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LRISK

Data-mining: new paradigm on the trading-floor

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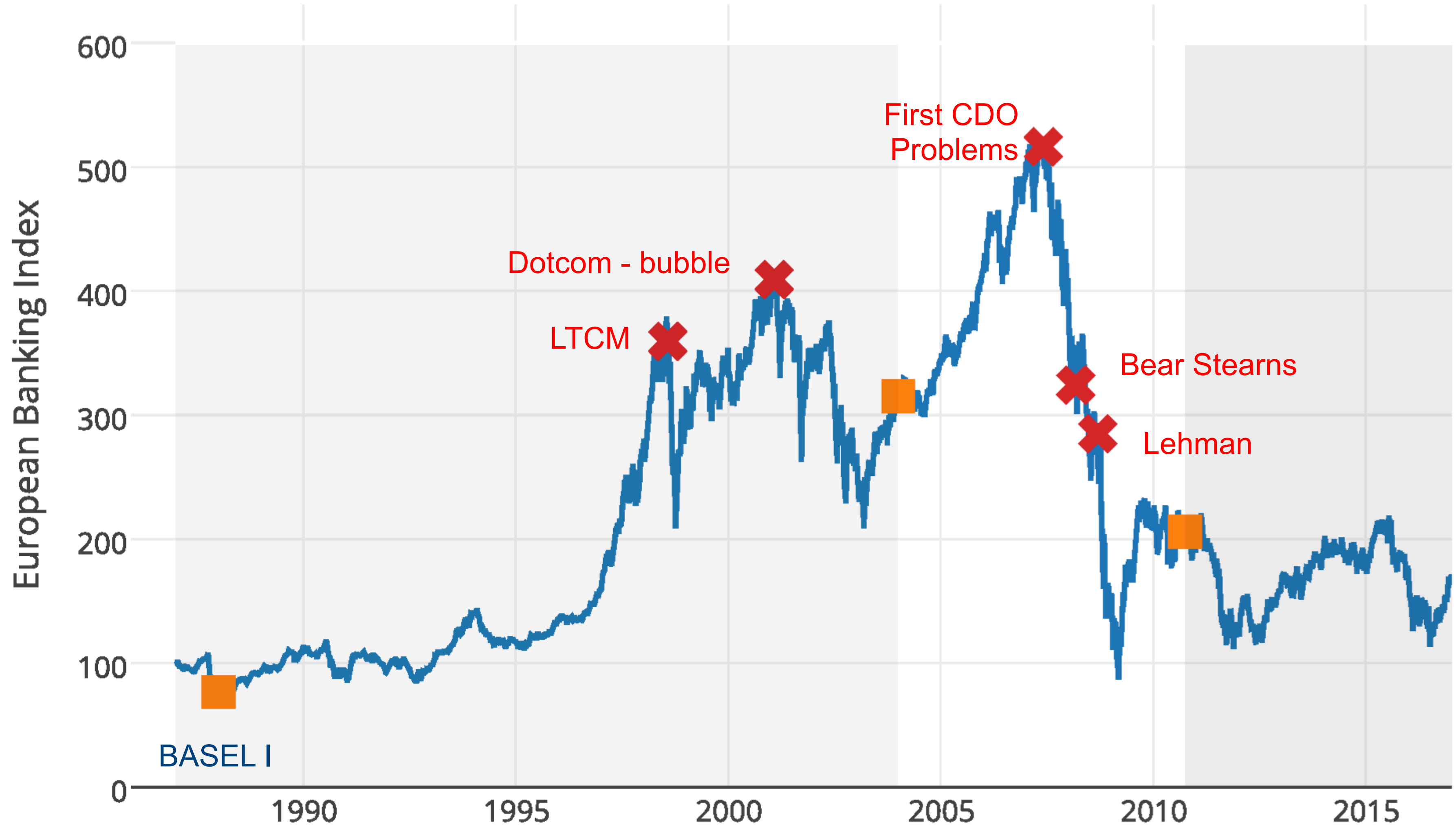
KU Leuven

Dept. of Mathematics

January 12, 2017


European Banking Index
600
500
400
300
200
100
0
1990
1995
2000
2005
2010
2015
First CDO
Problems
Dotcom - bubble
LTCM
Bear Stearns
Lehman
BASEL I

