

University of Texas at Austin
GOV 385L: Seminar in Methodology - Time Series Analysis (Unique No. 39105)

Instructor: Tse-min Lin
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Course Objectives:

This course is designed to examine the formal and statistical structure of a variety of techniques typically used to analyze dynamic processes, with an emphasis on the applications of these techniques in political science. Subtopics include difference equations; chaotic processes; stationary ARMA processes; persistent and/or nonstationary processes including integrated, fractionally integrated, and near-integrated processes; the estimation and forecasting of time series single equation regression and multi-equation systems; cointegration and error correction; Granger causality and vector autoregression; time-series cross-section methods; and modeling time dependence in binary data.

Course Requirements and Grading Policy:

In addition to regular homework assignments, you are required to write a research paper based on a statistical procedure introduced in this class. The topic of the paper is your own choice, but you should discuss your ideas with the instructor early in the semester to obtain his approval. By Week 12, you are required to turn in a paper proposal. You should work closely with the instructor in developing ideas, formulating models, acquiring data, and carrying out the analyses.

Homework Assignments (40%)
Paper/Project Proposal (20%)
Final Paper/Project (40%)

Note: Plus/minus grades will be assigned for the final grade.

Required Texts:

1. Enders, Walter. 2010. *Applied Econometric Time Series*. 3rd Ed. Wiley.
2. Brandt, Patrick T., and John T. Williams. 2007. *Multiple Time Series Models*. Sage.

Optional Texts:

1. Goldberg, Samuel. 1986. *Introduction to Difference Equations: With Illustrative Examples from Economics, Psychology, and Sociology*. New York: Dover.
2. Gujarati, Damodar N. 2003. *Basic Econometrics*, 4th Ed. McGraw Hill.

Useful Titles:

1. Box, George E. P., Gwilym M. Jenkins, and Gregory C. Reinsel. 1994. *Time Series Analysis: Forecasting and Control*, 3rd ed. Prentice-Hall.
2. Chatfield, C. 1996. *The Analysis of Time Series: An Introduction*, 5th Ed. Chapman and Hall.
3. Fuller, Wayne A. 1996. *Introduction to Statistical Time Series*, 2nd Ed. John Wiley & Sons.
4. Gottman, John M. 1981. *Time-Series Analysis: A Comprehensive Introduction for Social Scientists*. Cambridge University Press.
5. Granger, C. W. J., and Paul Newbold. 1986. *Forecasting Economic Time Series*, 2nd Ed. Academic Press.
6. Hamilton, James D.. *Time Series Analysis*. Princeton University Press, 1994.
7. Harris, Richard, and Robert Sollis. 2003. *Applied Time Series Modelling and Forecasting*. Wiley.
8. Klein, Judy L. *Statistical Visions in Time: A History of Time Series Analysis 1662-1938*. 1997. Cambridge.
9. Maddala, G. S., and In-Moo Kim. 1998. *Unit Roots, Cointegration, and Structural Change*. 1998. Cambridge.
10. McCleary, Richard, and Richard A. Hay, Jr. 1980. *Applied Time Series Analysis for the Social Sciences*. Sage.
11. Ostrom, Charles W. 1990. *Time Series Analysis: Regression Techniques*. 2nd Ed. Sage.
12. Pindyck, Robert S. and Daniel L. Rubinfeld. 1997. *Econometric Models & Economic Forecasts*, 4th Ed. McGraw-Hill.

Students with Disabilities:

Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259. For more information, visit <http://www.utexas.edu/diversity/ddce/ssd/>.

University Honor Code:

<http://registrar.utexas.edu/catalogs/gi09-10/ch01/index.html>

Accommodations for Religious Holidays:

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Emergency Evacuation Policy:

Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.

Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.

Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.

In the event of an evacuation, follow the instruction of faculty or class instructors.

Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.

Behavior Concerns Advice Line (BCAL): 232-5050

Emergency Information Web Site: <http://www.utexas.edu/emergency>

Course Outline and Readings (## Required; # Recommended)

Week 1: Overview

- # Lin, Tse-min. 1998. "Partisan Equilibrium Cycles in Presidential Elections." Typescript.
- ## Pevehouse, Jon C., and Jason D. Brozek. 2008. "Time-Series Analysis." Chapter 19 of Janet M. Box-Steffensmeier, Henry E. Brady, and David Collier, eds., *The Oxford Handbook of Political Methodology*. Oxford.
- # Beck, Nathaniel. 2008. "Time-Series Cross-Section Methods." Chapter 20 of Janet M. Box-Steffensmeier, Henry E. Brady, and David Collier, eds., *The Oxford Handbook of Political Methodology*. Oxford.

