

PSCI 7108: Time Series and Pooled Time Series

University of Colorado Boulder

Spring 2018

Time: Tuesday, 2:00-4:30
Location: KTCH 1B31
Instructor: Dr. Andrew Q. Philips
Office: KTCH 144
Email: andrew.philips@colorado.edu
Office hours: Thursday, 2:30-4:00, or by appointment

COURSE DESCRIPTION: Time series models—models which take advantage of variation over time in a single unit—and pooled time series (sometimes called cross-sectional time series or time series cross-sectional) models—which utilize variation across both time and spatial units—are very common in political science. While these models offer substantial leverage over important social science problems that use purely cross-sectional data, there are a number of pitfalls that are necessary to avoid during estimation.

In this course we will cover both time series and pooled time series. The first half of the class will be spent on time series. We will discuss the structure of these data, diagnosing certain characteristics, and cover a number of models that can be used to model time series data, such as autoregressive distributed lag, error-correction, and vector autoregressive models. In the second half of the course, we move to pooling time series data across multiple units. Much of the discussion during this part involves how we choose to model temporal and spatial heterogeneity—or, indeed—whether we model it at all.

By the end of this course you should be able to:

- Understand a variety of time series and pooled time series models
- Diagnose and test for characteristics unique to these types of data
- Be comfortable reading articles and books utilizing these data
- Apply what you have learned to your research.

PREREQUISITES: This is a graduate level course; students should have a background in advanced regression statistics (i.e., Data I, II and III).

SOFTWARE: We will use a mix of R and Stata in this course. Although both statistical packages can handle time series and pooled time series data, sometimes R excels at a particular tool, and sometimes Stata does. Although familiarity with either program is not necessary, it is a plus. Those unfamiliar with these programs may want to purchase or borrow some of the suggested textbooks that cover working with R and Stata, although there are copious amounts of information available for free online. Please download both R (<https://cran.r-project.org/>) and RStudio (<https://www.rstudio.com/>) before the first class session.

GRADES: Course grades will be based on the following. Participation is worth 15% of the final grade. An in-class presentation of the student's original research paper is worth 10%, as is the colleague critique. About halfway through the semester, a mid-term exam will be given that is worth

20% of the final grade. Last, the original research paper will comprise 45% of the final grade. Note that there are no opportunities for extra credit, nor is there a final exam.

Participation	15%
In-Class Presentation	10%
Colleague Critique	10%
Midterm Exam	20%
Original Research Paper	45%

The following scale will be used to turn numerical grades into letter ones. Note that I will round up a letter should your grade fall on the number (but on or above 0.5) between two letters (e.g., 89.5 up to 90 rounds up to an A-).

Grade Scale

A	95-100
A-	90-94
B+	87-89
B	84-86
B-	80-83
C+	77-79
C	74-76
C-	70-73
D+	67-69
D	64-66
D-	60-63
F	0-59

PARTICIPATION: Participation is an integral component of graduate courses. Students are expected to come to every class *having already read the assigned readings for that day*, and should be prepared to discuss them. Graduate-level courses only are successful when all participate actively in the discussion.

MIDTERM EXAM: About halfway through the semester there will be a mid-term exam. It will be in-class, open book, where you are free to consult your notes, readings, etc.

ORIGINAL RESEARCH PAPER: By the end of the class, students should have a solo-authored research article-length working paper that either: a.) a purely methodological paper (less common), or b.) an applied research paper that utilizes at least one of the maximum likelihood models discussed in the course. Since one semester is a short time in which to write such a paper, it is crucial to get some semblance of an research topic early in the semester. I encourage students to meet with me early on to discuss potential topics. Half-way through the semester, there will be a mandatory “check-in” to ensure all students have a feasible research topic. I am open to this paper being submitted for credit in another course, or a substantial re-write from a previous semester, but this needs to be cleared by me (and by the other professor if applicable). Note that the most important part of the research paper for the purposes of this class is the theory, hypotheses, research design, and presentation and interpretation of the results. Students are highly encouraged to write the paper using \LaTeX .

COLLEAGUE CRITIQUE: After all research papers are due, I will assign each student to read and critique *two* of their fellow students’ papers. Students should treat this just as they would an invitation to peer review a manuscript. Theory, research design, data, methods, etc,... should be critiqued.

IN-CLASS PRESENTATIONS: Instead of a final exam, students will give in-class presentations on their research papers. These are conference-length (i.e., about 10-15 minutes, depending on the number of students) presentations.

