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. <u>Macro</u>: 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. <u>Micro</u>: 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*
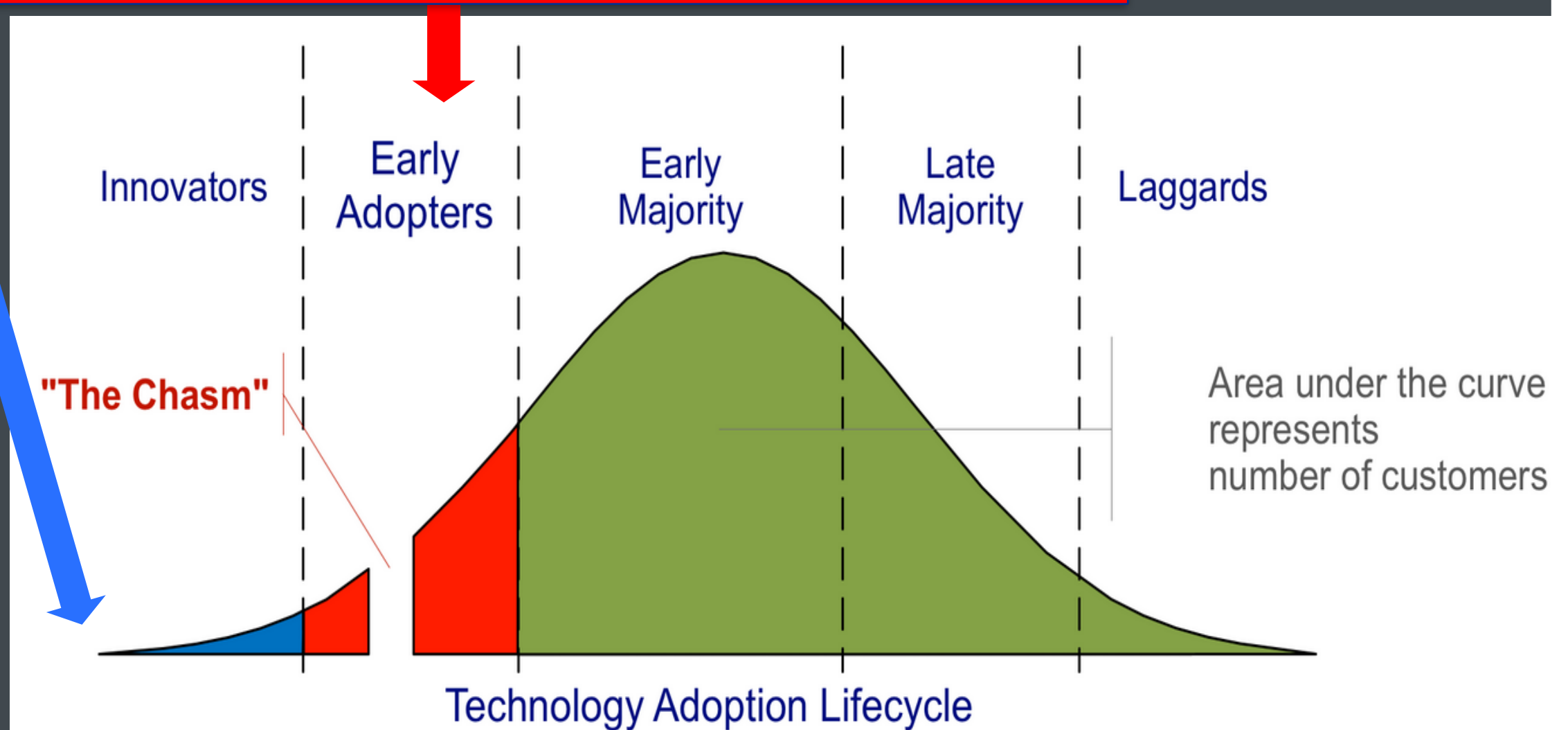
See: *Adaptive Stress Testing: Amplifying Network Intelligence by Integrating Outlier Information* (Laubsch 2014)

