Risk Management Beyond VaR

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Why Risk Management Has Lost Credibility
What a Difference a Decade Can Make!!

Published: 1996

Against the Gods: The Remarkable Story of Risk
Peter L. Bernstein

Published: 2007

The Black Swan: The Impact of the Highly Improbable
Nassim Nicholas Taleb

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Against the Gods – The Remarkable Story of Risk
The Limits of Distributional Analysis

VaR at the 99% Confidence Level

1% probability
The Central Limit Theorem

The mean of a sufficiently large number of independent random draws from a stable distribution, with finite mean and variance, will be approximately normally distributed.
The Limits of Distributional Analysis

There be dragons!

TBD
Op risk and Black Swans

Scarce data is a well-recognised problem for the assessment of operational risk. In such circumstances, David Rowe argues, it is necessary to blend professional judgement with the available data. In doing so, however, it is crucial to counter some well-documented psychological biases in our subjective estimates of probability – and a healthy dose of humility is also advisable.

Nassim Nicholas Taleb (2004) makes an interesting distinction between what he calls type 1 and type 2 environments. He defines a type 1 environment as one where most of the contribution to randomness comes from the body of a distribution (let’s say the middle 99.9%). This broadly characterises randomness in the physical world, where the normal distribution is common. A type 2 environment is one where most of the contribution to randomness comes from a small number of extreme events in the tails. Taleb argues that our social environment increasingly resembles his type 2 classification.

If this view is correct, it has some disconcerting implications for our ability to apply classical statistical methods to social and financial data. In particular, studying the bulk of observations in the ‘body’ of a distribution can be misleading. This is particularly true in the context of operational risk, where rare events can have a disproportionate impact.

Embrace humility

In the end, it is necessary to estimate a required capital amount on the best basis possible. One reasonable way to proceed is to use actual observed losses on an industry-wide basis as a starting point for the potential range of possible adverse outcomes. This means avoiding the temptation to accept the “It can’t happen here” attitude. Certainly, people at Barings or Allied Irish Bank would have said the same thing before their well-publicised losses occurred. Where judgement may be useful is in assessing the quality of an organisation’s control structure.
Nassim Taleb’s Main Point

Projecting far into the tails of a theoretical distribution estimated to fit the middle 99% or 99.9% of the data is not a valid procedure.

Imposing a mathematically tractable distribution on the problem imposed the hidden assumption of rapid attenuation in the tails.

This is what makes it mathematically tractable.
Assessing the impact of stress events

The Stress Testing Trident

• The market’s greatest hits.

• Endogenous stress scenarios (Achilles Heel approach)

• Imagination
Some of The Market’s Greatest Hits

- Oct 1973  First OPEC Oil Shock
- 1979     Iranian Revolution & Second OPEC Oil Shock
- Aug 1982  Mexican Debt Crisis
- Sep 1985  The Plaza Accord to weaken the USD
- Oct 1987  Black Monday in US Stocks
- Sep 1992  Speculative Attack on the European ERM
- Feb 1994  Dramatic Federal Reserve Tightening
- Jul 1997  Thai Baht Collapse → Asian Currency Crisis
- Aug 1998  Russian Default → Emerging Market Debt Crisis
- Sep 1998  Long-Term Capital Management Failure
- Jan 2002  Argentine Peso Devaluation
- Mar 2008  Bear Stearns Rescue
- Sep 2008  Lehman, AIG, FNMA & FHLMC Collapse
- Apr 2010  Greece Sovereign Downgrade → Euro Crisis
Assessing the Impact of Stress Events

The Stress Testing Trident

• The market’s greatest hits.
  + Addresses concerns of management who remember past crises
  + It is not credible to say “This couldn’t happen,” because it has
    - Is backward not forward looking
    - May not reflect the CURRENT portfolio’s vulnerabilities
Assessing the impact of stress events

The Stress Testing Trident

• Endogenous stress scenarios (Achilles’ heel approach)

...a bank should also develop its own stress tests which it identifies as most adverse based on the characteristics of its portfolio...