Week 2-3: Linear Difference Equations

- ## Enders, Chapter 1.
- ## Goldberg, Chapter 2, "Difference Equations."
- # Goldberg, Chapter 3, "Linear Difference Equations with Constant Coefficients."
- # Samuelson. Paul A. 1983. "Mathematical Appendix B: Difference Equations." In his *Foundations of Economic Analysis*, Enlarged Ed. Cambridge: Harvard University Press.
- # Aldrich, John. 1980. "A Dynamic Model of Presidential Nomination Campaigns." *American Political Science Review* 74: 651-669.
- # Sprague, John. 1981. "One-Party Dominance in Legislatures." *Legislative Studies Quarterly* 6: 259-285.
- # Midlarsky, Manus I. 1984. "Political Stability of Two-Party and Multiparty Systems: Probabilistic Bases for the Comparison of Party Systems." *American Political Science Review* 78: 929-951.
- # Merrill, Samuel, III, Bernard Grofman, and Thomas L. Brunell. 2008. "Cycles in American National Electoral Politics, 1854-2006: Statistical Evidence and an Explanatory Model." *American Political Science Review* 102: 1-17.

Optional Topic: Nonlinear Difference Equations and Chaos

- # Hofstadter, Douglas R. 1981. "Strange Attractors: Mathematical Patterns Delicately Poised Between Order and Chaos." *Scientific American* (December): 22-43. Reprinted as Chapter 16, "Mathematical Chaos and Strange Attractors," of his *Metamagical Themas: Questing for the Essence of Mind and Pattern*. New York: Basic Books, 1985.
- # May, Robert M. 1976. "Simple Mathematical Models with Very Complicated Dynamics." *Nature* 261: 459-467.
- # Richards, Diana. 1992. "Spatial Correlation Test for Chaotic Dynamics in Political Science." *American Journal of Political Science* 36: 1047-1069.
- # Richards, Diana. 1993. "A Chaotic Model of Power Concentration in the International System." *International Studies Quarterly* 37: 55-72.
- # Cheng, Yu-Ting, and Andrew H. Van de Ven. 1996. "Learning the Innovation Journey: Order out of Chaos?" *Organization Science* 7: 593-614.
- # Ramsey, James B., Chera L. Sayers, and Philip Rothman. 1990. "The Statistical Properties of Dimension Calculations Using Small Data Sets: Some Economic Applications." *International Economic Review* 31: 991-1020.
- # Williams, John T., and Robert Huckfeldt. 1996. "Empirically Discriminating between Chaotic and Stochastic Time Series." *Political Analysis* 6: 125-149.

Week 4-5: Univariate Stationary ARIMA Processes

- ## Enders, Chapter 2.
- ## Gujarati, Sections 22.2-22.8.

- # Li, Richard P. Y. 1976. "A Dynamic Comparative Analysis of Presidential and House Elections." *American Journal of Political Science* 20: 670-691.
- # Li, Richard P. Y., and W. R. Thompson. 1978. "The Stochastic Process of Alliance Formation Behavior." *American Political Science Review* 72: 1288-1303.
- # Lin, Tse-min. 1998. "Partisan Equilibrium Cycles in Presidential Elections." Typescript.

Week 6-7: Nonstationary Processes: Unit Roots

- ## Enders, Chapter 4.
- ## Gujarati, Sections 21.1-21.10.

- ## Ostrom, Charles W., Jr., and Renee M. Smith. 1993. "Error Correction, Attitude Persistence, and Executive Rewards and Punishments: A Behavioral Theory of Presidential Approval." *Political Analysis* 4: 127-183. (Note: Read pp. 152-159.)
- # Williams, John T. 1993. "What Goes Around Comes Around: Unit Root Tests and Cointegration." *Political Analysis* 4: 229-235.
- ## Green, Donald., Bradley Palmquist, and Eric Schickler. 1998. "Macropartisanship: A Replication and Critique." *American Political Science Review* 92: 883-899. (Note: Read pp. 886-887.)

