Time Series Analysis

POLS 8500, Spring 2018

Tuesday 3:30-6:30, Baldwin 101D

Instructor: Jamie Monogan
Office: Baldwin 413

Website: `http://j.mp/TSanalysis`
E-mail: `monogan@uga.edu`
Office hours: Thur 3:30-5:30 or by appointment

Course Description and Goals

This course considers statistical techniques to evaluate social processes occurring through time. The course introduces students to time series methods and to the applications of these methods. Coverage will begin with the traditional ARIMA (Box-Jenkins) approach to time series analysis and proceed through dynamic modeling and regression approaches to recent developments such as cointegration analysis, error correction models, and vector autoregression. We will learn not only how to construct these models but also how to use them in applied analysis.

Heavy emphasis will be given to fundamental concepts and applied work. Prerequisites for the course include a solid understanding of the fundamentals of statistical inference, regression analysis, matrix algebra, and the general linear model.

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

- Use the Box-Jenkins modeling approach to prewhiten data, conduct intervention analyses, and estimate transfer functions.
- Run and interpret time series models using econometric methods such as GLS and distributed lag models.
- Use vector autoregression to analyze data and apply techniques such as impulse response and moving average response analysis to interpret results.
- Analyze cointegrated data using an error correction model.
- Estimate and interpret an event history model.

Reading

Three textbooks are required. Note that the third is available to you for free:

- Box-Steffensmeier, Janet M., John R. Freeman, Matthew P. Hitt, & John C.W. Pevehouse. 2014. *Time Series Analysis for the Social Sciences*. New York: Cambridge University Press.
- Box-Steffensmeier, Janet M. and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*. New York: Cambridge University Press.
- Monogan, James E., III. 2015. *Political Analysis Using R*. New York: Springer. **Free download on campus:** `http://link.springer.com/book/10.1007/978-3-319-23446-5`

Students with Disabilities

Students with disabilities that have been certified by the UGA Disabilities Services office will be accommodated according to university policy. For more information, contact Disabilities Services at 706-542-8719.

Academic Integrity

Academic integrity is a core value of institutions of higher learning. All students, upon enrolling, must pledge: "I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others." It is your responsibility to avoid plagiarism, cheating, and dishonesty. The university policy on academic integrity is posted at: `http://www.uga.edu/honesty/`. To qualify the application of the policy in this course: tests should be your own work, papers should be your own work though you may ask others for suggestions, and studying and class preparation can (and should) be done with others.

Course Requirements and Evaluation

Nearly every class will require you to read as well as solve problems, conduct analysis with software, or write ahead of time to prepare. I will distribute these homework assignments one class ahead of time. With homework assignments, you are encouraged to work together. However, you need to turn-in your own solution set, typed and legible, where each keystroke is your own. These assignments will be graded pass/fail and are due in person at the start of class. I also will provide feedback on request to anyone who writes "please comment" at the top of a homework assignment. If you attend regularly and your class participation is average, then your score for "homework, attendance & participation" will be based on the proportion of homework assignments you pass. If your participation and attendance is particularly impressive or particularly poor, then this grade will be increased or decreased accordingly.

The research paper should be in the format of a journal article. The paper may be original work or it may be a replication of something already published that either uses time series methods or wrongfully omits them. If it is suitable to your dissertation chair or the instructor in another class, you may use this paper assignment to advance work on your dissertation or in a substantive class. The paper should be written exactly as it would be for journal submission. That entails two things in particular, (1) that it be written for a journal audience and not for the instructor of a methods course, and (2) that it not concentrate unduly on methodological issues. The burden of (1) is to explain that which needs explanation to a social scientific professional audience and not that which does not, often a pretty tough call. On (2) I recommend a relatively low tech paper, which often will display little knowledge of the course materials, on which you can add a technical appendix full of technical talk if you like. The purpose, of course, is that journal readers will not want to read an excess of technical talk just because you need to prove that you can speak it for a class. Read the following article by Gary King; it lays-out the design of a good replication project: `http://bit.ly/pubPub`.

Your final grade will be based on the sum of points earned from the following assignments:

Homework, in-class assignments, & participation	30 pts.
Midterm exam	20 pts.
Final exam	20 pts.
Research paper	30 pts.