ATTENDANCE AND LATE POLICY: Attendance is a key component of succeeding in graduate school. I provide slides for each class, but we will have a much more comprehensive discussion than what appears on the slide. Attendance is mandatory, with the exception of university-excused absences. If you need to miss a class, you should—if possible—let me know in advance so that we can make arrangements.

Assignments are due on the day listed in the syllabus. Late assignments will not be accepted.

REQUIRED TEXTS: The following text is required for the course. Any additional readings will be made available to you on the first day of class or as needed.

- Pickup, Mark. 2014. *Introduction to Time Series Analysis*. SAGE Publications. Quantitative Applications in the Social Sciences. 1st Edition.

Note that it is expected to read the week's required readings before coming to class.

RECOMMENDED TEXTS: The following texts are not required, but may be helpful to some. In the schedule below there are additional texts in the "suggested readings".

- On \LaTeX :
 - Philips, Andrew Q. 2016. " \LaTeX : A brief introduction". Available [here](#).
 - Various links provides on the \LaTeX Project website: <https://www.latex-project.org/help/links/>.
- On R:
 - Monogan, James E. 2015. *Political analysis using R*. Springer.
 - Burns, Patrick. 2011. *The RInferno*. Available at: <http://www.burns-stat.com/documents/books/the-r-inferno/>.
 - Philips, Andrew Q. 2017. "R: A brief introduction."
- On Stata:
 - Cameron, Adrian Colin, and Pravin K. Trivedi. 2009. *Microeconometrics using Stata* Volume 5. College Station, TX: Stata Press.
- On time series (general):
 - Asteriou, Dimitrios and Stephen G. Hall. 2011. *Applied Econometrics*. 2nd Edition. Palgrave.
 - Enders, Walter. 2010 *Applied Econometric Time Series*. 3rd Edition. John Wiley & Sons.
 - Box-Steffensmeier, Janet M., John R. Freeman, Matthew P. Hitt, and Jon C.W. Pevehouse. 2015. *Time series analysis for the social sciences*. Cambridge University Press.
- On pooled time series or econometrics in general:
 - Gelman, Andrew, and Jennifer Hill. *Data analysis using regression and multilevel/hierarchical models*. Cambridge University Press, 2006.
 - Greene, William. 2011. *Econometric analysis*. 7th Edition. Upper Saddle River, NJ: Prentice-Hall.
 - Baltagi, Badi. 2008. *Econometric Analysis of Panel Data*. 4th Edition. John Wiley & Sons.
 - Wooldridge, Jeffrey M. 2010. *Econometric analysis of cross section and panel data*. MIT Press.

TENTATIVE SCHEDULE:

Tuesday, January 16: NO CLASS

Week 1: Introduction to Time Series Data, Diagnosing Time Series Properties

Required Readings:

- Pickup, Introduction, Ch. 1 and 2

Week 2: ARIMA and Distributed Lag Models

Required Readings:

- Pickup Ch. 3, 4 (§4.1-4.3), and 5 (§5.1-5.4)
- Beck, Neal. 1991. "Comparing Dynamic Specifications: The Case of Presidential Approval." *Political Analysis*. 3:51-87.
- Keele, Luke and Nathan Kelly. 2006. "Dynamic models for dynamic theories: The ins and outs of lagged dependent variables." *Political Analysis*. 14 (2), 186-205.

Suggested Readings:

- Clarke, Harold D., William Mishler, and Paul Whiteley. 1990. "Recapturing the Falklands: Models of Conservative popularity, 1979-83." *British Journal of Political Science* 20(1):63-81.
- Shumway, Robert H. and David S. Stoffer. 2017 *Time series analysis and its applications*. Springer.

Week 3: Unit Roots, Cointegration, and ECMs

Required Readings:

- Pickup Ch. 6
- De Boef, Suzanna and Luke Keele. 2008. "Taking time seriously." *American Journal of Political Science*: 52(1): 184-200.
- Philips, Andrew Q. 2017. "Have your cake and eat it too? Cointegration and dynamic inference from autoregressive distributed lag models." *American Journal of Political Science*: 1-15.
- Jordan, Soren and Andrew Q. Philips. 2017. "Cointegration testing and dynamic simulations of autoregressive distributed lag models." Working Paper.

Suggested Readings:

- Pfaff, Bernhard. 2008 *Analysis of integrated and cointegrated time series with R*. Springer.
- Grant, Taylor, and Matthew J. Lebo. 2016. "Error Correction Methods with Political Time Series." *Political Analysis* 24(1): 3-30.
- Keele, Luke, Suzanna Linn, and Clayton M. Webb. 2016. "Treating Time with All Due Seriousness." *Political Analysis* 24(1): 31-41.

