# 財金計量方法

Quantitative Methods (Econometrics) for Finance

109 學年度第 2 學期

- Instructor: 繆維中，李盈儀 (財金所博班生)

- Introduction:

The aim of this course is to provide fundamental **quantitative training** for students studying in the areas of management (in general) and finance (in particular). It can be seen as a follow-up course of your undergraduate statistics (統計學) and a preparatory course for graduate econometrics (計量經濟學), and therefore it serves as a bridge between the two courses. The level of difficulty is also set somewhere in between, perhaps slightly closer to the former (depending on students' background knowledge). Apart from putting emphasis on the useful theoretical (mathematical) concepts, we shall also stress on applying the statistical methods and models you've learned to real world problems (you need to use proper software packages to analyze the data you collect). In other words, this course is intended to provide students with working knowledge for data analysis (thus it's important to balance between "mathematics" and "methods"). While our primary interests are financial data, some of the methods actually have wider applications and are also useful for other areas.

In this first few weeks we will start with a review on the key concepts in your undergraduate level statistics course (e.g. the important probability distributions, the estimation of parameters, how tests should be performed). With a sound background in distributions, estimations, and tests, we will introduce the core of this course – regression analysis (迴歸分析) and other related topics (e.g. ANOVA, and some more advanced topics, or even the very basic part of time series analysis). The time we spend on the review and the topics to be covered (these are to be discussed) in this course may vary to reflect students' background knowledge, learning interests, and expectations. In the review part we might stress more on mathematics with a view to build up theoretical foundation. In the core part we shall stress more on the usefulness and applications, i.e. methods, potential problems (or limitations), and intuitions (if the mathematics behind them are too deep for you). It is my hope that in this course you are able to develop some ideas or learn tools for data analysis and arouse your interest for future advanced study (keep in mind that this course is at a basic level).

- Prerequisite:

- Probability and Statistics at the undergraduate level (we will give a quick review)
- Basic background knowledge and interests in finance (e.g. stock returns, CAPM)

- Software packages:

- Excel, Python, EViews (statistics, econometrics, time series)

  Database: CMoney, TEJ, XQ

  (搭配課程: 「金融商品交易實務」: 亦使用以上軟體或資料庫進行分析)

- Textbook and References:

**有關一般統計學**

- 陳旭昇，「統計學 – 應用與進階」，三版，東華書局
- 林惠玲，陳正倉，「現代統計學」，修定版，雙葉書局
- 陳建勝等，「統計學管理個案分析與應用」，三版，智勝書局

**有關計量(迴歸分析)**

- 鍾惠民，周賓凰，孫而音，「財務計量 –EViews的運用」，修定版 (2014)，新陸書局
- 楊浩彥等，「實用財金計量方法」，雙葉書局
- 蔡立耑 (2017)，金融科技實戰: R語言與量化分析，博碩
- 蔡立耑 (2017)，金融科技實戰: Python與量化分析，博碩
- Brooks, "*Introductory Econometrics for Finance*", 3ed, Cambridge
- Gujarati and Porter, "*Essentials of Econometrics*", 4th ed. (2010), McGraw-Hill
- Wooldridge, "*Introductory Econometrics*", 6ed, South- Western
- Hill, Griffiths, and Lim, "*Principles of Econometrics*", 4th ed. (2012), Wiley
  Tsay, "*An Introduction to Analysis of Financial Data with R*", (2013), Wiley.

**有關時間序列**

- 陳旭昇，「時間序列分析」，東華書局
- 楊奕農，「時間序列分析」，雙葉書局
- Tsay, "*Analysis of Financial Time Series*", 3ed, Wiley

**有關Python**

- 徐淑如，董和昇，Python程式設計初學指引，滄海書局

- Synopsis: (we will be flexible about Parts 3 and 4)

**Part 1 – Review of Statistics**

- Probability distributions (normal, chi-square, *t*, *F*)
- Basic properties of estimators (biasedness, efficiency, etc)
- Testing (test for population means, population variances, proportions)
- Using EViews, Python, R (原則上以 Python 為主)

**Part 2 – Overview of Options**

- Option pricing formula (選擇權定價模型簡介)
- Black Scholes model (BS 公式)
- Greek letters (希臘字母的推導與應用) [如果時間允許]

**說明:**

「選擇權定價公式」本身在財金上有一定的重要性，此外，這個公式的多變數非線性的特性，也給予我們學習迴歸的一個良好素材。在本課程中，我們將用此公式來作為後面學習迴歸分析的一個很好的範例!