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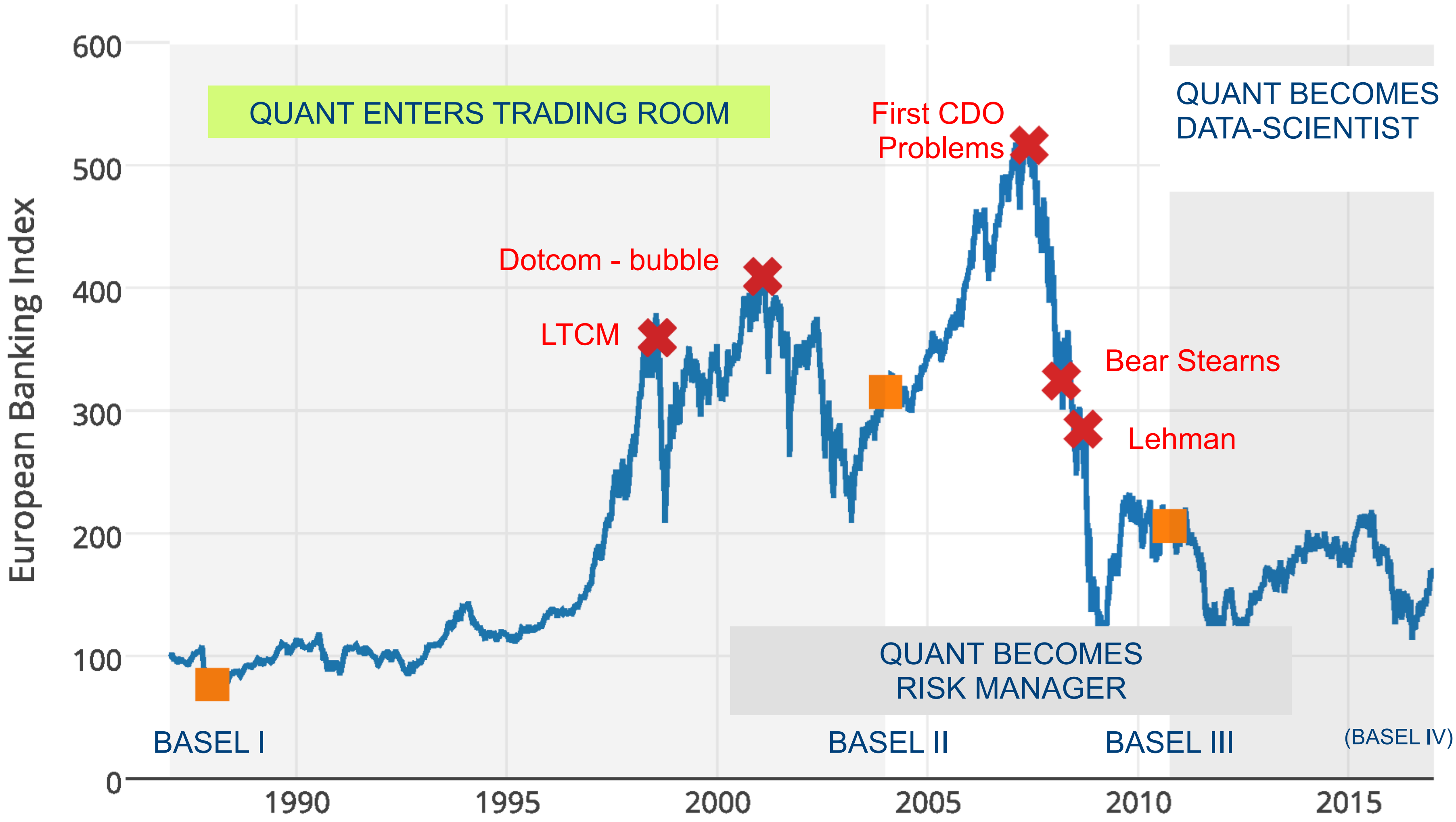
Each time BIS responds ...

Bank of International Settlements
Basel , Switzerland

banks adapt...



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QUANT ENTERS TRADING ROOM
QUANT BECOMES DATA-SCIENTIST
QUANT BECOMES RISK MANAGER
First CDO Problems
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Lehman
BASEL I
BASEL II
BASEL III
(BASEL IV)

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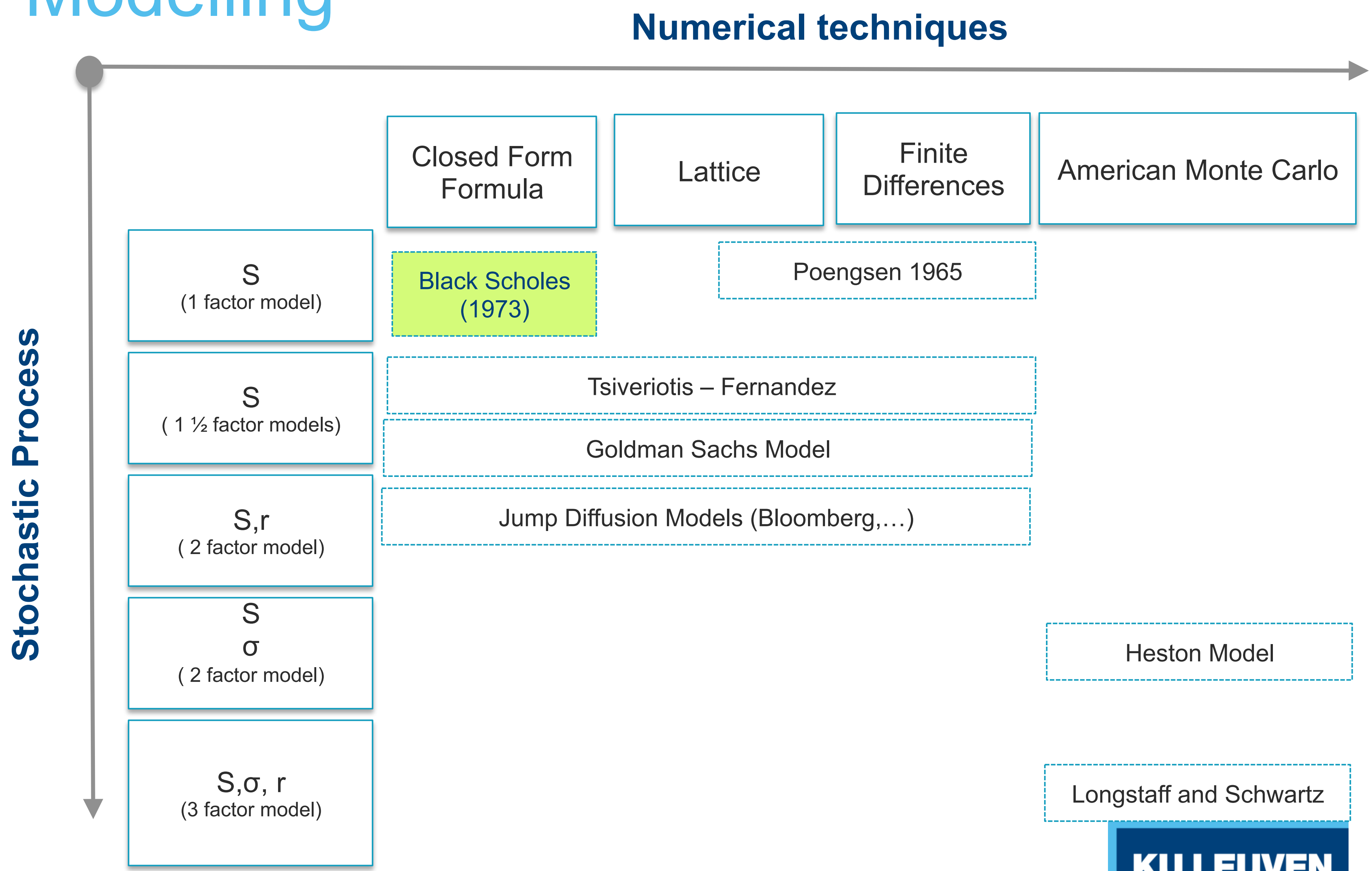
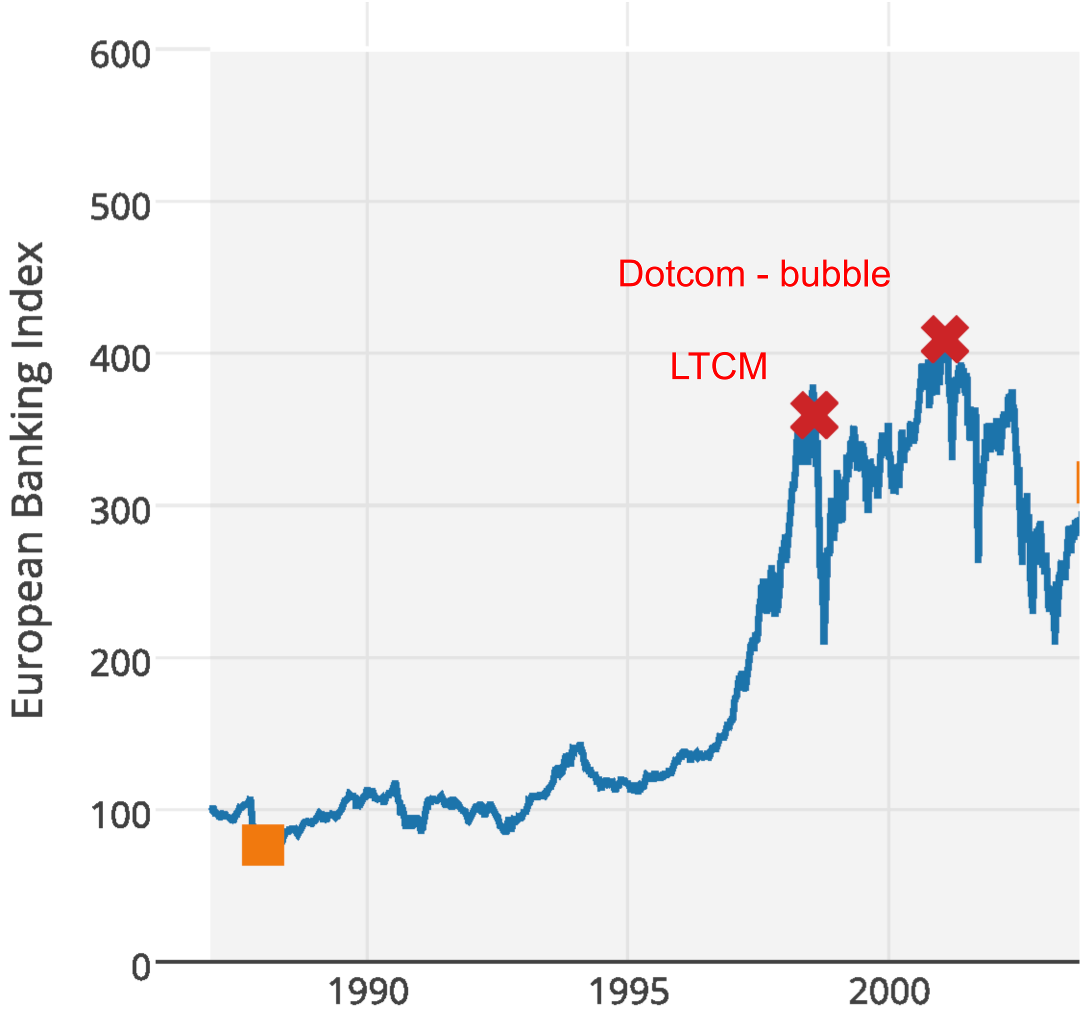
QUANT ENTERS TRADING ROOM

- 1973 Black Scholes model
- 1983 computers enter trading room
- Entry of the Quant / Rock-Scientist
- Focus on derivatives pricing and hedging ("modelling")