A Social Markets Hypothesis
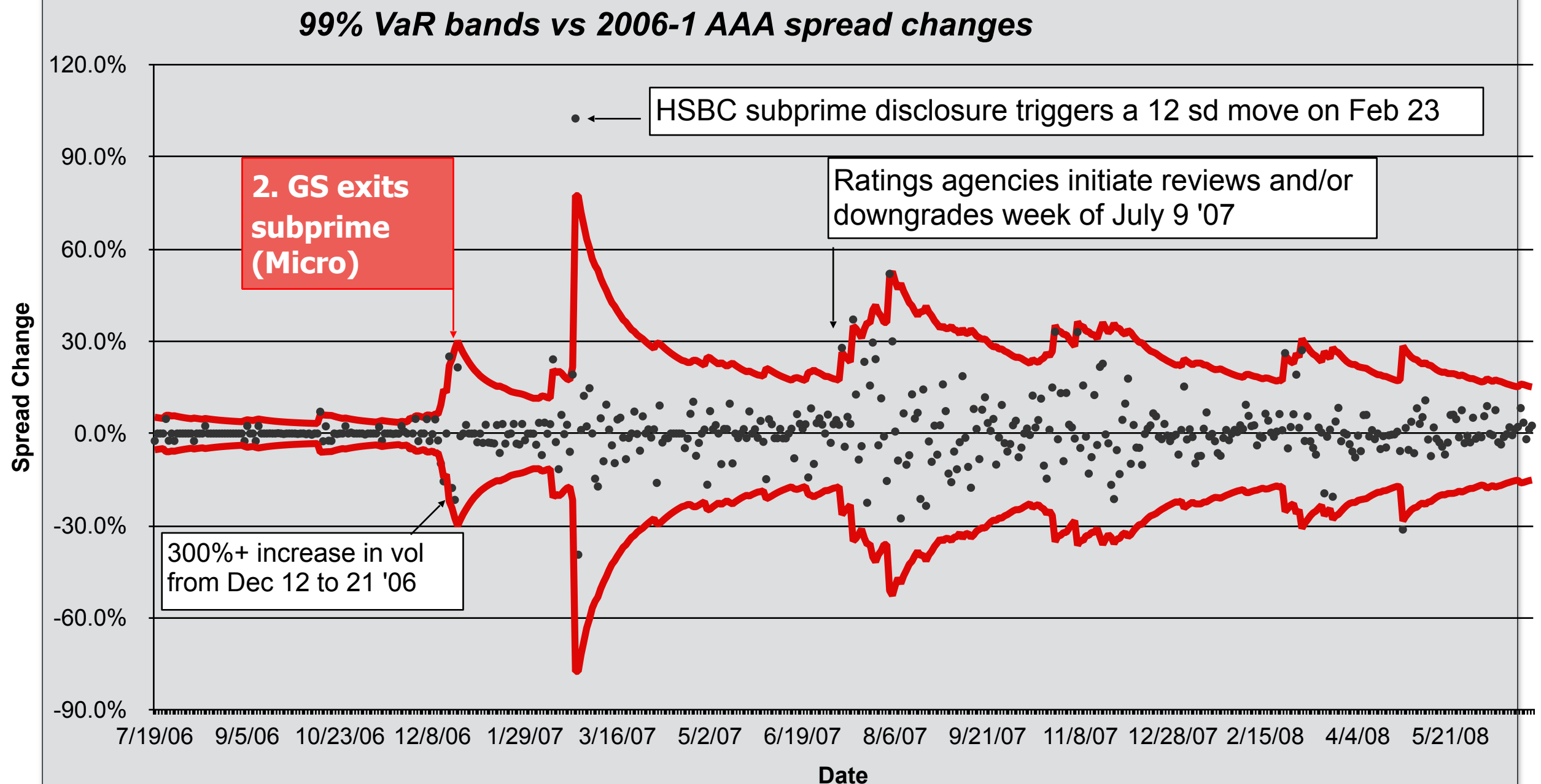
1.**Macro**: Scenarios from **Innovators**

