Some thoughts on today's modelling shortfall

Workshop on Understanding Financial Catastrophe Risk

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Agenda

- Background
  - The problems
- Tools
- Questions, shortfalls

Background

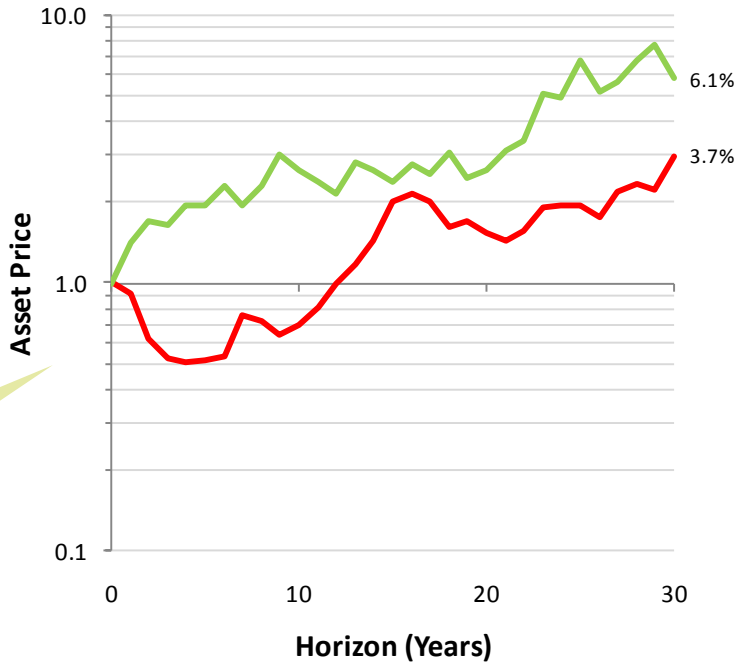
My perspective on financial catastrophe:

- Long-term savings industry (life & pensions)
- Various model applications
  - Market-consistent valuation
  - Projection e.g. capital, savings goals
  - Risk management
- Ultra-long horizon, path dependent
- Many risk factors
- High model / parameter risk
- Catastrophic scenarios for life and pensions

How are stochastic models used by financial intermediaries?

- Balance sheet management
  - What are the liabilities worth?
  - What mis-match between asset & liabilities?
  - How much risk capital required?
- Product design
- Product communication

Q: You save $1000 / month over 30 years. Which profile of returns would you prefer?



Background: Solvency II

- Part of worldwide move towards risk-based capital
- Gridlocked
  - Awareness of procyclical nature of chosen capital measure
  - Belated awareness and debate on impact of market pricing reality on legacy business models
  - Conflicting regulatory objectives
- Liquidity, ‘pseudo’-prices, “irrational” volatility

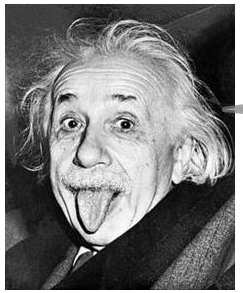
Current models

- “Crude” (low-dimension) representation of real-world asset prices
- Considerable *library* of models rates, equity, credit, FX
- Complexity / Simplification
- Statistical / Structural
  - Copula vs model structure

Greenspan / Turner

Let's blame the modellers

- Calibration to an inappropriate past period.
- 'Misplaced reliance on sophisticated maths'
  - Models were too complex for top management to understand.
  - Models were too simple to capture complex risk exposures.
- Mathematical sophistication created false assurance.

