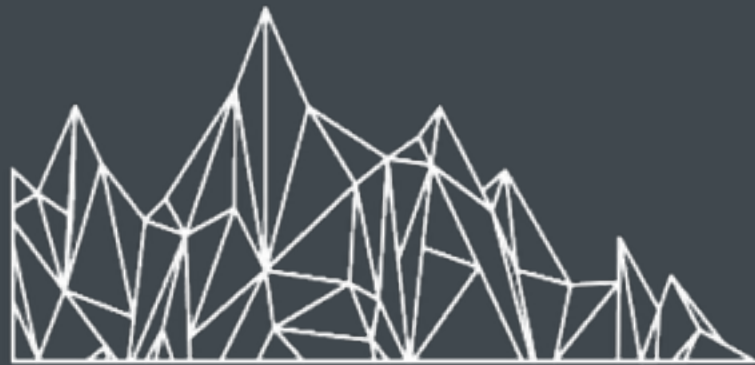




# ADAPTIVE STRESS TESTING WITH FNA HEAVY TAILS

*A new way to see risk with network science*



Perm Winter  
School  
2015

**Alan Laubsch**  
**Director, VP of Risk Products**

# Agenda

- 1. Adaptive Stress Testing Framework**
2. Financial Cartography using Network Science
3. HeavyTails Systemic Risk Monitor





# Implication of Complexity

From “Predict & Control” to “Sense and Respond”

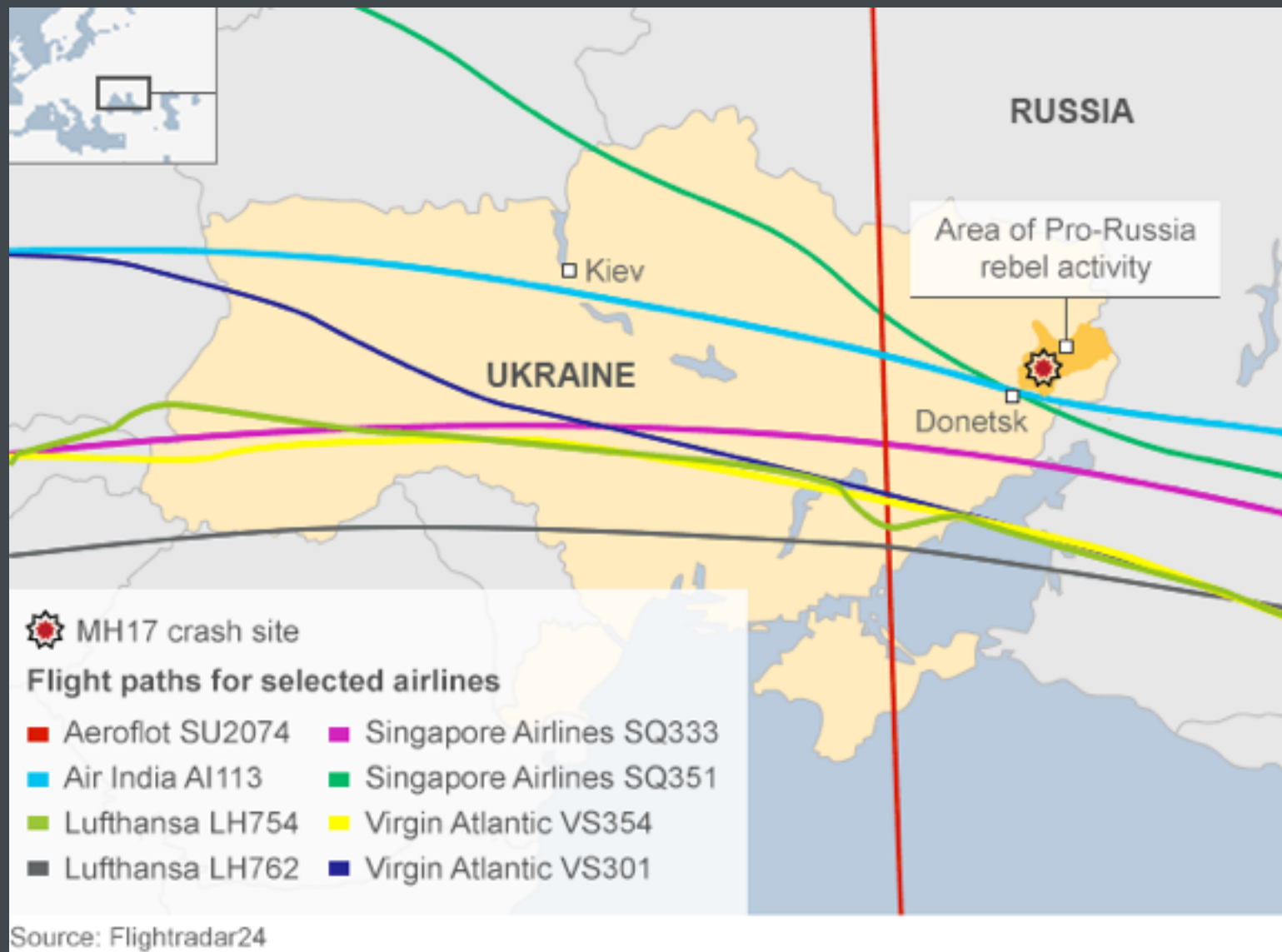
with Dynamic Steering



# Seek to understand hidden fault lines...

While Qantas & CX rerouted, many continued business as usual:

“We've flown this route for many years, it's safe and that's the reason why we are taking this route”