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

Source: Wikipedia; see Geoffrey Moore's "Crossing the Chasm" **(1999)**

U.S. Subprime Bond Early Warning Case Study

1. Robert Shiller warns of housing Bubble in 2005 (Macro)

99% VaR bands vs 2006-1 AAA spread changes

HSBC subprime disclosure triggers a 12 sd move on Feb 23

Ratings agencies initiate reviews and/or downgrades week of July 9 '07

2. GS exits subprime (Micro)

300%+ increase in vol from Dec 12 to 21 '06
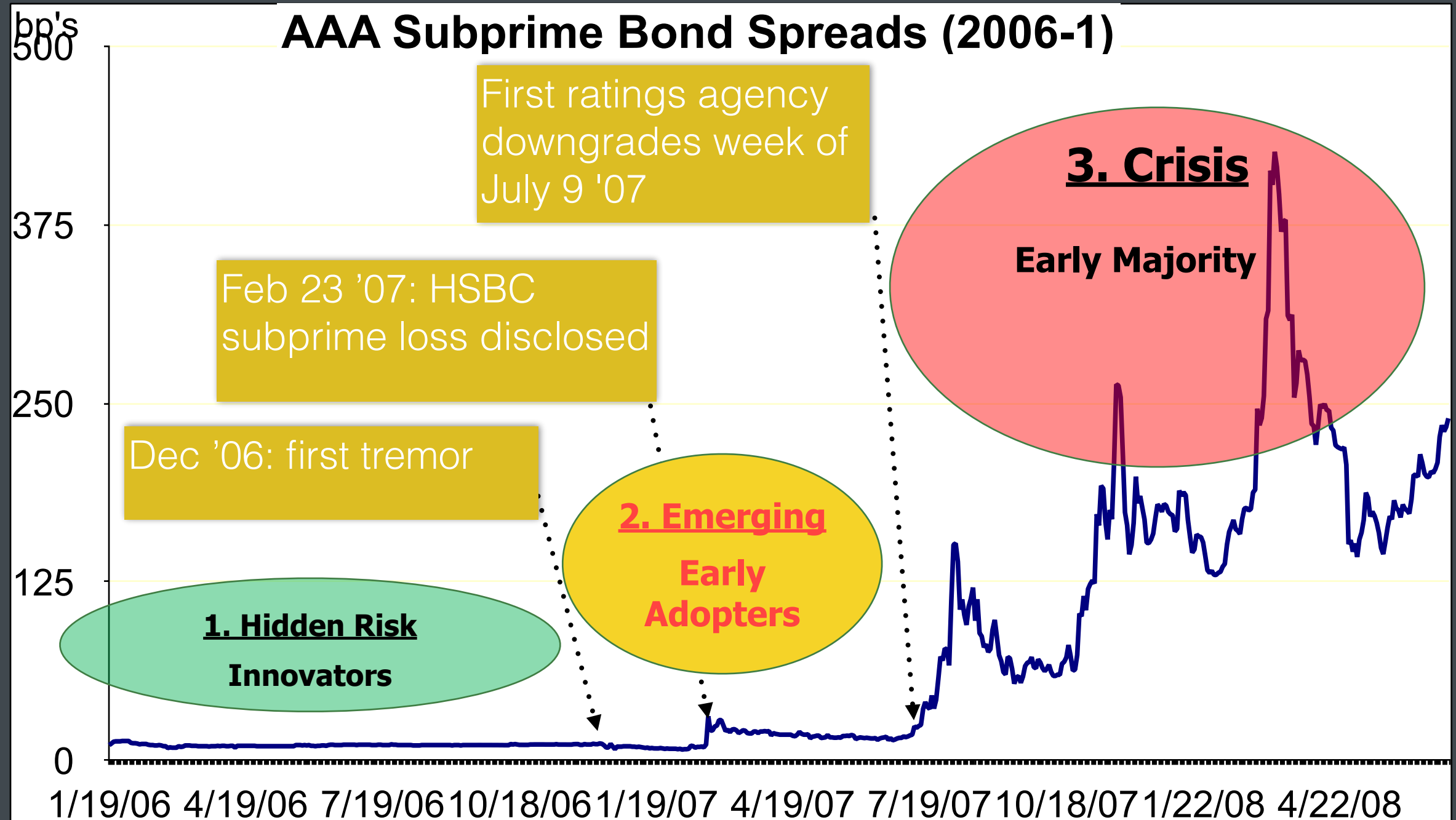
Spread Change

Date

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)

bp's

First ratings agency downgrades week of July 9 '07

3. Crisis

Early Majority

Feb 23 '07: HSBC subprime loss disclosed

250

Dec '06: first tremor

2. Emerging

Early Adopters

125

1. Hidden Risk

Innovators

500

375

0

1/19/06   4/19/06   7/19/06   10/18/06   1/19/07   4/19/07   7/19/07   10/18/07   1/22/08   4/22/08