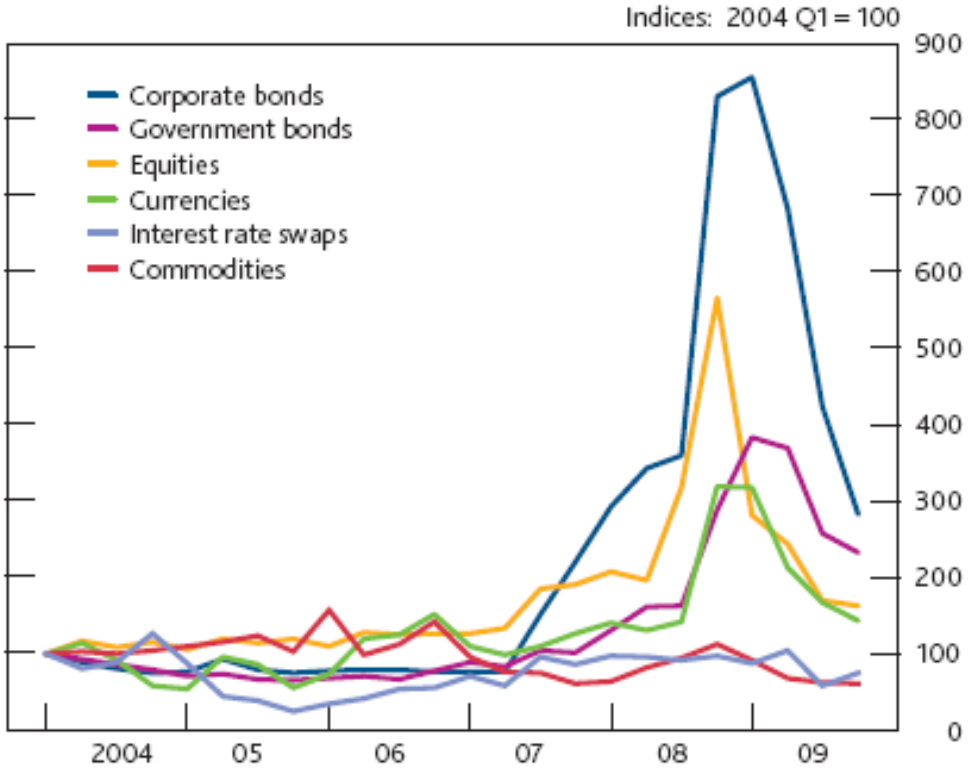


Everything should be made as simple as possible, but not simpler.

- Probably the biggest challenge for modellers is their interaction with firm management, regulators and accountants.
  - Complexity or simplicity?
  - Gaming and behavioural bias.

Liquidity & asset prices

Chart 1.8 Bid-ask spreads on selected assets[a][b]