Source: BBC



# 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*

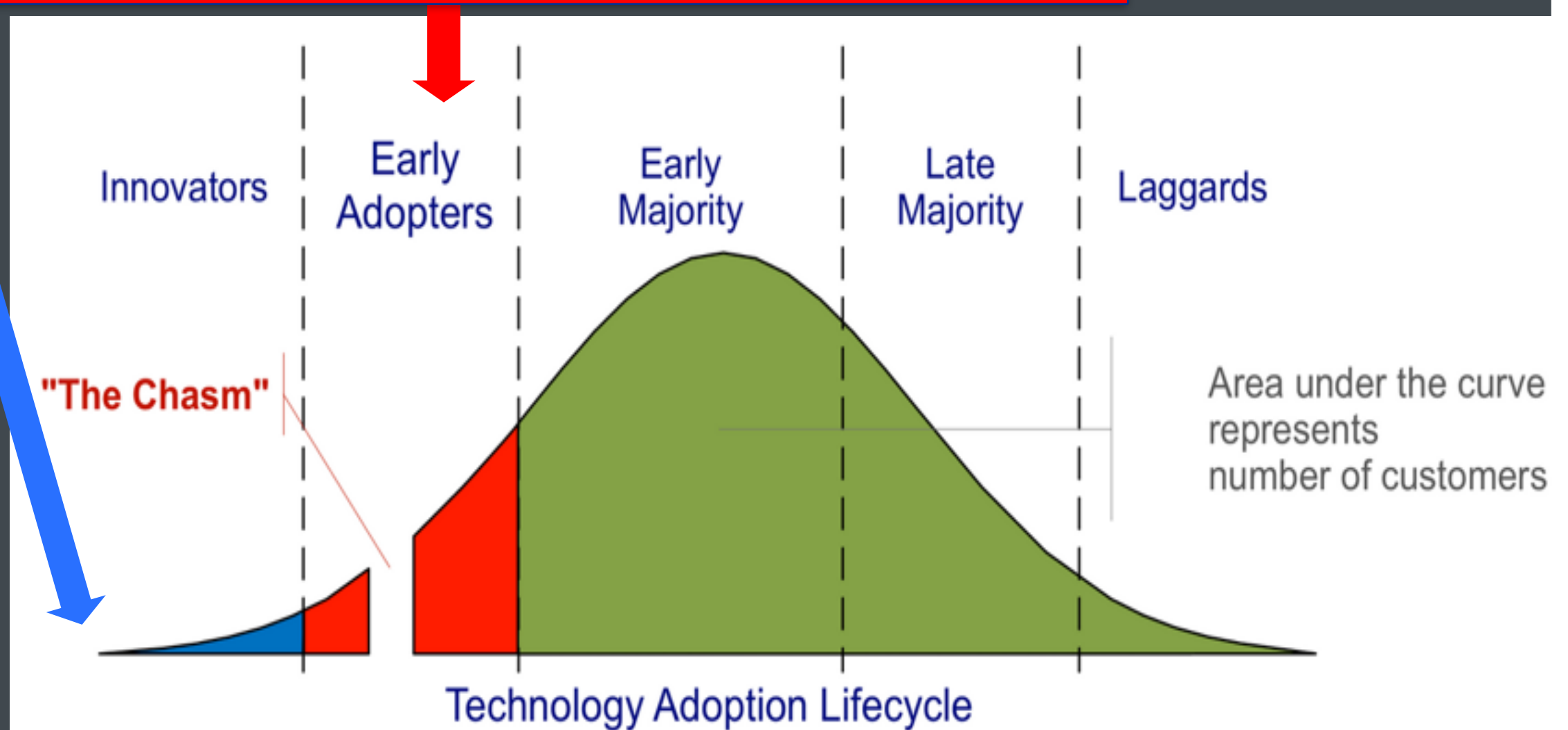
*See: Adaptive Stress Testing: Amplifying Network Intelligence by Integrating Outlier Information (Laubsch 2014)*



# A Social Markets Hypothesis

## 1. Macro: Scenarios from Innovators

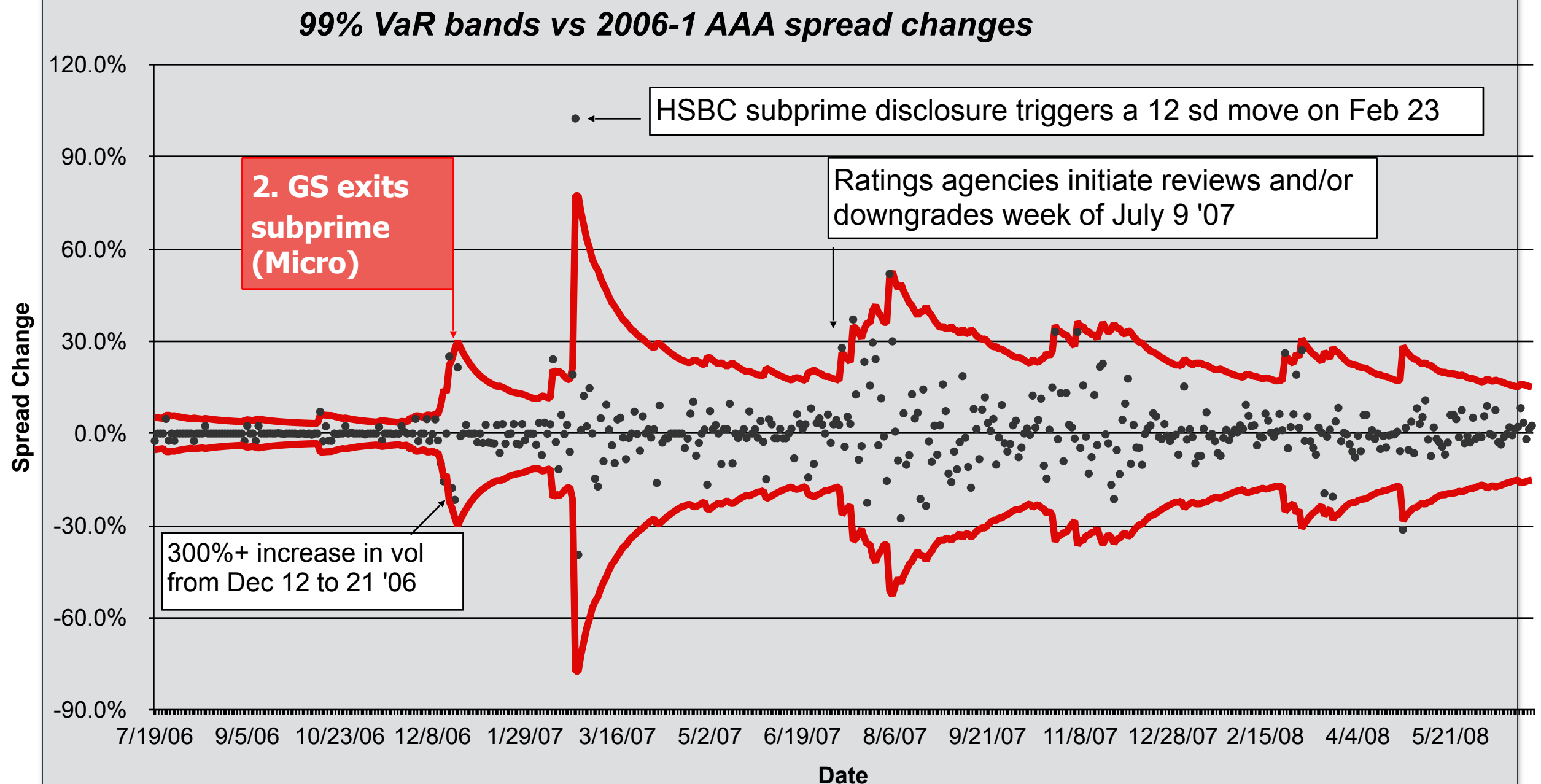
## 2. Micro: Market signals from Early Adopters



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)