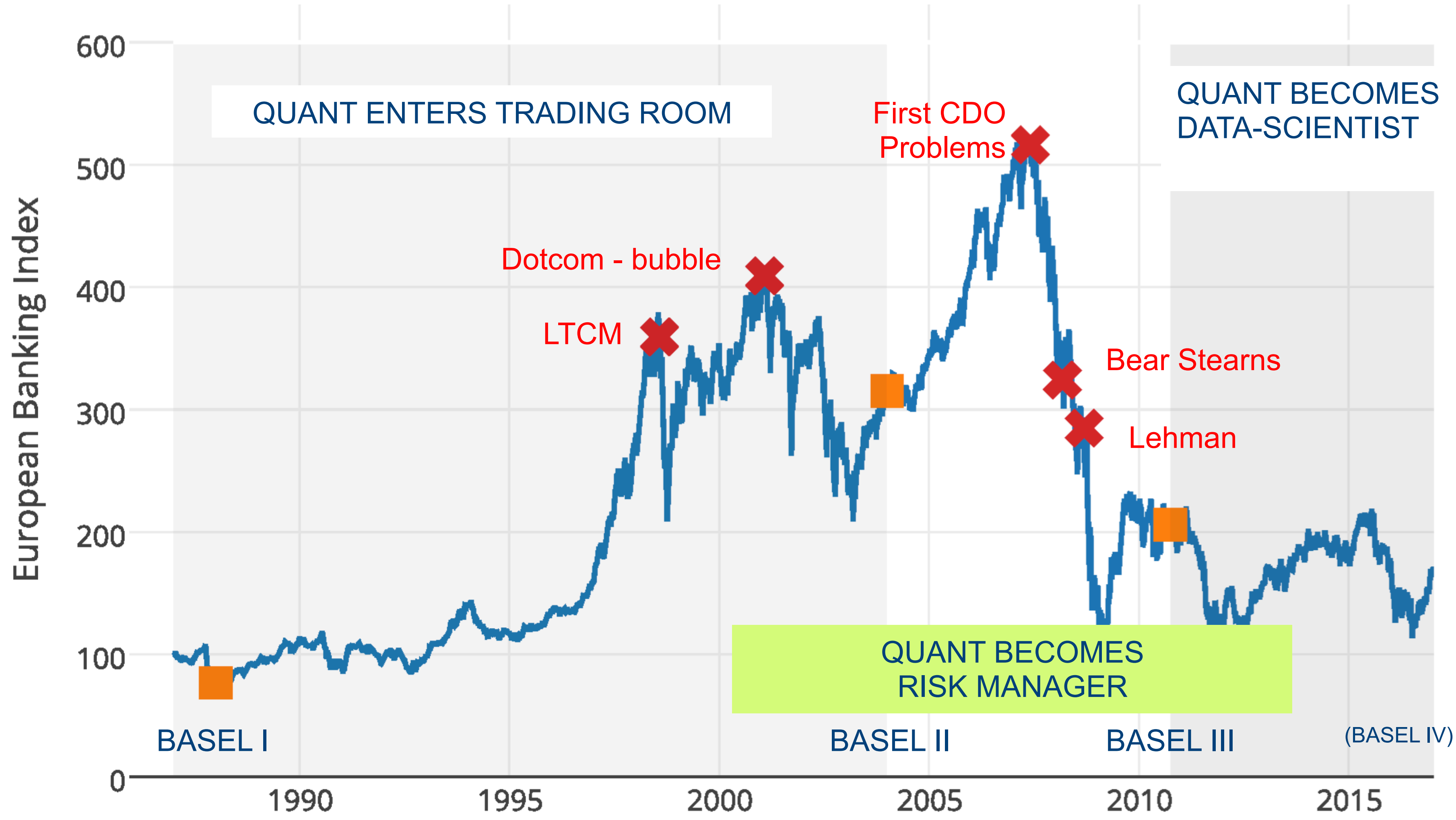
Modelling


Numerical techniques
Stochastic Process
Closed Form Formula
Lattice
Finite Differences
American Monte Carlo
S
(1 factor model)
S
(1 ½ factor models)
S,r
(2 factor model)
S
σ
(2 factor model)
S,σ, r
(3 factor model)
Black Scholes (1973)
Poengsen 1965
Tsiveriotis – Fernandez
Goldman Sachs Model
Jump Diffusion Models (Bloomberg,…)
Heston Model
Longstaff and Schwartz

QUANT ENTERS TRADING ROOM



- LTCM (1998) was the first warning signal things could go wrong
- When everybody is using the same model, bubbles get created and burst



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Quant becomes a risk manager

- 2004:
  Basel II allows capital ratios to be calculated using internal models
- Capital Ratio
  - Capital Ratio = Capital / RWA
  - Minimum Level 8%
  - RWA = Risk Weighted Assets
- Consequence:
  - Value at Risk entered the trading floor
  - Technology was lagging, hence corners being cut
  - CDO structuring becomes popular

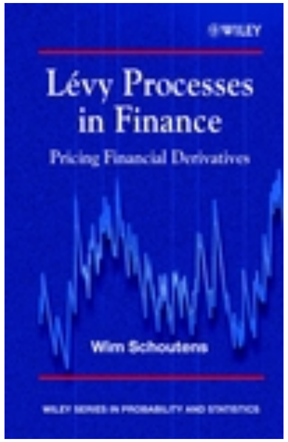
Quant becomes a risk manager

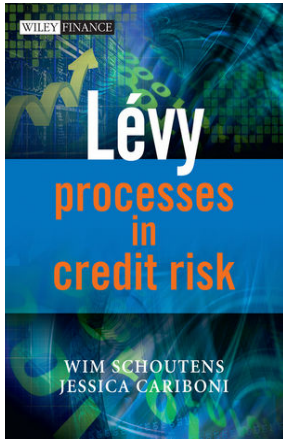
- Basel III (2010)
  - limits the risk-taking of banks
  - new products are developed
    - CoCo Bonds
    - Bail-In capital
- Other regulations
  - AIFMD
  - UCITS
  - MIFID
  - EMIR
  - FRTB
  - ...