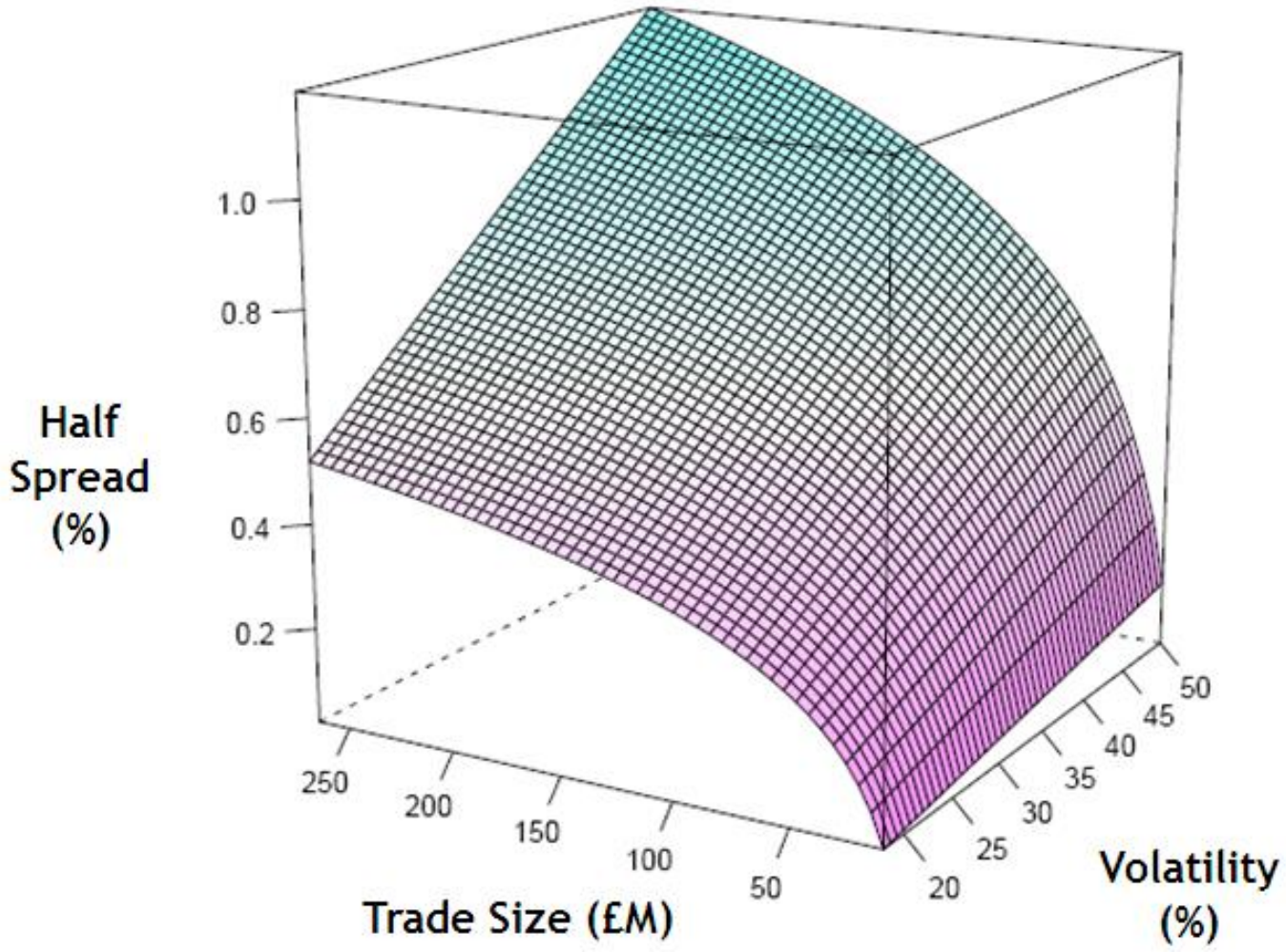


Sources: Bloomberg, UBS Delta and Bank calculations.

(a) Quarterly averages of daily bid-ask spreads. 2009 Q4 based on quarterly average to date.
(b) iBoxx € Corporates for corporate bonds; iBoxx € Sovereigns for government bonds; S&P 500 for equities; euro/dollar exchange rate for currencies; euro five-year swaps for interest rate swaps; and gold price for commodities.

*Source: *Bank of England Financial Stability Report December 2009*

A dealer's estimate of trading costs



Key challenges

- Dependence
- Stochastic asset premia
- Yield curves under stochastic risk premia
  - Evolution of ‘real-world’ curve
  - Evolution of price of derivatives
- Real-World projection and risk-neutral pricing models
- Behavioural challenges

Directions

- Risk premia appear to be stochastic (and driven by systematic factors)
  - Variation in discount rates as a primary source of risk
  - Endog / Exog?
- Liquidity effects are important in determining prices and sensitive to distress / uncertainty
  - ‘New’ thinking is not yet mainstream
- Transmission mechanisms
  - Flight-to-Quality
  - Flight-to-Liquidity
  - Flight-from-Leverage
- Leverage / borrowing as measure of system vulnerability

Resilience

- To what extent does the use of technology and increased connectedness of the global economy reduce resilience and increase financial market risk?

Events & responses

- Risk exposures are driven by
  - Events
  - Response of some system to an event / shock
- This observation triggers two different sets of questions:
  - What events are possible (given our limited observations)?
  - How will the system respond to a particular shock? Is the resilience / fragility of the system changing? Can the way the system responds be changed by action?

Events & responses

Event #1: Mount Tambora's eruption in 1815 was 1000-times more powerful than Eyjafjallajokull

Event #2: The solar 'super-storm' experienced in 1859

Both extreme and "*outside the realm of regular expectations*" but also possibly quite different in their impact in 2012 compared to the 19th century (on transport systems, satellites & power generation etc..).

Alternative capital measures

- An insurer holds a single unhedged position in a written 10-year put option with a strike at 90% of the current index level. Some alternate measures of capital as follows:
  - VAR measures at 1, 2 and 3 year horizons
  - A run-off capital requirement (the PV of the shortfall at the specified confidence level)
  - A conditional tail expectation (CTE)
- Consider the following alternatives:
  - Volatility is stochastic but its initial value is set to be LOW
  - Volatility is stochastic but its initial value is set to be HIGH
  - Equity returns are assumed to incorporate some 'mean reversion' which will limit the tails of long-horizon equity distributions.