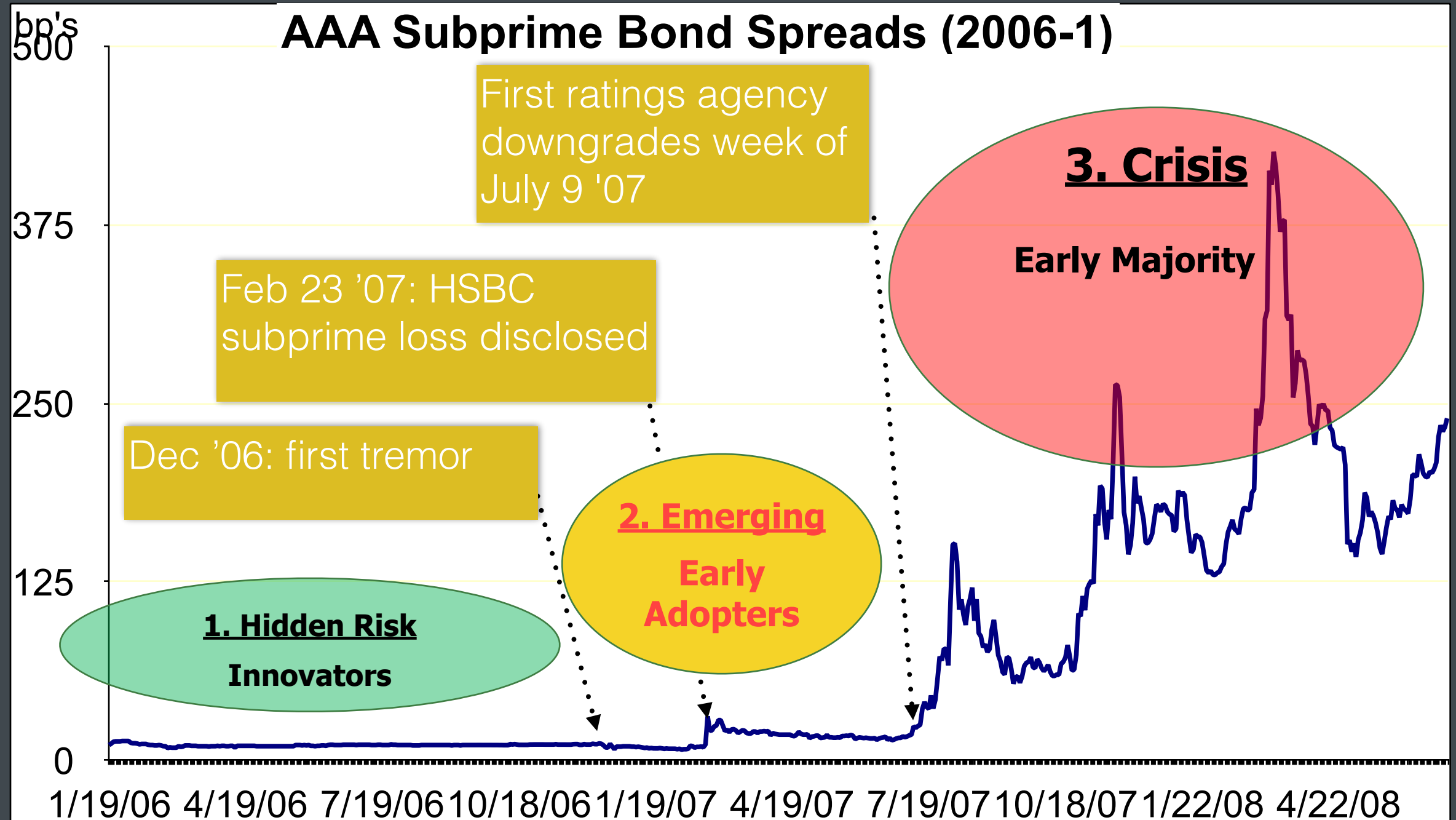
Source: Alan Laubsch "Subprime Risk Management Lessons", RiskMetrics



# Three Stages of Risk: U.S. Subprime Crisis

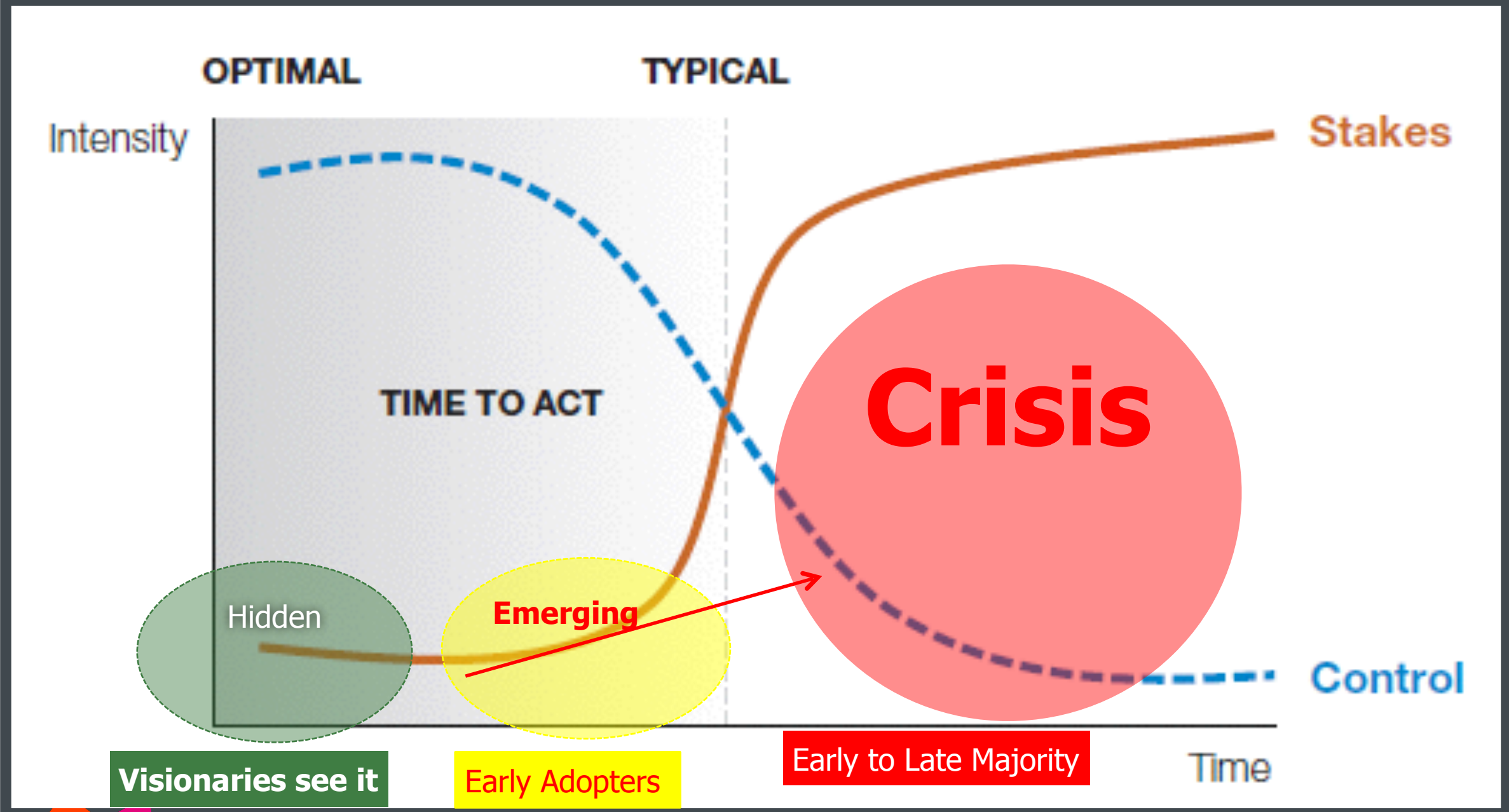
1. When was the biggest risk?