Week 8: Nonstationary Processes: Fractional and Near Integration

- # Granger, C. W. J., and Roselyne Joyeux. 1980. "An Introduction to Long-Memory Time Series Models and Fractional Differencing." *Journal of Time Series Analysis* 1: 15-29.
- # Hosking, J. R. M. 1981. "Fractional Differencing." *Biometrika* 68: 165-76.
- ## Box-Steffensmeier, Janet M., and Renée M. Smith. 1996. "The Dynamics of Aggregate Partisanship." *American Political Science Review* 90: 567-80.
- ## DeBoef, Suzanna, and Jim Granato. 1997. "Near-Integrated Data and the Analysis of Political Relationships." *American Journal of Political Science* 41: 619-640.
- # Box-Steffensmeier, Janet M., and Renée M. Smith. 1998. "Investigating Political Dynamics Using Fractional Integration Methods." *American Journal of Political Science* 42: 661-689.
- # DeBoef, Suzanna. 2000. "Persistence and Aggregations of Survey Data over Time: From Microfoundations to Macropersistence." *Electoral Studies* 19: 9-29.
- # Box-Steffensmeier, Janet M., Suzanna DeBoef, and Tse-min Lin. 2004. "The Dynamics of the Partisan Gender Gap." *American Political Science Review* 98: 515-528.

Week 9: Spring Break

Week 10: Linear Time Series Regression Models

Gujarati, Chapter 12.

- ## Hibbs, D. 1974. "Problems of Statistical Estimation and Causal Inference in Time-Series Regression Models." *Sociological Methodology* 5:252-308.
- # Fackler, Tim, and Tse-min Lin. 1995. "Political Corruption and Presidential Elections, 1929-1992." *The Journal of Politics* 57:971-993.
- # Erikson, Robert S. 1989. "Economic Conditions and the Presidential Vote." *American Political Science Review* 83:567-573.
- # Greene, Jay P. 1993. "Forewarned Before Forecast: Presidential Election Forecasting Models and the 1992 Election." *PS: Political Science and Politics* XXVI:17-21.
- # MacKuen, Michael B., Robert S. Erikson, and James A. Stimson. 1989. "Macropartisanship." *American Political Science Review* 83: 1125-1142.
- # Green, Donald., Bradley Palmquist, and Eric Schickler. 1998. "Macropartisanship: A Replication and Critique." *American Political Science Review* 92: 883-899.
- # Erikson, Robert S., Michael B. MacKuen, and James A. Stimson. 1998. "What Moves Macropartisanship? A Response to Green, Palmquist, and Schickler." *American Political Science Review* 92: 901-912.

Week 11-12: Cointegration and Error-Correction Models

Enders, Chapter 6.

Gujarati, Sections 21.11-21.13.

- # Beck, Nathaniel. 1992. "Comparing Dynamics Specifications: The Case of Presidential

Approval.” *Political Analysis* 3: 51-87.

Ostrom, Charles W., Jr., and Renee M. Smith. 1993. “Error Correction, Attitude Persistence, and Executive Rewards and Punishments: A Behavioral Theory of Presidential Approval.” *Political Analysis* 4: 127-183.

Durr, Robert H. 1993. “An Essay on Cointegration and Error Correction Models.” *Political Analysis* 4: 185-228.

Williams, John T. 1993. “What Goes Around Comes Around: Unit Root Tests and Cointegration.” *Political Analysis* 4: 229-235.

Beck, Nathaniel. 1993. “The Methodology of Cointegration.” *Political Analysis* 4: 237-247.

DeBoef, Suzanna, and Jim Granato. 2000. “Testing for Cointegrating Relationships with Near-Integrated Data.” *Political Analysis* 8:99-117.

DeBoef, Suzanna. 2001. “Modeling Equilibrium Relationships: Error Correction Models with Strongly Autoregressive Data.” *Political Analysis* 9:78-94.

Maddala, G. S.. 1999. “Recent Developments in Dynamic Econometric Modeling: A Personal Viewpoint.” *Political Analysis* 7: 59-87.