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Joe Farman discovered it in1980. How could NASA's satellite scans have missed it?
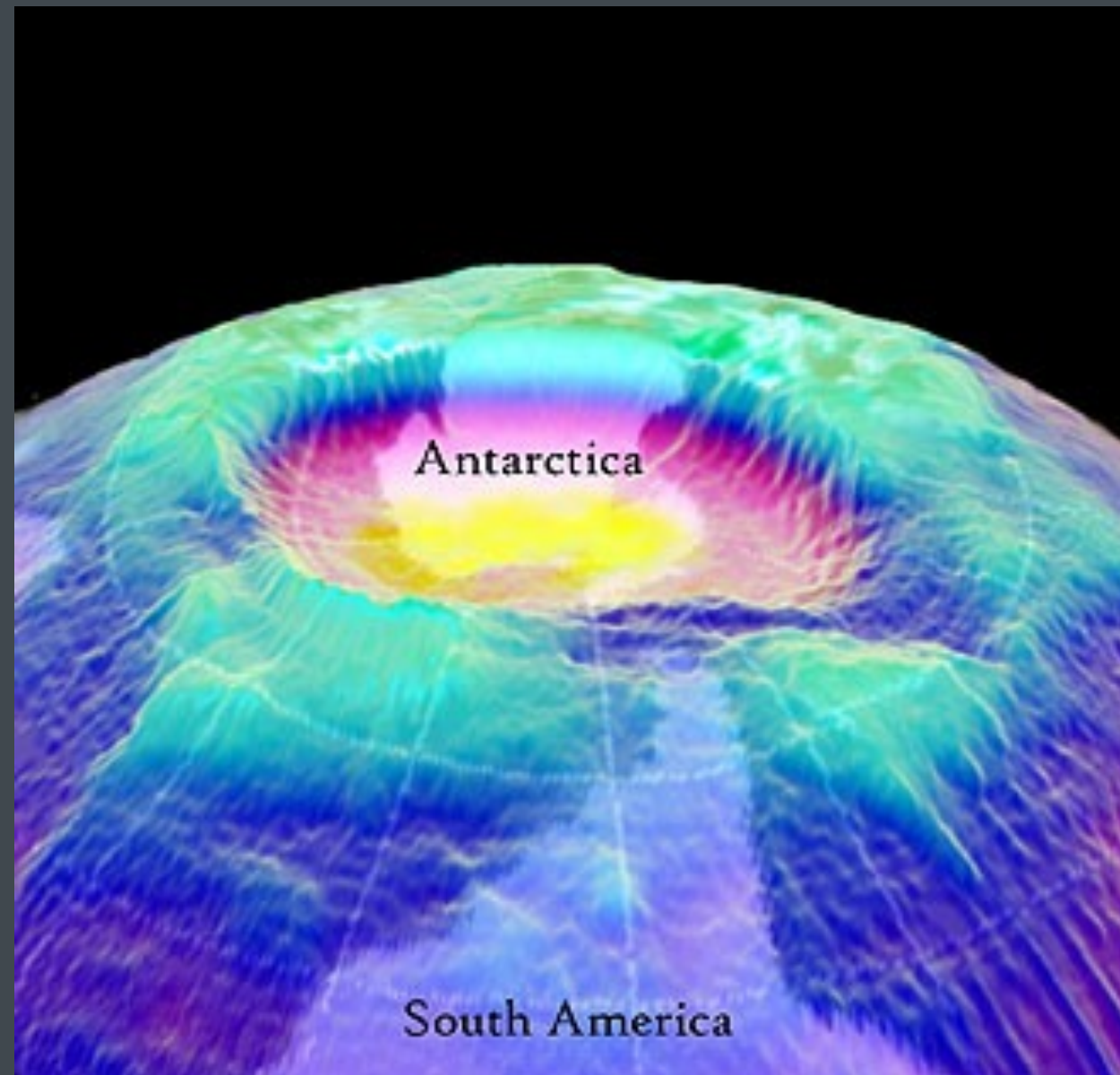
...scientists expect the first signs of recovery of springtime ozone depletion in the polar stratosphere around the year 2065. (Quirin Schiermeier, "Ozone: The patient is not getting sicker")

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)

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

6th biggest outlier in history of DJIA 4 days after largest spike in AAA subprime… a tipping point in contagion

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

DJIA daily returns vs 99% VaR bands (.94 decay, t dist)