2. And the biggest surprise?



# Tipping Point Dynamics require early detection and action

- Limited window of opportunity for exerting control



Source: "Building A Reputation Risk Management Capability", Diermeier & Loeb, 2011

# Agenda

1. Adaptive Stress Testing Framework
- 2. Financial Cartography using Network Science**
3. HeavyTails Systemic Risk Monitor



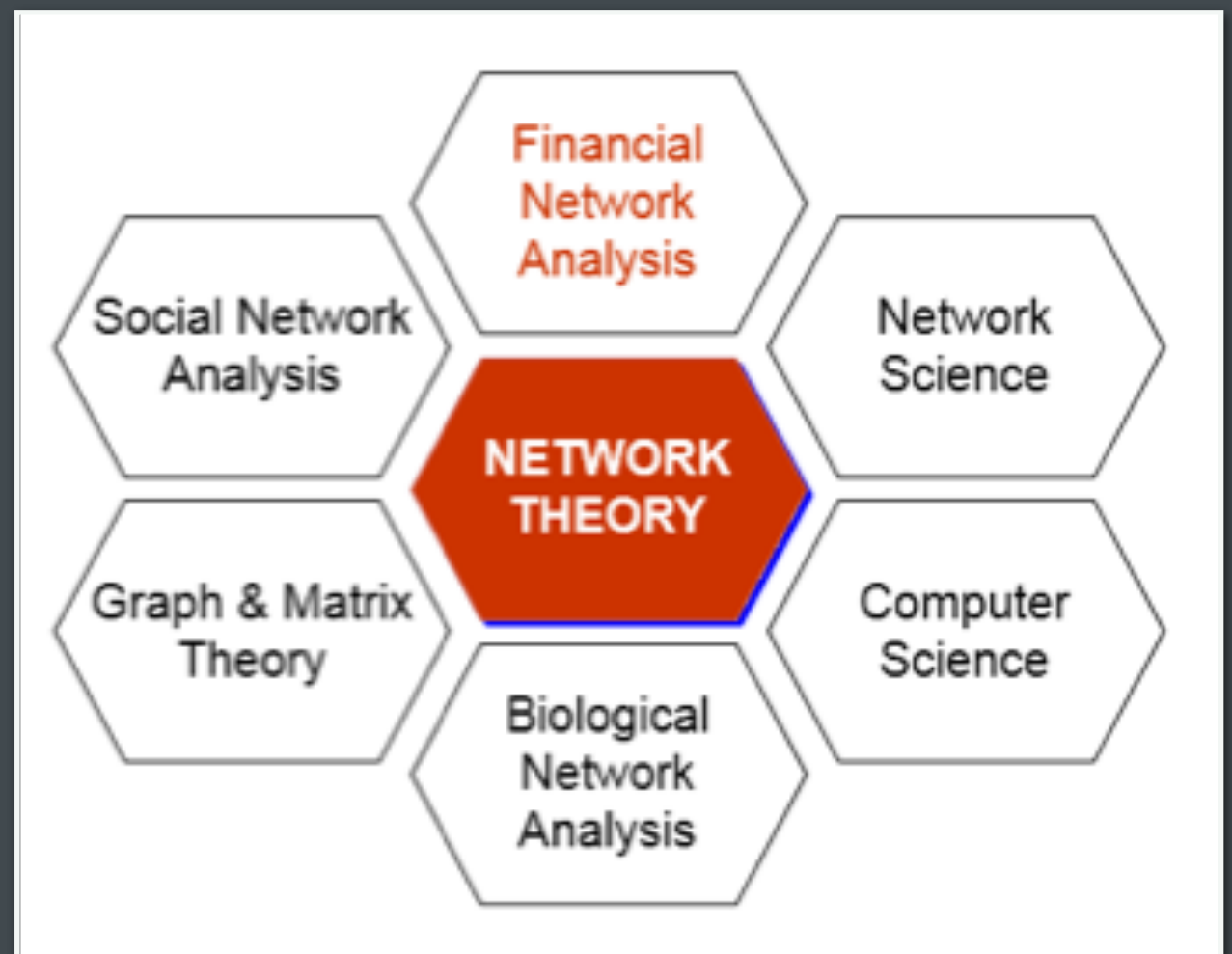


# Network Theory: uncover hidden patterns in complex data

Structure of links  
between nodes matters

Augments, does not  
replace other data  
analysis methods

Network aspect is an  
unexplored dimension of  
ANY data



# Maps depict key systemic features

Tube map



MAYOR OF LONDON

Website  
tfl.gov.uk

24 hour travel information  
0843 222 1234\*

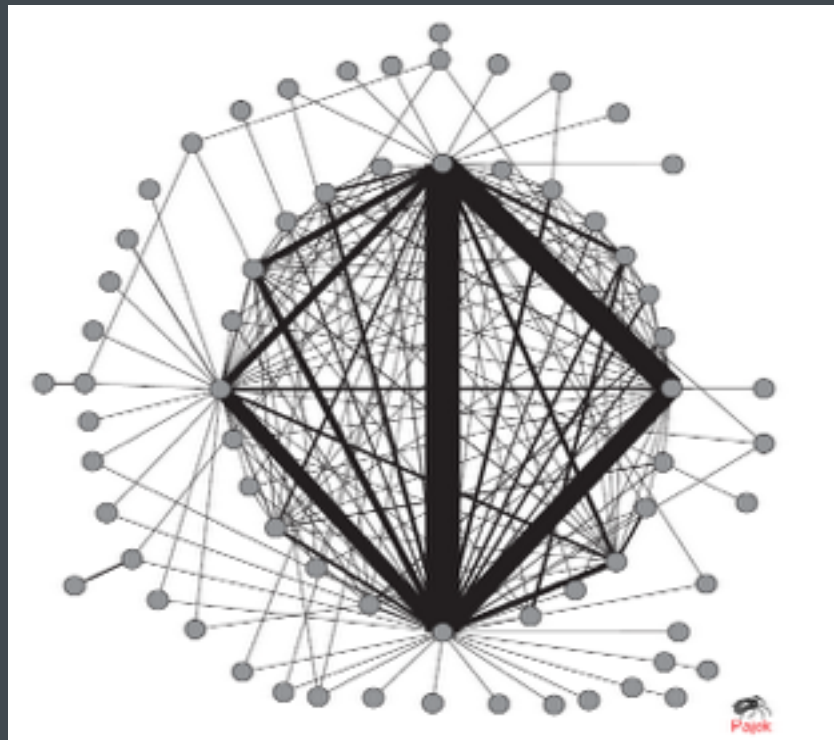
\*You pay no more than 1p per minute if calling  
from a BT landline. There may be a connection charge.  
Charges from mobiles or other landline providers may vary.

