

17.802. Quantitative Methods II

Spring 2009

Professor Orit Kedar

Monday, Wednesday, 1-2:30

Room E51-063

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Course site: <http://stellar.mit.edu/S/course/17/sp09/17.802/index.html>

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Recitation: TBA

Course description

The main goal of the course is to develop (i) understanding, (ii) ability to critically evaluate, and (iii) ability to confidently apply statistical analyses of the type covered in the course in order to answer substantive questions in political science.

The course will cover the classical linear regression (including assumptions, properties of estimators, violations of assumptions and solutions, tests, interpretation, extensions, and the like.) Toward the end of the course, we will also introduce in brief maximum likelihood and models of qualitative dependent variable.

The course should give you tools to assess what is an appropriate estimation technique by which to analyze your data, and, no less important, what are the pitfalls of using particular techniques versus others.

Books and reading materials

The following books are on reserve and available for purchase at the COOP:

Greene, William H. 1990. *Econometric Analysis*. Prentice Hall. Sixth edition.

Achen, Christopher H. 1982. *Interpreting and Using Regression*. Sage: Quantitative Applications in the Social Sciences.

We also put on reserve the following books:

Gujarati, Damodar N. 1978. *Basic Econometrics*. Fourth edition.

Johnston J. 1963. *Econometric Methods*. McGraw Hill. (Chapter 4)

Simon, Carl P., and Lawrence Blume. 1994. *Mathematics for Economists*. Norton.

Strang, Gilbert. 1976. *Linear Algebra and Its Applications*. Saunders HBJ. Third edition.

They might come in handy in the matrix algebra section of the course.

Different people find different texts intuitive and helpful for different topics. I list below a few statistics/econometrics textbooks. I will occasionally refer to them. Please take the time to browse through them and find the ones helpful to you. These books are on reserve:

King, Gary. 1989. *Unifying Political Methodology: the Likelihood Theory of Statistical Inference*. Cambridge University Press.

Long, J. Scott. 1997. *Regression Models for Categorical and Limited Dependent Variable*. Sage publications.

Maddala, G. S. 1983. *Limited-dependent and Qualitative Variables in Econometrics*. Cambridge University Press.

Stock, James H., and Mark W. Watson. 2007. *Introduction to Econometrics*. Addison Wesley. Second edition.

And these are a few additional ones:

Cameron. A. Colin, and Pravin K. Trivedi. 2005. *Microeconometrics: Methods and Applications*. Cambridge University Press.

Johnston J. 1963. *Econometric Methods*. McGraw Hill.

Kennedy, Peter. 2003. *A Guide to Econometrics*. MIT Press. Fifth edition.

Woolridge, Jeffrey 2006. *Introductory Econometrics: A Modern Approach*, 3rd Edition.

Substantive readings/applications/additional readings. I weaved into the course plan substantive readings which are excellent examples of the topics learned. These readings are marked with *. A good example of an application goes a long way in demonstrating how a method is used and what its advantages are. We will discuss these readings in class. Please make sure to come prepared.

Our main textbook for the course is Greene's. However, on some of the earlier weeks we will use other texts. Also, for every topic, I list below Greene some alternative readings from other textbooks should you prefer to consult with them. It is important that you read *before* the lecture.

We will have a mailing list for the class. Please make use of it to ask and answer each other's questions. We all learn from each other's questions.

Assignments

Weekly problem set. Problem sets will be handed on recitation and will be due the following recitation at the beginning of the session. They will include empirical and theoretical questions, depending on the topic. You may work in groups but do the write-up on your own.

The data we will use for most problem sets is the Comparative Study of Electoral Systems. The CSES is a terrific data set which allows for investigation of a variety of questions. It is a multi-country dataset including information both at the micro level about individuals and at the macro level about political systems. We will ask you to

focus on different parts of it depending on the week. The data are available at: www.cses.org. Please go ahead and acquaint yourself with these data.

Midterm exam. This will be a take-home exam, to take place on Wednesday, April 1st. It will be a 48-hour exam or more. Please plan accordingly.

Research paper. Research paper in which students will conduct original research. More details will be provided in class. Papers are due on Monday, May 18 at 4PM. Heads up: on Thu/Fri., April 16/17, as part of the weekly assignment, we will ask you to demonstrate initial progress on the research paper.

Draft of research paper. A rough draft is due on May 1st. Please hand in two copies (to us and to an assigned peer).

Peer commentary. Each student will be assigned to a peer and will provide commentary on the draft. The commentary should be constructive and aim at improvement of the work read. Please hand in two copies of the commentary (to us and to the assigned peer). The commentary is due on May 6 in class.

Grading. Weekly problem set - 20%, midterm exam – 30%, paper draft + peer commentary 15%, final paper - 35%.

Course plan

Wednesday, February 4 **Introduction**

Monday, February 9 **Probability and Statistical Inference - Review**
bias, consistency, efficiency

Greene, C1-C5
Gujarati, A1-A4, A6-A8
S+W, 2.1, 2.2, 2.5, 3.1, 3.2, 3.3

For recitation:

King, Gary. 1995. "Replication, Replication". *PS: Political Science and Politics*, Vol. 28(3): 444-452.

Nagler, Jonathan. 1995. "Coding Style and Good Computing Practices." *PS: Political Science and Politics*, Vol. 28(3): 488-492.

Linear Regression - Bivariate Model

Wednesday, February 11 - Least Squares assumptions
Tuesday, February 17 model fit

(Monday schedule)	<p>properties: finite sample, asymptotic</p> <p>Gujarati, Ch. 2, 3 S+W, Ch. 4 Begin reading Achen, Sage monograph</p>
Wednesday, February 18	<p>Linear Regression – Multivariate Model Gauss-Markov assumptions and problems (no solutions yet) model fit properties</p> <p>Gujarati, 4.1-4.3, 7.1-7.8 S+W, Ch. 5.4, 5.5, 6.2-6.6 Complete Achen, Sage monograph.</p>
Monday, February 23 – Wednesday, February 25	<p>Review of Matrix Algebra Vectors, matrices, addition, multiplication, identity, inversion, rank, dependence and independence, partition.</p> <p>Greene, Appendix A Johnston, Ch. 4 Simon and Blume, Ch. 6, 7, 8 (partition) Strang, Ch. 1, 2</p>
Monday, March 2	<p>Linear Regression Model in Matrix Form</p> <p>Greene, Ch. 2, 3.1-3.2, 3.5, 4.4, 4.8, 4.9</p>
Wednesday, March 4 – Monday, March 9	<p>Linear Regression confidence intervals, hypothesis testing restrictions on coefficients transformations, non-linearity</p> <p>Greene, Ch. 4.6-4.7, 5.1-5.3, 5.6, 6.3 Gujarati, Ch. 8 S+W, 5.1-5.2, 7.1-7.2 (homoskedasticity only), 8.2</p>
Wednesday, March 11- Monday, March 16	<p>Linear Regression dummy variables, interaction terms predictions interpretation</p> <p>Greene, 5.6, 6.1-6.2 Gujarati, 9.1-9.6 S+W, 5.3, 8.3</p>

*Brambor, Thomas, William Roberts Clark, and Matt Golder. 2006. "Understanding Interaction Models: Improving Empirical Analyses." *Political Analysis* Vol. 14: 53-82.

Wednesday, March 18

Linear Regression

Plots, graphs, and common mistakes

*Wright, Gerald C. "Linear Models for Evaluating Conditional Relationships." 1976. *American Journal of Political Science*, Vol. 20(2): 349-373.

*Achen, Christopher H. 1977. "Measuring Representation: Perils of the Correlation Coefficient." *American Journal of Political Science*, Vol. 21(4): 805-815.

*King, Gary. 1986. "How Not To Lie with Statistics: Avoiding Common Mistakes in Quantitative Political Science." *American Journal of Political Science*, Vol. 30(3): 666-687.

Monday, March 23

No class, spring break

Wednesday, March 25

No class, spring break

Monday, March 30

catch-up and review

Wednesday, April 1

midterm take-home exam. (This is a 48-hour exam or more. Please plan accordingly.)

Monday, April 6

Problems, Violations of Assumptions, Solutions

outliers

missing data

collinearity

*Lieberman, Evan S. 2005. "Nested Analysis as a Mixed-Method Strategy for Comparative Research." *American Political Science Review*. Vol. 99(3): 435-452.

Greene, 4.8.1, 4.8.2

S+W, 6.7

Gujarati, 10.1-10.5, 10.7-10.9

Wednesday, April 8,
Monday, April 13,
Wednesday, April 15

More Problems

heteroskedasticity
correlated disturbances

Greene, 8.4-8.7
Gujarati, 11.1-11.7, 12.1-12.4, 12.6

measurement error
omitted-variable bias
Instrumental variable

Greene, 12.1-12.5
Gujarati, 7.7-7.8
S+W, 6.1, 7.5, Ch. 12

Monday, April 20

No class, Patriots Day

Wednesday, April 22
Monday, April 27

Endogeneity, Simultaneous Equations

Greene, 12.1-12.5 (continued)
S+W, 6.1, 7.5, Ch. 12 (continued)
Gujarati, 18.1-18.3, 19.1-19.3, 20.4

*Gabel, Matthew, and Kenneth Scheve. 2007.
“Estimating the Effect of Elite Communications on
Public Opinion Using Instrumental Variables.” *American
Journal of Political Science*, Vol. 51(4): 1013-1028.

Wednesday, April 29,
Monday, May 4

Maximum Likelihood

dichotomous dependent variable
Logit, Probit

King, Ch. 4, Ch. 5.1
Long, 2.6, 4.1

Wednesday, May 6

Logit and Probit

quantities of interest

King, 5.2
Long, 3.1-3.5

*King, Gary, Michael Tomz, and Jason Wittenberg.
2000. “Making the Most of Statistical Analyses:
Improving Interpretation and Presentation.” *American
Journal of Political Science*. Vol. 44(2): 347-361.

Monday, May 11
Wednesday, May 13

Multinomial Choice Models
MNL, CL, IIA

Maddala, 2.10-2.12
Long, 6.1-6.3, 6.7-6.8

*Alvarez, R. Michael and Jonathan Nagler. "When Politics and Models Collide: Estimating Models of Multiparty Elections." *American Journal of Political Science*, Vol. 42 (1): 55-96.