model, test hypotheses, and interpret the results. This experience will facilitate an integration of the statistical and econometric methodologies discussed in class with other economics courses that may focus on institutional descriptions of events and organizations or on theoretical models. Models are merely hypothesized explanations of observed economic data and should be estimated and tested. Econometric methods provide the basis for testing the validity of the hypotheses underlying economic models.

- Model Selection and Data

The selection of a model and data to be used are the first steps in an econometric project. Other economics courses or related journal articles may provide a source of potential topics. The determination of an econometric project should be based on both an interesting model or question and available data. Possible data sources include printed and electronic sources. Printed sources include such publications as the Economic Report of the President, Statistical Abstracts, and various Statistical Handbooks. Extensive data sources are available on the web, such as:

- http://www.econdata.net/
  This website includes links to many different types of data, including some of the following sites.
- http://www.Census.Gov
  Includes all data for the 1990 Census of Population and Housing, the U.S. and World Population data and the latest info on the 2000 Census.
- http://www.un.org/Depts/unsd/ [United Nations Statistical Division
- http://www.stls.frb.org [St. Louis Federal Reserve Economic Data Base]
  Price indices, interest rates, balance of payments, employment, and monetary data.
- http://rfe.org [Resources for Economists on the Internet]
  U.S. macro and regional data, other U.S. data, international data, financial data, and academic journal archive data.
- http://www.bea.doc.gov
  The Bureau of Economic Analysis provides time-series data on a variety of U.S. macroeconomic variables.

Previous topics have been very diverse in terms of both topic and scope and have included:

- Simple macroeconomic models
- Growth models
- Production functions – cross sectional, time series, and panel data
- Phillips Curve
- Prediction of consumer default on loans
- An analysis of the success of Mt. Everest expeditions
- Determination of factors related to admission to professional programs

- Supply and demand relations in particular markets
- A comparative analysis of the properties of alternative estimators
    - Analysis of the impact of education on the distribution of earnings using quantile regression
- A comparison of alternative forecasting techniques
- An inter-temporal analysis of the distribution of income across countries
- Estimation of salary distributions by professions
- Estimation of the impact of the correlation between measurement error and true income using copulas
- An inter-temporal analysis of the impact of taxes and transfer payments on inequality for different countries
- Estimation of GARCH models for stock returns
- Vector Auto Regression Models
- Applications of Kernel estimation
- Applications of Generalized Method of Moments
- Applications of hazard functions: firm survival, factors related to divorce
- Analysis of health care expenditure using QMLE and semiparametric models
- Comparing the size of alternative test statistics associated with non-linear models
- Multinomial logit analysis: employment practices
- The impact of student mentors and distance learning
- An application of the Bootstrap
- Wavelets
- The effect of a waiting period on sales of handguns

Once a topic has been selected, you should review the related literature. In specifying your model, clearly identify the endogenous (dependent) variables to be explained as well as the exogenous (independent) variables in your model. Replicating a previously published empirical study can be a very instructive exercise; however, it would be interesting to update the analysis. In time series applications it may be instructive to perform out of sample forecasts. For simultaneous equations models, six endogenous variables is a reasonable upper limit with at least six or eight exogenous variables. In these models, both the structure and reduced form parameters should be estimated.

2. Model Estimation

For single equation models or reduced form representations, ordinary least squares can be used if no autocorrelation or heteroskedasticity are present. Multicollinearity may make it difficult to obtain accurate estimates of the effects of individual variables. Improved estimation procedures are available if either autocorrelation or heteroskedasticity are present. Simultaneous structural equation models are better treated with estimation techniques specifically developed for these models. The most widely used of these techniques is probably two stage least squares, limited information maximum likelihood, or another instrumental variables or GMM estimator. Alternative methods are also available for structural models. Ordinary least squares, two stage

least squares and many other estimators are available in such computer packages as EVIEWS, SAS, Shazam, SPSS, STATA, RATS, or TSTP.

3. Organization of the write-up

The format for a paper being submitted to a scholarly-refereed journal provides a good model for your term paper. This would include:

(a) Title page

(b) Abstract. This should be less than one page in length and summarize the topic, methodology, and findings.

(c) Introduction. This section should state the nature and objectives of the project along with a review of the relevant literature.

(d) Description of the model. The model should be defined and each equation carefully explained. The variables should be clearly defined. The expected impact of each exogenous variable on the dependent variable and the reasons explained, i.e., discuss the comparative statics of the model.

(e) Interpretation of the variables and estimation of the model. The interpretation of the variables and data references should be included in the paper. The results of estimating the model should be reported and discussed in this section and would include: parameter estimates, standard errors, t-statistics, F-statistics, R^2, tests for normality, autocorrelation, heteroskedasticity and possibly the degree of multicollinearity. Important computer printouts may be included in an appendix.

(f) Economic analysis of the estimated model and implications. This section would include a comparison of the estimated results with the comparative static implications of the economic model. Policy implications, if any, and predictive capability of the model could also be included in this section.

(g) Summary and conclusions. Review the major findings as well as possible extensions for future work.

(h) Bibliography. Include complete citations for all references in the paper including data sources.