FSRM 583
Methods of Statistical Inference with Financial Applications

Spring 2014

Lecture
Hours: Wed., 6:40pm - 9:30pm
Location: ARC, Room 105

Instructor: Lee Dicker
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Office: Hill Center 477
Office hours: Wed. 5:00pm-6:00pm, or by appointment

Teaching Assistant:TBA

There is no required textbook for the course. Course notes will be posted on the course website (login at `sakai.rutgers.edu`) in advance of each lecture.

Supplemental references that you may find useful include: *Mathematical Statistics and Data Analysis*, by John A. Rice (Third Edition, 2006, Duxbury); *Statistical Inference*, by George Casella and Jim Berger (Second Edition, 2002, Duxbury); *Statistical Models and Methods for Financial Markets*, by Tze Leung Lai and Haipeng Xing (2008, Springer); *Statistics and Finance: An Introduction*, by David Ruppert (2004, Springer); *All of Nonparametric Statistics*, by Larry Wasserman (2005, Springer)

Overview: This course is about statistical inference, and techniques for formalizing and understanding uncertainty that is inherent in data analysis. While many of the tools we discuss are very broadly applicable, we will focus our attention on applications in finance. Two cornerstones in the theory of statistical inference form the core of this course:

(i) parameter estimation and
(ii) hypothesis testing.

Topics on parameter estimation to be covered in the first part of the course include:

- Parametric models in statistics.
- Methods for evaluating the performance of parameter estimates (unbiasedness, MSE, standard errors).
- Methods for constructing estimators (method-of-moments and maximum likelihood).
- Asymptotic theory.
- Confidence intervals.
- Sufficiency, data reduction and the Rao-Blackwell theorem.
- Bayesian inference.

The second part of the course focuses on hypothesis testing, including:

- The Neyman-Pearson lemma.
- p-values.
- The relationship between confidence intervals and p-valus.
- Uniformly most powerful tests.
- Likelihood ratio tests.
- Tests for normality.
- Chi-squared tests.

Other topics to be covered in the course, as time allows, include linear regression, nonparametric regression and density estimation, and the bootstrap.

The syllabus described above is relatively theoretical. However, throughout the course I will aim to convince you that each of the topics covered in class has important practical applications in finance. The constant expected return (CER) model for asset returns will serve as a running example throughout the semester (background on the CER model will be provided as needed). By the end of the course, you should be comfortable with performing statistical inference on many of the important parameters in this model – e.g. constructing confidence intervals for the Sharpe ratio or Markowitz portfolio weights, and understanding how to interpret them – and you should feel prepared to apply similar tools to more complex models that you may encounter in real life.

Evaluation: Homework will be assigned weekly and there will be two exams: a midterm and final. Some homework assignments may contain basic statistical computing problems, which you may implement with any of your favorite statistical software packages. I will use Sakai to regularly post assignments, notes, and other information relevant to the course.

Each student must also complete a final project, which will involve reading and understanding a paper related to statistics in finance. There will be a poster session during the last week of class, for students to present the results of their project. The project will also involve submitting a written project report (less than 10 pages) during the last week of class.

Final grade breakdown:
20% Weekly homework
25% Midterm exam
30% Final project
25% Final exam

Homework policy: Homework will be assigned weekly and will be due one week from the date it is assigned. Collaboration on homework assignments is encouraged. However, you should write up solutions for submission individually. **Late homework will not be accepted.**

Submitted homework should be legible, stapled, not contain excessive erasing or whiteout, and not be submitted on spiral-bound paper. **I reserve the right to refuse to grade homework that I judge to be excessively messy.**