

Financial Data Analysis and Application (70510983, Fall 2023)

Instructor: Shuo Liu

Time: Wednesday 8:30am-11:45am

Contact: liushuo3@sem.tsinghua.edu.cn

Office hour: Thursday 17:30-19:30pm or by appointment

Teaching Assistant: Mingyu Hu, hu-my21@mails.tsinghua.edu.cn

References:

1. Analysis of Financial Time Series, Ruey S. Tsay, 3rd Edition, 2010.
2. Statistics and Data Analysis for Financial Engineering (with R examples), David Ruppert and David S. Matteson, 2nd Edition, 2015.
3. An Introduction to Statistical Learning (with Applications in R), Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, 2013.
4. **Slides should be the main focus for assignments and exams.**

Grading:

- Two Assignments (30%) + Midterm (40%) + Final Group Project and Presentation (30%)
- 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 31**.
- 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.
- There are in all two assignments. Assignments are mostly textbook questions. For each assignment, each group submits one copy of **electronic version files**, TA will randomly choose two or three questions to grade. Group members are equally graded. **The first assignment is due on Oct 31, the second one is due on Nov 30.**

Tentative Time Table:

Date	Topics
Sep 20	Review of Basic Econometrics: Cross-Sectional Model <ul style="list-style-type: none">– simple linear model: OLS estimator, heteroskedasticity– multivariate linear model: collinearity, model specification, and etc– endogeneity problem: IV regression– specific-form independent variable: indicator variable, difference-in-difference (DID)
Sep 27	Review of Basic Econometrics: Cross-Sectional Model <ul style="list-style-type: none">– specific-form dependent variable: Logit model, Probit model 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 model, random effect model– within estimator, HAC standard errors , clustering standard errors Panel Data Model #2 <ul style="list-style-type: none">– dynamic panel data model, varying-coefficient model
Oct 18	Structural Model Estimation <ul style="list-style-type: none">– mediation analysis with structural equation modelling (SEM)– estimation with moment conditions: GMM Causal Inference (Dealing with Endogeneity) <ul style="list-style-type: none">– Propensity Score Matching (PSM)– Regression Discontinuity Designs (RDD)
Oct 25	Asset Pricing #1 <ul style="list-style-type: none">– Capital Asset Pricing Model (CAPM), Security Market Line– Fama-Macbech regression Asset Pricing #2 (Multi-Factor Model) <ul style="list-style-type: none">– Fama-French-Carhart four factor models, Portfolio Sorting Analysis– Arbitrage Pricing Theory (APT)– model with security characteristics (e.g. fixed income securities)

Nov 1	Fixed Income Securities: <ul style="list-style-type: none"> – main features of bonds – yield to maturity (YTM), realized returns and yield curve – liquidity measures and liquidity premium, corporate bond pricing
Nov 8	Midterm Python and R basics
Nov 15	Trading Strategies: <ul style="list-style-type: none"> – strategies based on factor models – other strategies: mean reversion, momentum, and etc. – strategies for fixed income securities
Nov 22	Machine Learning-1: Regularized Estimation and Unsupervised Learning <ul style="list-style-type: none"> – High-dimensional Cross-Sectional Models (with Machine Learning Techniques): Lasso, Ridge, ElasticNet – Unsupervised Learning: Principal Component Analysis (PCA), Clustering Methods
Nov 29	Machine Learning-2: Tree Methods <ul style="list-style-type: none"> – basics of Decision Trees – Random Forests and Boosting Machine Learning-3: Neural Networks
Dec 6	Machine Learning in Asset Pricing and Trading Strategies Group Presentations
Dec 13	Group Presentations