Transport for London

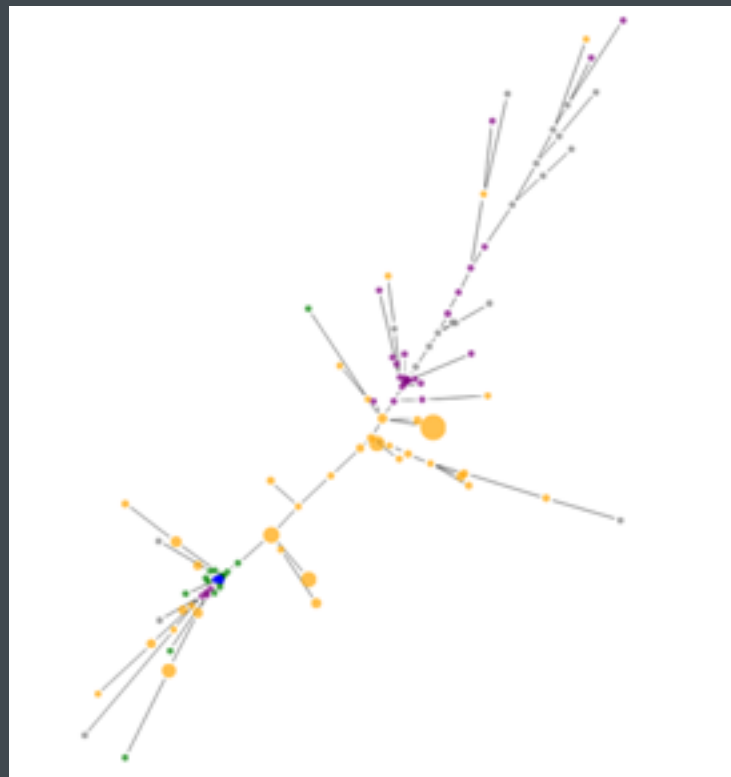


# Financial Cartography reveals interconnectedness

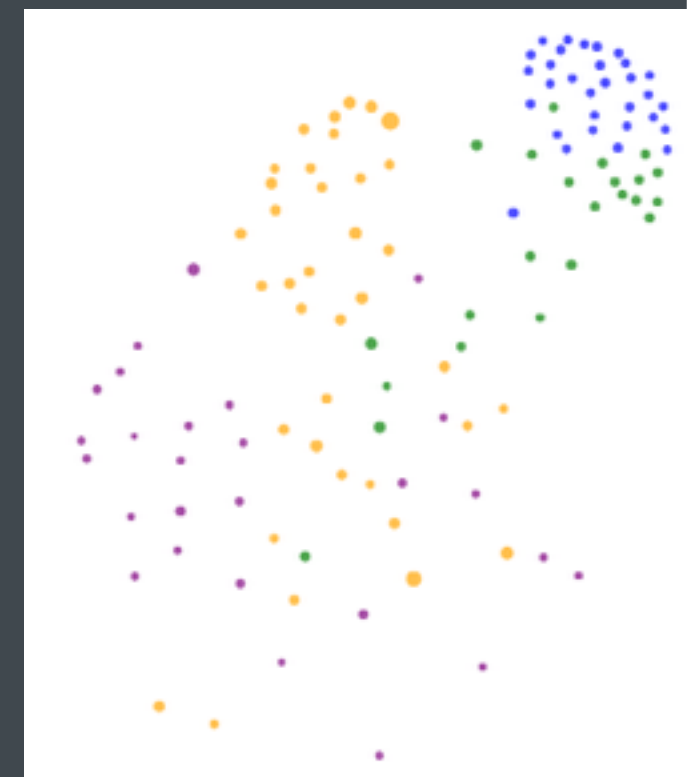
Central nodes



Market linkages



Clustering



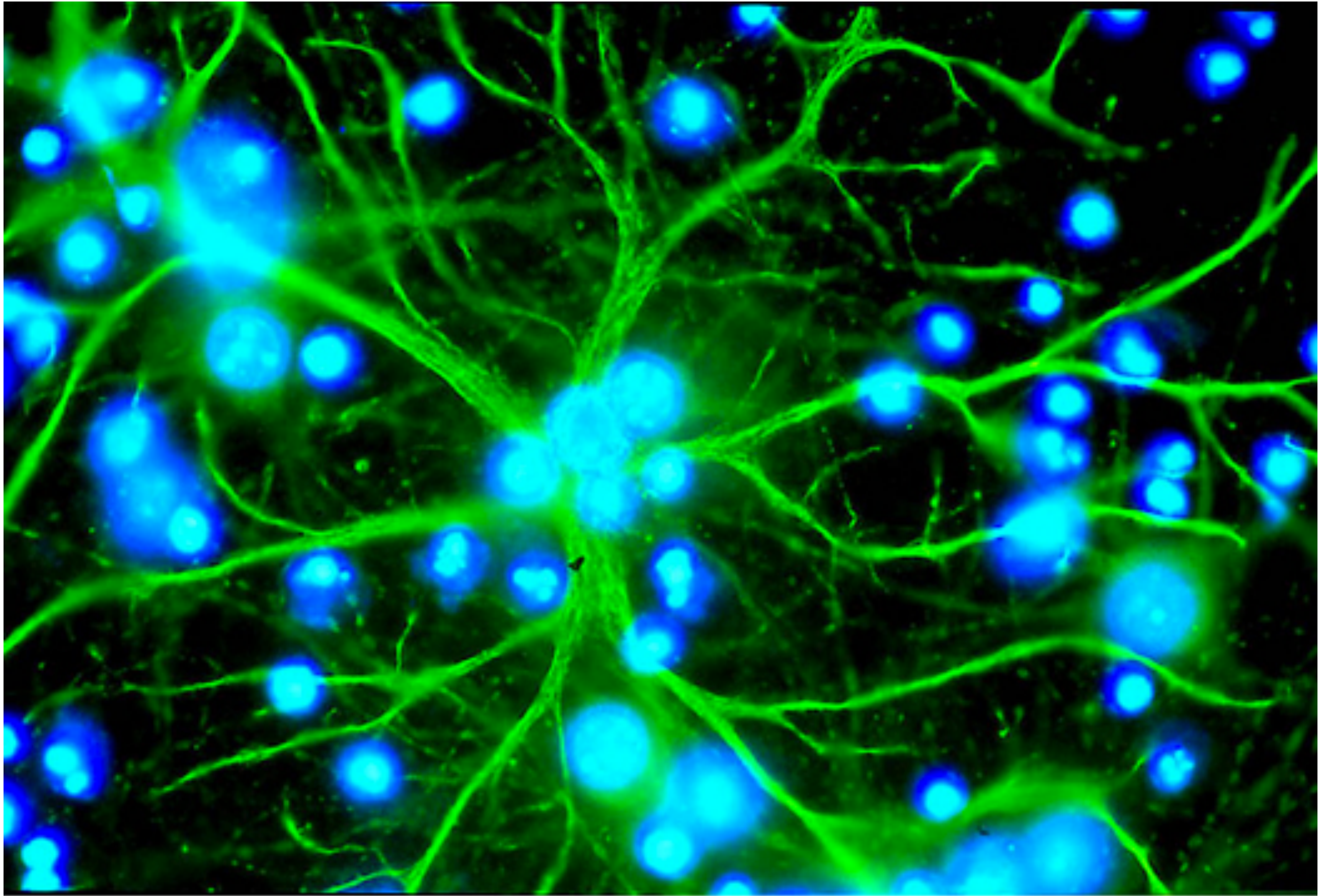
Bilateral exposure data

Asset price data

Balance sheet data







# Agenda

1. Adaptive Stress Testing Framework
2. Financial Cartography using Network Science
- 3. HeavyTails Systemic Risk Monitor**