Feb 20, DJIA Peak

Feb 27, 6th biggest outlier in DJIA history 4 days after largest spike in subprime spreads
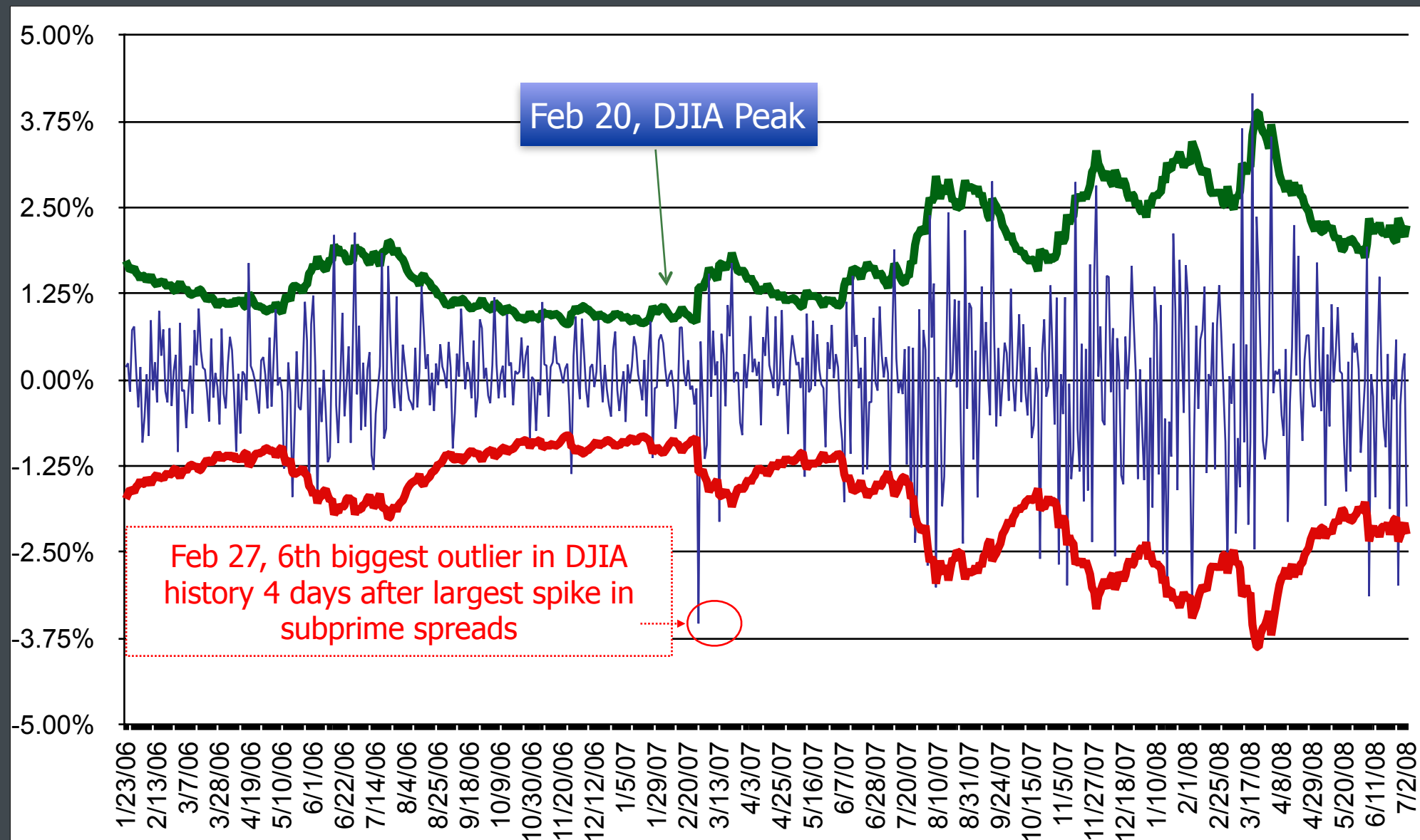
Source: Alan Laubsch "Integrated Risk