

Financial Engineering Research Schedule

University of Southern California (USC)

Tutoring Subject: Applications of advanced regression analysis and time series theory to Finance and Economics

Abstract: Financial engineering is the application of mathematical methods to the solution of problems in finance, employing tools from applied mathematics, computer science, statistics, and econometrics theory. Businesses apply the methods of financial engineering to solve problems such as new product development, portfolio management, risk management, and optimization. This program exposes students to the theoretical and practical aspects of this field by applying a set of different methodologies to financial data. More specifically, advanced regression analysis will be used to build a solid framework on quantitative finance, and ordinary least square method and time series analysis will be deeply illustrated by using Microsoft Excel Analysis tool-pack, Solver, and a specialized software, EViews.

This program aims to develop the financial, statistical, and econometric tools used in many practical problems of modern economics and finance. The quantitative tools developed in this course will enable practitioners to estimate various asset-pricing models, assess financial risk, and manage portfolios by using investment theory.

Schedule:

Session 1-2: Classic Linear Regression Model (CLRM)

Time and location: TBD

Highlights:

- Introduction to the theory of Ordinary Least Square methodology and development of the CLRM. Review of important statistical concepts.
- Implementation of CLRM using Excel and EView

Task 1-2: Developing and evaluating a linear regression model. Application to house pricing prediction and forecasting.

Session 3-4: Capital Asset Pricing Model (CAPM)

Time and location: TBD

Highlights:

- Return, Expected Return and risk
- Systematic and Idiosyncratic risks
- Assets evaluation through CAPM

Task 3-4: Calculation of the volatility of stocks (beta) in relation to the overall market.

Session 5-6: Financial Forecasting

Time and location: TBD

Highlights:

- Moving Average
- Weighted Moving Average
- Simple Exponential Smoothing
- Naive forecasting
- Measure of error/Accuracy for forecasting evaluation

Task 5-6: Application of different forecasting techniques to current financial and economic data. Evaluation and selection of best forecasting methodology.

Session 7-8: Cointegration

Time and location: TBD

Highlights:

- Short- and long-term association among stocks and markets
- Stationarity of a time series
- Correlograms
- ADF - Augmented Dickey-Fuller statistical test (unit-root test)

Task 7-8: Building a model to determine if assets or markets are cointegrated

Session 9-10: Time Series Analysis

Time and location: TBD

Highlights:

- Time series decomposition
- Introduction to ARIMA models (Box-Jenkins methodology)
- ARIMA Identification, estimation and diagnostics

Task 9-10: Modeling time series processes using ARIMA methodology

Session 11: Research Project definition and discussion

Time and location: TBD

Highlights:

- Review of the topics covered during the program
- Brainstorming on potential finance and economics applications
- Final project selection by each student

Task 11: Determining and discussing the final project deliverables for each student in the program

Session 12: Final presentation

Time and location: TBD

Highlights: The research apprentices will be required to be working, solving and presenting a specific financial problem using the techniques learned in the program. The project will be assigned by the mentor. The final report (5 pages total) and presentation should cover all the necessary contents, including data (preparation, cleaning), methodology (model construction), and results (discussion and conclusion). The presentation will be organized in the form of international conference. Some experts in the field will be present there as reviewers.

Task 12: Prepare a 5-page report and a presentation.