Risk management failures in the crisis and other myths

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Outline

1. The crisis
2. Risk management “failures”
3. Lessons learned from the crisis for risk management.
4. A framework for “fixing” risk management.
5. An example from Norway’s SWF
6. Going further - Predicting
7. The alliance for mitigating the next crisis.
The Crisis Causes (depends on who is looking)

IMF Report
“Capital flows provided the fuel which the developed world’s inadequately designed and regulated financial system then ignited to produce the firestorm that engulfed us all.”

BIS and Basel III
Financial crisis caused by:
• Excess global liquidity
• Too much leverage
• Too little high-quality capital
• Inadequate liquidity buffers

Levin-Coburn Report
Found a “snake pit” in the financial crisis rife with:
• Greed;
• Conflicts of interest; and
• Wrong doing.

Siglitz - failure in economic models – but …

B. DeLong
Could not impact WS, MS, Congress
Don’t stop the dancing
Kill pessimistic risk depts.
Didn’t speak in “exec speak”

P. Krugman

N. Roubini

So if risk management didn’t fail, summarize what happened please!

• People failed to use correct available tools
• People preferred simplicity that didn’t work over complexity that did
• Few wanted to stop the music
• Greed dominated fear
• People failed to set and follow up on the regulations
• The financial system (liquidity, leverage, …) made it easy for “animal spirits” to dominate
• And there also was ....

The usual guilty party
<table>
<thead>
<tr>
<th>Failure Type</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Failure to use appropriate risk metrics</td>
<td>• Picking the right risk metric appropriate to questions asked&lt;br&gt;• VaR: does it answer the right question; is it misused; is it abused&lt;br&gt;• Time: is it measured daily, monthly, yearly, longer</td>
</tr>
<tr>
<td>Mismeasurement of known risks</td>
<td>• Possible mismeasurement of known risks including a mistake in assessing the probability of a large loss&lt;br&gt;• A mistake in assessing magnitude&lt;br&gt;• A mismeasurement in correlations&lt;br&gt;• A misidentification of correlation convergence&lt;br&gt;• Without the historical data to evaluate some risks (such as subprime mortgages), risk managers cannot model them using conventional quantitative techniques</td>
</tr>
<tr>
<td>Mismeasurement stemming from overlooked risks</td>
<td>• Risk managers may ignore a known risk because they believe it to be immaterial&lt;br&gt;• It is difficult to incorporate in risk models&lt;br&gt;• They may put risks in silos&lt;br&gt;• New instruments are not properly vetted&lt;br&gt;• Risks are truly unknown or Black Swans</td>
</tr>
<tr>
<td>Failure in communicating risk to top management</td>
<td>Top managers and board set strategy and risk managers must:&lt;br&gt;• provide timely information to the right people&lt;br&gt;• make them understand the risks&lt;br&gt;• not use “black boxes”&lt;br&gt;• judge the right level of risks</td>
</tr>
<tr>
<td>Failure in monitoring and managing risks</td>
<td>• Some risk factors may be very sensitive to market conditions&lt;br&gt;• Quick reaction – within day hedge&lt;br&gt;• Contingency hedging and risk characteristics may change too rapidly</td>
</tr>
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### DSP Rudiments

1. Time series entry and regime construction.
2. Process estimation using history, expert views, implied prices, theories, hypothesis, heuristics, etc.
3. Uncertainty topology construction.
4. Modeling with adjustments and selections and solutions.
5. Multi-process density shaping.
6. Insight, intuition, and understanding through visualization and analysis.

All independent of one another!
### DSP Myths

- The “curse of dimensionality”
- Underlying distributions must be right
- Dynamics are not important
- Optimization solutions are uncontrollable
- Long time to build DSP model
- DSP model is a black box
- Scenarios need to be correct
- DSP is not tractable

See references in papers at end.

