

Introduction

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Outline

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Administrative Details

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Class Website

- Class website:
http://www.hec.unige.ch/scaillet/cours_stats/contents_stats.htm
- Check the website OFTEN. ALL announcements will be posted there!
- **BEFORE TP 1**, please read the Introduction to MATLAB chapter in the TP section of the webpage. Play around with the M-Files to gain familiarity with the software
 - In the first computer session, we will review MATLAB concepts while doing TP 1
- **Take The Review Quiz!!** If you feel you have some difficulties, consult the basic Probability and Statistics section in the References link

Outline

- Introduction
- A. Static (Marginal) Analysis
 - A.I. Descriptive Statistics
 - A.II. Kernel Estimation of Densities
 - A.III. Asymptotic Properties
 - A.IV. Linear Regression
 - A.V. Application to CAPM
 - A.VI. Application to APT
 - A.VII. Life Cycle Models and CCAPM
 - A.VIII. Optimisation Algorithms
 - A.IX. Kernel Estimation of Cond. Mean
 - A.X. Applications: Sensitivity Analysis of Var and ES
 - A.XI. Introduction to Extreme Value Theory
 - A.XII. Scoring Procedures
 - A.XIII. Bootstrap Procedures

Outline

- B. Dynamic (Conditional) Analysis
 - B.I. Stationary Processes
 - B.II. Innovation of a Process
 - B.III. ACF, PACF and ARMA Models
 - B.IV. Nonlinear AR Models B.V. Conditional Var and ES
 - B.VI. ARCH Models
 - B.VII. Stochastic Volatility Models
 - B.VIII. Exponential Smoothing Methods
 - B.IX. Multivariate Extensions
 - B.X. Nonstationary Series
 - B.XI. ARFIMA Models
 - B.XII. Cointegration

Questions in Financial Econometrics

The course is dedicated to

financial econometrics

We will address questions such as

- How distributions of financial assets look like?
- How to summarize the information about their shape?
- How can we explain return behaviour in terms of other economic variables?
- How individual stock returns behave when stock market moves?
- How can we estimate factors affecting stock returns?
- How is it possible to conduct estimation and sensitivity analysis of standard risk measures used in financial institutions?

Questions in Financial Econometrics

- How is it possible to conduct estimation and sensitivity analysis of standard risk measures used in financial institutions?
- How do extreme negative stock returns behave?
- How can we determine the probability of default of a borrower?
- How can we use simulations to better assess statistical properties?
- How can we account for temporal dependence in stock returns?
- How can we model time changing variability of stock returns?
- Is it possible to account for the latest price information when designing measures of risk?
- How do we deal with series with explosive behavior?
- Is it possible to account for long memory in stock returns ?
- Can we find some long term relationships between economic variables?

Why Statistical methods?

Why do we need statistical methods?

They allow for better assessment of financial risks

Sudden increase in financial market risks:

29 : Stock market crash

33 : Glass Steagall banking act Separation between retail banking and investment banking

71 : Bretton Woods Breakdown of fixed exchange rate system

Passage to floating exchange rates

73 : Oil price shock, Volatile interest rates 87 : Stock market crash (breakdown of portfolio insurance, pronounced volatility smile ever since)

Development of Financial Derivatives

Development of financial derivatives:

Help to better hedge financial risks

72 : FX futures traded on International Monetary Market (IMM) and at Chicago Mercantile Exchange (CME)

May 73 : Options on stocks traded on Chicago Board Options Exchange (CBOE) founded by members of Chicago Board of Trade (CBOT)

75 : GNMA futures (CBOT) 77 : Treasury bond futures (CBOT)

82 : Options on T-bond futures (CBOT)

83 : Stock index options (CBOE)

Option Pricing Theory

Birth of option pricing theory:

Answer the need to put a price on derivative assets.