**Objective is to efficiently represent a complex system moving in time**

16

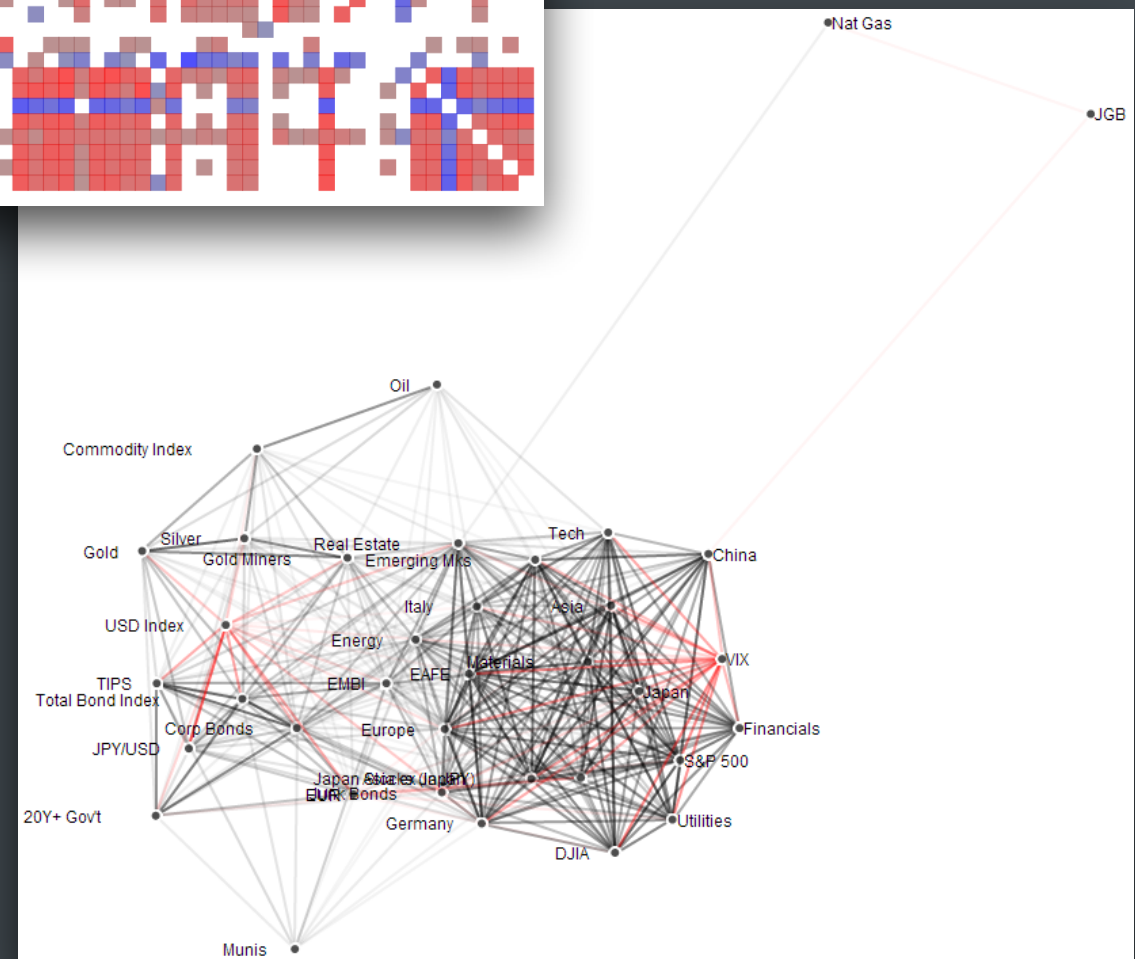
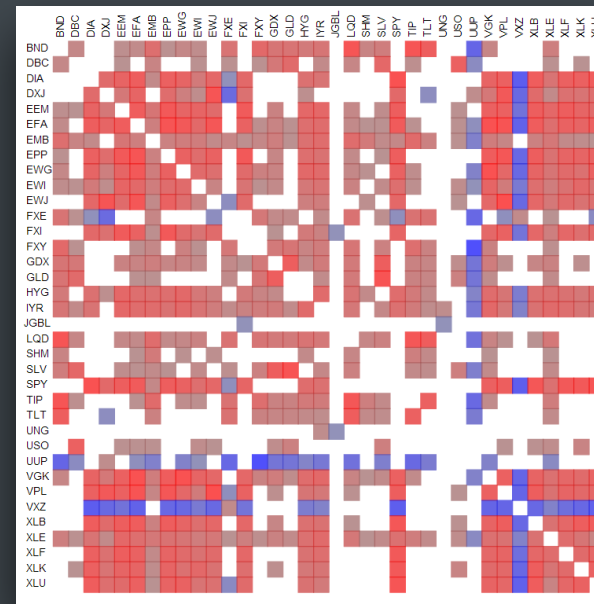


# Correlation Networks

We encode correlations as links between the correlated nodes/assets.

Red link = negative correlation  
Black link = positive correlation

Absence of link marks that asset is not significantly correlated.



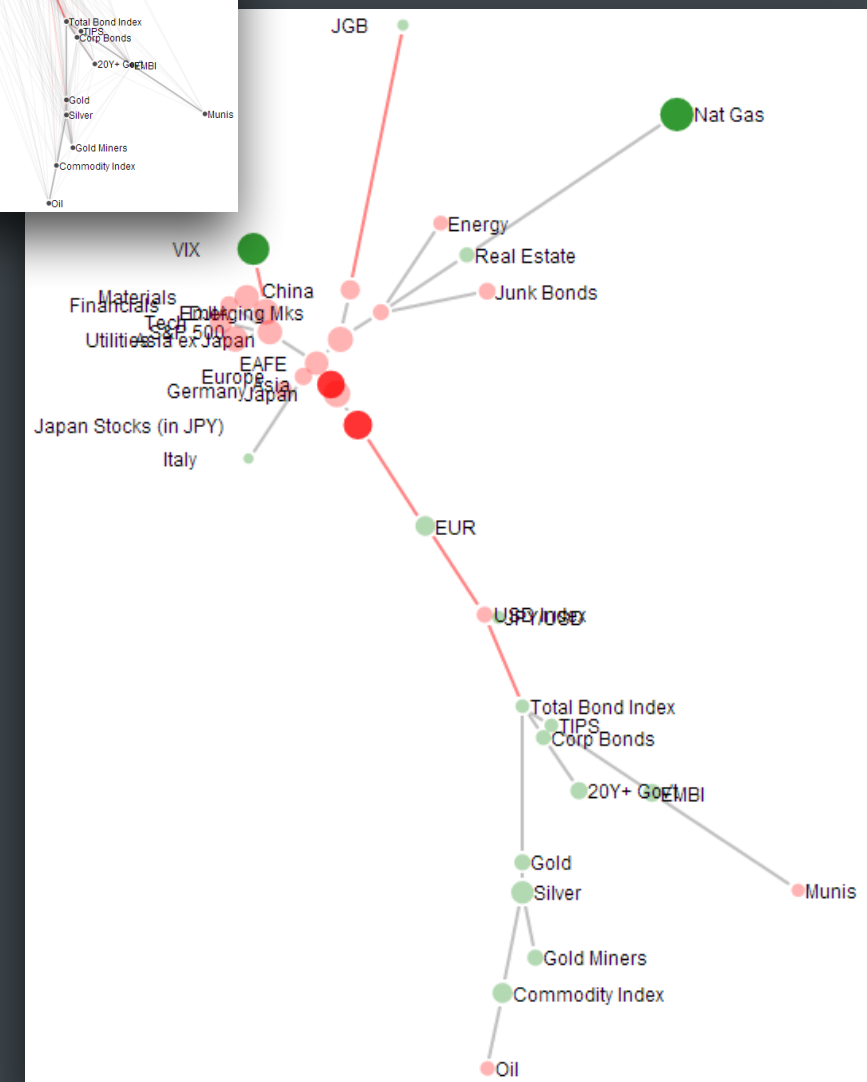
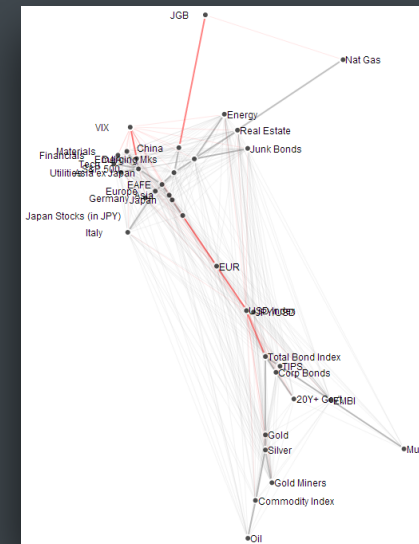
# We highlight VaR outlier returns

