
PLSC 43410 Introduction to Multilevel Modeling
Fall 2011
Pick 506 Thursday 9 - 12 AM

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Course Outline

This course introduces students to multilevel statistical analysis which deals with complex interaction and classification within clustered (and longitudinal) data. You will learn how to model various types of relationships in clustered data and how to use statistical software for multilevel analysis.

Requirements and Grade Policy

- Weekly Assignments (30 %): There will be five weekly assignments during the course.
- Reading Presentation (10 %): All students should present one of research papers, marked by (P), in the syllabus.
- Project Presentation (10 %): All students should present their own research papers in the last class.
- Final Project (50%): The final project of this class is a pilot data analysis of students' own research topics. Piloting a method is an important step to evaluate the performance of the chosen method in the data set and for the research design. The replication of published work is not recommended.

Textbook

- Andrew Gelman and Jennifer Hill. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. 2007. Cambridge University Press.

Useful Materials

- S. W. Raudenbush and A. S. Bryk. *Hierarchical Linear Models*. 2002. Sage.
- Siddhartha Chib, "Panel Data Modeling and Inference: A Bayesian Primer" In L. Matyas, P. Sevestre (eds.), *The Econometrics of Panel Data*
- *Political Analysis* Special Issue on Multilevel Modeling for Large Clusters, 2005, 13(4).

Software

- The two software packages for the class are BUGS (WinBugs for Window or JAGS for Mac) and lme4. BUGS is a software for Bayesian inference Using Gibbs Sampling and lme4 is an R package for the ML estimation of multilevel models. They are highly reliable statistical packages and freely available via online.
- Other commercial packages (MLwin, HLM, SAS, Stata, etc) can be used for class assignments but the instruction on the programming will not be provided for these packages.
- Students are recommended to use L^AT_EX for weekly assignments and the final project.

Course Plan

1. Course Introduction (9/29)
2. Statistical Inference: Building, Fitting, and Checking a Statistical Model (10/6)
 - Gelman and Hill. Ch. 2 - 4 and Ch. 7 - 8.
 - Gary King, Michael Tomz, and Jason Wittenberg. “Making the Most of Statistical Analyses: Improving Interpretation and Presentation,” *American Journal of Political Science*, 2000, 44(2): 341-355
 - (P) Andrew Gelman and Gary King. “Estimating Incumbency Advantage without Bias,” *American Journal of Political Science*, 1990, 34(4): 1142-1164.

Recommended

- Jouni Kerman, Andrew Gelman, Tian Zheng, and Yuejing Ding, “Visualization in Bayesian Data Analysis” In *Handbook of Computational Statistics, vol. III: Data Visualization*.
 - Paul W. Holland. “Statistics and Causal Inference.” *Journal of the American Statistical Association*, 1986, 81: 945-960.
 - Jerome Reiter. “Using Statistics to Determine Causal Relationships.” *American Mathematical Monthly*, 2000, 107(1): 24-32.
 - Jasjeet S. Sekhon. “Quality Meets Quantity: Case Studies, Conditional Probability, and Counterfactuals.” *Perspectives on Politics*. (June 2004) Vol. 2, No. 2.
3. Introduction to Bayesian Hierarchical Model (10/13)
 - Simon Jackman, 2009, “Ch. 7. Hierarchical Statistical Models” *Bayesian Analysis for the Social Sciences*, Wiley.
 - Larry Bartel, 1996, “Pooling Disparate Observations,” *American Journal of Political Science*, 40(3): 905-942.
 - Bruce Western, 1998. “Causal Heterogeneity in Comparative Research: A Bayesian Hierarchical Modelling Approach, *American Journal of Political Science* 42:1233-1259.
 - (P) Rubin, Donald, 1980. “Using Empirical Bayes Techniques in the Law School Validity Studies” *Journal of the American Statistical Association*, 75(372): 801- 816

Recommended

- Jose C. Pinheiro and Douglas M. Bates, Ch. 1 - 5, *Mixed-Effects Models in S and S-PLUS*, 2000, Springer.
- John Fox, “Linear Mixed Models: Appendix to *An R and S-PLUS Companion to Applied Regression*,” <http://cran.r-project.org/doc/contrib/Fox-Companion/appendix-mixed-models.pdf>

4. What is a Multilevel Model? (10/20)

- Gelman and Hill, Ch. 11, 12, and 18.
- Andrew Gelman, “Multilevel (Hierarchical) modeling: what it can and can’t do.” *Technometrics* **48**: 432-435.
- Andrew Gelman and Iain Pardoe, “Bayesian measures of explained variance and pooling in multilevel (hierarchical) models.” *Technometrics* **48**, 241–251.

5. Fitting Multilevel Models using BUGS (10/27)

- Gelman and Hill, Ch. 13, 16, 21, 22, 24, Appendix A and B.

6. Fitting Multilevel Models using the Maximum Likelihood Method (11/3)

- Douglas Bates, *lme4: Mixed-effects Modeling with R*, Ch. 1, 2, 4, 5.
- (P) Andrew Gelman, Boris Shor, Joseph Bafumi and David Park. “Rich state, poor state, red state, blue state: What’s the matter with Connecticut?” *Quarterly Journal of Political Science* **2**: 345–367.

7. What is a Poststratification? (11/10)

- Gelman, A. and T.C. Little. 1997. Poststratification into many categories using hierarchical logistic regression. *Survey Methodology* **23**: 127-135.
- Jeffrey R. Lax and Justin H. Phillips, 2009, “How Should We Estimate Public Opinion in The States?” *American Journal of Political Science*, **53**:107-121.
- (P) Lax, J.R. and J.H. Phillips. 2009b. Gay rights in the States: Public opinion and policy responsiveness. *American Political Science Review* **103**: 367-386.
- (P) David Park, 2004, “Bayesian Multilevel Estimation with Poststratification: State-Level Estimates from National Polls,” *Political Analysis*, **12**(4):375-385.

8. Multilevel Models in Longitudinal Data and Roll Call Data (11/17)

- Nathaniel Beck and Jonathan N. Katz, 2011, “Modeling Dynamics in Time-Series Cross-Section Political Economy Data,” *Annual Review of Political Science*
- Jong Hee Park, “Joint Modeling Dynamic and Cross-sectional Heterogeneity” Unpublished manuscript.
- Joseph Bafumi, Andrew Gelman, David K. Park, and Noah Kaplan, 2005, “Practical Issues in Implementing and Understanding Bayesian Ideal Point Estimation,” *Political Analysis*, **13**:171-187

9. No class: Thanksgiving Holiday (11/24)

10. Paper Presentation (12/1)

11. Final Paper Due (12/8)