Course description:
Statistical models can be applied to time series data – chronological sequences of observations – to examine the movement of social science variables over time (e.g., public opinion, government policy, judicial decisions, socioeconomic measures), allowing analysts to estimate relationships between variables and test hypotheses. This course introduces time series methods and their application in social science research. We will focus on conceptualization and practice, with some attention to the underlying statistical theory.

The course will provide a comprehensive discussion of the core concepts in time series analysis, including autoregressive, moving-average and unit-root processes, and the two most important assumptions underlying time series models: stationarity and exogeneity. The lab component of the course will demonstrate the use of, and assumptions underlying, common models of time series data: autoregressive distributive-lag, moving average (autocorrelated error), differenced data, ARMA, equilibrium (error) correction, and vector autoregression models. These models will be demonstrated with the goal of giving participants the tools necessary to apply them to their own research.

A sound background in OLS and linear regression models is assumed but prior training in time series analysis is not required. The lab component of this course will employ STATA. Some familiarity with STATA would be helpful but for those without that familiarity, a crash course on STATA will be provided during the first lab session. While knowledge of advanced mathematics is not necessary, familiarity and comfort with the use of basic mathematical and statistical tools – e.g., algebra and the basic fundamentals of probability – is required. The first day of the course will provide some review of basic mathematics and statistical theory but it is strongly recommended that workshop participants review the readings listed under pre-course preparation.

Making Contact:
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Course outline:

Day 1.
Introduction and a Review of Essential Mathematics and Statistical Theory
- Thinking time-serially (versus cross-sectionally)
- Notation
- Basic mathematics
- Basic statistical theory
  - probability, variance and covariance
- Limits and derivatives
The Simple Linear Regression Model – A Review
- Classical linear modelling assumptions of OLS and the challenge of time series data
- Endogeneity – omitted variable bias
  - Lab: crash course in STATA

Day 2.
The Characteristics of Time Series analysis
- Static and Finite Distributed Lag models
- Classical linear modelling assumptions for OLS with time series
- Asymptotic OLS assumptions for time series
- Testing for serial correlation and heteroscedasticity
- Tests for randomness and normality
- Correcting for serial correlation (FGLS)
- Correcting for heteroscedasticity
  - Lab: examples of Static and Finite Distributed Lag models

Day 3.
Stationary Dynamic Time Series Models
- Trending (Part 1)
- Autoregressive (AR) processes
- The Autoregressive Distributed Lag (ADL) model
- The Lag Dependent Variable (LDV) model
- Conditions for Stability
- Conditions for Stationarity
- Moving average (MA) processes
- The ARMA model
- Maximum Likelihood Estimation - An Overview
  - Lab: examples of LDV, ADL, MA models
Day 4.
Model Selection and Nonstationarity
- The Box-Jenkins approach for ARMA model selection
- Testing for unit root processes
- Random Walk Model
- Trending (Part 2)
- Differenced data models
- The ARIMA model

- Lab: examples of ARMA and ARIMA models

Day 5.
Introduction to More Advanced Time Series Models
- Cointegration
- Equilibrium/Error Correction models
- Introduction to Vector Autoregression Models

- Lab: examples of VAR and Error Correction models

Readings:
Pre-course preparation


(It is also strongly advisable to get started with the course readings.)

Day 1.

Day 2.

Day 3.


Day 4.


Day 5.


Other interesting readings:
