COURSE OUTLINE

INSTRUCTOR: JEN-WEN LIN, PH.D., FRM
Office: SS6008
Office Hours: By appointment
Phone: TBA
Class Time/Place: Tuesday 6-9 pm, SS2135
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Course Description

This course provides an introduction to time series analysis with finance applications. However, the techniques can be applied to other disciplines as well. Students will gain hands-on knowledge on how to analyze and model time series data after finishing this course. Topics in this course include

I. Fundamental Concepts
   a. Stochastic processes
   b. Stationarity (Weakly and Strongly)
   c. Autocovariance functions, autocorrelation functions and partial Autocorrelation Functions

II. Stationary Linear Time Series
   a. AR, MA, and ARMA (Autoregressive-Moving Average) Models
      • Causal and invertible ARMA processes
      • Moving average processes of infinite order
      • Computing the autocovariance functions of ARMA(p,q) processes
   b. Model Construction
      • Identification Techniques
      • Model Selection
      • Yule-Walker equations and Durbin-Levinson algorithm
      • Conditional maximum likelihood estimations
      • Diagnostic checking

III. Models of Non-stationary Time Series
   a. Stochastic versus deterministic time trends
   b. ARIMA (Autoregressive integrated moving average) models

IV. Prediction of Time Series
   • Minimum mean squared error forecasts
• Computation of forecasts
• Updating forecasts

V. Vector Autoregressive (VAR) Models
   a. Introduction to VAR models
   • Granger Causality
   • Stationarity and model construction

VI. Spurious regression and Cointegration
   a. Spurious regression
   b. Introduction to cointegration
   c. Applications: Pair trading and index arbitrage

The following topics will be covered if time allows:
   Continuous-time models, FARMA (Fractional Autoregressive-Moving Average) models, GARCH (Generalized Autoregressive Conditional Heteroscedastic) models, intervention analysis, Kalman filter and state space models, spectral Analysis, threshold Models, transfer function models

Grading

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<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm exam</td>
<td>20 % / 0%</td>
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<tr>
<td>Group project</td>
<td>40 % / 50%</td>
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<tr>
<td>Final exam</td>
<td>40 % / 50%</td>
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Textbook


Reference Books