

Statistical Methods in Political Research II - PS 699
Department of Political Science - University of Michigan
Winter 2017

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Instructor:	Rocío Titiunik, < titiunik@umich.edu >
Instructor's Office:	6640 Haven Hall
Class Location:	1448 Mason Hall
Class Time:	Tue-Thu 2:30-4:00 pm
Instructor's Office Hours:	Tuesday 4:00-5:00 pm
Prerequisites:	PS599 or equivalent course
Graduate Student Instructor:	Patrick Wu, < pywu@umich.edu >
Discussion Section:	Thursday 4:00-5:00 pm, at 7603 Haven Hall
GSI's Office Hours:	TBA

Course Outline. This course is an introduction to statistical and econometric analysis for social scientists. We will cover linear regression analysis, and nonlinear models as time permits. The course will be both theoretical and practical. There will be problem sets that will be both theoretical and empirical; we will use the software R.

Software. The course will use the statistical software R (see <http://cran.r-project.org> for excellent online documentation, manuals, and resources). All students are expected to learn R and use it to solve the problem sets. We will teach how to use R in the discussion section, but students are expected to be familiar with the language, in particular with the contents of PS514.

Books. The required book for the course is Greene's textbook:

- Greene, William H., *Econometric Analysis*, 2012. Prentice Hall, 7th Edition.

In addition to the required book, some lectures will also rely on the following books:

- Wooldridge, Jeffrey M., 2010. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, 2nd Edition. (If you want to buy an advanced econometrics book in addition to Greene's, I strongly recommend this one.)

- Cameron, Colin A. and Pravin K. Trivedi, 2005. *Microeconometrics: Methods and Applications*. Cambridge University Press.
- Angrist, Joshua D. and and Jorn-Steffen Pischke, 2008. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press, First Edition.
- Casella, George and Roger L. Berger, 2001. *Statistical Inference*. Duxbury Press, 2nd edition.
- Hogg, Robert V., Allen Craig, and Joseph W. McKean, 2004. *Introduction to Mathematical Statistics*. Prentice Hall, 6th edition.
- Simon, Carl P., and Lawrence Blume, 1994. *Mathematics for economists*. New York: Norton.
- Shao, Jun, 2005. *Mathematical Statistics*. New York: Springer.
- Lehmann, E. L., 1999. *Elements of Large-Sample Theory*. New York: Springer.

If you are finding the level of difficulty in Greene (2011) a little too high, you can refer to the following more basic textbooks:

- Stock, James H. and Mark W. Watson, 2006. *Introduction to Econometrics*. Addison-Wesley Series in Economics, 2nd Edition.
- Fox, John, 2008. *Applied Regression Analysis and Generalized Linear Models*. Sage Publications, Inc, 2nd edition. (If you want to buy a more basic book, I highly recommend this one.)

Requirements. There will be frequent problem sets, a midterm exam, and a final exam. All students must complete the problem sets, the midterm exam and the final exam to pass the course. Students are also expected to do the weekly readings, and come to class prepared to participate in lecture and ask questions.

Problem Sets. Problem sets are a very important part of the course. All calculations requiring computing and graphing must be done with the statistical software R. All problem sets must be submitted electronically via the Canvas website. Late problem sets will be given no points. The main body of your problem set should consist of clearly typed answers to the questions. The R code used to solve the questions should be attached as *an appendix at the end of the file*. Graphs should be clearly numbered and labeled, and should be placed on the main body of the file. The raw output from the R console will *not* be accepted as a solution.

You should think of your problem set as a mini-report that is to be clearly organized and written.

Grading Policy. The final grade will be determined by problem sets (20%), midterm exam (30%) and final exam (50%).

Incomplete policy. No incompletes will be given.

Accommodations for Students with Disabilities. If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the *Services for Students with Disabilities (SSD)* office to help us determine appropriate academic accommodations. SSD (734-763-3000; <http://ssd.umich.edu>) typically recommends accommodations through a *Verified Individualized Services and Accommodations (VISA)* form. Any information you provide is private and confidential and will be treated as such.

Religious and Academic Conflicts. Although the University of Michigan, as an institution, does not observe religious holidays, it has long been the University's policy that every reasonable effort should be made to help students avoid negative academic consequences when their religious obligations conflict with academic requirements. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the period of absence. Students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall be provided with a reasonable alternative opportunity to complete such academic responsibilities. It is the obligation of students to provide faculty with reasonable notice of the dates of religious holidays on which they will be absent. Such notice must be given by the drop/add deadline of the given term. Students who are absent on days of examinations or class assignments shall be offered an opportunity to make up the work, without penalty, unless it can be demonstrated that a make-up opportunity would interfere unreasonably with the delivery of the course. Should disagreement arise over any aspect of this policy, the parties involved should contact the Director of Graduate or Undergraduate Studies. Final appeals will be resolved by the Provost.