Week 4: VAR and VECM Models

Required Readings:

- Freeman, John, John Williams and T. Lin. 1989. "Vector Autoregression and the Study of Politics." *American Journal of Political Science* 33: 842-77.
- Wood, B. Dan. 2009. "Presidential saber rattling and the economy." *American Journal of Political Science* 53(3):695-709.

- Whiteley, Paul, Harold Clarke, David Sanders and Marianne Stuart. 2016. "Hunting the Snark: A reply to 'Re-evaluating the valence models of political choice.'" *Political Science Research and Methods*: 221-240.

Suggested Readings:

- Brandt, Patrick T., and John T. Williams. 2007. *Multiple Time Series Models*
- Johansen, Soren. 1995. *Likelihood-based inference in cointegrated vector autoregressive models*. Oxford University Press.

Week 5: ARCH/GARCH and DCC

Required Readings:

- Pickup Ch. 4 (\$4.4) and 5 (\$5.5)
- Bernhard, William and David Leblang. 2006. "Polls and pounds: Public opinion and exchange rate behavior in Britain." *Quarterly Journal of Political Science* 1:25-47.
- Benton, Allyson L., and Andrew Q. Philips. 2018. "Does the @realDonaldTrump really matter to financial markets?" Working paper.
- Kellstedt, Paul M., Suzanna Linn, and A. Lee Hannah. 2015. "The usefulness of consumer sentiment: Assessing construct and measurement." *Public Opinion Quarterly* 79(1):181-203.

Suggested Readings:

- Hellwig, Timothy. 2007. "Economic openness, policy uncertainty, and the dynamics of government support." *Electoral Studies* 26(4):772-786.
- Gronke, Paul and John Brehm. 2002. "History, heterogeneity, and presidential approval: a modified ARCH approach." *Electoral Studies* 21(3):425-452.

Week 6: Fractional [Co]Integration, and Asymmetric Dynamic Effects

Required Readings:

- Box-Steffensmeier, Janet M., and Renee M. Smith. 1998. "Investigating political dynamics using fractional integration methods." *American Journal of Political Science* 42(2): 661-89.
- Box-Steffensmeier, Janet M., and Andrew R. Tomlinson. 2000 "Fractional integration methods in political science." *Electoral Studies* 19.1:63-76.
- Lebo, Matthew J., Robert W. Walker, and Harold D. Clarke. 2000. "You must remember this: Dealing with long memory in political analyses." *Electoral Studies* 19(1): 31-48.

Suggested Readings:

- Clarke, Harold D., and Matthew Lebo. 2003 "Fractional (co) integration and governing party support in Britain." *British Journal of Political Science* 33.02: 283-301.

Week 7: Why Pool? Modeling Out Heterogeneity and Dynamic Issues

Required Readings:

- Stimson, James. 1985. "Regression in Time and Space: A Statistical Essay." *American Journal of Political Science* 29:914-947.
- Beck, Nathaniel and Jonathan Katz. 1995. "What To Do (and Not To Do) with Time Series Cross-Section Data." *American Political Science Review* 89:634-47.
- King, Gary and Margaret E. Roberts. 2015. "How robust standard errors expose methodological problems they do not fix, and what to do about it." *Political Analysis* 23: 159-179.

Week 8: Midterm Exam

Week 9: Modeling Heterogeneity: Intercepts and Slopes

Required Readings:

- Bell, Andrew, and Jones, Kelvyn, 2015. "Explaining fixed effects: Random effects modeling of time-series cross-sectional and panel data." *Political Science Research and Methods*, 3(1):133-153.
- Clark, Tom S., and Linzer, Drew A., 2015. "Should I use fixed or random effects?" *Political Science Research and Methods* 3(2):399-408.
- Kittel, Bernhard, and Hannes Winner. 2005. "How reliable is pooled analysis in political economy? The globalization-welfare state nexus revisited." *European Journal of Political Research* 44(2):269-293.

Suggested Readings:

- Arceneaux, Kevin, and David W. Nickerson. 2009. "Modeling certainty with clustered data: A comparison of methods." *Political Analysis* 17(2):177-190.
- Steenbergen, Marco R., and Bradford S. Jones. 2002. "Modeling multilevel data structures." *American Journal of Political Science* 46(1):218-237.

