

# POLS W4292

## Advanced Topics in Quantitative Research: Models for Panel and Time-Series Cross-Section Data

Fall 2011

Tuesdays and Thursdays, 9:10–10:25am  
503 Hamilton Hall

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Office Hours: Tues. and Wed. 11am–12pm and by appt.  
741 International Affairs Building

### Course Description

This course covers methods for making inferences with repeated observations data, focusing mostly on the theory and estimation of models for panel and time-series cross-section data. Topics covered include fixed effects, random effects, dynamic panel models, random coefficient models, models for qualitative dependent variables, and panel attrition.

**Prerequisites:** Students wishing to take this course should have taken an introductory course in probability, a course on regression analysis, and have basic knowledge of calculus and matrix algebra.

**Course Requirements:** The grading for the course is based on a mid-term and final exam (30% and 40%, respectively), and homework assignments (30%).

#### Lecture Notes:

A PDF version of my lecture notes are available through CourseWorks. Students should download and print up a copy of the notes for themselves so that they can follow along with the lectures. Students who do not have a copy of the notes will be at a severe disadvantage. Useful links for the course can be found at <http://www.columbia.edu/~gjw10/w4292.html>.

**Texts:** I have ordered the following books for this course through Book Culture on 112th St.

Baltagi, Badi H. 2008. *Econometric Analysis of Panel Data*, 4th edition. New York: Wiley.

Crawley, Michael J. 2007. *The R Book*. New York: Wiley.

Fox, John and Harvey Sanford Weisberg. 2010. *An R Companion to Applied Regression*, 2nd edition. Thousand Oaks, CA: Sage Publications.

Greene, William H. 2011. *Econometric Analysis*, Seventh Edition, Pearson Prentice Hall.

Hsiao, Cheng. 2003. *Analysis of Panel Data*, 2nd edition. New York: Cambridge University Press.

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

All of these books are useful and are strongly recommended. We will treat the Hsiao book as the primary text, but reading more than one treatment will help students grasp the material.

All readings are either on reserve at Lehman Library or are available through various electronic services that Columbia subscribes to ([E] denotes electronic availability).

**Software:** We will use **R** and **Stata** for computational exercises in this class, with more emphasis on **R**. The latter is free and available for download from <http://www.r-project.org/>. Students are welcome to use other software packages that they are familiar with, but we will provide support only for **R** and students will be required to program in **R** for problem sets and exams. Be prepared to devote a good deal of time to programming, which is essential to becoming proficient in the methods covered in this course.

## Course Outline

Based on prior experience with courses of this nature, I have not included dates to allow for maximum flexibility in covering the topics listed below.

### 1. General Issues With Repeated Observations Data

1.1 Unit and time effects

1.2 Panel v. time-series cross-section data

#### Readings

- Hsiao, Chapters 1–3.
- Baltagi, Chapters 1, 2, and 4.
- Stimson, James. 1985. “Regression in Space and Time: A Statistical Essay.” *American Journal of Political Science* 29: 914–947. [E]

### 2. Matrix algebra and OLS/GLS review

#### Readings

- Greene, Appendix A (especially section A.1–A.5)

### 3. Fixed effects estimators

3.1 Least squares dummy variable estimator/within estimator

#### Readings

- Hsiao, Ch. 3
- Baltagi, Ch. 2

4. Random effects estimators
  - 4.1 Generalized least squares
  - 4.2 Maximum likelihood estimation
  - 4.3 Fixed v. random effects
  - 4.4 Correlated random effects models

### Readings

- Hsiao, Ch. 3
- Baltagi, Ch. 2

5. Non-Spherical Errors
  - 5.1 The Method of Panel Corrected Standard Errors
  - 5.2 Heteroskedasticity in FE and RE models
  - 5.3 Serial Correlation in RE and FE models
  - 5.4 Robust standard error estimation with unit effects

### Readings

- Hsiao, 3.7–3.9
- Baltagi, Ch. 5
- Beck, Nathaniel, and Jonathan N. Katz. 1995. “What To Do (and Not To Do) with Time-Series Cross-Section Data in Comparative Politics.” *American Political Science Review* 89: 634–647. [E]

6. Dynamic panel models
  - 6.1 General issues
  - 6.2 Generalized methods of moments estimators
  - 6.3 Lagged specifications for TSCS data

### Readings

- Hsiao, pp. 69–109
- Baltagi, Ch. 8
- Wawro, Gregory J. 2002. “Estimating Dynamic Panel Models in Political Science.” *Political Analysis* 10:25–48. [E]

7. Variable coefficient models

### Readings

- Hsiao, Ch. 6

- Beck, Nathaniel, and Jonathan N. Katz. 2004. “Random Coefficient Models For Time-Series Cross-Section Data.” Social Science Working Paper 1205. Division Of The Humanities And Social Sciences. California Institute Of Technology. [E] (see CourseWorks)

Beck, Nathaniel, and Jonathan N. Katz. 2007. “Random Coefficient Models for Time-Series Cross-Section Data: Monte Carlo Experiments” *Political Analysis* 15(2):182–195. [E]

## 8. Models for qualitative dependent variables

8.1 Dichotomous Dependent Variables

8.2 Fixed Effect Logit

8.3 Random Effects Probit

8.4 Correlated Random Effects Probit

8.5 Binary Time-Series Cross-Section Data

8.6 Generalized Estimating Equations

### Readings

- Hsiao, Chapters 7 and 8.
- Zorn, Christopher J. W. 2001. “Generalized Estimating Equation Models for Correlated Data: A Review with Applications.” *American Journal of Political Science* 45: 470–90. [E]

## 9. Panel attrition

### Readings

- Hsiao, Ch. 9
- Baltagi, Ch. 9
- Honaker, James and Gary King. 2010. “What to do About Missing Values in Time Series Cross-Section Data.” *American Journal of Political Science* 54: 561-81. [E]

## 10. Catch-up and review

### Readings

- Hsiao, Ch. 11