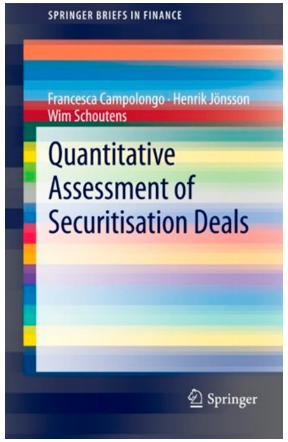
Banks' IT department are 100% engaged implementing this new environment

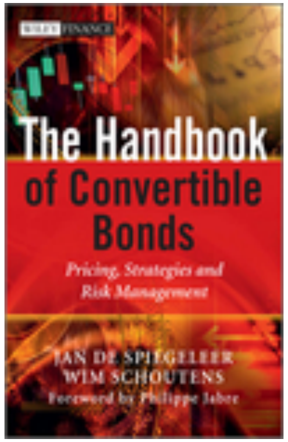
Opportunity for FINTECH startups

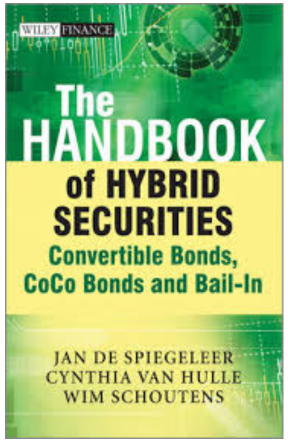
Our research in models & risk

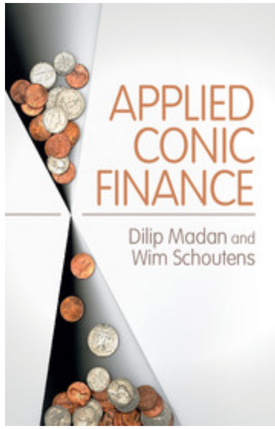




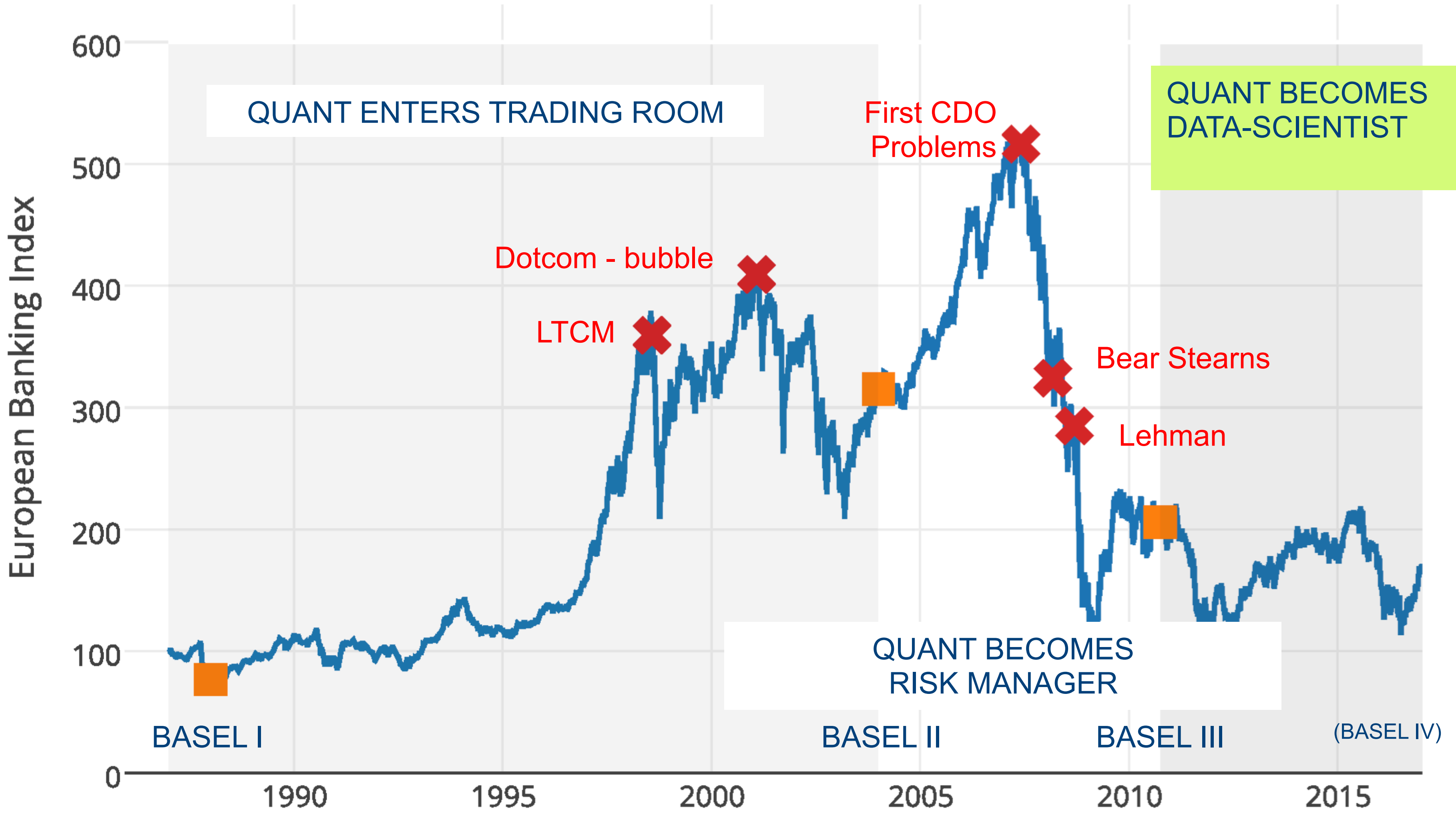








- **Modelling**
  - CoCo Bonds
  - Convertible Bonds
- **Stochastic Processes**
  - Levy
  - Variance Gamma
- **Risk**
  - Bail-In Capital
- **Liquidity**
  - Conic Finance



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Quant becomes data-scientist

	1983-2004	2004-2010	2010...
Quant	trading & models	risk management	data-scientist
Data	time-series : share prices, interest rates, ...		cross sectional data: - time series - news feed (twitter, websites)
Infrastructure	client - server		cloud (storage and calculations)
Software	dedicated portfolio management systems (expensive)		data-analytics tools widely available (cheap)
Algorithms	Black-Scholes	Gaussian copula	
Who	Phd's , Engineers, Mathematicians, Computer Scientists,...		Low barriers to entry

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Low barriers to entry

Microsoft Azure

amazon web services

MATLAB

IBM Watson Analytics

sas THE POWER TO KNOW.