May 73 : Black-Scholes paper on option pricing (geometric Brownian motion based on no-arbitrage arguments, PDE approach)

76 : Cox and Ross (alternative processes, probabilistic approach)

79 : Harrison and Kreps (« elegant » martingale approach, general theoretical understanding)

Regulatory Actions

Regulatory actions :

74 : Collapse of Herstatt bank,

Basel committee on banking regulations and supervisory practices
founded by central banks of G-10 countries

Jul 88 : Basel accord

First step toward tighter risk management and international
risk-based capital adequacy standards

Goals: Secure bank deposits,
 Control of credit risks

Regulatory Actions

Two minimum standards for meeting acceptable capital adequacy requirements:

- ① An assets-to-capital multiple, which measures the overall bank's capital bank adequacy.
- ② A risk-based ratio, which focuses on credit risk associated with specific on- and off-balance-sheet asset categories.

Risk-based ratio = Solvency ratio
= Cooke ratio

defined as the ratio of capital to risk weighted on-balance-sheet plus off-balancesheet exposures, where weights are assigned on the basis of counterparty credit risk.

Regulatory Actions

Hence: Capital ≥ 8 of risk weighted assets

Control of credit risks but

- Static approach
- Diversification and netting effects ignored
- No market risk

89 : EU solvency ratio and own fund directives

91 : Federal deposit insurance corporation (FDIC) improvement act

Apr 93 : First proposal of the building block approach, now called standard method

Goal : control of market risks

Decomposition : Commodity risk, FX risk, interest rate risk, equity risk \Rightarrow Still static but incorporate some diversification

Mar 93 : Capital Adequacy Directive (CAD) by EU council

Disaster Period

Disaster period:

Development of off-balance-sheet instruments (derivative assets) leads to severe losses (lack of pricing knowledge, of risk management systems)

Feb 93 : Showa Shell: USD 1580 million in currency forward

Jan 94 : Metallgesellschaft: USD 1340 million in oil futures

Apr 94 : Kashima oil: USD 1450 million in currency forward

Dec 94 : Orange County (Bob Citron): USD 1810 million in reverse repo

Feb 95 : Barings (Leeson): USD 1330 million in stock index futures

External Reactions: Regulators

External reactions: Regulators

93 : G-30 report «derivatives : practices and principles»

May 94 : General accounting office report

94 : Derivatives policies group «framework for voluntary oversight»

Apr 95 : Proposal by Basel committee for

a) use of internal model in market risk measurement

b) reduction of credit exposures by bilateral netting procedures.

Jan 96 : Amendment of Basel accord (internal models). Becomes effective in Jan 98: “BIS98”

External Reactions: Regulators

Jun 98 : CAD 2 by EU council

a) Internal model approach:

Authorities recognized in BIS98 the complexity of correctly assessing market risk exposure, especially for derivatives products, such as options.

Flexibility in the modeling of the many components of market risk is now allowed.

External Reactions: Regulators

Sophisticated institutions, namely institutions with independent risk management function in place and sound risk management practice may choose between

- standard model proposed by the Committee = “standardized approach”

- own “internal VaR model” = “internal model approach”

Capital to run a bank should be directly linked to risk measures (capital = multiple of the VaR computed on a ten-day horizon)

Incentive to design efficient proprietary VaR measurement systems in order to capture diversification effects by realistically modeling the dependence between positions

External Reactions: Regulators

b) Netting procedures:

Generally speaking, when trading partners agree to offset their positions or obligations, we say that they are netting.

They reduce a large number of positions or obligations to a smaller number, and it is on this netted position that the two trading partners settle their outstanding obligations.

In the financial community, positions are most of the time netted inside standardized legal contracts.

Streamlining of documentation has taken place as a result of joint efforts by regulators and financial industry organizations.

In 1990, BIS issued minimum standards for the design and operation of netting schemes. They are known as the Lamfalussy standards after the chairman of the Committee that wrote the report.

External Reactions: Regulators

In 1991, the Federal Deposit Insurance Corporation Improvement Act (FDICIA) provided support for netting contracts among banks and other financial institutions.

In 1992, the International Swaps and Derivatives Dealers (ISDA) issued its first version of the well-known “ISDA Master Agreement” for over-the-counter (OTC) derivatives markets.

Its amended versions are still in force between most market participants around the globe today.

The term netting is used to describe the process of offsetting mutual positions or obligations e.g. to offset an obligation owed by bank A to bank B with an obligation owed by bank B to bank A.

External Reactions: Regulators

Netting can be either

- bilateral or multilateral,
- monocurrency or multicurrency,
- monoprodukt or multiprodukt.

Netting can bring significant benefits for balance-sheet purposes, capital usage, credit risk and operational efficiencies.

Besides reducing transaction costs and communication expenses, netting is important because it reduces credit and liquidity risks, and ultimately systemic risk.

Taking an offsetting position subject to a netting agreement is thus related to credit risk mitigation.

The tendency of the regulator is to allow wider range of credit risk mitigants to avoid the so-called "domino effect" in the financial sector.

Internal Reactions

Internal reactions :

January 92: Warning by Jerry Corrigan (President of NY federal reserve bank) leads to a request by Dennis Weatherstone, chairman of JP Morgan.

He asked his staff to deliver him a daily one page report indicating risk and potential losses over the next 24 hours across the bank's entire trading book.

⇒ synthetic internal report containing risk measurement figures

This report, the famous "4.15 report" was to be given to him at 4.15 each day after the close of trading.

To meet this demand JP Morgan staff had to design a neat methodology to measure risks across different trading positions across the institution, and aggregate these values into a single number.

Internal Reactions

Number derived from standard portfolio theory using estimated standard deviations and correlations of financial asset returns, as well as the normality assumption.

Hence birth of JP Morgan Riskmetrics in Oct 94 and shared freely on the web.

Nowadays in most banks there exist sophisticated risk measurement systems

These systems increase the transparency of banking activities.

Banking activities are complex, difficult to understand and risky.

Internal Reactions

Opacity of activities yields an increased risk premium and thus a discount on stock value.

Hence there is need to improve Asset Liability Management (ALM) to alleviate this discount.

Good risk assessment allows disentangling risks and eliminating those which we do not wish to take.

It allows concentrating on core business and avoiding unnecessary risks by adopting an adequate hedging strategy.

This will help to achieve a better picture of the intrinsic business performance of the firm.

Impact on Corporate Reporting

Impact on corporate reporting:

1997: US securities and Exchange Commission issued disclosure rules for the use of derivative securities.

This was essentially dictated by their concern about undisclosed risks lurking in off-balance-sheet instruments and their influence on corporate health (cf disaster period).

The rules allow corporates to choose one of three possible ways of disclosing risks from derivatives use: a tabulation of the fair market value, a sensitivity measure or VaR.

The availability (free or not) of VaR systems has without doubt helped corporate to match these new reporting rules.

Consequently VaR practice is now widely embraced by the non-financial sector and one can read about VaR calculations in the annual reports of many large companies.

The Future?

The future?

The new Basel Capital Accord (see the 2001 consultative document) scheduled for 2006?

Focus on use of internal models for credit risk measurement.

Significant changes in the complexity of wholesale and retail products, and risk management practices

Hence in January 2001, the Committee issued a proposal for a new capital accord (the Accord).

Expected introduction in the members of the EU through an EU Directive by the end of 2006.

The Future?

Three mutually supporting pillars form the basis of the new Accord:

- Pillar 1 describes the calculations for regulatory capital for credit, operational and market risk.
- Pillar 2 is therefore intended to bridge that gap between regulatory and economic capital requirements and gives supervisors discretion to increase regulatory capital requirements if weaknesses are found in a lender's internal capital assessment process.
- The aim of Pillar 3 is to allow market discipline to operate by requiring lenders to publicly provide details of their risk management activities, risk rating processes and risk distributions.