Management - Early Overview", RiskMetrics
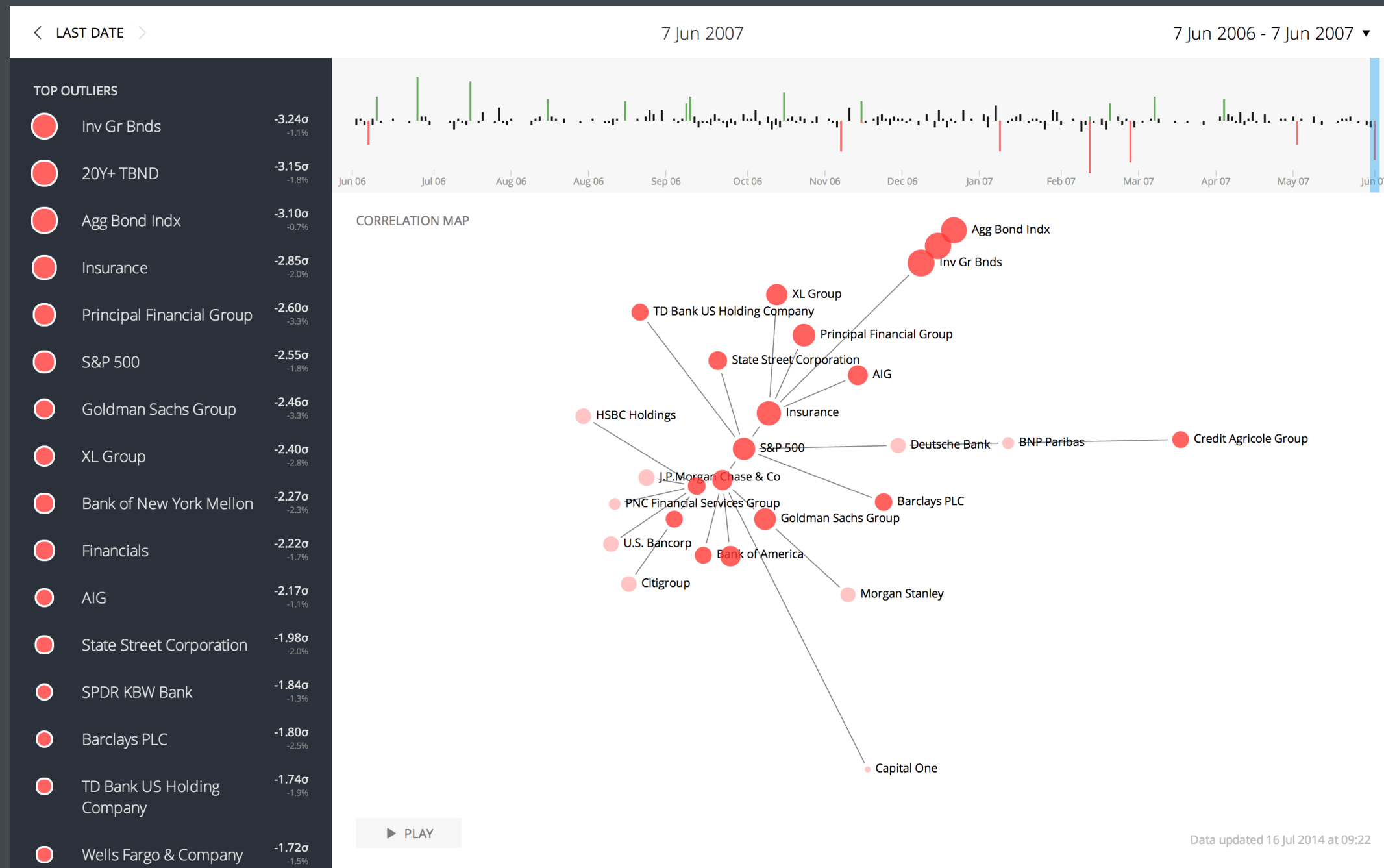
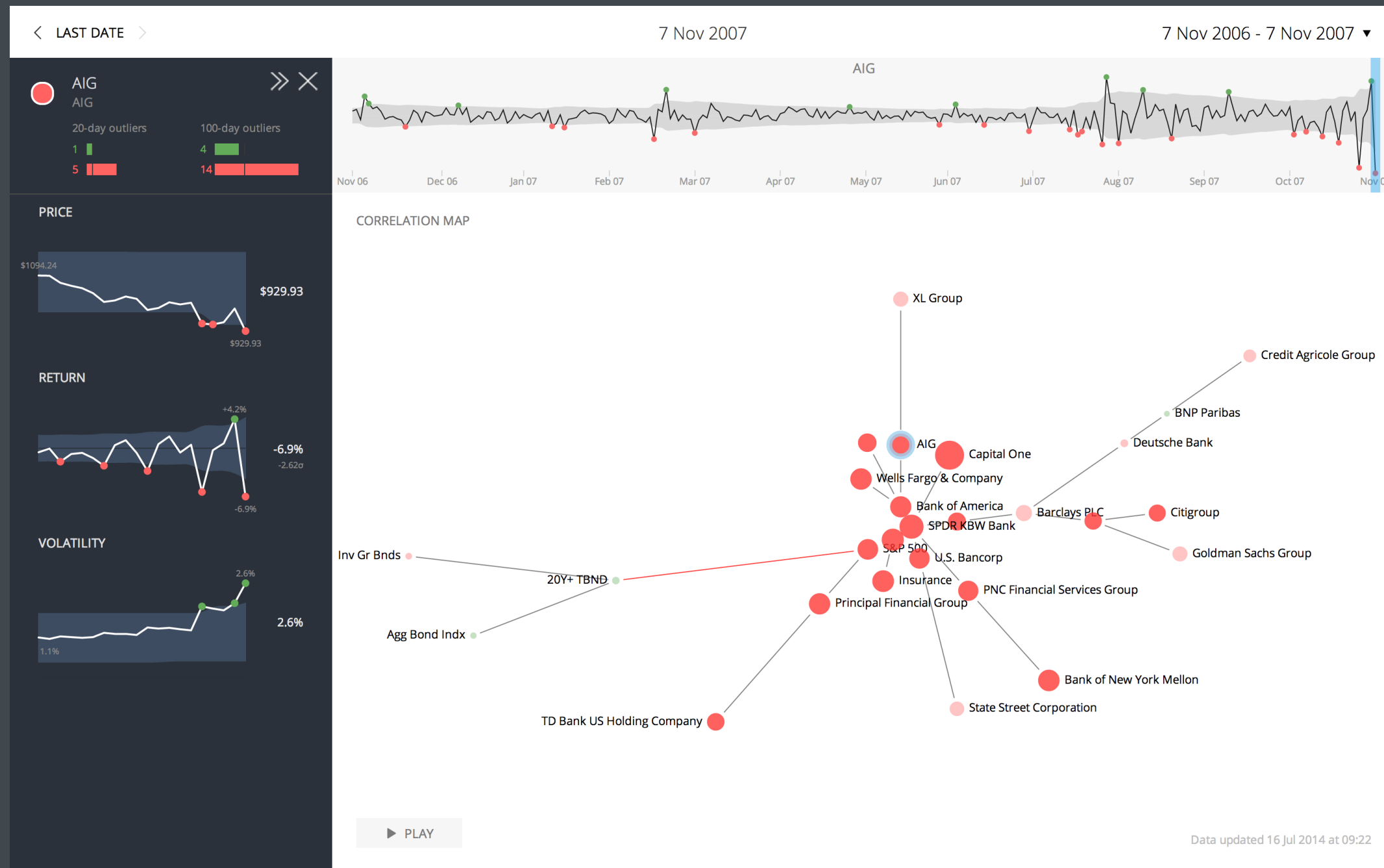# 27 Feb 2007: HeavyTails map of major financial institutions & ETFs

