ADAPTIVE STRESS TESTING

Amplify Network Intelligence by Integrating Outlier Information

Financial Risk & Network Theory
Cambridge Centre for Risk Studies Seminar
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Agenda

1. Adaptive Stress Testing Framework

2. Outliers: Signal or Noise?

3. Amplify Network Intelligence
Adaptive Stress Testing: An ecosystem powered by Macro and Micro intelligence

I. **Macro**: identify potential risks (hidden, structural)
   - Stress Library based on Thought Leaders
   - Focus on cycles (e.g., credit bubbles), amplifiers, imbalances, critical points
   - E.g., Robert Shiller: (a) tech bubble (2000), (b) housing bubble (2005)

II. **Micro**: monitor visible risk with market signals
   - Construct Stress Indices using traded factors to represent scenarios
   - Monitor market signals, focusing on outliers and critical points
   - Examples: vol spike in (a) tech stocks and (b) US mortgages & financials

A Social Markets Hypothesis

1. **Macro**: Scenarios from *Innovators*

2. **Micro**: Market signals from *Early Adopters*

Source: Wikipedia; see Geoffrey Moore’s “Crossing the Chasm” *(1999)*
1. Robert Shiller warns of housing Bubble in 2005 (Macro)

2. GS exits subprime (Micro)

Source: Alan Laubsch “Subprime Risk Management Lessons”, RiskMetrics
Three Stages of Risk: U.S. Subprime Crisis

1. When was the biggest risk?

2. And the biggest surprise?

AAA Subprime Bond Spreads (2006-1)

- **First ratings agency downgrades week of July 9 '07**
- **Feb 23 '07: HSBC subprime loss disclosed**
- **Dec '06: first tremor**

1. Hidden Risk
   - Innovators

2. Emerging
   - Early Adopters

3. Crisis
   - Early Majority

1/19/06 4/19/06 7/19/06 10/18/06 1/19/07 4/19/07 7/19/07 10/18/07 22/08 4/22/08
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Joe Farman discovered it in 1980. How could NASA’s satellite scans have missed it?

...scientists expect the first signs of recovery of springtime ozone depletion in the polar stratosphere around the year 2065. (Quirin Schiermeier, “Ozone: The patient is not getting sicker”)
Two theories of crises

Black Swan
(Taleb 2001, 2007)

Dragon King

The future is already here. It’s just not very evenly distributed.
- William Gibson
Case: U.S. Subprime Crisis

see http://www.fnalab.com/data/sam/charts/public/FED_HeavyTails.html#
### Top ten DJIA outliers (1900 to 2008)

<table>
<thead>
<tr>
<th>Date</th>
<th>Residual</th>
<th>Return (%)</th>
<th>Volatility (%)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>26-Sep-1955</td>
<td>-13.3</td>
<td>-6.5</td>
<td>8.1</td>
<td>Eisenhower heart attack</td>
</tr>
<tr>
<td>19-Oct-1987</td>
<td>-12.6</td>
<td>-22.6</td>
<td>32.4</td>
<td>Black Monday</td>
</tr>
<tr>
<td>29-Jul-1927</td>
<td>-10.1</td>
<td>-5.2</td>
<td>8.3</td>
<td>[May 13 German economy collapsed; rise of Hitler]</td>
</tr>
<tr>
<td>13-Oct-1989</td>
<td>-10.0</td>
<td>-6.9</td>
<td>11.4</td>
<td>Collapse of junk bond market</td>
</tr>
<tr>
<td>26-Jun-1950</td>
<td>-8.1</td>
<td>-4.7</td>
<td>9.3</td>
<td>Start of Korean War</td>
</tr>
<tr>
<td>27-Feb-2007</td>
<td>-7.8</td>
<td>-3.3</td>
<td>6.8</td>
<td>Beginning of subprime, China worries</td>
</tr>
<tr>
<td>20-Jan-1913</td>
<td>-7.0</td>
<td>-4.9</td>
<td>11.4</td>
<td>?</td>
</tr>
<tr>
<td>30-Jul-1914</td>
<td>-6.7</td>
<td>-6.9</td>
<td>16.9</td>
<td>NYSE about to close, WW1</td>
</tr>
<tr>
<td>28-Jul-1914</td>
<td>-6.7</td>
<td>-3.5</td>
<td>8.5</td>
<td>Austria’s ultimatum to Serbia, war looming</td>
</tr>
<tr>
<td>15-Nov-1991</td>
<td>-6.6</td>
<td>-3.9</td>
<td>9.6</td>
<td>Program trading losses due to options/futures expiry</td>
</tr>
</tbody>
</table>

27 Feb 2007: subprime spreads to equities, and continues to amplify

Source: Alan Laubsch “Integrated Risk Management - Early Overview”, RiskMetrics
27 Feb 2007: HeavyTails map of major financial institutions & ETFs

www.heavytails.com
Broad fixed income markets infected on 7 June 2007 as Bear subprime hedge funds halt redemptions

See AIG Early Warning HeavyTails Case Study
7 Nov 2007: 14 negative outliers/100 days for AIG, pressured by GS collateral calls as subprime escalates

See AIG Early Warning HeavyTails Case Study
15 September 2008: markets clearly sensed AIG’s vulnerability as it records highest level of outliers

See AIG Early Warning HeavyTails Case Study
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Manage polarities for virtuous cycles

Positive attributes
- Big picture, holistic, ecosystem view
- Long term orientation
- Aware of interdependent risks

Positive attributes
- Agile, quick to respond to change
- Highly focused, fast decisions
- Learning through feedback and data

Downsides if polarities not managed:
- Theoretical, ignores reality
- Slow to learn and adapt
- Rigid frameworks risk breakdown

Downsides if polarities not managed:
- Overfocus, misses big picture
- Reactive, short term decisions
- Uncoordinated, isolated

Outcomes reflect compounding feedback loops which create virtuous cycles or death spirals ("Rethinking capitalism,” Hanauer & Liu, 2012)
Mass collaboration platforms empower social intelligence

"...if you have an idea and I have an idea and we exchange them, then we both have two ideas. It's nonzero." -- Dean Kamen ("Abundance" by Diamandis & Kotler)
Conclusions

- We face unprecedented eco-systemic risks
- Risk management is a common good
- Spark an evolutionary leap in risk culture with collaborative intelligence platforms
Thank You!

FNA

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