UNIVERSITY OF MARYLAND
Department of Economics

GUIDO KUERSTEINER

ECON 623
Fall 2022

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http://econweb.umd.edu/~kuersteiner/
Lecture: Tu/Th 11-12:15pm, TYD 1114
Discussion: W 5:30-7:15pm, TYD 1101
Office Hours: M: 11am-12pm, Th: 2-3pm (and by appointment)

Teaching Assistant

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Office Hours: Tu/Th 9:30-10:30am, TYD 3115N

ECON 623 - ECONOMETRICS I

COURSE DESCRIPTION

This course provides a rigorous introduction into the linear regression model and related statistical tools used in econometrics. We focus on estimation by least squares and its optimality properties but also briefly consider alternative estimators such as least absolute deviations and quantile regression. Properties of estimators and test statistics are investigated from an exact finite sample as well as an approximate asymptotic point of view. Hypothesis testing as well as specification and model selection are considered. Matrix algebra and matrix calculus is used throughout and familiarity with basic concepts of probability and statistics is assumed. Towards the end of the course we investigate extensions of the basic model to systems of equations, endogeneity and non-linearity. Key concepts are illustrated with empirical applications. This is done mostly through problem sets where the software Stata is being used. The problem sets also have a mathematical component where theoretical concepts covered in class are explored further.

PREREQUISITS

Students are assumed to have knowledge of the fundamental concepts in probability and statistics at the level of textbooks by Casella and Berger, Statistical Inference, Duxbury Press, and Hogg, McKean and Craig, Introduction to Mathematical Statistics, Prentice Hall. Students are also assumed to have a strong background in linear algebra, real analysis and multivariate calculus.

TEXTBOOK: Econometrics (2022) by Bruce Hansen, recommended but not required.
https://www.ssc.wisc.edu/~bhansen/econometrics/

COMPLEMENTARY LITERATURE IN ECONOMETRICS:

Angrist, J.D. and J. Pischke (2009): Mostly Harmless Econometrics - An Empiricists Companion, Princeton University Press
Amemyia, T. (1985): Advanced Econometrics, Blackwell
Berndt, E.R., *The Practice of Econometrics: Classic and Contemporary.* Addison-Wesley, 1991.
Chow, G. C. *Econometrics.* McGraw Hill, 1983.
Cameron, A. C. and Travedi, P.K. (2005): Microeconometrics – Methods and Applications, Cambridge University Press
Davidson, R. and McKinnon, J.G. (1993): Estimation and Inference in Econometrics, Oxford University Press
Drhymes, P. (1994) Topics in Advanced Econometrics, Vol 2: Linear and Nonlinear Simultaneous Equations, Springer Verlag
Green, W.A., *Econometric Analysis*, 8th edition, Prentice Hall.
Goldberger, A. S., *A Course in Econometrics.* Harvard University Press, 1991.
Hayashi, F. (2000). *Econometrics*. Princeton: Princeton University Press
Malinvaud, E. *Statistical Methods of Econometrics*, 3rd Edition. North-Holland, 1980.
Ramanathan, R. *Statistical Methods in Econometrics,* Academic Press, 1993.
Ruud, P.A. (2002): An Introduction to Classical Econometric Theory, Oxford University Press.
Sargan, J. D. *Lectures on Advanced Econometric Theory.* Basil Blackwell, 1988
Wooldridge, J.M . (2002): Econometric Analysis of Cross-Section and Panel Data, MIT Press.
Schervish, M.J. (1995): Theory of Statistics, Springer Verlag
Spanos, A. *Statistical Foundation of Econometric Modeling.* Cambridge University Press, 1986.
Theil, H. (1971): Principles of Econometrics, Wiley
White, H. (2000): Asymptotic Theory for Econometricians (Revised Edition), Academic Press
Zellner, A. *An Introduction to Bayesian Inference in Econometrics.* Wiley-Interscience, 1996.

Statistics Texts:
These are especially useful for students who desire a more complete treatment of a topic in statistical theory or who plan further work in econometrics.

D. Cox and D. Hinkley, *Theoretical Statistics.* Chapman and Hall, 1974.
E. L. Lehmann and G. Casella, *Theory of Point Estimation*, 2nd Edition Springer, 1998.
E. L. Lehmann and J.P. Romano, *Testing Statistical Hypotheses*, 3rd Edition. Springer, 2005.
C. R. Rao, *Linear Statistical Inference and Its Application.* Wiley, 1973.
R. J. Serfling, *Approximation Theorems of Mathematical Statistics.* Wiley, 1980.
S. D. Silvey, *Statistical Inference.* Chapman and Hall, 1975.
A.W. van der Vaart, *Asymptotic Statistics,* Cambridge University Press, 1998.