Student Mental Health and Wellbeing. The University of Michigan is committed to advancing the mental health and wellbeing of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, contact *Counseling and Psychological Services (CAPS)* at (734) 764-8312 and <https://caps.umich.edu/> during and after hours, on weekends and holidays, or through its counselors physically located in schools on both North and Central Campus. You may also consult *University Health Service (UHS)* at (734) 764-8320 and <https://www.uhs.umich.edu/mentalhealthsvcs>, or for alcohol or drug concerns, see www.uhs.umich.edu/aodresources. For a listing of other mental health resources available on and off campus, visit: [http:](http://)

[//umich.edu/~health](http://umich.edu/~health).

Academic Integrity. The LSA academic community, like all communities, functions best when its members treat one another with honesty, fairness, respect, and trust. The College holds all members of its community to high standards of scholarship and integrity. To accomplish its mission of providing an optimal educational environment and developing leaders of society, the College promotes the assumption of personal responsibility and integrity and prohibits all forms of academic dishonesty and misconduct. Academic dishonesty may be understood as any action or attempted action that may result in creating an unfair academic advantage for oneself or an unfair academic advantage or disadvantage for any other member or members of the academic community. Conduct, without regard to motive, that violates the academic integrity and ethical standards of the College community cannot be tolerated. The College seeks vigorously to achieve compliance with its community standards of academic integrity. Violations of the standards will not be tolerated and will result in serious consequences and disciplinary action. See [examples of academic misconduct](#).

Overview of covered topics

1. Review of basic matrix algebra, statistics and asymptotic theory
 - (a) Random variables
 - (b) Distribution, density and mass functions
 - (c) Expectation, Median and Variance
 - (d) Conditional distributions
 - (e) Convergence in probability and distribution
 - (f) Weak law of large numbers and central limit theorem
 - (g) Asymptotic distribution
2. Maximum Likelihood Estimation
 - (a) General approach
3. Hypothesis testing and interval estimation
4. Classical Linear Regression
 - (a) Ordinary Least Squares (OLS) estimation and inference
 - (b) Finite-sample properties of OLS
 - (c) Large-sample properties of OLS
 - (d) Estimation via maximum likelihood
 - (e) Basic statistical inference
5. Departures from classical assumptions in linear regression model
 - (a) General model with non-spherical disturbances
 - (b) Heteroskedasticity
 - (c) Serial correlation
 - (d) Endogeneity (instrumental variables)
6. Non-linear regression functions
 - (a) Non-linear least squares
 - (b) Discrete choice models
7. Linear Panel Data Models

Course outline

Note 1: This outline may change, please check periodically for updates.

Note 2: Starred readings are suggested and encouraged, but not required.

First part: January 2nd-February 22nd

1. Review of matrix algebra, statistics, and asymptotics

- *Greene*, appendices A, B, C, and D.
- *Casella and Berger*, Chapters 1-5, 10.
- *Hogg et al*, Chapters 1-5.

2. Maximum Likelihood Estimation

- Maximum Likelihood Estimation, *Greene*, Chapter 14.
- *Casella and Berger*, Chapter 7.
- *Hogg et al*, Chapters 6.

3. Hypothesis testing and interval estimation

- *Casella and Berger*, Chapters 8-9.
- *Hogg et al*, Chapter 8.
- *Greene*, Chapter 5, Chapter 14.

Winter break: Monday February 26th through Friday March 2nd

Second part: March 7th-April 18th

4. Classical linear regression model

- The model and its assumptions, *Greene*, Chapter 2, *Fox**, Chapter 5.
- Ordinary least squares, definition and algebraic properties *Greene*, Chapter 3, *Fox**, Chapter 10.

- Ordinary least squares, statistical properties *Greene*, Chapter 4, *Fox**, Chapter 9.
- Ordinary least squares, inference *Greene*, Chapter 5, *Fox**, Chapter 6.
- Applications of MLE: classical linear regression with normal errors, *Greene*, Chapter 14, *Fox**, Chapter 9, 197-198.

<p>Take-home midterm exam: Friday March 9th through Sunday March 11th</p>
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5. Generalizing the classical linear regression model

- Generalized least squares, *Greene*, Chapters 9, 10, 11, *Fox**, Chapter 12.
- Heteroskedasticity, *Greene*, Chapter 9.
- Weighted least squares, *Greene*, Chapter 9.
- Serial correlation, *Greene*, Chapter 20, *Fox**, Chapter 16.
- Omitted variable bias and endogeneity (instrumental variables estimation) *Greene*, Chapter 8, *Fox**, Chapter 6, pp. 110-112.

6. Non-linear regression

- Non-linear least squares, *Greene*, Chapter 7, *Fox*, Chapter 17.
- Binary choice models, *Greene*, Chapter 17, *Fox**, Chapter 14, pp. 335-355.
- Multinomial choice models, *Greene*, Chapter 18, *Fox**, Chapter 14, pp. 355-378.

7. Panel Data

- Linear panel data models, *Greene*, Chapter 11, *Wooldridge*, Chapter 10.

<p>Take-home final exam: Friday, April 20th through Sunday, April 22nd</p>

A summary of the relevant due dates is given below:

Table 1: Dates of relevant events and assignments

Event/Assignment	Date/Due date
Winter Break:	Mon Feb 27 through Fri March 3
Midterm exam:	Fri March 9 through Mon March 12
Final exam:	Friday April 20 through Sunday April 23
