Approach to Time Series Analysis

Department: Fudan International Summer Session (This course is a compulsory course for economics majors at Fudan.)

Course Code	ECON130083		
Course Title	Approach to Time Series Analysis		
Credit	3	**Credit Hours**	54+3 tutorial hours (one credit hour is 45 minutes)
Course Nature	□Specific General Education Courses □Core Courses □General Education Elective Courses □Basic Courses in General Discipline ☑Professional Compulsory Courses □Professional Elective Courses □Others		
Course Objectives	This course focuses on the economic intuition and theoretical justification behind the econometric modeling of financial time series.		
Course Description	It begins with the basic concepts in time series analysis and the stylized facts of financial times series data, then covers the univariate and multivariate time series with topics including ARIMA models, GARCH models, VAR models, factor models, and machine learning methods in big data analysis, etc. This course emphasizes the application of time series models in financial data. Empirical examples related to testing the efficient market hypothesis, CAPM, predicting excess equity return, derivative pricing, financial contagion, risk management, and exchange rate prediction will be covered.		

Course Requirements:

Prerequisites: Undergraduate level courses in calculus and probability and statistics. Some background in undergraduate time series analysis is useful but not required. The course is self-contained.

Teaching Methods:

Lectures

Instructor's Academic Background:

Dr. Zhonghao Fu is currently an assistant professor in Economics at the School of Economics, Fudan University. He obtained his PhD degree in economics from Cornell University in 2017. His research area includes econometric theory, time series analysis, and financial econometrics.

Course Schedule:

· **Intro to time series analysis:**

Math reviews on probability and statistics; Basic concepts of time series process: stationarity, ergodicity, serial dependence, etc; Basic characteristics of financial data; Reviews on static time series regression model.

· **Modeling conditional mean dynamics:**

ARIMA models: Estimation and Forecasting

· **Modeling conditional mean dynamics:**

Stylized features of nonlinear time series; Nonlinear autoregressive models: threshold auto regressive model, smooth transition autoregressive model, Markov Chain regime switching autoregressive model, and random coefficient autoregressive model;

· **Modeling conditional variance dynamics:**

Conditional Volatility Models: Linear ARCH models (GARCH(p; q), IGARCH, RiskMetrics, and long memory volatility model);

· **Modeling nonstationary time series:**

Trending stationary process; Unit root; Locally stationary process;

· **Modeling vector time series:**

VAR; Co-integration; Statistical Arbitrage;

· **Factor models:**

Principal Component Analysis (PCA); Single-factor models (CAPM); Multi-factor models (Fama-French three-factor model);

· **Portfolio theory:**

Tangency portfolio; Mean-variance efficiency;

· **Copula:**

Tail dependence; Rank statistics; Financial contagion;

· **Big data:**

Machine learning; Shrinkage estimation; Random forest.

· **Final Exam**

The design of class discussion or exercise, practice, experience and so on:

Class participation is highly recommended. Students are encouraged to share their thoughts or current works in class.

Grading & Evaluation (Provide a final grade that reflects the formative evaluation process):

Student grade in this courses will be based on:

Class Participation (10%);

Homework (40%);

Final exam (50%).

There will be no make-up exam.

Teaching Materials & References:

Ruppert D. Statistics and data analysis for financial engineering. New York: Springer, 2011;

Tsay R S. Analysis of financial time series. John Wiley & Sons, 2005;

Hamilton J D. Time series analysis. Princeton: Princeton University Press, 1994;

Brockwell P J, Davis R A. Introduction to time series and forecasting. Springer, 2016;

Hong Y. Lecture notes on nonlinear time series, 2012.