

PADP 8130: Linear Models (Spring 2014)

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Course Information

Classroom: Baldwin Hall 206

Class Time: Tues., 12:00–3:00pm

Course Description

This course is an introduction to the theory and application of linear modeling to social science problems. The focus of this class will be to provide you with the theoretical and practical skills necessary to conduct your own empirical research. Topics will include ordinary least squares, hypothesis testing, dealing with violations of the underlying assumptions of multiple regression, instrumental variables estimation, simultaneous equations, and panel data techniques. I will also provide an introduction to the R software for statistical analysis.

By the end of the course, students should be able to:

- Identify the most appropriate methodological techniques for analysis given a research question and available data, as well as identify, understand the implications, and offer resolution to various problems encountered during quantitative analysis.
- Conduct data analyses using the methodologies covered in the course. In particular, students should be able to diagnose and test empirical models, and apply the techniques for correcting models that violate statistical assumptions.
- Manage data and conduct analyses using R.

Required Materials

Applied Regression Analysis and Generalized Linear Models by John Fox, 2nd edition.

Book website: <http://tinyurl.com/arabook>

One of the following:

- *Econometric Analysis* by William H. Greene, 7th edition.
- *A Guide to Econometrics* by Peter Kennedy, 6th edition.

Additionally, you will need access to R. There are two ways to obtain it:

1. Download it at the Comprehensive R Network (CRAN) webpage: <http://cran.us.r-project.org/>.
2. Use it at the computer lab in Baldwin Hall.

You may want to install a Graphical User Interface (GUI) for R. If so, I recommend RStudio, available for free at <http://www.rstudio.com/>.

Other online materials and articles will be handed out (and posted on the website) as needed.

Recommended Materials

An R Companion to Applied Regression, by John Fox and Sanford Weisberg, 2nd edition.
Book website: <http://tinyurl.com/carbook>

Grading

Class attendance is not required, though there is little prospect of success without it.

Exam

There will be a take-home exam worth 30% of your course grade handed out on **April 22**. It will be due on **April 28 by 11:59pm**. It will be cumulative and open-book. **Unless you receive prior authorization from the instructor in writing, late exams will be penalized two full letter grades for each day—or fraction thereof—that they are late.**

Weekly Homework Assignments

There will be weekly homework assignments, which will count for 20% of the course grade. These will be graded on a 3 point scale (check plus, check and check minus). **Unless you receive prior authorization from the instructor in writing, late assignments will be given a check minus if they are late.** Your lowest grade will be dropped.

Original Research Paper

This paper will count for 40% of the course grade. Conduct empirical research on the question of your choice using a dataset of your choice. Note that you must use linear models in your analysis. A research proposal that includes the dataset, the research question and details about the key variables of interest is due on **February 4**. The research paper is due on **April 22**. This paper will include a brief introduction to the research question, a description of the data and measures, including descriptive statistics, an explanation of the empirical methodology, results, and the discussion/interpretation of the results. No literature review is necessary. The question does not need to be vigorously motivated with the literature or interpreted in the context of other findings in the literature. However, aside from the reduced-form literature review, the style of the paper should be similar to that of published journal articles. If you are unsure of what this entails, consult recent issues of journals like the *Journal of Public Administration Research and Theory* and the *Journal of Policy Analysis and Management*. **Unless you receive prior authorization from the instructor in writing, late papers will be penalized two full letter grades for each day—or fraction thereof—that they are late.**

Presentation

This presentation will count for 10% of the course grade. On **April 22**, all students will present their original research papers to the class. Each student will be allotted 12–15 minutes for presenting and each presentation will be followed by 3–5 minutes' worth of questions from the class. Each student will present the following about their assigned paper: the research question, the data used, the empirical methodology, and the findings. The presentation will include an interpretation of the findings and how these results answer the original research question. **If your paper is not turned in by the beginning of the day of presentations, you will not be able to present and you will receive a zero for the presentation. No exceptions.**

Course Topics

Note: The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary. We may not cover all of these topics. Conversely, time permitting, other topics might be covered in this course. Optional readings are marked with an asterisk. Additional optional readings may be provided. **Where readings from both Greene and Kennedy are assigned, you only need to read one. If only one is assigned, the relevant readings will be posted online.**

January 7: Introduction

- Fox, Chapters 1, 2, and 3
- Greene, Chapter 1
- Kennedy, Chapters 1 and 2
- *King, Gary. 1986. "How Not to Lie with Statistics: Avoiding Common Mistakes in Quantitative Political Science." *American Journal of Political Science* 30(3): 666–687.

January 14: Math (P)Review

- Greene, Appendix A
- *Fox and Weisberg, Chapter 8.2

January 21: Two Regressor Linear Model

- Fox, Chapters 5.1, 6.1, 9, and 10.1
- Greene, Chapters 2 and 3
- Kennedy, Chapter 3
- *Fox and Weisberg, Chapters 4.1, 4.2.1, 4.3, 4.8, 4.9, and 4.10

January 28: Multiple Regression

- Fox, Chapters 5.2, 6.2, 7, and 10.2
- Greene, Chapter 4
- *Fox and Weisberg, Chapter 4.2

February 4: Hypothesis Testing

- **Research proposal due**
- Greene, Chapter 5
- Kennedy, Chapter 4
- *Fox and Weisberg, Chapters 4.4

February 11: Snow Day — No Class

February 18: Functional Form and Specification

- Greene, Chapter 6
- Kennedy, Chapters 5 and 15

February 25: Data Problems

- Fox, Chapters 11 and 13
- Kennedy, Chapters 6, 7, and 12
- *Fox and Weisberg, Chapter 6

March 4: Nonspherical Disturbances

- Fox, Chapter 12
- Greene, Chapters 9 and 20

March 11: Spring Break

March 18: Instrumental Variables

- Greene, Chapter 8
- Kennedy, Chapters 9 and 10
- *Henningsen, Arne and Jeff D. Hamann. "systemfit: A Package for Estimating Systems of Simultaneous Equations in R."

March 25: Simultaneous Equations

- Greene, Chapter 10
- Kennedy, Chapter 11
- *Henningsen, Arne and Jeff D. Hamann. “systemfit: A Package for Estimating Systems of Simultaneous Equations in R.”

April 1: Panel Data

- Greene, Chapter 11
- Kennedy, Chapters 18 and 22
- TBD (hierarchical and mixed-effects models)
- *Croissant, Yves and Giovanni Millo. “Panel Data Econometrics in R: The plm Package.”
- *Torres-Reyna, Oscar. “Getting Started in Fixed/Random Effects Models using R.”

April 8: Time Series

- Fox, Chapter 16
- Greene, Chapter 21
- Kennedy, Chapter 19
- *Fox, John and Sanford Weisberg. “Time-Series Regression and Generalized Least Squares in R.”

April 15: Factor Analysis and Other Data Reduction Methods

- TBD

April 22: Paper Presentations

- **Research paper due**
- **Final exam handed out**

April 28: FINAL EXAM DUE VIA EMAIL BY 11:59 PM