Probability Theory, Real Analysis, Linear Algebra:

Billingsley, P. (1995): Probability and Measure, Wiley
Breiman, L. (1992): Probability, SIAM.
Chow, Y.S. and H. Teicher (1997): Probability Theory, Third Edition, Springer.

Chung, K.L. (2001): A Course in Probability Theory, Third Edition, Academic Press.
Magnus,J.R. and Neudecker, H (1988): Matrix Differential Calculus with Applications in Statistics and Econometrics, Wiley.
Halmos, P.R. (2016): Finite Dimensional Vector Spaces, Oxford.
Royden, H.L (1988): Real Analysis, Macmillan.
Rudin, W. (1976): Principles of Mathematical Analysis, McGraw Hill.

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.

Exercise Collections:

P. C. B. Phillips and M. R. Wickens, *Exercises in Econometrics,* Vol. I & II. Allen/Ballinger, 1978.
K. Abadir and J. Magnus, *Econometric Exercises Vol 1: Matrix Algebra*. Cambridge University Press, 2005.

SOFTWARE

The homework assignments will involve statistical analysis of datasets. The software recommended for these homework assignments is Stata. There are a number of web-based resources that can be used to acquire basic skills of using Stata. Examples are: http://www.ats.ucla.edu/stat/stata/ http://cameron.econ.ucdavis.edu/stata/stata.html

The second link contains links to additional resources. Cameron and Trivedi (2009) also have written a book on how to use Stata for econometric applications. While the use of statistical or numerical software for empirical work is clearly important it is not the main focus of this course, partly because the commands necessary to run standard statistical procedures are easy to learn and use.

Statistical Software can be used remotely via the "UMD Virtual Desktop" which can be accessed from Windows and Mac Computers. Software for installation on student owned computers is also available here: https://terpware.umd.edu/Windows (Mac and Linux are also supported)

GRADING POLICY

Econ 623 will be graded based on

Homework	25%
Midterm	35%
Final	40%

MIDTERM Tuesday, October 25, 11-12:15pm, during class time, open book.
FINAL EXAM: Wednesday, December 14, 8-10am (set by the UMD registrar's office)

Homework (10)	25%	Problem Set 1 due: Sep 13 Problem Set 2 due: Sep 20

		Problem Set 3 due: Sep 27 Problem Set 4 due: Oct 4 Problem Set 5 due: Oct 11 Problem Set 6 due: Oct 18 Problem Set 7 due: Nov 1 Problem Set 8 due: Nov 8 Problem Set 9 due: Nov 15 Problem Set 10 due: Nov 22 Problem Set 11 due: Nov 29 Problem Set 12 due: Dec 6
Midterm	35%	October 25
Final	40%	Wednesday, December 14, 8-10am

UNIVERSITY AND GRADUATE SCHOOL RULES AND REGULATIONS:

University policies can be found here: https://policies.umd.edu/
In particular:

- https://policies.umd.edu/general-administration/university-of-maryland-disability-accessibility-policy-and-procedures
- https://policies.umd.edu/general-administration/university-of-maryland-policy-and-procedures-on-sexual-harassment-and-other-sexual-misconduct
- https://policies.umd.edu/student-affairs/university-of-maryland-policy-on-excused-absence
- https://policies.umd.edu/research/university-of-maryland-intellectual-property-policy

All graduate school policies can be found here: https://gradschool.umd.edu/course-related-policies

COURSE OUTLINE:

The course covers the following topics. Required reading in the text book by Hansen is listed for each topic. Besides the textbook attendance of the lectures is essential.

1. The Classical Multiple Linear Regression Model (H: Ch 2)
   - Conditional Expectations
   - Projections
   - Best Linear Predictor
   - Omitted Variable Bias
   - Identification
2. Least Squares (H: Ch 3)
   - Matrix notation
   - Projections
   - Partitioned Regression
3. Statistical Properties of the Least Squares Estimator (H: Ch 4-5)
   - Gauss-Markov Theorem
   - Covariance Matrix Estimation

- Estimation with Gaussian Errors and Maximum Likelihood

4. Asymptotic Theory (H: Ch 6-7, Handout)
   - Modes of Convergence
   - Weak Laws of Large Numbers
   - Strong Laws of Large Numbers
   - Central Limit Theorem
   - Asymptotic Analysis of the Least Squares Estimator
5. Restricted Least Squares (H: Ch 8)
6. Inference (H: Ch 9)
   - Tests of Statistical Hypotheses
   - Testing principles: Wald, LM, LR
   - Specification tests
   - Hausman Tests
7. The Generalized Regression Model
8. Systems of Regression Equations (H: Ch 11)
9. Instrumental Variable Estimation (H: Ch 12)
10. Bootstrap (H: Ch10)
11. Simultaneous Equations Models