

**Advanced Econometric Methods (Econometrics II)**  
(Tuesday 2:35-5:15 p.m.)

In this class we will study, review and practice the major traditional econometric techniques as well as some recently developed methods in econometrics and statistics. The main objective of this class is to provide the background for understanding the theory and to develop the necessary theoretical and empirical tools for practicing the theory in a wide range of economic and econometric estimation problems.

To achieve this objective, we will (i) study the theory and the relevant assumptions, (ii) study economic applications and (iii) perform computer experiments (including analyzing real and artificial data).

An empirical paper, developed by each student is an essential (and required) component of this class.

During the semester, we will discuss and investigate some of the basic concepts of estimation and inference in econometrics. For each econometric problem we study, we will discuss the data generation process, the corresponding statistical models behind these processes, the information we have (such as observable and unobservable, known and unknowns), how to recover the unknowns from the data (the known), the estimator's properties and related inference (e.g., hypothesis tests, likelihood ratio, confidence intervals, basis for prediction, etc.) We will follow these questions and guidelines as we investigate and analyze each one of the following topics.

**Basic Outline of the Class** (*we may add/change topics throughout the semester*):

**I. Introduction, Review and the basics of GLS - 2-3 weeks** (*Greene, 1 – 6, 9; and additional – optional - MJM, Chaps. 5, 6, 14.4, 15.4*).

The review will include a (brief) discussion of the General Linear Model (Known and Unknown Error Covariance Matrix; Heteroskedasticity and Autocorrelation).

**II. Additional Background Material (Read only) - Stochastic Regressors and Asymptotics** (*Greene, 4.3-4.4; MJM 10.1-10.5*) - (*no discussion, only reading*)

**III. Nonlinear Least Squares, Nonlinear Maximum Likelihood and Empirical Likelihood Estimation – 3 weeks** (*Greene Chap. 7.1-7.2; 12.1; 12.2.1; 14; Also highly recommended: MJM Part III;*).

1. Nonlinear LS
2. Nonlinear ML
3. Empirical Likelihood (*Greene, 12.3.2; 12.3.1; 12.5-12.6; 13; MJM Chap 12; Owen, 1991, Ann. Stat., 19 1725-47; Qin and Lawless, Ann. Stat., 22 300-325, Bera A and Y. Biliyas, 2002, J. Econometrics; and additional reading that will be provided.*)

**IV. Sets of Linear Statistical Models (Seemingly Unrelated Regressions, SUR) - 1 week** (*Greene, 10.1-10.4; MJM 15.2, 16.9.3; Judge, Chapters 11 and pp. 420-433*).

**V. Instrumental Variables and Simultaneous Equation Statistical Models – 2-3 weeks** (*Greene, 8, 10.5-10.7; MJM 17.1, 17.3, 17.4*).

**VI. A Brief Introduction to GMM** (*Greene, 14.3, 14.5, 16.5; Hall, 2005; Imbens et. al. 1998*)

**VII. Discrete Choice and Censored Models - 2 weeks** (*Greene, 17-18; 19.1-19.3; Maddala; MJM Chap 20*).

**VIII. A Brief Introduction to Time-series (*Tentative*) - 2 weeks** (*Greene, 20*).

(Note, discussion on VIII above will be very limited here and we will just give very basic background to the topics.)

**IX. Tentative (if time permits) : Non Parametric and/or Ill-Posed Inverse Problems - 1-2 weeks** (*Greene, 14.4; MJM 21, 13, CD-ROM E3*).

**X. Possible Additional Topics.**

**XI. Review.**

**Computer Labs** (These are tentative – we will have at most two lab sessions):

1. September 11 (2:30 – 5:15 p.m. – Hurst 202)
2. September 18 (2:30 – 5:15 p.m. – Hurst 202)
3. October 23 (2:30 – 5:15 p.m. – Hurst 202)
4. November 13 (2:30 – 5:15 p.m. – Hurst 202)

### **Grades:**

1. Approximately six - seven problem sets will be given (about every two weeks) and will involve analytical problems and computer work. This will amount to 25% of final grade. Note: you may collaborate on the computer programming part of the problem sets, but **not** on the analysis, explanation, interpretation and write up of the problem set. From approximately PS 3, a part of each problem set will relate to the research paper.
2. Research Paper (60%). **Paper is due on Friday, November 30.**
3. A Quiz (15%). Will be give without notice during the second part of the class in one of the last four lectures.

*Office Hours:* Tuesday 12:00-2:00 p.m. and by appointment.

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### Note Special Dates:

- September 11: Computer Lab (Tentative).
- September 18: Computer Lab (Tentative).
- October 23: Computer Lab (Tentative).
- November 13: Computer Lab
- November 20: No Class (No Tuesday classes).
- November 30 (Friday): Papers are due by 5:00 pm. (No late submissions will be accepted.)
- December 4: Paper presentations in class – **Attendance and Presentation are mandatory.**

**Partial Reading List** (additional readings will be provided during the semester)

### **BOOKS**

#### Required

**Greene, W. H., "Econometric Analysis" (7<sup>th</sup> Edition, New York, Prentice Hall, 2011).**

#### Recommended

Mittelhammer, Judge, Miler, "Econometric Foundations" (Cambridge, 2000): *MJM*.

#### Additional Texts

Amemyia, T., Advanced Econometrics (Cambridge Univ. Press, 1985).

Cameron C. and P. Trivedi, "Microeconometrics: Methods and Applications" (Cambridge, 2005).

Hall, A., "Generalized Method of Moments" (Oxford University Press, 2005).

Hamilton, J. D., "Time Series Analysis" Princeton, 1994).

Maddala, G. S., "Limited Dependent Variables and Qualitative Variables in Econometrics"

Owen, A. B., "Empirical Likelihood" (Chapman & Hall/CRC), 2001).

Wooldridge, J., "Introductory Econometrics: A Modern Approach," (South Western College Publishing, 2<sup>nd</sup> Edition, 2002).

Partial List of Papers

1. Amemyia, T., Tobit Models: A Survey, *J. of Econometrics* 24, 3-61.
2. Bera A and Y. Biliias, The MM, ME, ML, EL, EF, and GMM approaches to estimation: A synthesis, *J. Econometrics* 107 (2002) 51-86.
3. Heckman, James. 1978. "Dummy Endogenous Variables in Simultaneous Equation System." *Econometrica* 46:931-960.
4. Heckman, James. 1990. "Varieties of Selection Bias." *American Economic Review* 80:313-318.
5. Imbens G. et. al., Information Theoretic Approaches to Inference in Moment Condition Models, *Econometrica*, (1998) 333-358.
6. Kitamura, Y. and M. Stutzer, "An information-theoretic alternative to generalized method of moment estimation." *Econometrica* (1997) 66 4, 861-874.
7. Owen A. B., Empirical Likelihood for Linear Models, *Ann. Statistics*, (1991) 19, 1725-1747.
8. Powell, J. L., Least Absolute Deviations Estimation for the Censored Regression Model, *J. of Econometrics* (1983) 25, 303-325.
9. Qin J., and J. Lawless, Empirical Likelihood and General Estimating Equations, *The Ann. of Statistics*, (1994) 22, 300-325.
10. Tobin, J. Estimation of Relationship for Limited Dependent Variables, *Econometrica* (1958) 26, 24-36.