ALGOLYTICS

DBMiner technology inc

hadoop

FUJITSU

NUGGETS® The Data Mining Toolkit

R

tableau

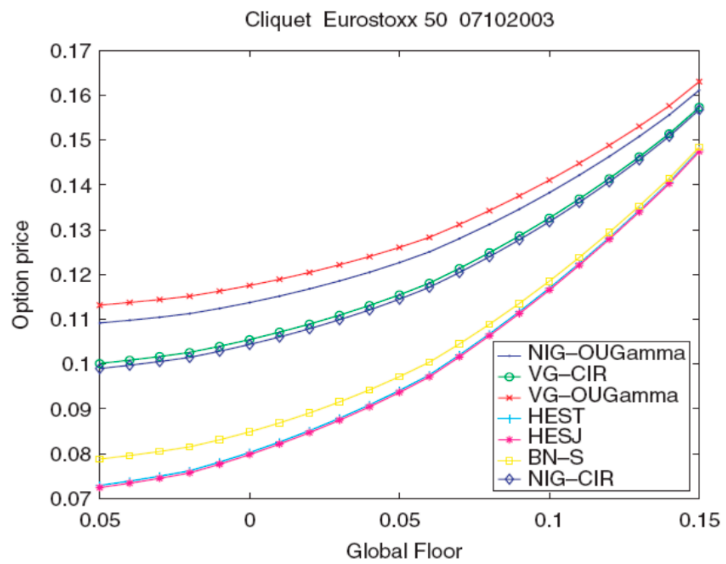
Qlik

python

neo4j

Low barriers to entry

- Every model has assumptions and its limitations
- Lessons from the past : perfect calibration does guarantee an adequate price of the financial product.

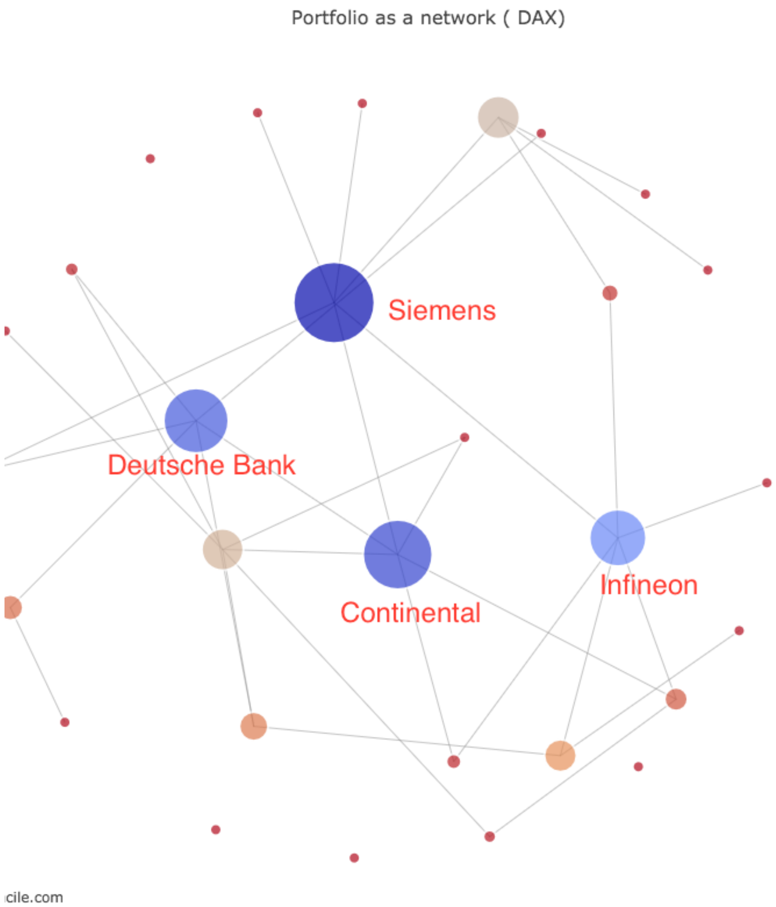


Dept.Mathematics

Some case studies

Portfolio as a Network

- Using network metrics in portfolio analysis
- Brings more insight to the trading desk
- Example:
  - DAX 30 index
  - 4 stocks drive the market

