I. Introduction

II. Regression with Autocorrelated Errors:
  - (i) Review of Simple and Multiple Linear Regression
  - (ii) Regression with Serially Correlated Errors
  - (iii) Durbin-Watson Statistic
  - (iv) Cochrane-Orcutt Procedure

III. Deterministic Time Series Regression Methods:
  - (i) Structural Decomposition
  - (ii) Trend Fitting by Polynomial Trend Models
  - (iii) Trend Fitting by Moving Averages
  - (iv) Seasonality Fitting using Seasonal Indicators
  - (v) Seasonality Fitting using Trigonometric Functions
  - (vi) Steps in Structural Time Series Modeling
IV. Time Series Smoothing Methods:
- (i) Simple Exponential Smoothing
- (ii) Double Exponential Smoothing
- (iii) Holt-Winters Procedure: Additive and Multiplicative
- (iv) Trend Elimination by Differencing

V. Stochastic Properties of a Time Series:
- (i) Strict and Weak Stationarity
- (ii) General Linear Process - Properties
- (iii) Estimation of Mean, ACVF and ACF
- (iv) Further Look at residuals for structure

VI. ARIMA Models:
- (i) General Linear Process and its Properties
- (ii) AR, MA, ARMA and ARIMA Models and Properties
- (iii) Stationarity and Invertibility
- (iv) Model Identification: ACF, PACF
- (v) Model Estimation: Yule-Walker, LSE, Approximate and Exact MLE
- (vi) Model Adequacy and Model Selection
- (vii) Prediction

VII. Regression with ARIMA Errors

VIII. Nonstationary Time Series, Unit Roots

IX. Conditionally Heteroscedastic Time Series Models
I. Introduction

Observe $X_1, X_2, \cdots, X_n$ at equi-spaced discrete times $t = 1, \cdots, n$. What is the behavior of such data over time? Examples:
Fluctuate randomly about a given value
Fluctuate with some pattern about a given value
Change linearly over time
Change over time according to some function, say exponential.

Observe $(X_t, Z_{t,1}, \cdots, Z_{t,k})$ at times $t = 1, \cdots, n$, where $X_t$: response (dependent) variable observed over time; $Z_{t,1}, \cdots, Z_{t,k}$: explanatory (independent) variable observed over time; $k$: number of explanatory variables; $n$: number of time points (observations).
Possibilities:

1. Discrete-time, continuous-valued series;

2. Continuous-time, continuous-valued series;

3. Discrete-time, discrete-valued series;


In this course, we will discuss discrete-time, continuous-valued time series.