Grades are constructed to reflect the university standards posted at `http://bulletin.uga.edu/Bulletin_Files/acad/Grades.html`, which are summarized below. Grades will be based on how many points you earn according to the following distribution:

"Excellent"	A-=90-92 pts.	A=93-100 pts.	
"Good"	B-=80-82 pts.	B=83-86 pts.	B+=87-89 pts.
"Satisfactory"	C-=70-72 pts.	C=73-76 pts.	C+=77-79 pts.
"Passing"	D =60-69 pts.		
"Failure"	F =fewer than 60 pts.		

Auditing the Course

Course auditors are welcome in this class, provided there are enough students enrolled for credit and enough seats after all who want credit enrolled. Please keep up with weekly reading and homework. No assignments will be graded, though. **To audit a course:** After registering for the class, you must complete the following form, obtain my signature, and present it to the Registrar:
`http://reg.uga.edu/files/forms/newforms/Permission_to_Register_for_Audit.pdf`

COURSE SCHEDULE

Jan. 9: Review of Estimators' Properties and Approaches to Time Series
Reading:

- *Time Series Analysis for the Social Sciences*, Chapter 1.
- *Political Analysis Using R*, Chapter 3.
- Additional source: Chapter 1 of Brandt, Patrick T. and John T. Williams. 2007. *Multiple Time Series Models*. Thousand Oaks, CA: Sage.

Jan. 16: ARIMA Estimation: The Box-Jenkins Modeling Strategy
Reading:

- *Time Series Analysis for the Social Sciences*, Chapter 2, pages 22-58.
- *Political Analysis Using R*, Section 9.1.
- Additional source: Gujarati & Porter's (2009) *Basic Econometrics*, Sections 22.1-22.6.

Jan. 23: Intervention Analysis and Forecasting
Reading:

- *Time Series Analysis for the Social Sciences*, Chapter 2 (pages 58-67) and Section 7.3 (pages 187-205).
- Additional sources:
  - Gujarati & Porter's (2009) *Basic Econometrics*, Sections 22.7-22.8.
  - Box, G. E. P. and G. C. Tiao. 1975. "Intervention Analysis with Applications to Economic and Environmental Problems." *Journal of the American Statistical Association*. 70:70-79.
  - Hibbs, Douglas A. Jr. 1977. "Political Parties and Macroeconomic Policy." *American Political Science Review*. 71:1467-1479.
  - Wakiyama, Takako, Eric Zusman, and James E. Monogan III. 2014. "Can a Low-Carbon-Energy Transition Be Sustained in Post-Fukushima Japan? Assessing the Varying Impacts of Exogenous Shocks." *Energy Policy* 73:654-666.
  - Wood, B. Dan. 1988. "Principals, Bureaucrats, and Responsiveness." *American Political Science Review*. 82:213-234.

Jan. 30: Regular Transfer Functions: Identification, Estimation, and Diagnosis
Reading, to be chosen from:

- Carmines, Edward G. and James A. Stimson. 1986. "On the Structure and Sequence of Issue Evolution." *American Political Science Review.* 80:901-920.
- Clark, Harold D., Jonathan Rapkin, and Marianne C. Stewart. 1994. "A President Out of Work: A Note on the Political Economy of Presidential Approval in the Bush Years." *British Journal of Political Science* 24:535-561.
- Enders, Walter, Todd Sandler, and Gerald F. Parise. 1992. "An Econometric Analysis of the Impact of Terrorism on Tourism." *Kyklos* 45:531-554.
- Gurnell, Angela M. and Colin R. Fenn. 1984. "Box-Jenkins Transfer Function Models Applied to Suspended Sediment Concentration-Discharge Relationships in a Proglacial Stream." *Artic and Alpine Research* 16(1):93-106.
- Wood, B. Dan and Han Soo Lee. 2009. "Explaining the President's Issue Based Liberalism: Pandering, Partisanship, or Pragmatism." *Journal of Politics* 71(4):1577-1592.