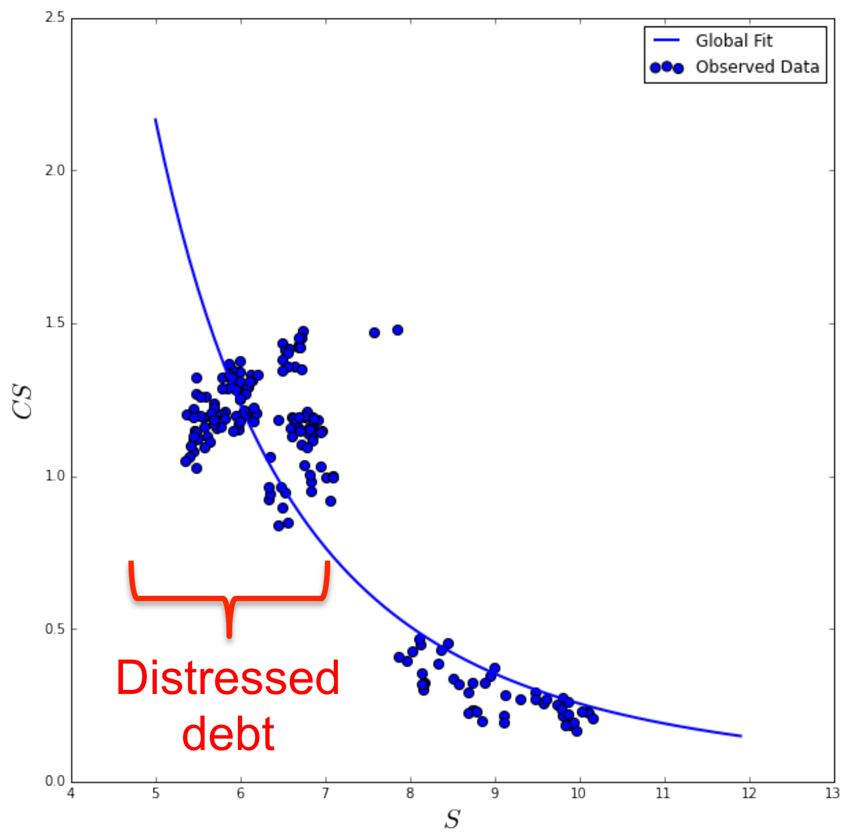


Liquidity of Convertible Bonds

- Post Basel III:
  Liquidity in the markets has dropped
  - Dodd-Frank (US)
  - CRDIV (Europe)
- For most (convertible) bonds there is no trading venue

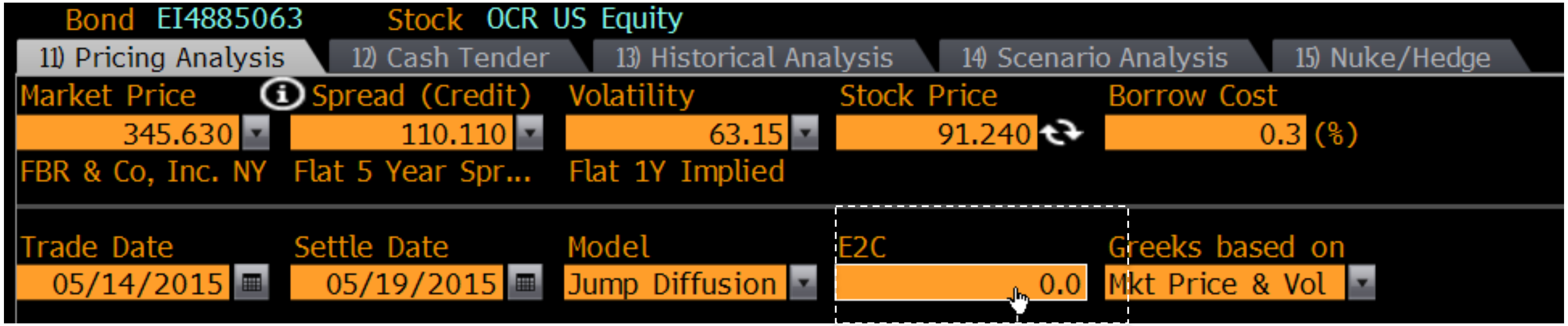
- Using data on US convertible bond quantify what is driving liquidity ?
  - seniority
  - credit quality
  - underlying share
  - age of the bond
  - ...

Capital Structure Arbitrage



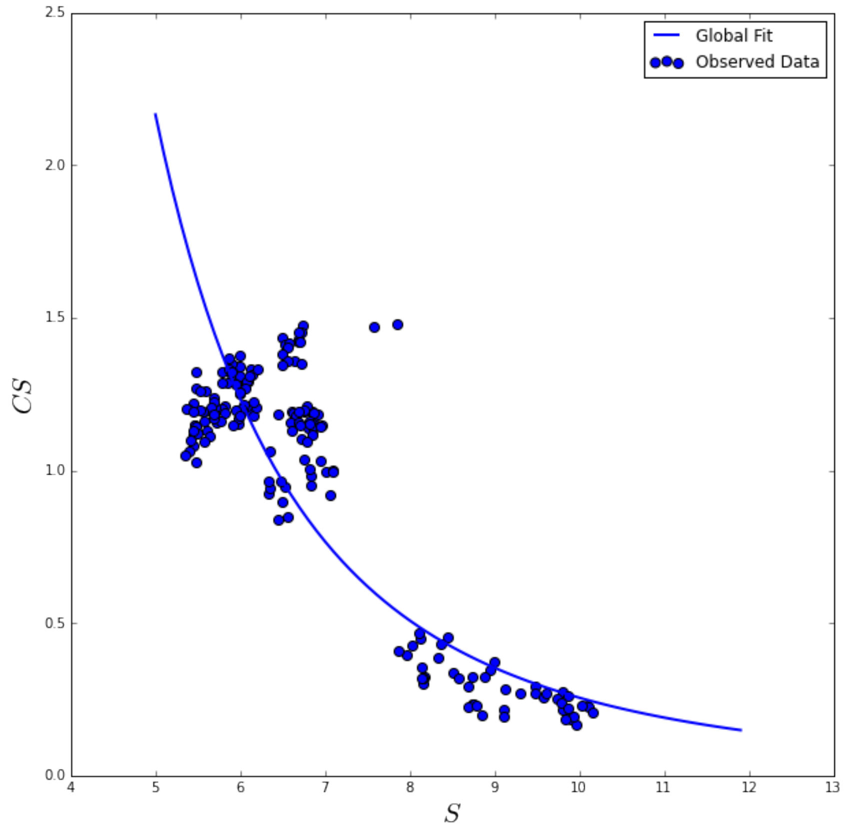
- Financial institutions will hedge bonds with shares
- Rely on Equity / credit relationship
- Clustering has to be used

