

# Modeling Temporal and Spatial Processes in the Social Sciences

University of Colorado Boulder

ARSC 5040-002

Spring 2023

**Time:** Wednesday, 10:00AM-12:30PM, Feb 22-March 22  
**Location:** IBS 150 (except IBS 1B46 on March 22)  
**Instructors:** Dr. Srinivas Parinandi and Dr. Andrew Q. Philips  
**Emails:** [srinivas.parinandi@colorado.edu](mailto:srinivas.parinandi@colorado.edu), [andrew.philips@colorado.edu](mailto:andrew.philips@colorado.edu)  
**Office hours:** by appointment

**Course Description:** This short course is designed to introduce you to modeling spatial and temporal processes. We will investigate a variety of ways in which to model time-dependent and spatially dependent processes related to social science questions.

This course places a healthy emphasis on implementing these models using statistical software (Stata and R), visualizing and interpreting the results.

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

- Understand the various issues that can arise when working with these types of data
- Model spatio-temporal data using a variety of approaches
- Incorporate the approaches discussed in the course to your own applied work

In terms of labs, readings, slides, and software, students will have access to a course Dropbox folder, where they can view slides, readings, and any data and labs for the week. We will use a mix of Stata

**Prerequisites:** It is assumed that students will have taken at least one (and hopefully several) graduate-level regression courses; i.e., it is assumed that students are familiar with OLS at a minimum. If you have no prior R or Stata experience (or need a refresher), please see Philips' "Introduction to R" and "Introduction to Stata" readings in the course Dropbox.

**Grades:** There are no grades for this course, although it can be taken for one credit.

**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. It is expected that students will attend every class.

**Contact, Office Hours, and TA:** The instructors can be contacted at [srinivas.parinandi@colorado.edu](mailto:srinivas.parinandi@colorado.edu) and [andrew.philips@colorado.edu](mailto:andrew.philips@colorado.edu).

**Required Texts:** There are no required texts for this course.

**Recommended Texts:** You could spend an entire semester on each of the topics (time series, cross-sectional time series, spatial statistics) we will briefly cover. Below are helpful additional texts grouped by subject:

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

- 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.
- Enders, Walter. 2010. *Applied Econometric Time Series*. 3rd Edition. John Wiley & Sons.
- Cross-Sectional Time Series
  - Gelman, Andrew, and Jennifer Hill. *Data analysis using regression and multilevel/hierarchical models*. 2006. Cambridge University Press.
  - Baltagi, Badi. *Econometric analysis of panel data*. 2008. 4th Edition. John Wiley & Sons.
  - Wooldridge, Jeffrey M. *Econometric analysis of cross section and panel data*. 2010. MIT Press.
- Spatial Statistics
  - Arbia, Giuseppe. *A Primer for Spatial Econometrics*. 2014. Palgrave Macmillan.

**Tentative Schedule:** Below is the schedule. Note that this is subject to change (see the “Syllabus Changes” section)

## Week 1:

Course overview, modeling dynamic processes

Required Readings:

- De Boef, Suzanna and Luke Keele. 2008. “Taking time seriously.” *American Journal of Political Science*. 52(1): 184-200.
- Philips, Andrew Q. 2018. “Have your cake and eat it too? Cointegration and dynamic inference from autoregressive distributed lag models.” *American Journal of Political Science*. 62(1): 230-244.

Suggested Readings:

- Pickup, M. and Kellstedt, P.M., 2021. “Balance as a pre-estimation test for time series analysis.” *Political Analysis*: 1-10.
- Jordan, Soren and Andrew Q. Philips. 2018. “Cointegration testing and dynamic simulations of autoregressive distributed lag models.” *The Stata Journal*. 18(4): 902-923.

## Week 2:

Introduction to modeling spatial processes

Required Readings:

- Ross, Marc and Elizabeth Homer. 1976. “Galton’s Problem in Cross-National Research.” *World Politics*. 29(1): 1-28.
- Brueckner, Jan 2003. “Strategic Interaction among Governments: An Overview of Empirical Studies.” *International Regional Science Review*. 26(2): 175-188.
- Simmons, Beth and Frank Dobbin and Geoffrey Garrett. 2006. “The International Diffusion of Liberalism.” *International Organization*. 60(4): 781-810.

Suggested Readings:

- Franzese, Robert, and Jude Hays. 2008. “Contagion, Common Exposure, and Selection: Empirical Modeling of the Theories and Substance of Interdependence in Political Science.” *Concepts and Methods: Newsletter of the International Political Science Association*. 4(2): 3-9.

### Week 3:

Modeling cross-sectional time series data

Required Readings:

- 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.
- 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.

Suggested Readings:

- 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.
- Williams, Laron K., and Guy D. Whitten. 2011. "Dynamic simulations of autoregressive relationships." *The Stata Journal* 11(4):1-12.
- 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.

### Week 4:

Advanced spatial modeling

Required Readings:

- Franzese, Robert, and Jude 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.
- Hays, Jude, Aya Kachi, and Robert Franzese. 2010. "A Spatial Model Incorporating Dynamic, Endogenous Network Interdependence: A Political Science Application." *Statistical Methodology*. 7(3): 406-28.
- Parinandi, Srinivas. 2013. "Conditional Bureaucratic Discretion and State Welfare Diffusion under AFDC." *State Politics and Policy Quarterly*. 13(2): 244-261.

### Week 5:

Modeling spatio-temporal processes

Required Readings:

- Cook, Scott, Jude Hays, and Robert Franzese. 2023. "STADL-Up! The Spatio-Temporal Autoregressive Distributed Lag Model for TSCS Data Analysis." *American Political Science Review* 117(1): 59-79.

### Syllabus Changes

We 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 or over email.

**Last updated:** February 14, 2023

### University-Mandated Statements

#### Accommodation for disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is

located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website.

### **Classroom behavior**

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteranphilosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the Student Code of Conduct.

### **Honor code**

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu; 303-492-5550). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the Honor Code Office website.

### **Sexual misconduct, discrimination, harassment and/or related retaliation**

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (including sexual assault, exploitation, harassment, dating or domestic violence, and stalking), discrimination, and harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website. Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

### **Religious holidays**

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, I will try to accommodate your requests, but you must contact me early in the semester. See the campus policy regarding religious observances for full details.