UNIVERSITY OF GEORGIA

SYLLABUS

POLS 8500 — Fall 2026
Special Topics in Research Methods — 5:55pm-7:15pm
Regression Models in Time and Space — Baldwin 101D

Course Description and Prerequisites

Special topics in advanced research methodology.
Prerequisites: POLS 7050 or equivalent course

Learning Outcomes or Course Objectives

By the end of the course, students will be able to:

- Articulate the challenges and opportunities presented by autocorrelation in observational data
- Estimate and interpret dynamic regressions and spatial regressions in the generalized linear model
- Consume advanced texts detailing the latest techniques for modelling autocorrelation

Instructor Information

Dr. Garrett N. Vande Kamp — T 2:00 – 4:00
garrettvandekamp@uga.edu — Baldwin 409

Textbook and/or Resource Material

Textbooks*:* The following textbooks are good introductions to dynamic and spatial regression models, listed in alphabetical order. Required texts are bolded.

Time Series:
Hyndman, Rob J and George Athanasopoulos. 2021. *Forecasting: Principles and Practice*, 3rd Edition. OTexts: Melbourne, Australia. https://otexts.com/fpp3/
Linn, Suzanna, Matthew J. Lebo, and Clayton Webb. 2026. *A Practical Guide to Time Series Analysis.* Cambridge University Press.
Pickup, Mark. 2015. *Introduction to Time Series Analysis.* Quantitative Applications in the Social Sciences. Thousand Oaks, CA: SAGE Publishing.

Spatial:
Darmofal, David. 2015. *Spatial Analysis for the Social Sciences.* Analytical Methods for Social Research. Cambridge: Cambridge University Press.
Pebesma, Edzer and Roger Bivand. 2023. *Spatial Data Science with Applications in R*. Chapman and Hall/CRC. https://r-spatial.org/book/
Ward, Michael D. and Kristian S. Gleditsch. 2018. *Spatial Regression Models*, Second Edition. Quantitative Applications in the Social Sciences. Thousand Oaks, CA: SAGE Publishing.

One of the following software will be required:
R. R Core Team. (In class examples and instructional files will use this software)
STATA 17, IC. StataCorp. (Additional code will be annotated in instructional files)

In addition, journal articles will be required reading during the semester. They can be accessed through the university's resources available freely to students.

Class Format and Attendance Policy

The course is an in-person class. Attendance is discretionary, but multiple absences may result in the professor's consultation with a student's Director of Graduate Studies (or similar officer).

Make-up opportunities will only be provided for students with unforeseen, unavoidable absences. Foreseen and avoidable absences can schedule earlier testing, if necessary. Unforeseen and unavoidable absences will require documentation for verification.

In the absence of written authorization from Accessibility and Testing at UGA, students may not make a video or audio recording of any aspect of this course. Students who have a recording accommodation agree in writing that they:

- Will use the records only for personal academic use during the specific course.
- Understand that faculty members have copyright interest in their class lectures and that they agree not to infringe on this right in any way.
- Understand that the faculty member and students in the class have privacy rights and agree not to violate those rights by using recordings for any reason other than their own personal study.
- Will not release, digitally upload, broadcast, transcribe, or otherwise share all or any part of the recordings. They also agree that they will not profit financially and will not allow others to benefit personally or financially from lecture recordings or other course materials.
- Will erase/delete all recordings at the end of the semester.
- Understand that violation of these terms may subject them to discipline under the Student Code of Conduct or subject them to liability under copyright laws.

For more information on securing an accommodation to record lectures, see: https://accessibility.uga.edu/faculty-guidelines-for-record-lecture/

Grading Policies and Grading Scale

Homework	40%	A = 90-100
Final Exam	30%	B = 80-90
Research Paper	30%	C = 70-80
		D = 60-70
		F < 60

Homework: Students will assigned homework to learn to implement the techniques discussed in class. The professor will review the homework assignment each week. Students will grade their homework during this time and, after class, submit a memo to the professor indicating how they did on each problem and whether they understood the professor's explanation of a problem. These memos are graded for completion.

Research Paper: Students will write a research paper on a topic of their choice that is related to their research agenda and employs the quantitative methods learned in this class. Students may write a replication and extension paper or an original research paper. Ideally, students should produce a paper that can either be used in their dissertation or be submitted to a peer-reviewed journal. This paper may be one written for another class, given that the student has permission from other instructor(s) the student is currently taking classes with. This paper cannot be coauthored with another student in the class. This paper cannot be coauthored with a professor or another student in this class.

Final Exam: Students will have an in-person, open-book final exam administered on eLC.

Major Class Dates

Wednesday-Tuesday, August 17-21: Add/Drop Period
Monday, September 7: Labor Day (No classes)
Friday, October 30: Fall Break (No classes)
Monday, November 11: Withdrawal Deadline
Monday-Friday, November 23-27: Thanksgiving (No classes)
???: Final Exam

Academic Integrity

UGA Student Honor Code: "I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others."

In this course, academic dishonesty could include plagiarism and unauthorized assistance. A Culture of Honesty, the University's policy and procedures for handling cases of suspected dishonesty, can be found at www.uga.edu/ovpi .

UGA Well Being Resources

UGA Well-being Resources promote student success by cultivating a culture that supports a more active, healthy, and engaged student community.

Anyone needing assistance is encouraged to contact Student Care & Outreach (SCO) in the Division of Student Affairs at 706-542-8479 or visit sco.uga.edu. Student Care & Outreach helps students navigate difficult circumstances by connecting them with the most appropriate resources or services. They also administer the Embark@UGA program which supports students experiencing, or who have experienced, homelessness, foster care, or housing insecurity.

UGA provides both clinical and non-clinical options to support student well-being and mental health, any time, any place. Whether on campus, or studying from home or abroad, UGA Well-being Resources are here to help.

- *Well-being Resources: well-being.uga.edu*
- *Student Care and Outreach: sco.uga.edu*
- *University Health Center: healthcenter.uga.edu*
- *Counseling and Psychiatric Services: caps.uga.edu or CAPS 24/7 crisis support at 706-542-2273*
- *Health Promotion/ Fontaine Center: healthpromotion.uga.edu*
- *Accessibility and Testing: accessibility.uga.edu*

Additional information, including free digital well-being resources, can be accessed through the UGA app or by visiting https://well-being.uga.edu.

Syllabus as a Contract

This syllabus is a contract between the professor and the individual student. Every student in this class receives an identical syllabus; therefore, every student in this class will be taught and evaluated in the same manner. This syllabus is unique to this class; therefore, the students in this class may not be taught and evaluated as students in other sections of this class, past or present, even if taught by the same professor.

A Word of Thanks

I appreciate the help of my peers who contributed to the creation of this syllabus: Scott Cook, Guy Whitten, Clayton Webb, Andrew Philips, Soren Jordan, and Reshi Rajan.

Tentative Course Calendar

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.

Week 1: Review of Matrix Algebra and Linear Model

Fox, John. 2016. “Matrices, Linear Algebra, and Vector Geometry.” In *Applied Regression Analysis and Generalized Linear Models*, 3rd edition. Thousand Oaks, CA: Sage Publications.
Wasserstein, Ronald L. & Nicole A. Lazar. 2016. “The ASA's Statement on p-Values: Context, Process, and Purpose.” The American Statistician 70(2): 129-133.
Hoekstra, Rink, Richard D. Morey, Jeffrey N. Rouder and Eric-Jan Wagenmakers. 2014. "Robust misinterpretation of confidence intervals." Psychonomic bulletin & review 21(5): 1157-1164.

Regression Models in Time

Week 2: Serial Autocorrelation: Detection, Visualization, and “Cures”

Needed packages: tidyverse, sandwich, forecast, tsibble
Pickup, Chapter 1-3

Week 3: Dynamic Regression Models – Opportunities for Richer Inferences

Needed packages: dynlm, tseffects
Pickup, Chapter 4
De Boef, Suzanna and Luke Keele. 2008. “Taking time seriously.” *American Journal of Political Science*: 52(1): 184-200.

Advanced References:
Page, Scott E. 2006. "Path dependence." *Quarterly Journal of Political Science* 1(1): 87-115.
Freeman, John R. and John E. Jackson. 2012. “Symposium on models of path dependence.” *Political Analysis* 20(2):137–145.
Warner, Zach, Garrett N. Vande Kamp, and Soren Jordan. 2026. "Conditional relationships in dynamic models." *Political Science Research and Methods*.
Esarey, Justin, and Jacqueline HR DeMeritt. 2014. "Defining and modeling state-dependent dynamic systems." *Political Analysis* 22(1): 61-85.

Week 4: Dynamic Regression Models – Challenges and Appropriate Solutions

Needed packages: hdm
Pickup, Chapter 5.
Webb, Clayton and Suzanna Linn. 2020. “A Principled Approach to Time Series Analysis.” In *The SAGE Handbook of Research Methods in Political Science and International Relations*, First Edition. Edited by Luigi Curini and Robert Franzese. pp. 600-615. Los Angeles: Sage Reference.
Wilkins, Arjun S. 2018. "To lag or not to lag?: Re-evaluating the use of lagged dependent variables in regression analysis." *Political Science Research and Methods* 6(2): 393-411.
Vande Kamp, Garrett N. and Soren Jordan. 2025. “The Necessity of Moving Averages in Dynamic Linear Regression Models.” *American Journal of Political Science* 69(1): 176-193.