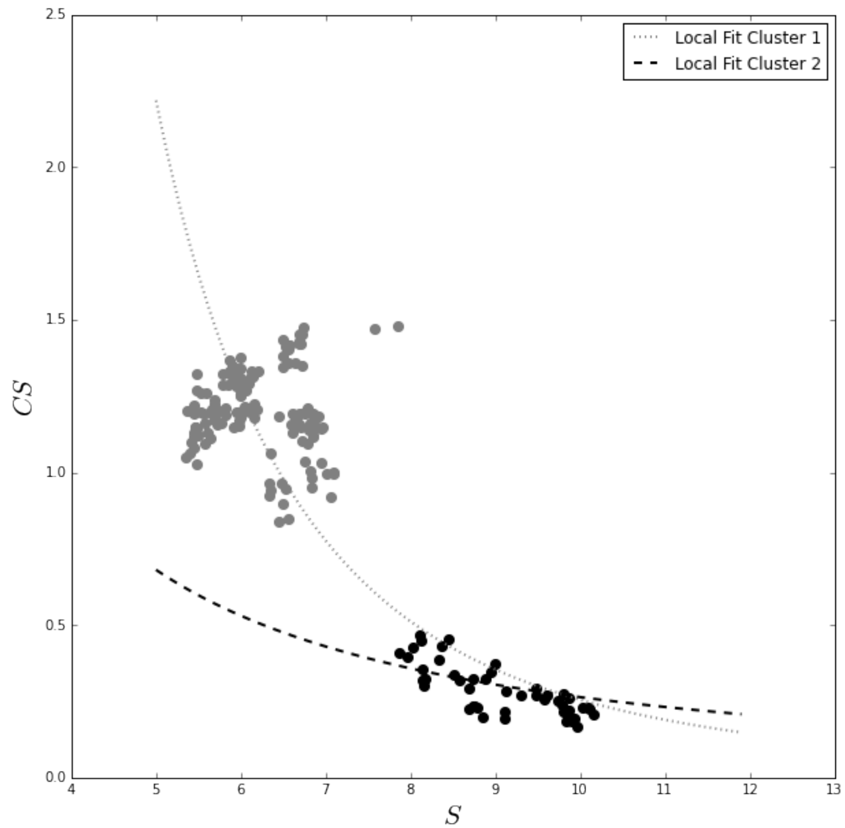
Capital Structure Arbitrage



source: screenshot from Bloomberg's CB valuation model

Capital Structure Arbitrage



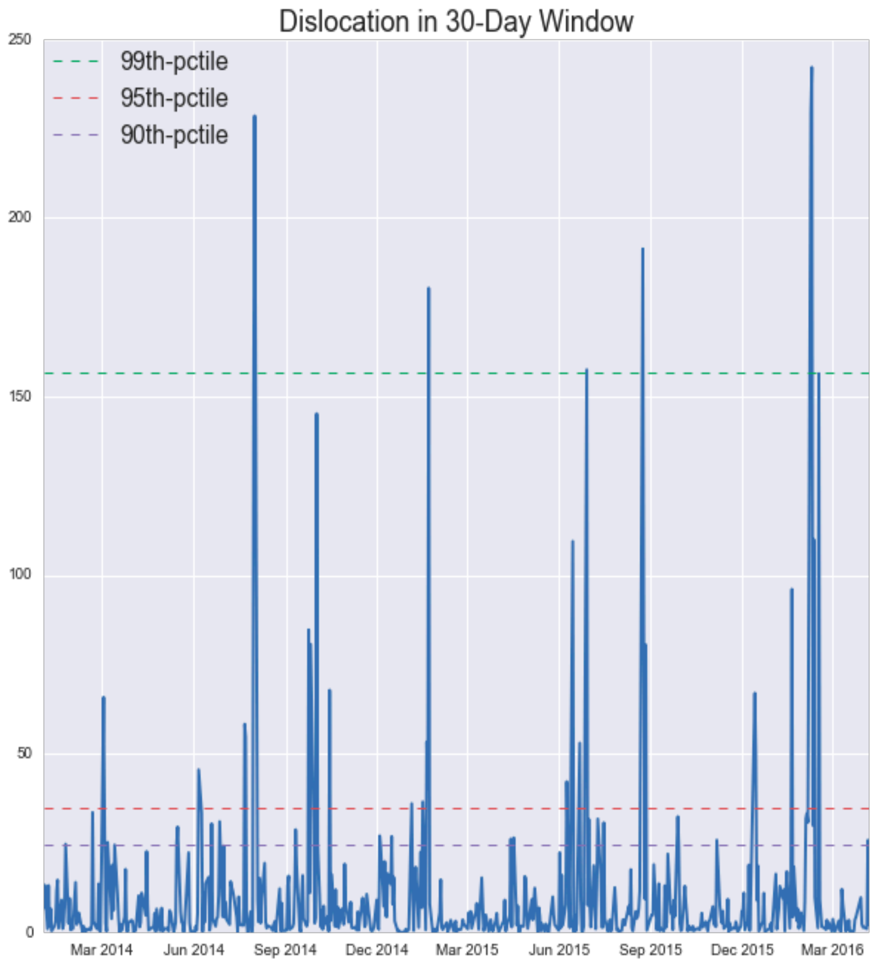


Fraud Analytics

- Using data analytics and robust statistical techniques in early stage detection of
  - payment fraud
  - insurance fraud

- Chair holders
  - Prof. Verdonck (Factulty of Sciency)
  - Prof. Baessens (Faculty of Economy)

Dislocation in a rolling 30D-window



- Using robust statistics (Minimum determinant covariance method), one can measure the dislocation of a financial instruments
- Trading & risk management purposes

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LRisk

Leuven center for research, training and advice in the field of insurance and financial risk analysis combining all relevant KU Leuven expertise:

- offers multidisciplinary approach to the study of insurance and financial risks, with experts from actuarial and financial mathematics, statistics, economics, finance and law, …
- collaborates closely with other leading universities and research centers in the field, see our international ties;
- maintains close connections with the actuarial and financial industry, built on a broad community of alumni.

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