The Stress Testing Trident

- Endogenous stress scenarios (Achilles’ heel approach)
  - Focuses on the vulnerability of current positions
  - Allows judgmental definition of stress scenarios
  - Leverages output of Monte Carlo VaR estimates
  - May not capture every possible vulnerability
Assessing the impact of stress events

The Stress Testing Trident

- Imagination
  - Euro crisis (Italian or Spanish Default)
  - Political upheaval in Russia or China
  - Closure of the Straits of Hormuz or an attack on the Saudi oil fields
  - A nuclear device goes rogue or Kim Jong Un loses it completely
  - A volcanic collapse in the Canary Islands creates a mega tsunami on the U.S. East Coast.
Assessing the Impact of Stress Events

The Stress Testing Trident

• Imagination
  + Is explicitly forward looking based on current geo-political and market conditions
  + The resulting scenarios may appear more plausible
  + Thinking out loosely causal scenarios can highlight early warning signals to watch
  - May not reflect the current portfolio’s vulnerabilities
Beyond Comparative Statics

“The only reason for time is so that everything doesn’t happen at once.” - Albert Einstein

Too often we don’t think beyond Comparative Statics. (Indeed, the discussion so far falls into that mode.)

Real systemic crises don’t happen overnight. They develop and unfold over time.

Certainly the crisis starting in 2008 did so.

Brainstorming loosely causal sequences of events and potential reinforcing feedback loops is an essential part of the Imagination approach to Stress Testing.

The military does this quite effectively in what are known as war games.
Statistical analysis can **extract** information from data, it **cannot create** information not already contained in the data.

Stated more casually:

Like water, **information cannot rise higher than its source.**
Beware of Statistical Entropy

EVERYWHERE and ALWAYS, this is extraction of information. It can NEVER create information.

Data

Information
Risk Estimates Based on Historical Data Become Progressively Less Reliable

Further Innovations (e.g. Compound Repackaging, CDO\(^2\)) Increased Complexity

Achieving Greater Volume Required Relaxing Underwriting Standards

A Unique Innovation Generated Attractive Returns

Growth in Volume

Self-Referential Feedback – The Subprime Boom

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Self-Referential Feedback – The Subprime Bust

Defaults are Magnified by the Inflated Volume of Poorly Collateralized Mortgages

Credit Losses Hurt Bank Earnings

More Stringent Credit Conditions and Increased Liquidation Sales

An Initial Economic Shock

Compound Economic Impact

Home Price Declines

Eliminated statistical independence

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Some Points In Passing

- The role of supernodes:
  - in promoting stability in normal times but creating vulnerability to periodic crisis
  - as a conduit for spreading contagion
- Complexity breeds opacity and, thus uncertainty
  - When it’s dark outside – SLOW DOWN!
- History doesn’t repeat itself, but it does rhyme
  - From LIBOR\(^2\) to CDO\(^2\)
- Not all prices are created equal
  - Consider how value could be determined if liquidity fails
Is risk management playing the wrong game?

Most financial risk management measurement is based on classical statistical techniques.

Central to classical statistical theory is the concept of a Stable Random Distribution \( \text{Does this apply here?} \)
Is risk management playing the wrong game?

A better analogy
Is risk management playing the wrong game?
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A better analogy
Is risk management playing the wrong game?

A better analogy

Adaptation
Some Relevant History

US % Chg in GDP (annual rate)

The Great Moderation

The Great Recession

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Some Relevant History

25 years of

- comparatively stable markets due, in part, to the entry of something like a billion people into the global labor force
- public policy reinforced this stability by successfully preventing all but the smallest corrections

bred complacency toward risk

The result was excessive leverage and vulnerability to a loss of market confidence

“History has not dealt kindly with the aftermath of protracted periods of low risk premiums.”

Alan Greenspan (2007)
The Adaptation of Traders

VaR at the 99% Confidence Level

1% probability

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The Adaptation of Traders

• Once VaR became the almost universal metric for measuring market risk, traders had incentives to sell out-of-the-money options to generate returns

• These had little impact on VaR as long as markets were fairly stable, but…

• They represented a significant threat of huge losses in a genuine systemic crisis

• The system we are trying to manage adapts to the measure we put in place to control it.
One Final Thought

- It’s Epidemiology – **Not** Roulette
One Final Thought

• As Larry O’Brien said about politics, so is it true of risk management – there are