Advanced references:
Baek, ChaeWon, and Byoungchan Lee. 2022. "A guide to autoregressive distributed lag models for impulse response estimations." *Oxford Bulletin of Economics and Statistics* 84(5): 1101-1122.
Cook, Scott J., and Clayton Webb. 2021. "Lagged outcomes, lagged predictors, and lagged errors: a clarification on common factors." *Political Analysis* 29(4): 561-569.
Keele, Luke, and Nathan J. Kelly. 2006. “Dynamic models for dynamic theories: The ins and outs of lagged dependent variables.” *Political Analysis* 14(2): 186-205.

Regression Models in Space

Week 5: Spatial Autocorrelation: Detection, Visualization, and “Cures”

Needed packages: sf, spdep, rnaturalearth
Ward and Gleditsch, Chapters 1-3

Week 6: Spatial Regression Models – Opportunities for Richer Inferences

Needed packages: spatialreg
Ward and Gleditsch, Chapter 4

Fingleton, Bernard. 2009. "Spatial autoregression." *Geographical Analysis* 41(4): 385-391.
Wimpy, Cameron, Guy D. Whitten, and Laron K. Williams. 2021. "X marks the spot: unlocking the treasure of spatial-X models." *The Journal of Politics* 83(2): 722-739.
Whitten, Guy D., Laron K. Williams, and Cameron Wimpy. 2019. "Interpretation: the final spatial frontier." *Political Science Research and Methods* (2019): 1-17.

Week 7: Spatial Regression Models – Challenges and Appropriate Solutions
Needed packages: cshapes
Ward and Gleditsch, Chapter 5
Neumayer, Eric and Thomas Plumper. 2016. "W." *Political Science Research and Methods* 4(1): 175-193.
Cook, Scott J., Jude C. Hays, and Robert J. Franzese. 2020. "Model Selection and Spatial Interdependence." In *The SAGE Handbook of Research Methods in Political Science and International Relations*, First Edition. Edited by Luigi Curini and Robert Franzese. pp. 730-747. Los Angeles: Sage Reference.

Advanced references:
Beck, Nathaniel, Kristian Skrede Gleditsch, and Kyle Beardsley. 2006. "Space is more than geography: Using spatial econometrics in the study of political economy." *International studies quarterly* 50(1): 27-44.

Mid-Semester Reprieve

Week 8: Midterm?
The midterm will be scheduled so that it does not conflict with anyone taking their comprehensive exams. As such, the exact timing of the midterm may be changed.

Week 9: Stationarity, Ergodicity, and Valid Inferences in Time and in Space
Needed packages: tseries
Pickup Chapters 2 and 6
Pickup, Mark, and Paul M. Kellstedt. 2023. "Balance as a pre-estimation test for time series analysis." *Political Analysis* 31(2): 295-304.
Vande Kamp, Garrett N., Soren Jordan, and Reshi Rajan. N.D. "Dynamic Quantities of Interest for Variables that are Integrated but not Cointegrated." Unpublished Manuscript.
Mur, Jesús, and F. Javier Trívez. 2003. "Unit roots and deterministic trends in spatial econometric models." *International Regional Science Review* 26(3): 289-312.
Fingleton, Bernard. 1999. "Spurious spatial regression: some Monte Carlo results with a spatial unit root and spatial cointegration." *Journal of regional science* 39(1): 1-19.

Advanced References:
Sims, Christopher A., James H. Stock, and Mark W. Watson. 1990. "Inference in linear time series models with some unit roots." *Econometrica: Journal of the Econometric Society* 58(1): 113-144.

Regression Models in Time and Space

Week 10: Unobserved Effects – Beyond Fixed Effects and Random Effects
Needed packages: sandwich, plm
Arceneaux, Kevin, and David W. Nickerson. 2009. "Modeling certainty with clustered data: A comparison of methods." *Political Analysis* 17(2):177-190.
Esarey, Justin, and Andrew Menger. 2019. "Practical and effective approaches to dealing with clustered data." *Political Science Research and Methods* 7(3): 541-559.

Advanced References:
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.
Hazlett, Chad, and Leonard Wainstein. 2022. "Understanding, choosing, and unifying multilevel and fixed effect approaches." *Political Analysis* 30(1): 46-65.

