Statistical Techniques of Financial Data Analysis

Department: MATH
Course Number: 6783
Hours - Lecture: 3
Hours - Lab: 0
Hours - Recitation: 0
Hours - Total Credit: 3
Typical Scheduling: Every spring semester
Description:
Fundamentals of statistical inference are presented and developed for models used in the modern analysis of financial data. Techniques are motivated by examples and developed in the context of applications. Crosslisted with ISYE 6783
Prerequisites:

Math 3215 (or equivalent), some knowledge of programming, and MS QCF standing or some previous exposure to the topics of stocks, bond options

Course Text:

No text

Topic Outline:

The following probability topics are covered in the models that are presented:

Distributions such as the normal (Gaussian), lognormal, geometric, binomial, Poisson, Student's t, F, chi-square, gamma, and Pareto
Characteristic functions, sums of independent random variables, a-stable random variables
Limit Theorems for sums
Order statistics
Limit Theorems for extremes
Elementary stochastic processes such as Markov chains
Dynamic linear models
Time series models

The following topics in statistical inference are covered in the models that are presented:

Likelihood functions
Estimation
Testing Hypotheses via Neyman-Pearson tests, likelihood ratio tests, and Wald tests
Tests of fit
Markov chain and time series inference
Regression
Principal components analysis
Non-parametric analyses

Applications to financial data are made throughout and include the topics such as the following:

Testing hypotheses of independence, normality, homoscedascticity, and symmetry for returns, and the Bachelier and Mandelbrot models
Efficient frontier in portfolio analysis under short selling and riskless borrowing and lending, optimal portfolio under single index and multi-index models, principal components analysis, stability tests of betas from auxiliary data
Simulation and Monte-Carlo, estimation and assessment of accuracy of path integrals arising in option pricing
Hill's estimator of the Pareto index, application to solvency analysis and ruin probabilities, connections with a-stability
Analysis of ar, ma, arma, arima, arch, garch, and stochastic volatility time series models applied to exchange rates, indexes, interest rates, and returns.