

Course Syllabus : 金融数据分析方法与应用 (Financial Data Analysis)

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课程简介:

《金融数据分析方法与应用》为金融硕士课程。通过本课程的学习，学生能够掌握如何通过搜集和分析数据来检验金融学的经典理论，以及掌握金融学中常用的比较先进的计量方法。本课程将重点关注，在金融问题背景下做实证分析，所常见的问题和相应的解决方法。本课程主要包含“计量方法”和“实证资产定价”两部分。其中，“计量方法”部分将介绍截面数据模型、时间序列模型、面板数据模型，以及讨论如何解决内生性问题。“实证资产定价”部分将介绍如何用数据来检验经典的金融理论，例如权益资产定价、投资组合管理、资本资产定价模型、Fama-Macbeth回归方法、套利定价理论，以及分别应用于股票和固定收益证券的多因子模型。最后，本课程将介绍基于因子模型的交易策略、风险管理和常用的机器学习方法。

Course Description (course objectives and content):

Financial Data Analysis is a course for master students who are interested in applying real data to test classical asset pricing theories and in the applications of commonly used and advanced econometric methods to financial problems. This course will more focus on empirical analysis method under financial background, and also related issues and solutions. This course mainly contains two parts: “econometrics method” and “empirical asset pricing”. The first part introduces cross-sectional models, time series models, panel data models, and discusses how to solve endogeneity problem. The second part introduces how to apply real data or simulation methods to test classical financial theories, including equity valuation, portfolio management analysis, CAPM model, Fama-Macbeth regression, Fama-French-Carhart factor model, Arbitrage Pricing Theory, and multi-factor pricing models for fixed income securities. Finally, the course will introduce trading strategies based on factor models, risk management topics, and commonly used machine learning techniques.

Textbooks & 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 size up to 4 people. For each assignment, each group submits one copy of slides which presents the main results, and puts the calculation details as appendix. For the final project, each group just submits one copy of report.
- For assignments and final project, group members are equally graded.
- 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)

| No. | Assessment method | Percentage |
|-----|-------------------|------------|
| 1 | three assignments | 30% |
| 2 | midterm | 30% |
| 3 | final project | 40% |

Teaching Schedule:

| Week | Contents | Assignment Due |
|------|---|----------------|
| 1 | 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. | |
| 2 | 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) | |
| 3 | 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 | |
| 4 | Time Series Model <ul style="list-style-type: none"> • AR, MA, ARMA, ARIMA • ARCH, GARCH • Vector autoregression (VAR), impulse response, variance decomposition | Assignment-1 |



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| 5 | Panel Data Model #1 <ul style="list-style-type: none">fixed effect modelswithin estimator, HAC standard errors, clustering standard errors Panel Data Model #2 <ul style="list-style-type: none">dynamic panel data model | |
| 6 | Asset Pricing #1 <ul style="list-style-type: none">Capital Asset Pricing Model (CAPM), Security Market LineFama-Macbech regression Asset Pricing #2 (Multi-Factor Model) <ul style="list-style-type: none">Fama-French-Carhart four factor models, Portfolio Sorting AnalysisArbitrage Pricing Theory (APT)model with security characteristics (e.g. fixed income securities) | |
| 7 | Midterm Fixed Income Securities: <ul style="list-style-type: none">main features of bondsyield to maturity (YTM), realized returns and yield curveliquidity measures and liquidity premium, corporate bond pricing | Assignment-2 |
| 8 | Examples of Trading Strategies: <ul style="list-style-type: none">strategies based on factor modelsother strategies: mean reversion, momentum, and etc. Risk management: Value at Risk (VaR) | |
| 9 | More on Machine Learning-1: Tree-Based Methods <ul style="list-style-type: none">basics of Decision TreesRandom Forests and Boosting | |
| 10 | More on Machine Learning-2: Unsupervised Learning <ul style="list-style-type: none">Principal Component Analysis (PCA)Clustering Methods More on Machine Learning-3: Neural Networks | |
| 11 | EXCEL Application <ul style="list-style-type: none">efficient frontier, estimate βestimate yield curvebinomial tree pricing Group Presentations | Assignment-3 |
| 12 | Group Presentations | |

Shuo LIU

Shuo LIU is currently an assistant professor of Finance in the School of Economics and Management at Tsinghua University.

He received a Ph.D. in Economics from University of California, Los Angeles. During his study at UCLA, he worked as intern at International Monetary Fund, Washington DC, and Federal Reserve Bank at St. Louis.

His research interests include over-the-counter markets, corporate bond pricing, financial intermediation and asset pricing. He teaches empirical finance (undergraduate level), financial economics (undergraduate level), and financial data analysis and application (graduate level).

教师简介:

刘硕于2020年加入清华大学经济管理学院，目前担任金融系助理教授。他于2020年获得加州大学洛杉矶分校经济学博士。博士在读期间，他曾在美联储圣路易斯分行、国际货币基金组织华盛顿总部等机构进行研究实习。他的研究领域包括柜台交易市场、公司债券定价、金融中介和资产定价。他讲授的课程包括实证金融学（本科）、金融经济学（本科）、金融数据分析方法与应用（硕士）。