Node color indicates last daily return

Green = positive

Red = negative

Node size indicates magnitude of return



# “Here be Dragons”

*Didier Sornette (2009)*

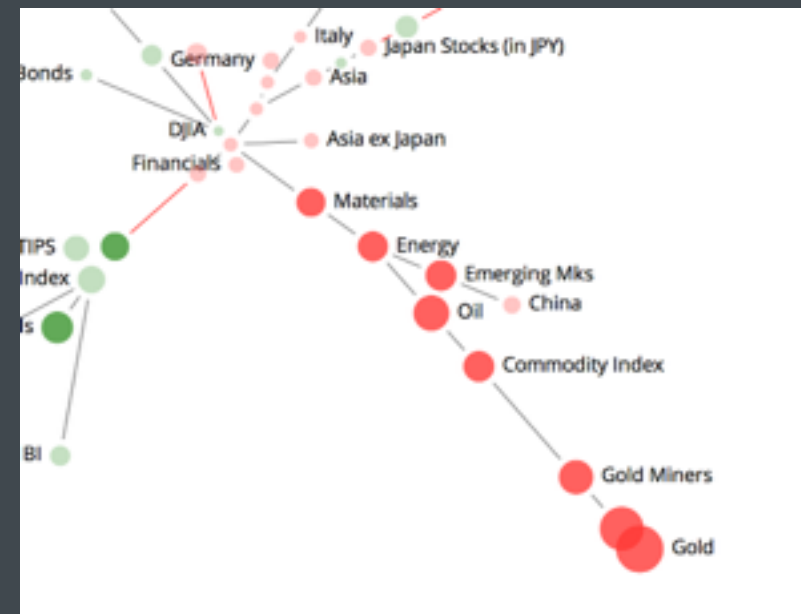
Dragon King: “Extreme events can be predicted”

*Benoit B. Mandelbrot (1963)*

Volatility Clustering: “Large changes tend to be followed by large changes”

-> Identify VaR exceptions (return outside 95% VaR bounds)

-> Map them as bright green or red nodes



Highlight outliers in their context



Track the number of outliers each day



# HeavyTails Systemic Risk Analytics

## TOP OUTLIERS

Russia	-3.41σ	-7.5%
Eastern Europe	-3.41σ	-6.2%
Junk Bonds	-3.17σ	-0.7%
Emerging Mks	-2.70σ	-1.9%
VIX	+2.42σ	+3.1%
S&P 500	-2.32σ	-1.1%
TIPS	+2.22σ	+0.6%
South Africa	-2.21σ	-2.2%
Financials	-2.15σ	-1.3%
Italy	-2.15σ	-3.2%
Europe	-2.13σ	-1.6%
EAFF	-2.10σ	-1.3%
Tech	-2.10σ	-1.3%
Insurance	-2.09σ	-1.1%

Thu, 17 Jul 2014



## CORRELATION MAP



# Case: Escalating Systemic Risk 2014

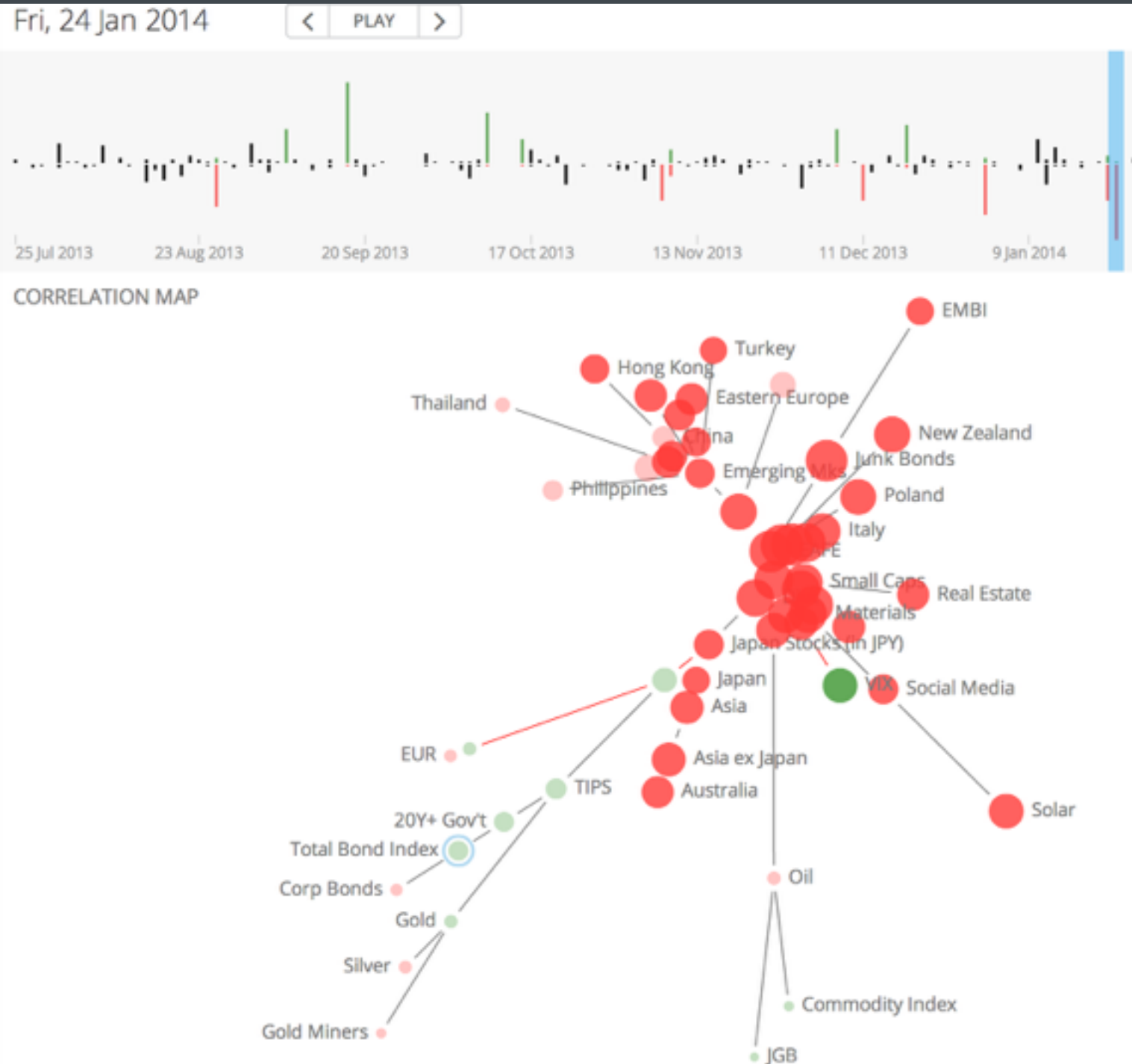
<http://bit.ly/1j24pIH>





# Tapering fears drove the largest global daily selloffs in 2013 and 2014

TOP OUTLIERS		
Europe	-3.09σ	-3.3%
France	-3.04σ	-3.4%
EAFE	-3.04σ	-2.8%
Junk Bonds	-3.02σ	-0.7%
Germany	-2.81σ	-3.3%
S&P 500	-2.74σ	-2.2%
Healthcare	-2.72σ	-2.4%
Materials	-2.69σ	-2.7%
Insurance	-2.69σ	-2.7%
Small Caps	-2.67σ	-2.6%
DJIA	-2.64σ	-2.0%
South Africa	-2.54σ	-4.6%
New Zealand	-2.53σ	-2.7%
Italy	-2.52σ	



# Won Leads Weekly Drop in Asia Currencies on Fed Bets China Data

By Justina Lee | Jan 25, 2014 10:32 AM GMT+0700 [8 Comments](#) [Email](#) [Print](#)

Asian currencies fell this week, led by South Korea's won, as Chinese economic data missed estimates and a stronger U.S. recovery added to speculation the **Federal Reserve** will cut its stimulus further.

