POLS W4292
Advanced Topics in Quantitative Research: Models for Panel and Time-Series Cross-Section Data

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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 from the course web site (the URL is `http://www.columbia.edu/~gjw10/w4292.html`). 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.

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

Baltagi, Badi H. 2005. *Econometric Analysis of Panel Data*, 3rd edition. New York: Wiley.

Fox, John. 2002. *An R and S-Plus Companion to Applied Regression*. Thousand Oaks, CA: Sage Publications.

Greene, William H. 2003. *Econometric Analysis*, 5th edition. Upper Saddle River, NJ: Prentice-Hall.

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

Wooldrige, 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`. Be prepared to devote a good deal of time to programming, since that is essential to becoming proficient in the methods discussed 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 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 course web site)

     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
    - King, Gary and James Honaker. 2006. "What to do About Missing Values in Time Series Cross-Section Data" Paper presented at the annual meeting of the Society for Political Methodology. [**E**] (see course web site)

10. Catch-up and review

    Readings

    - Hsiao, Ch. 11