Week 11: Spatiotemporal Regression Models for TSCS Data
Needed packages: splm
Plümper, Thomas and Vera E. Troeger. 2018. "Not so Harmless After All: The Fixed-Effects Model." *Political Analysis* 27(1): 21-45.

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

Advanced References:
Beck, Nathaniel, and Jonathan N. Katz. 1993. "What to do (and not to do) with time-series cross-section data." *American Political Science Review* 89(3): 634-647.
Beck, Nathaniel, and Jonathan N. Katz. 2011. "Modeling dynamics in time-series–cross-section political economy data." *Annual Review of Political Science* 14: 331-352.

Week 12: Spatiotemporal Regression Models for Count Dependent Variables
Needed Packages: tscount, coconots, dyn
Vande Kamp, Garrett N. and Soren Jordan. N.d. “A Log-Linear Autoregressive Count Model that is Trivial to Estimate.” Unpublished manuscript.
Franzese, Robert J. and Jude C. Hays. 2017. “A Comparison of the Small-Sample Properties of Several Estimators for Spatial-Lag Count Models” in Franzese, ed., *Advances in Political Methodology*, Elgar Research Collections, pp. 180-207.

Week 13: Spatiotemporal Regression Models for Binary Dependent Variables
Needed packages: spmle <devtools::install_github("hunzikp/spmle")>
Carter, David B. and Curtis S. Signorino. 2010. “Back to the future: Modeling time dependence in binary data.” *Political Analysis* 18(3):271-292.
Wucherpfennig, Julian, et al. "A fast estimator for binary choice models with spatial, temporal, and spatio-temporal interdependence." *Political Analysis* 29.4 (2021): 570-576.
Beck, Nathaniel, David Epstein, Simon Jackman, and Sharyn O’Halloran. 2001. “Alternative Models of Dynamics in Binary Time-Series-Cross-Section Models: The Example of State Failure.” Institute for Social and Economic Research and Policy Working Papers, Columbia University.
Cook, Scott J., Jude C. Hays, and Robert J. Franzese. 2020. “Fixed Effects in Rare Events Data: A Penalized Maximum Likelihood Approach,” *Political Science Research and Methods*. 8(1): 92-105.

Advanced Topics (Covered as Desired if Time Permits)

Week ??: Cointegration and Dynamic Relationships in Nonstationary Data
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.

Advanced References:
Webb, Clayton, Suzanna Linn and Matthew J. Lebo. 2020. “Beyond the Unit Root Question: Uncertainty and Inference.” *American Journal of Political Science* 64(2):275–292.

Week ??: Causal Inference with Dynamic Regression
Lechner, Michael. 2010. "The relation of different concepts of causality used in time series and microeconometrics." *Econometric Reviews* 30(1): 109-127.
Blackwell, Matthew, and Adam N. Glynn. 2018. "How to make causal inferences with time-series cross-sectional data under selection on observables." *American Political Science Review* 112(4): 1067-1082.
Menchetti, Fiammetta, Fabrizio Cipollini and Fabrizia Mealli. 2023. “Combining counterfactual outcomes and ARIMA models for policy evaluation.” *The Econometrics Journal* 26(1):1–24.
Anastasopoulos, L. Jason and Inkyu Kang. N.D. “Mapping the Temporal Evolution of Causal Effects in Public Administration and Policy Research.”

Advanced Readings:
Reed, William Robert. 2015. "On the practice of lagging variables to avoid simultaneity." *Oxford Bulletin of Economics and Statistics* 77(6): 897-905.
Bellemare, Marc F., Takaaki Masaki, and Thomas B. Pepinsky. 2017. "Lagged explanatory variables and the estimation of causal effect." *The Journal of Politics* 79(3): 949-963.

Week ??: Causal Inference without Regression?

Xu, Yiqing. 2026. “Causal Inference with Time-Series Cross-Sectional Data: A Reflection.” In *Oxford Handbook of Engaged Methodological Pluralism in Political Science,* In Press. Edited by Janet Box-Steffensmeier, Dino P. Christenson, and Valeria Sinclair-Chapman.
Hacker, Jacob S., and Paul Pierson. 2019. "Policy feedback in an age of polarization." *The ANNALS of the American Academy of Political and Social Science* 685(1): 8-28.
Marx, Philip, Elie Tamer, and Xun Tang. 2024. "Parallel trends and dynamic choices." *Journal of Political Economy Microeconomics* 2(1): 129-171.
Masini, Ricardo and Marcelo C. Medeiros. 2022. “Counterfactual analysis and inference with nonstationary data.” *Journal of Business & Economic Statistics* 40(1):227–239.