### Remedies from Stulz vs. Solutions via DSP

<table>
<thead>
<tr>
<th>Remedies from Stulz</th>
<th>Solutions via DSP</th>
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</thead>
<tbody>
<tr>
<td>Look at longer horizon</td>
<td>Arbitrary with intermediate rebalancing</td>
</tr>
<tr>
<td>Comprehensive integrated risks</td>
<td>With small smart trees/scenarios</td>
</tr>
<tr>
<td>Stress tests for crisis and contingencies</td>
<td>Better than pass fail with reverse tests</td>
</tr>
<tr>
<td>Good risk measures</td>
<td>Capture extremes: e.g. CVaR and more</td>
</tr>
<tr>
<td>Plan for liquidity withdrawal</td>
<td>With changing regimes</td>
</tr>
<tr>
<td>Consider risk concentrations</td>
<td>With changing regimes and CVaR</td>
</tr>
<tr>
<td>Consider herding</td>
<td>With changing regimes and CVaR</td>
</tr>
<tr>
<td>Consider scenarios and extreme events</td>
<td>Low prob/high impact on variable prob tree</td>
</tr>
</tbody>
</table>
## Lessons Learned from the Financial Crisis and Stulz for Risk Management

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Remedy</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track global imbalances</td>
<td>Use macroeconomic information</td>
<td>These were important and often left out of risk management systems</td>
</tr>
<tr>
<td>Old theories failed</td>
<td>New theories</td>
<td>EMH and rational expectations theories failed. We need non-equilibrium theories and others.</td>
</tr>
<tr>
<td>Need better assessment of leveraging, etc.</td>
<td>Enhance stress testing methodology</td>
<td>Stress tests and reverse stress testing methods need improvement.</td>
</tr>
<tr>
<td>Poor communication between risk and senior managers</td>
<td>Risk managers need to learn and apply “executive speak”</td>
<td>It was usually the other way around resulting in missed or poorly understood messages.</td>
</tr>
<tr>
<td>Need better estimations of deviations</td>
<td>Need to consider changing regimes</td>
<td>Regimes are changing and need to be factored into risk management.</td>
</tr>
<tr>
<td>Mismeasurement of known risks</td>
<td>Historical information is not enough</td>
<td>You can’t estimate μ and σ well so you need additional information such as expert views, theories, and implied prices.</td>
</tr>
<tr>
<td>Poor assessment of credit risks and high risk lending</td>
<td>Incorporate extreme movement and non-normal processes</td>
<td>Prices and macroeconomic indicators do not generally follow processes with normal distribution but have fatter tails.</td>
</tr>
<tr>
<td>Imitation implicated in herding</td>
<td>Avoid too much imitation where possible</td>
<td>Imitation in the sense of herding has been implicated in causing crashes in unstable financial systems. Here we add an additional aspect: avoid where possible tracking to the same benchmark everyone else uses.</td>
</tr>
<tr>
<td>Better theories and mismeasurement</td>
<td>Allow processes to change over time and level</td>
<td>They change in reality and need to be mimicked as least probabilistically.</td>
</tr>
<tr>
<td>Need liquidity buffers, assess off-balance sheet exposures, and measure than VaR etc.</td>
<td>A wider view of risk and risk control</td>
<td>Need to consider more risks impacting the portfolio like uncertainties due to politics, fiscal problems, regulations, liquidity, counterparty risks, A&amp;L, new risk measures to capture tail risk, etc.</td>
</tr>
<tr>
<td>Inadequate supervision and prudent policies</td>
<td>Enhancing the risk culture</td>
<td>The risk culture generally needs improvements and better governance.</td>
</tr>
<tr>
<td>Behavioral factors implicated in herding</td>
<td>Need to capture behavioral factors</td>
<td>They played a role in the crisis such as in imitation, herding, irrational behavior, etc.</td>
</tr>
<tr>
<td>Track and assess potential bubbles</td>
<td>Forecast bubbles</td>
<td>It is possible and estimates should be incorporated into risk management.</td>
</tr>
<tr>
<td>Improved risk monitoring</td>
<td>Insight and analysis improvements</td>
<td>Improvements needed in stress testing, sensitivity analysis, and insight appropriate to the situation.</td>
</tr>
</tbody>
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## Addressing the Lessons Learned from the Financial Crisis via DSP