www.heavytails.com

Broad fixed income markets infected on 7 June 2007 as Bear subprime hedge funds halt redemptions
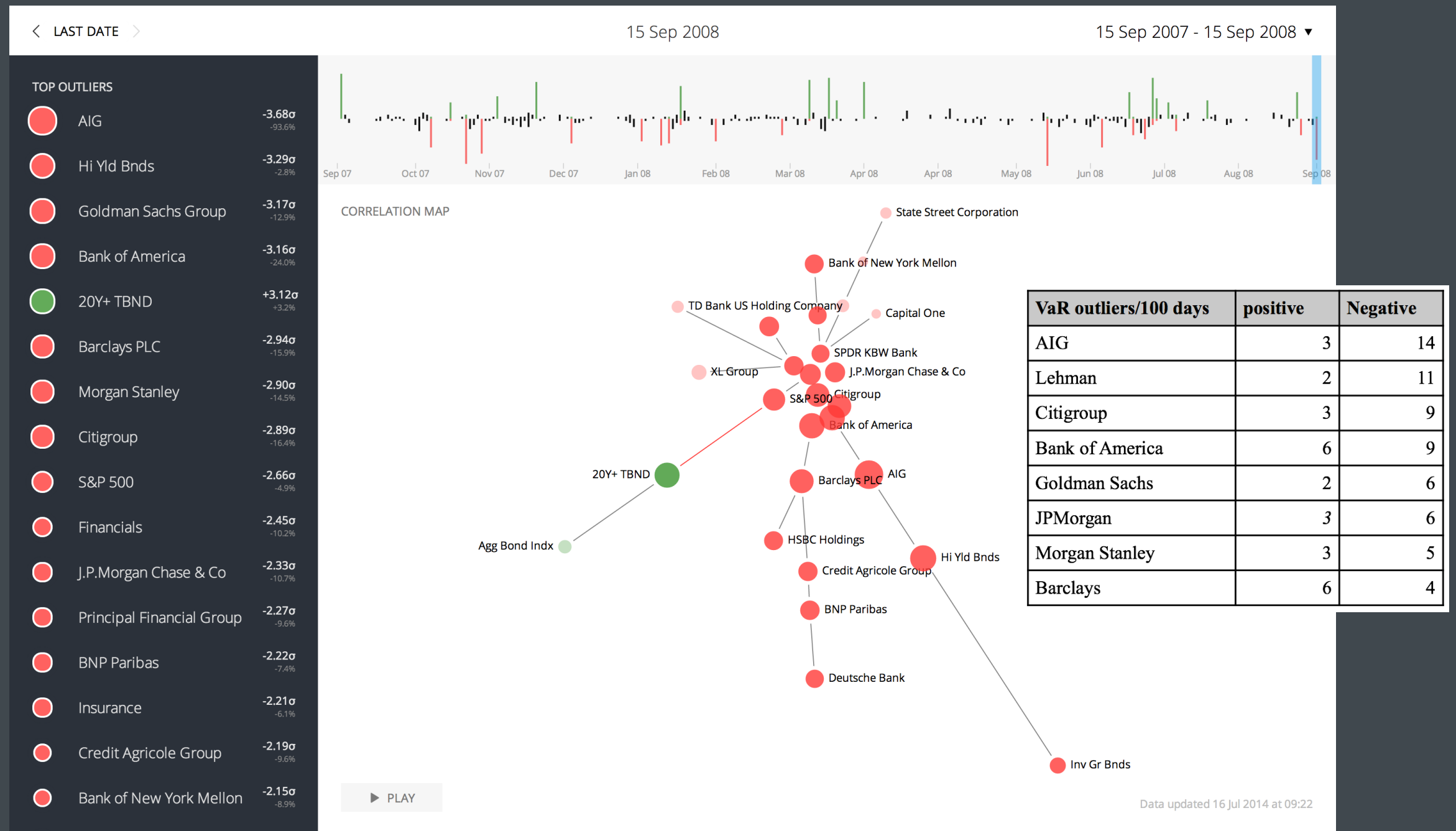
See AIG Early Warning HeavyTails Case Study

