

# PSC 405: Linear Models

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Spring 2012

Lecture: TR 3:25-4:40 (Harkness 210)

Course website: <http://www.rochester.edu/College/faculty/mperess/lm2012.html>

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Harkness 326

OH: TR 2:00-3:00

Overview: In this course, we will examine the linear regression model and its variants.

The course has two goals: (1) to provide students with the statistical theory of the linear model, and (2) to provide students with skills for analyzing data. The linear model is a natural starting point for understanding regression models in general, inferences based on them, and problems with our inferences due to data issues or to model misspecification.

The model's relative tractability has made it an attractive tool for political scientists, resulting in volumes of research using the methods studied here. Familiarity with the linear model is now essentially required if one wants to be a consumer or producer of modern political science research.

Recommended Textbook: William Greene - Econometric Analysis, Any Edition

Grading: Grading will be based on a midterm (33%), a final (33%), and six (plus or minus one) homework assignments (33%).

Course Outline: I plan on covering the following topics throughout the semester. The list may be contracted or expanded based on how long things are taking.

- A. Bivariate Regression
- B. Linear Algebra
- C. Ordinary Least Squares (OLS)
- D. Finite Sample Properties of OLS
  - 1. Tests of a coefficient
  - 2. Tests of multiple coefficients
- E. Justifications for OLS Estimator
  - 1. Maximum likelihood
  - 2. Gauss-Markov theorem
  - 3. Rao-Blackwell theorem
  - 4. Generalized method of moments
- F. Specification for OLS
  - 1. Multicollinearity
  - 2. Heteroskedasticity and Weighted least squares
  - 3. Autocorrelation
  - 4. Structural change
  - 5. Non-nested model testing
- G. Prediction
- H. Large Sample Properties of OLS
  - 1. Huber-White covariance matrix
- I. Functional Form
  - 1. Logs
  - 2. Dummy variables
  - 3. Polynomials
  - 4. Tests of functional form
- J. Endogeneity and Instrumental Variable Estimation
  - 1. Endogeneity
  - 2. Two-stage least squares
  - 3. LIML and other estimators
  - 4. Weak instruments
- K. Time Series Models
  - 1. Lagged dependent variables
  - 2. ARMA errors
  - 3. Newey-West covariance matrix
  - 4. Unit roots

#### L. Panel Data Models

1. Fixed effects
2. Random effects and the Hausman test
3. Dynamic panel data models
4. IV estimators for panel data models
5. Clustered standard errors

#### M. Sample Selection Models

#### N. Nonparametric Techniques

1. Kernel regression
2. Nonparametric IV
3. Regression discontinuity
4. Nearest neighbor matching