Feb. 6: Regression Models for Dynamic Causation
Reading:

- *Time Series Analysis for the Social Sciences*, Chapter 3, pages 68-78.
- *Political Analysis Using R*, Section 9.2.
- Additional sources:
  - Gujarati & Porter's (2009) *Basic Econometrics*, Sections 17.1-17.13.
  - Beck, Nathaniel. 1985. "Estimating Dynamic Models is Not Merely a Matter of Technique." *Political Methodology.* 11:71-89.
  - Keele, Luke and Nathan Kelly. 2006. "Dynamic Models for Dynamic Theories: The Ins and Outs of Lagged Dependent Variables." *Political Analysis.* 14:186-205.
  - Monogan, III, James E. and Austin C. Doctor. 2017. "Immigration Politics and Partisan Realignment: California, Texas, and the 1994 Election." *State Politics & Policy Quarterly* 17(1):3-23.

Feb. 13: Feasible GLS and Additional Lag Structures
Reading:

- *Time Series Analysis for the Social Sciences*, Chapter 3, pages 78-91.
- Additional sources:
  - Gujarati & Porter's (2009) *Basic Econometrics*, Chapter 12.
  - Granger, C. W. J. and P. Newbold. 1974. "Spurious Regressions in Econometrics." *Journal of Econometrics*. 2:111-120.
  - Hibbs. D. 1974. "Problems of Statistical Estimation and Causal Inference in Time-Series Regression Models." *Sociological Methodology*, 252-307.
  - Monroe, Kristen R. 1981. "Presidential Popularity: An Almon Distributed Lag Model." *Political Methodology* 7(1):43-69.

Feb. 20: **MIDTERM EXAMS DISTRIBUTED**, Structural Equations, and Granger Causality Tests
Reading:

- *Time Series Analysis for the Social Sciences*, Chapter 4, pages 92-106.
- Additional sources:
  - Gujarati & Porter's (2009) *Basic Econometrics*, Section 17.14.
  - Freeman, John R. 1983. "Granger Causality and Time Series Analysis of Political Relationships." *American Journal of Political Science*.
  - Sheehan, Richard G. and Robin Grieves. "Sunspots and Cycles: A Test of Causation." *Southern Economic Journal*. 1982:775-777.
  - Thurman, W. and M. Fisher. 1988. "Chickens, Eggs, and Causality, or Which Came First?" *American Journal of Agricultural Economics*, 237-238.

Feb. 27: **MIDTERM EXAMS DUE** and Vector Autoregression (VAR)
Reading:

- *Time Series Analysis for the Social Sciences*, Chapter 4, pages 106-124.
- *Political Analysis Using R*, Section 9.3.
- Additional sources:
  - Chapters 2 & 3 of Brandt, Patrick T. and John T. Williams. 2007. *Multiple Time Series Models*. Thousand Oaks, CA: Sage.
  - Gujarati & Porter's (2009) *Basic Econometrics*, Section 22.9.
  - Eshbaugh-Soha, Matthew and Jeffrey S. Peake. 2005. "Presidents and the Economic Agenda." *Political Research Quarterly* 58(1):127-138.
  - Fogarty, Brian J. and James E. Monogan III. Forthcoming. "Patterns in the Politics of Drugs and Tobacco: The Supreme Court and Issue Attention by Policymakers and the Press." *Politics*.
  - Freeman, J., J. Williams. and T. Lin. 1989. "Vector Autoregression and the Study of Politics." *American Journal of Political Science*. 33:842-877.

Mar. 6: Pooling Cross Sections of Time Series (Panel) Models
Reading:

- Monogan III, James E. 2011. "Panel Data Analysis." In *International Encyclopedia of Political Science*. Bertrand Badie, Dirk Berg-Schlosser, and Leonardo Morlino, eds. Thousand Oaks, CA: Sage Publications. pp. 1760-1763. Available via Sage Reference Online at `http://library.uga.edu` or on campus at `http://sagereferenceonline.com`. (Search on "Monogan.")
- Beck, Nathaniel and Jonathan N. Katz. 1995. "What to do (and not to do) with Time Series Cross-Section Data." *American Political Science Review*. 89:634-647.
- Additional sources:
  - Gujarati & Porter's (2009) *Basic Econometrics*, Chapter 16.
  - Beck, Nathaniel. Introduction to special issue of Political Analysis (Volume 15, Number 2, Spring, 2007).
  - Moldogaziev, Tima T., James E. Monogan, and Christopher Witko. Forthcoming. "Income Inequality and the Growth of Redistributive Spending in the United States (US) States: Is There a Link?" *Journal of Public Policy*.
  - Plümper, Thomas and Vera Troger. 2007. "Efficient Estimation of Time-Invariant and Rarely Changing Variables in Finite Sample Panel Analyses with Unit Fixed Effects." *Political Analysis*. 15:124-139.
  - Stimson, James A. 1985. "Regression Models in Space and Time: A Statistical Essay." *American Journal of Political Science*. 29:914-947.
  - Wilson, Sven E. and Daniel M. Butler. 2007. "A Lot More to Do: The Sensitivity of Time-Series Cross-Section Analyses to Simple Alternative Specifications." *Political Analysis*. 15:101-123.

Mar. 13: NO CLASS, UNIVERSITY HOLIDAY

Mar. 20: Univariate, Nonstationary Processes
Reading: *Time Series Analysis for the Social Sciences*, Chapter 5.

Mar. 27: Cointegration and Error Correction
Reading:

- *Time Series Analysis for the Social Sciences*, Chapter 6.
- Additional sources:
  - Gujarati & Porter's (2009) *Basic Econometrics*, Chapter 21.
  - Box-Steffensmeier, Janet M. and Renée M. Smith. 1996. "The Dynamics of Aggregate Partisanship." *American Political Science Review*. 90:567-580.
  - DeBoef, Suzanna and Jim Granato. 1999. "Testing for Cointegrating Relationships with Near Integrated Data." *Political Analysis*. 8:99-117.
  - Enns, Peter K., Nathan J. Kelly, Takaaki Masaki, and Patrick C. Wohlfarth. "Don't Jettison the General Error Correction Model Just Yet: A Practical Guide to Avoiding Spurious Regression with the GECM." *Research and Politics* 3(2):1-16.
  - Grant, Taylor and Matthew Lebo. 2016. "Error Correction Methods with Political Time Series." *Political Analysis* 24(1):3-30.

Apr. 3: Event History Models: Parametric Models and Cox Proportional Hazards Models
Reading:

- Chapters 1-4 from *Event History Modeling*
- Additional source: Box-Steffensmeier, Janet M. and Bradford S. Jones. 1997. "Time is of the Essence: Event History Models in Political Science." *American Journal of Political Science*. 41:1336-1383.

Apr. 10: Event History Models: Models for Discrete Data, Issues in Model Selection, and Inclusion of Time-Varying Covariates
Reading:

- Chapters 5-7 from *Event History Modeling*
- Additional source: Peterson, David A.M., Lawrence J. Grossback, James A. Stimson, and Amy Gangl. 2003. "Congressional Response to Mandate Elections." *American Journal of Political Science* 47(3):411-426.

Apr. 17: Additional Topics in Event History Methods
Reading: Chapters 8-11 from *Event History Modeling*

Apr. 24: **TERM PAPERS DUE** and Heteroscedasticity in Time Series
Reading:

- *Time Series Analysis for the Social Sciences*, Section 7.2.
- Additional source: Gujarati & Porter's (2009) *Basic Econometrics*, Sections 22.10-22.11.

April 26: READING DAY

May 3 (Thur.): **FINAL EXAM**, 3:30-6:30pm, Baldwin 101D

Additional topics for study (time permitting):

- Bayesian Vector Autoregression
  Reading: Brandt, P. T. and J. R. Freeman. 2006. "Advances in Bayesian Time Series Modeling and the Study of Politics: Theory Testing, Forecasting, and Policy Analysis." *Political Analysis*. 14(1):1-36.

- Changepoint Modeling
  Reading: Box-Steffensmeier, Freeman, Hitt & Pevehouse, Section 7.4.

- Measurement in Time Series

- Missing Time Series and Panel Data

- Spatiotemporal Modeling
  Reading: Chapter 8 of Banerjee, Sudipto, Bradley P. Carlin, and Alan E. Gelfand. 2004. *Hierarchical Modeling and Analysis for Spatial Data*. New York: Chapman & Hall.

- Time Series Count Models

- Wavelets