**Part 3 – Regression**

- Calculation of stock return
- ANOVA (focusing on one-way ANOVA)
- Simple regression (單迴歸)
- Multiple regression (複迴歸)
- Dummy variable (虛擬變數)
- Stepwise regression (逐步迴歸)
- Advanced issues in linear regression (omitted variable bias, collinearity, nonlinearity – log/quadratic form, heteroskedasticity, autocorrelation)

**說明:**

此處迴歸進階議題研討，暫定在以下三個子題

(1) Omitted variable bias (OVB): 缺失變數偏誤

(2) Collinearity (Multi-collinearity): (多重)共線性

(3) Nonlinearity – log/quadratic form: 非線性

(指用非線性函數來描繪 *y* 與 *x* 的關係，像 log 函數，二次函數等)

上列的另外兩個主題較深，本課程可能只會簡單帶到，此兩主題為

(4) Heteroskedasticity: 異質變異

(5) Autocorrelation: 自我相關

此兩個進階主題一般是在研究所的計量課中討論

**Part 4 – Advanced topics*** (depending on students' interests and time)

- Basic time series analysis (AR, VAR, Cointegration)
- Limited dependent variable models (logistic model)

**說明:**

按時間與同學興趣,我們擬僅挑出一兩項與財金數據分析較為相關的模型作研討題材

- Grading (provisional):

- Homework (perhaps evaluated by quizzes): 25%
- Midterm Exam (the first half of this course): 25%
- Presentation (of your practical homework with EViews work, or reading on FinTech topics or successful cases): 25%
- Final exam or report (reading a paper, conducting your own research, etc): 25%

- Teaching assistants: 蔡祥恩

- Some basic questions

**Probability and statistics**

1. What are the basic probability distributions? List some of them and describe their relations.
2. What are the probability distributions that are related to statistics? How are they constructed?
3. What are the difference between descriptive statistics (敘述統計) and inferential statistics (推論統計)?
4. What is an estimator (of population mean or population variance) (估計量)? What does it mean by an unbiased estimator (不偏估計量)?
5. What are the most fundamental tests (檢定)? What are the null and alternative hypotheses (虛無假設，對立假設)? What are test statistics (檢定統計量)? How do you decide whether to reject a null hypothesis? How do you define *p*-value?

**Finance**

1. How do you define stock returns?

2. What is CAPM (capital asset pricing model)?

- Time table

| 週次 | 日期 | 老師 | 主題 |
|---|---|---|---|
| 1 | 2/26 | 繆維中 | 課程簡介 |
| 2 | 3/5 | 繆維中 | 機率分配與統計檢定 |
| 3 | 3/12 | 林昌燿<br>李盈儀 | XQ，CMoney 資料庫教學 |
| 4 | 3/19 | 李盈儀 | Python 入門教學<br>TEJ 資料庫教學 |
| 5 | 3/26 | 繆維中 | 統計檢定 |
| 6 | 4/2 | 清明節放假 | |
| 7 | 4/9 | 繆維中 | 統計檢定，ANOVA 檢定 |
| 8 | 4/16 | 繆維中 | 選擇權定價模型簡介<br>BS 公式與希臘字母的推導與應用 |
| 9 | 4/23 | 期中考週 | |
| 10 | 4/30 | 李盈儀 | 迴歸 1-單複迴歸 |
| 11 | 5/7 | 李盈儀 | 迴歸 2-dummy |
| 12 | 5/14 | 李盈儀 | 迴歸 3-stepwise |
| 13 | 5/21 | 李盈儀 | 迴歸 4-複迴歸進階議題 |
| 14 | 5/28 | 李盈儀 | 迴歸 5-複迴歸進階議題 |
| 15 | 6/4 | 李盈儀 | 進階 1-單根與共整合 |
| 16 | 6/11 | 李盈儀 | *進階 2-logistic (暫定) |
| 17 | 6/18 | 李盈儀 | *進階 3- AR (暫定) |
| 18 | 6/25 | 期末考週 | |