<table>
<thead>
<tr>
<th>Lesson</th>
<th>How DSP can address it</th>
</tr>
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<tbody>
<tr>
<td>Use macroeconomic information</td>
<td>These are entered as additional stochastic processes. When the tree is created, values of these macroeconomic indicators will be generated with dependencies on other factors including prices.</td>
</tr>
<tr>
<td>Failure of classical theories</td>
<td>Non-equilibrium theories and others can be entered via stochastic equation parameters or through econometric equations.</td>
</tr>
<tr>
<td>Enhance stress testing methodology</td>
<td>Stress tests and reverse stress testing methods with stochastics and dynamics can be entered as indicated.</td>
</tr>
<tr>
<td>Risk managers need to learn and apply “executive speak”</td>
<td>It is easy to translate executive speak because you have a variety of objectives and risk constraints over time. An example is sown in the case study.</td>
</tr>
<tr>
<td>Need to consider changing regimes</td>
<td>Enter changing regimes by time and level on the scenario tree.</td>
</tr>
<tr>
<td>Historical information is not enough</td>
<td>You can enter expert views, theories, and implied prices by putting additional constraints on the parameters that generate the tree.</td>
</tr>
<tr>
<td>Incorporate extreme movement and non-normal processes</td>
<td>These can be done by triggering on processes depending on their time and level on the tree.</td>
</tr>
<tr>
<td>Avoid imitation where possible</td>
<td>A DSP model is tailored to each individual institution and naturally avoids imitation.</td>
</tr>
<tr>
<td>Allow processes to change over time and level</td>
<td>This can be done to mimic correlation convergence, herding, concentration (in the case of multiple institutions), etc.</td>
</tr>
<tr>
<td>A wider view of risk and risk control</td>
<td>Uncertainties can be entered by changing stochastics and addressing issues such as political and other risks including contingent liabilities and control multiple risks using CVaR constraints.</td>
</tr>
<tr>
<td>Enhancing the risk culture</td>
<td>The incorporation of DSP into the risk culture is covered below.</td>
</tr>
<tr>
<td>Need to capture behavioral factors</td>
<td>This can be done by adjusting tree generation factors.</td>
</tr>
<tr>
<td>Assess bubbles</td>
<td>See references at end and incorporate scenarios coming from external sources.</td>
</tr>
<tr>
<td>Insight and analysis improvements</td>
<td>There is considerable flexibility because you have the complete stochastic scenarios.</td>
</tr>
</tbody>
</table>
From Ziemba’s Top 10 points
Try to get relative means in the short-term and long-term as best as possible
Mean-variance is useful as a guideline but do not use for ALM models
Do not over bet when a bad scenario might occur unless you have hedges
Need scenario dependent correlations when you have extremes and large drops
Use DSP when you have assets, liabilities, liquidity, taxes, etc. and a lot at stake
Be wary of other methods and closed form solutions and non-normal processes
Do not be concerned with getting all the scenarios right but try to cover the tails etc.
DSP models can be built quickly, cheaply, and accurately and be open with new techs

Kreuser’s Top 12 points to consider
Translate manager risk speak to analytics and not the other way around
Establish a robust risk culture that is mirrored by the analytics
Must include additional information such as theories, implied values, and expert views
Need to consider regime changes
Need a short-term and a long-term view
Assess bubbles/Dragon Kings and include external stress scenarios
Add extremes or stress scenarios as contaminations
Consider not tracking the same benchmark as everyone else
Need excellent analysis tools to build intuition and insight especially for visualization
Move slowly to a full DSP
Use enterprise risk management
Provide a suitable pathway to action

Application to Government Pension Fund – Global of Norges Bank
NBIM benchmarks and 2008 Quarterly Report and Comparison
Adding alternate assets, swaps, oil funds flows

Fig 6: Distribution of “Fixed Benchmark as per NBIM versus “Allowing Rebalancing” in 2025
Fig 7: Distribution of “With only Oil Funds” versus “with Oil Funds, Swaps, Assets” in 2025

DSP exhibits stochastic dominance
Nothing really new here: DSP with some twists (not the yield curve kind)

It accounted for:
- Regime switching
- Momentum
- Mean-reversion
- Dynamic rebalancing
- Stochastics

And would have saved $US 20 billion over 5 months

Model Calibrated Prior to Lehman Collapse
One problem is that many early warning systems are thinking of crises as Black Swans which by definition you can do nothing reasonable about (insurance and/or long put) and wait for (maybe hope for) a crisis to occur.

But financial crises are not (usually) Black Swans.

They are Dragon Kings!

