

Financial Data Analysis and Application

Instructor: Shuo Liu

Time: Monday 8:50am-12:15pm

References:

1. Principles of Econometrics. Hill, R. C., Griffiths, W. E. and G. C. Lim, 4th Edition, 2011.
2. Analysis of Financial Time Series, Ruey S. Tsay, 3rd Edition, 2010.
3. Statistics and Data Analysis for Financial Engineering (with R examples), David Ruppert and David S. Matteson, 2nd Edition, 2015.
4. An Introduction to Statistical Learning (with Applications in R), Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, 2013.

Grading:

- Three Assignments (30%) + Midterm (30%) + Final Group Project and Presentation (40%)
- Students can form groups of 4 people. In the last two weeks, each group makes one oral presentation (english). Each group submits **one final project report which is due on Dec 15**.
- Midterm is two-hour exam, most of the questions are multiple choice question, and also includes some written questions. (the written questions are mainly about reading software outputs and related applications)
- For final project, group members are equally graded.
- Assignments are mostly textbook questions. For each assignment, please submit **electronic version files**, TA will randomly choose two or three questions to grade. **The first**

assignment is due on Oct 4, the second one is due on Nov 1 and the third one is due on Dec 15.

Course Time Table:

Date	Topics
Sep 13	Review of Basic Econometrics: Cross-Sectional Model <ul style="list-style-type: none"> – simple linear model: OLS estimator, heteroskedasticity – multivariate linear model: collinearity, specification, and other issues – endogeneity problem: IV regression – specific-form independent variable: indicator variable, difference-in-difference (DID), test for parallel-trend assumption.
Sep 18	Review of Basic Econometrics: Cross-Sectional Model <ul style="list-style-type: none"> – specific-form dependent variable: Logit model, Probit model Dealing with Endogeneity Issue <ul style="list-style-type: none"> – Propensity Score Matching (PSM) – Regression Discontinuity Designs (RDD)
Sep 27	Clarifying Economic Channels <ul style="list-style-type: none"> – mediation analysis with structural equation modelling (SEM) – estimation with moment conditions: GMM High-dimensional Cross-Sectional Models (with Machine Learning Techniques) <ul style="list-style-type: none"> – Lasso, Ridge, ElasticNet
Oct 4	Time Series Model <ul style="list-style-type: none"> – AR, MA, ARMA, ARIMA – ARCH, GARCH – Vector autoregression (VAR), impulse response, variance decomposition
Oct 11	Panel Data Model #1 <ul style="list-style-type: none"> – fixed effect models – within estimator, HAC standard errors, clustering standard errors Panel Data Model #2 <ul style="list-style-type: none"> – dynamic panel data model

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- Oct 18 Asset Pricing #1
- Capital Asset Pricing Model (CAPM), Security Market Line
 - Fama-Macbech regression
- Asset Pricing #2 (Multi-Factor Model)
- Fama-French-Carhart four factor models, Portfolio Sorting Analysis
 - Arbitrage Pricing Theory (APT)
 - model with security characteristics (e.g. fixed income securities)
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Oct 25 **Midterm**

Fixed Income Securities:

- main features of bonds
 - yield to maturity (YTM), realized returns and yield curve
 - liquidity measures and liquidity premium, corporate bond pricing
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Nov 1 Examples of Trading Strategies:

- strategies based on factor models
- other strategies: mean reversion, momentum, and etc.

Risk management: Value at Risk (VaR)

Nov 8 More on Machine Learning-1: Tree-Based Methods

- basics of Decision Trees
 - Random Forests and Boosting
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Nov 15 More on Machine Learning-2: Unsupervised Learning

- Principal Component Analysis (PCA)
- Clustering Methods

More on Machine Learning-3: Neural Networks

Nov 22 EXCEL Application

- efficient frontier, estimate β
- estimate yield curve
- binomial tree pricing

Group Presentations

Nov 29 **Group Presentations**