March 27: NO CLASS (Spring Break)

Week 10: Modeling Dynamics, GMM and DPD Estimators

Required Readings:

- Plumper, Thomas, Vera E. Troeger, and Philip Manow. 2005. "Panel data analysis in comparative politics: Linking method to theory." *European Journal of Political Research* 44:327-354.
- Wawro, Gregory. 2002. "Estimating dynamic panel data models in political science." *Political Analysis* 10(1):25-48.
- Williams, Laron K., and Guy D. Whitten. 2012. "But Wait, There's More! Maximizing Substantive Inferences from TSCS Models." *Journal of Politics* 74(3): 685-93.

Suggested Readings:

- Williams, Laron K., and Guy D. Whitten. 2011. "Dynamic simulations of autoregressive relationships." *The Stata Journal* 11(4):1-12.
- Plumper, Thomas, and Vera E. Troeger. 2007. "Efficient estimation of time-invariant and rarely changing variables in finite sample panel analyses with unit fixed effects." *Political Analysis* 15:124-139.

Week 11: Modeling Dynamic Heterogeneity, Introduction to Modeling Spatial Heterogeneity

Required Readings:

- Pesaran, M. H., Shin, Y., and Smith, R. P. 1999. "Pooled mean group estimation of dynamic heterogeneous panels." *Journal of the American Statistical Association*, 94(446): 621-634.
- Beck, Nathaniel, Kristian Skrede Gleditsch, and Kyle Beardsley. "Space is more than geography: Using spatial econometrics in the study of political economy." *International Studies Quarterly* 50.1 (2006):27-44.

Week 12: Modeling Spatial Heterogeneity

Required Readings:

- Neumayer, Eric and Thomas Plumper. 2016. "W." *Political Science Research and Methods* 4(1):175-193.
- Vega, S.H. and J.P. Elhorst. 2015. "The SLX Model." *Journal of Regional Science* 55(3): 339-363.

- Franzese, Robert J., and Jude C. Hays. 2007. "Spatial-econometric models of cross-sectional interdependence in political science panel and time-series-cross-section data." *Political Analysis* 15(2): 140-164.

Suggested Readings:

- Williams, Laron K., and Guy D. Whitten, 2015. "Don't stand so close to me: Spatial contagion effects and party competition." *American Journal of Political Science*, 59(2): 309-325.

Week 13: Modeling Dichotomous Data, Missing Data and Unbalanced Datasets

Required Readings:

- Honaker, James, Gary King, and Matthew Blackwell. 2011. "Amelia II: A program for missing data." *Journal of Statistical Software* 45(7):1-47.
- Carter, David B. and Curtis S. Signorino. 2010. "Back to the future: Modeling time dependence in binary data." *Political Analysis* 18(3):271-292.
- Beck, Nathaniel, Jonathan N. Katz, and Richard Tucker. 1998. "Taking time seriously: Time-series-cross-section analysis with a binary dependent variable." *American Journal of Political Science* 42:1260-1288.

Suggested Readings:

- Rubin, Donald B. 1976. "Inference and missing data." *Biometrika* 63(3):581-592.

Week 14: Student Presentations

Research papers due Friday, April 27, by 11:59pm.

Student critiques due Tuesday, May 1 by Noon.

STATEMENT ABOUT STUDENTS WITH DISABILITIES

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services—either online at <http://www.colorado.edu/disabilityservices/>—or at the Center for Community, N200, 107 UCB.

To best accommodate students who may require alternative services, it is crucial that you contact me *early in the semester* if you need such accommodations.

HONOR CODE, COPYRIGHT, AND PLAGIARISM STATEMENTS

"On my honor, as a University of Colorado Boulder student, I have neither given nor received unauthorized assistance"

The CU Honor Code is intended to uphold the intellectual reputation of the university by establishing trust among individuals regarding intellectual honesty. As the website states, "The Honor Code secures an environment where academic integrity can flourish and aims to install the principles of honesty, trust, fairness, respect, and responsibility as essential features of the University of Colorado Boulder campus". Violations of intellectual honesty include plagiarism, cheating, and the unauthorized use of materials, all of which erode trust among individuals. If you have any questions about this, please see me, the Honor Code website (<http://www.colorado.edu/honorcode/>), or the Honor Code Office (1B70 Regent Admin Building).

The handouts and lectures used in this course are copyrighted. By “handouts,” I mean all materials generated for this class, which include but are not limited to syllabi, exams, in-class materials, and review sheets. Because these are copyrighted, you do not have the right to copy them or distribute them to others outside class, unless I expressly grant permission. In addition, I do not grant permission to tape class lectures.

SYLLABUS CHANGES

I reserve the right to make changes to the syllabus during the course of the semester as needed and will make the most updated copy available to you and announce said changes during class.

Last updated: January 7, 2018