Week 13-14: Multiple Time-Series Models

Brandt and Williams

Enders, Chapter 5.

Gujarati, Section 22.9.

Freeman, John R. 1983. “Granger Causality and the Time Series Analysis of Political Relationships.” *American Journal of Political Science* 27: 327-58.

Freeman, John R., John T. Williams, and Tse-min Lin. 1989. “Vector Autoregression and the Study of Politics.” *American Journal of Political Science* 33: 842-77.

Freeman, John R. 1990. “Technical Report.” Appendix B to his *Three-Way Street: Strategic Reciprocity in World Politics*. University of Chicago Press.

MacKuen, Michael B., Robert S. Erikson, and James A. Stimson. 1992. “Peasants or Bankers? The American Electorate and the U.S. Economy.” *American Political Science Review* 86: 597-611.

Freeman, John, Daniel Houser, Paul M. Kellstedt, and John T. Williams. 1998. “Long-Memored Processes, Unit Roots, and Causal Inference in Political Science.” *American Journal of Political Science* 42: 1289-1327.

Additional Optional Readings:

Granger, C. W. J. 1969. “Investigating Causal Relations by Econometric Models and Cross-Spectral Methods.” *Econometrica* 37: 424-438.

Sims, Christopher A. 1972. “Money, Income, and Causality.” *The American Economic Review* 62: 540-552.

Haugh, Larry D. 1976. “Checking the Independence of Two Covariance-Stationary Time Series: A Univariate Residual Cross-Correlation Approach.” *Journal of the American Statistical Association* 71: 378-85.

Haugh, Larry D., and G. E. P. Box. 1977. “Identification of Dynamic Regression (Distributed

Lag) Models Connecting Two Time Series.” *Journal of the American Statistical Association* 72: 121-30.

Pierce, David A. 1977. “Relationship -- and the Lack Thereof -- Between Economic Time Series, with Special Reference to Money and Interest Rates.” *Journal of the American Statistical Association* 72: 11-22.

Pierce, David A., and Larry D. Haugh. 1977. “Causality in Temporary Systems: Characterizations and a Survey.” *Journal of Econometrics* 5: 265-93.

Sims, Christopher A. 1980. “Macroeconomics and Reality.” *Econometrica* 48: 1-48.

Runkle, David E. 1987. “Vector Autoregressions and Reality” with Comments by Christopher A. Sims, Olivier Jean Blanchard, and Mark W. Watson and Reply by David E. Runkle. *Journal of Business & Economic Statistics* 5: 437-454.

Week 14-15: Time Series Cross-Section Models

Gujarati, Chapter 16.

Stimson, J. A. 1985. “Regression in Space and Time: A Statistical Essay.” *American Journal of Political Science* 29:914-947.

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.

Beck, Nathaniel., and Jonathan. N. Katz. 1996. “Nuisance vs. Substance: Specifying and Estimating Time-Series Cross-Section Models.” *Political Analysis* 6: 1-36.

Maddala, G. S.. 1999. “Recent Developments in Dynamic Econometric Modeling: A Personal Viewpoint.” *Political Analysis* 7: 59-87.

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.

Beck, Nathaniel. 2008. “Time-Series Cross-Section Methods.” Chapter 20 of Janet M. Box-Steffensmeier, Henry E. Brady, and David Collier, eds., *The Oxford Handbook of Political Methodology*. Oxford.

Beck, Nathaniel and Jonathan M. Katz. 2011. “Modeling Dynamics in Time-Series-Cross-Section Political Economy Data.” *Annual Review of Political Science* 14: 331-352.

Week 16: Modeling Time Dependence in Binary Data

Poirier, D. J., and P. A. Ruud. 1988. “Probit with Dependent Observations.” *Review of Economic Studies* 55: 593-614.

N. Beck, J. N. Katz, and R. Tucker. 1998. “Taking Time Seriously: Time- Series Cross-Section Analysis with a Binary Dependent Variable.” *American Journal of Political Science* 42:1260-1288.

Carter, David B., and Curtis S. Signorino. 2010. “Back to the Future: Modeling Time Dependence in Binary Data.” *Political Analysis* 18: 271-292.

Simon Jackman, “Time Series Models for Discrete Data: Solutions to a Problem with Quantitative Studies of International Conflict.” Typescript.