Crises are not Black Swans but Dragon Kings (Sornette)

<table>
<thead>
<tr>
<th></th>
<th>Dragon-Kings</th>
<th>Black Swans</th>
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</thead>
<tbody>
<tr>
<td>Responsibility</td>
<td>Real trigger within or outside system</td>
<td>“wrath of God”</td>
</tr>
<tr>
<td>Event</td>
<td>Identifiable</td>
<td>Unknowable</td>
</tr>
<tr>
<td>Impact</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
<tr>
<td>Quantifiable</td>
<td>Yes, probabilistically</td>
<td>No</td>
</tr>
<tr>
<td>Predictability</td>
<td>Probabilistically</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Mechanism</td>
<td>Feedback</td>
<td>Unknown</td>
</tr>
<tr>
<td>Location</td>
<td>Endogenous</td>
<td>Exogenous</td>
</tr>
<tr>
<td>Failure</td>
<td>Multiple</td>
<td>Single</td>
</tr>
<tr>
<td>System</td>
<td>Complex</td>
<td>Depends</td>
</tr>
<tr>
<td>Strategy</td>
<td>Early warning</td>
<td>Long put option</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and insurance</td>
</tr>
</tbody>
</table>
H1 (FBE): “financial (and other) bubbles can be diagnosed in real-time before they end.”

H2 (FBE): The termination (regime change) of financial (and other) bubbles can be bracketed using probabilistic forecasts, with a reliability better than chance.

FCO hypothesis for diagnosis of bubble ends and regime changes

H1 (FBE): “financial (and other) bubbles can be diagnosed in real-time before they end.”

H2 (FBE): The termination (regime change) of financial (and other) bubbles can be bracketed using probabilistic forecasts, with a reliability better than chance.”
Sornette – Black Swans, Dragon Kings, and Prediction propose that, to understand stock markets, one needs to consider the impact of positive feedbacks via possible technical as well as behavioral mechanisms, such as imitation and herding, leading to self-organized cooperativity and the development of possible endogenous instabilities. We thus propose to explore the consequences of the concept that most of the crashes have fundamentally an endogenous, or internal, origin and that exogenous, or external, shocks only serve as triggering factors. As a consequence, the origin of crashes is probably much more subtle than often thought, as it is constructed progressively by the market as a whole, as a self-organizing process. In this sense, the true cause of a crash could be termed a systemic instability.

Brazo IBOVEST
Forecast: between 10.19.2009 and 12.17.2009 the probability of a regime shift is 95%; between 10.27.2009 and 11.29.2010 it is 60%. Result: the regime shift began within the forecast window. Within this window, the proportion of "good days" started with a peak and declined steeply; also within the window, the growth rate of the price dropped sharply. A large draw-down of 11% in 30 days occurred approximately two weeks after the end of the forecast window.
Brazil Market Studied by FCO!

Bubble Experiment

BVSP

Sept. 29, 2011  Northfield Research Conference - Sao Paulo

Brazil IBOVESPA

Forecast

Realized

Sept. 29, 2011  Northfield Research Conference - Sao Paulo
SCAT initiative
Sovereign Crises Alert Transmitter
An initiative to alert sovereign institutions to potential crises by transmitting information between the sovereign, The RisKontral Group, the Financial Crisis Observatory, and back into policy action.

Predicting crises and translating them to policy actions to mitigate uncertainty.

Alliance hypothesis for making decisions and policy actions on bubbles and regime changes.

H3 (SCAT initiative – alliance between FCO and The RisKontral Group): Information on bubbles and regime changes can be effectively used to generate trees and overlay models that can be used to develop policies that mitigate their impact.
Extracting this to stress tree to contaminate baseline tree

The Global BUBBLE

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Brazil – Bubbles, crises, regime changes???

Global downturn impacts Brazil economic growth

Brics propose Eurozone rescue package

Currency wars: temporary peace or lull before the storm?

Inflation drives Brazil stocks to bear market?

GDP contraction in the offering?

Inflation

Paul Krugman: 50% chance global economy will enter recession

Brazil interest rates and foreign investment

What can we (central bank, regulator, investment houses, business, etc.) do?

Global adjustment (recession)

Record low unemployment

The hoped for crisis?

Pricess/Wages

Are we or have we already entered a regime switch?

Rate cut roils Brazil’s currency, stock and interest rate futures market.

Exchange rates

Commodity prices

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Brazil – Bubble, inflation, Big Mac Index

The beefed-up index suggests that the Brazilian Real is the most overvalued currency in the world;

We propose to study the forces, bubbles, regime switches, their quantification, and their mitigation.

Contact: kreuser@RisKontroller.com
References and info:

FCO:  http://www.er.ethz.ch/fco
Risk Center:  http://www.riskcenter.ethz.ch/
Sornette:  http://www.er.ethz.ch/people/sornette

Sornette:  Many books

The RisKontrol Group:  http://RisKontroller.com
and in references at end of presentation

Extracted from full paper to be published by
Bloomsbury Press and in Q Finance Fall of 2011
Check with Kreuser before referencing