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
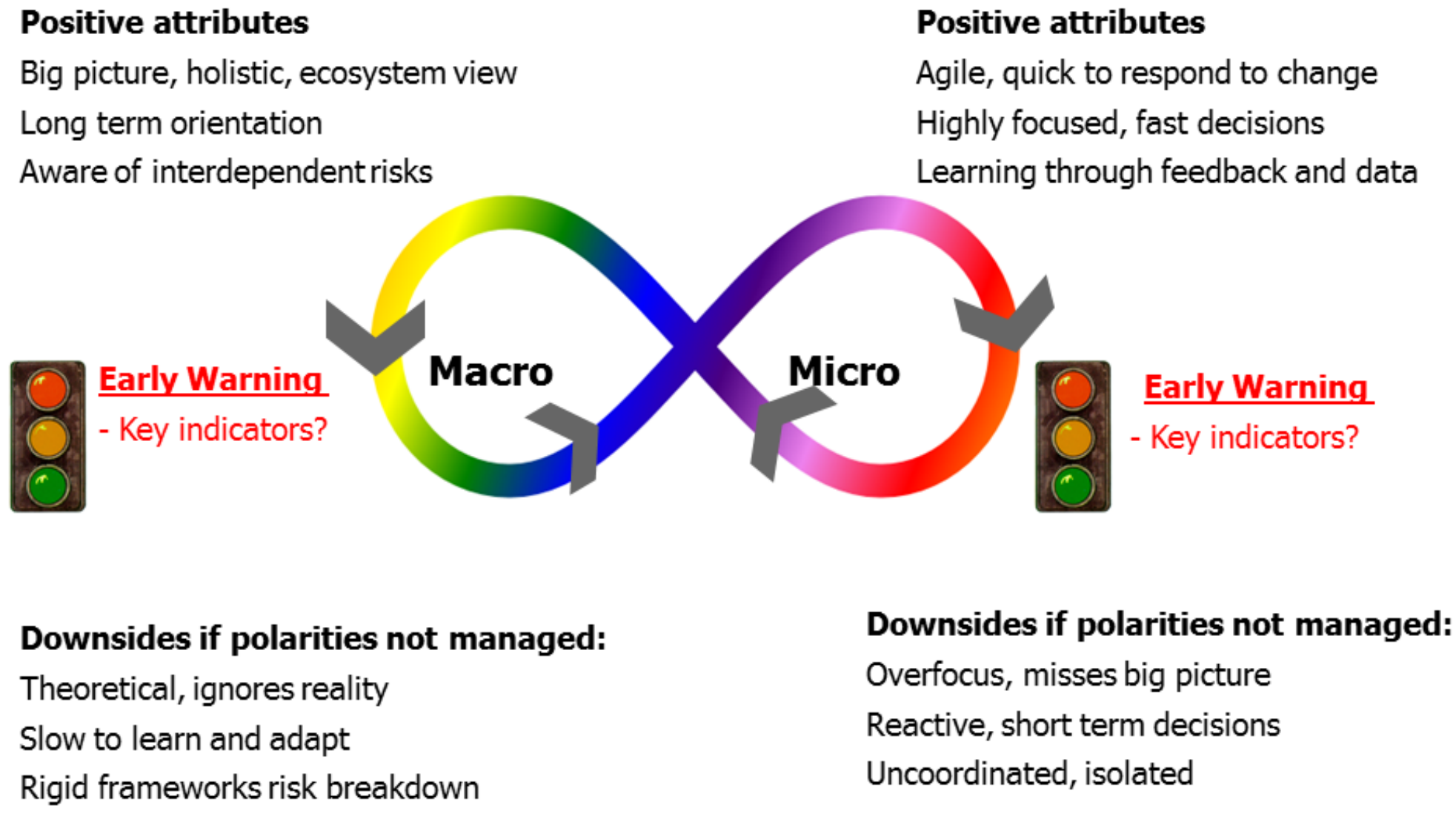
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Manage polarities for virtuous cycles

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

Early Warning
- Key indicators?

Macro

Micro

Early Warning
- Key indicators?

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

facebook graph of social relationships

December 2010

"…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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