

Statistics for Financial Engineering

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Objective

To prepare students for the statistics demands of the MFE program and to give finance professionals basic statistical tools for analyzing and modeling financial data. The course will be centered on risk management and valuation issues in finance.

Session 1

- Histograms and frequency distributions
- Events and sampling spaces
- Random variables
- Tchebysheff's theorem
- Discrete and continuous probability distributions
- Probability transforms

Session 2

- Order statistics
- Probability plots
- Sampling distributions and point estimators
- Maximum likelihood estimation
- Small sample estimation
- Moment generating functions and applications

Session 3

- Correlation analysis
- Measures of association
- Joint distributions
- Pearson and rank correlation
- The covariance matrix – eigenvalues, estimation, and positive definiteness
- Hypothesis testing
- Mean and variance of two populations
- The Kolmogorov-Sminov test

Session 4

- Time series modeling and analysis
- Asset price modeling
- Conditional and unconditional moments
- Autoregressive processes
- Correlograms and the Yule-Walker equations
- Moving average processes
- ARMA processes
- Heteroskedasticity modeling
- ARCH and GARCH modeling
- Option pricing under GARCH and its extensions

Session 5

- Linear regression:
 - Prediction
 - Confidence intervals
 - Extensions to categorical variables

Session 6

- Multidimensional regressions
- Partial regression coefficients
- OLS and ML estimations
- Marginal contributions
- Analysis of variance
- Co-linearity issues

Reference materials

Comprehensive notes will be provided, but the following references will be useful:

1. Mathematical Statistics and Data Analysis by John A. Rice (Duxbury Press)
2. Time Series Models by Andrew C. Harvey (MIT Press)
3. Numerical Recipes in C/C++ by William H. Press et al. (Cambridge University Press)

Requirements

Linear algebra and calculus.

Programming knowledge in a high level language (C,C++,VB) desirable but not essential

Grading criteria

Participants will be given a letter grade based on homework projects

There is no final exam