The Actuarial Profession
making financial sense of the future

Risk and investment conference 2010
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**Lessons we have
learned regarding risk
management modeling**

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Lessons from crises: academic research

- Academic research is often presented as one of the guilty party of the current crisis.
- **Financial economics** is primarily about concepts. One major conclusion is that excess return cannot be generated without taking systematic risk, risks that CANNOT be diversified away.
- **Financial mathematics** is another branch of modern finance originating in option pricing and dynamic hedging. It developed powerful models. In particular they assume that markets are liquid with continuous prices. Parameters of the processes must be estimated using past and present data. Even if future volatility can be inferred from current option prices, the assumption is that this volatility estimates are good estimates of future volatility. In turn, these models are used to implement sophisticated risk management systems.

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Mathematics and finance

- Over time finance has become more mathematics and less economics. In itself such a trend is not bad, but increased model sophistication gives a false sense of security and makes models appear as infallible black boxes. It is sad to see that many concepts such as VaR and risk management are poorly understood by board of directors and top management of financial institutions, rating agencies or regulators.
- Riskless profit?

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Lessons from crises

- Market crash of 1987 (Portfolio Insurance,…) :
  - Illiquidity can fail models badly
  - estimated parameters such as delta/hedge ratio can be very wrong ex-post, especially with disruptions in market volatility.
- Demise of LTCM in 1998
  - Illiquidity can fail models badly
  - All models are primarily based on past data (possibly adjusted); estimated parameters can be very wrong ex-post especially with disruptions in market volatility.
  - Correlation is extremely important in risk management. Market crashes can lead to extreme rise in correlation across all markets.
- Financial Tsunami of 2007/2008
  - Illiquidity can fail models badly
  - All models are primarily based on past data (possibly adjusted); estimated parameters can be very wrong ex-post especially with disruptions in market volatility.
  - Correlation is extremely important in risk management. Market crashes can lead to extreme rise in correlation across all markets.

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## Implication of recent market situation

- Illiquidity: implies serial correlation (big losses followed by big losses)
- Periods of high volatility: amplitude of Profit/Losses increases because higher sigma.
- Return distributions are not unconditionally normal: Fat tails, etc…
- High correlation across assets: amplitude of Profit/Losses increases, because no diversification of risks

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Daily VAR and daily realized Profit&Loss

VAR BACK-TESTING USING THE REGULATORY SCOPE DURING 2008 VaR (1 DAY, 99%) IN MILLIONS OF EUROS
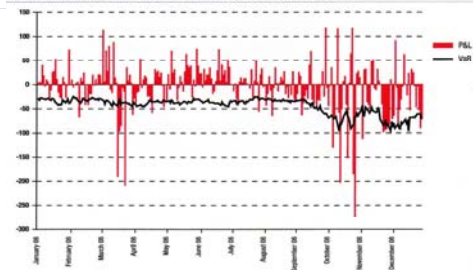
2008 Registration document - SOCIETE GENERALE GROUP

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The case of SocGen 2008 (Annual report)

- Daily VaR at 99% implies that in a year, the daily loss should exceed VaR around 2 or 3 days per year (1% of 250 trading days). In 2008, it happened 26 days.
    - Periods of high volatility
    - Illiquidity induced serial correlation
    - Dramatic increase in correlation across markets/asset classes (loss of diversification benefits) has an huge impact on P&L.

Example of the impact of correlation rise

- One trade of 100, with daily σ of return 1%, VaR at 99% is 2.326 (*Investment $\times \sigma \times$ 2.326*)

- Ten uncorrelated trades (ρ = 0): then daily σ of return 0.316%, VaR at 99% is **7.35**

- (*Investment $\times \sigma \times$ 2.326 = 1000 $\times$ 0.316% $\times$ 2.326 = 7.35, not ten times 2.326*)

Example of the Impact of Correlation Rise

- Assume now that Correlation is actually One between the ten trades. Then daily σ of return 1% *(no diversification benefits)*, VaR at 99% is **23.26** (*ten times 2.326, the VaR of each project*).

- Further assume that markets volatility has doubled to a daily 2%. VaR at 99% is **46.52** (*1000 $\times$ 2% $\times$ 2.326*).

    - VaR rise from **7.35** to **46.52.**

Recent academic research (very partial)

- I believe that we focused too much on modeling individual asset prices/risks, and not enough on modeling correlation (except on CDOs).
- "Extreme Value Theory" brings useful contribution.
- A seminal paper: "Extreme Correlation of International Equity Returns ", F. Longin and B. Solnik, *Journal of Finance*, April 2001.
- Yes, extreme events are rare, but there are techniques that allow to get better estimations and models of correlation during crises. That is a very fruitful area of research.

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Fat and Quant

- Quant is desperately needed for "normal" risk management. It simplifies life but may give a false sense of security.
- Risk managers live in the « fat tails » and they also need quantitative tools in those fat tails. Common sense is needed to « fly » the starship in this space, but that is not enough, you also need instruments.
- Stress-testing ...

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Final words

- I also believe that education has badly failed.
- Risk management models are based on assumptions and estimated parameters. When these assumptions (illiquidity) and parameters (past data not good estimates of future) fail, one needs to adapt very quickly.
- Institutions were risk management was a "culture" and top management was well "educated" fared much better than others.
- The mission of researchers is not only to build further black boxes, but also, and maybe more importantly , educate the whole institutions (from traders/asset managers to top management) in terms that they can understand.
- There is no alternative to quantitative techniques.

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