The **Bloomberg-JPMorgan Asia Dollar Index (ADXY)** dropped for a second week as reports showed U.S. December sales of existing homes capped the best year since 2006 and jobless claims held near a six-week low. Signs of a sustained economic pickup fueled bets the Fed will continue to reduce bond-buying that has spurred fund flows to **emerging markets**. Manufacturing in **China**, Asia's biggest economy, may have contracted this month, a preliminary reading showed on Jan. 23.

"Weak data in China are strengthening demand for safety assets like the dollar," said Hong Seok Chan, a currency analyst at Daishin Economy Research Institute in Seoul. "U.S. tapering expectations offer a continued boost for the greenback."

The won recorded its worst week in seven months, slumping 1.9 percent from Jan. 17 to 1080.36 per dollar, data compiled by Bloomberg show. Malaysia's ringgit slid 1.1 percent, its biggest weekly loss in a month, to 3.3334. **India's** rupee dropped 1.8 percent, the most since August, to 62.6850 and Indonesia's rupiah fell 0.7 percent to 12,180.

The Fed, which next meets Jan. 28-29, downsized its monthly debt-buying program in January by \$10 billion to \$75 billion. The Bloomberg Dollar Spot

# S&P 500 Slides Most Since June on Emerging Market Turmoil

By Nick Taborek | Jan 25, 2014 4:54 AM GMT+0700 [- Comments](#)

[Email](#) [Print](#)

k

U.S. **stocks** sank the most since June, capping the worst week for benchmark indexes since 2012, as a selloff in developing-nation currencies spurred concern global markets will become more volatile.

Caterpillar Inc., General Electric Co. and Boeing Co. slid at least 2.6 percent to pace **losses** in the **Dow Jones Industrial Average (INDU)** Kansas City

Southern plunged 15 percent, the biggest retreat since 2008, after reporting lower-than-estimated earnings. International Game Technology tumbled 15 percent as the maker of **slot machines** posted first-quarter profit that missed analysts' projections.

The **Standard & Poor's 500 Index (SPX)** retreated 2.1 percent to 1,790.29 at 4 p.m. in **New York** to close at the lowest level since Dec. 17. The benchmark index declined 2.6 percent this week. The Dow slid 318.24 points, or 2 percent, to 15,879.11 today. The 30-stock gauge lost 3.5 percent this week. About 8.8 billion shares changed hands on U.S. exchanges, the busiest trading day of the year.



Photographer: Jin Lee/Bloomberg

*Traders work on the floor of the New York Stock Exchange on Jan. 24, 2014.*



# First wave of escalating tremors

Energy 24 Jun

Europe 7 Jul

Oil 9 Jul (jul 2-11)

Commodities 15 Jul

Euro 15 Jul to 4 Sep

Russia, Junk, EM 17 Jul

The Canary: Energy Bull Phase Transition

Europe Bull Phase Transition

MH 17

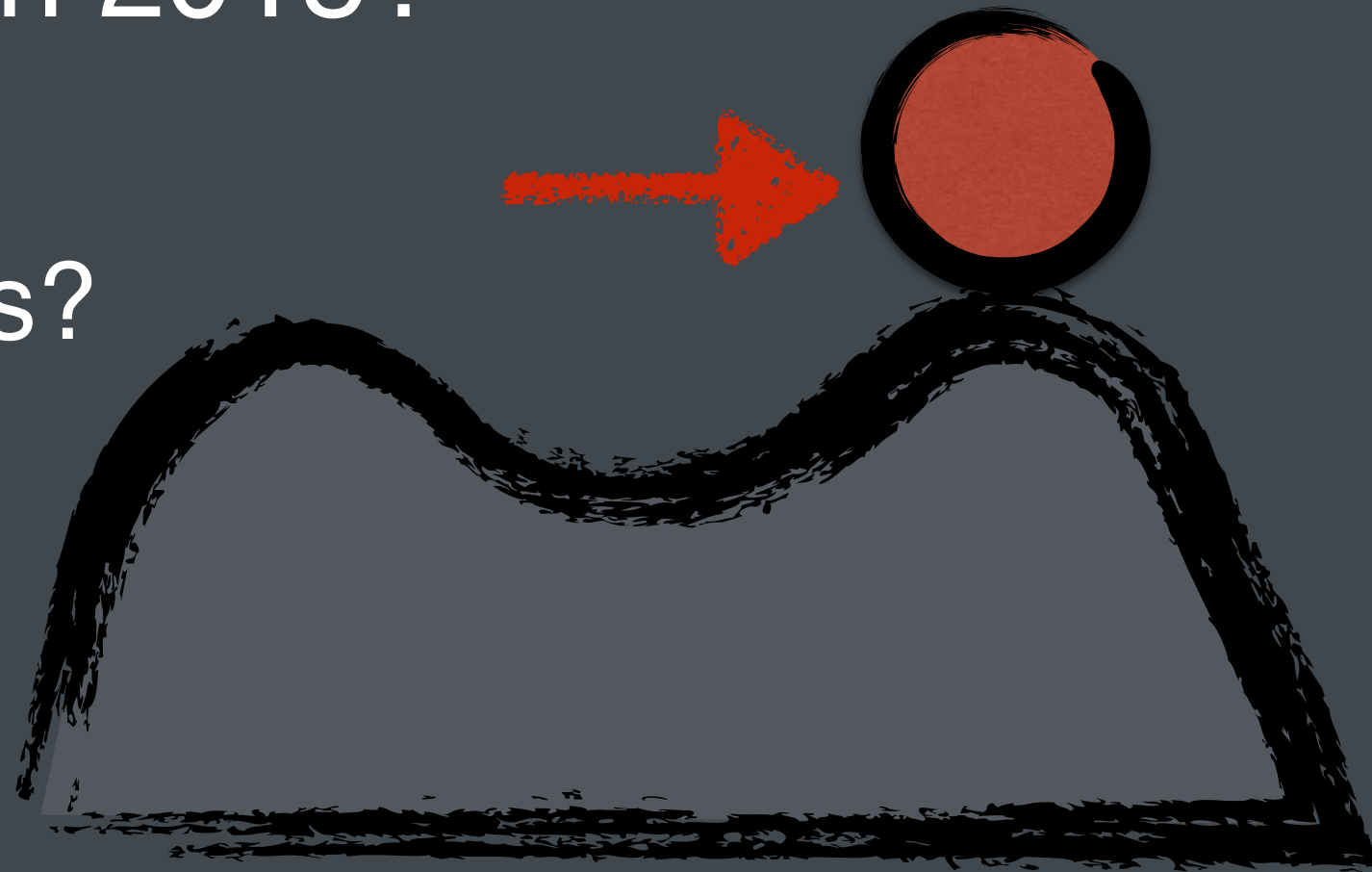
JPY/USD 30 Jul

US, Materials, 31 Jul



# What Precipitated the Energy Share Bear Market in 2015?

Amplifiers?

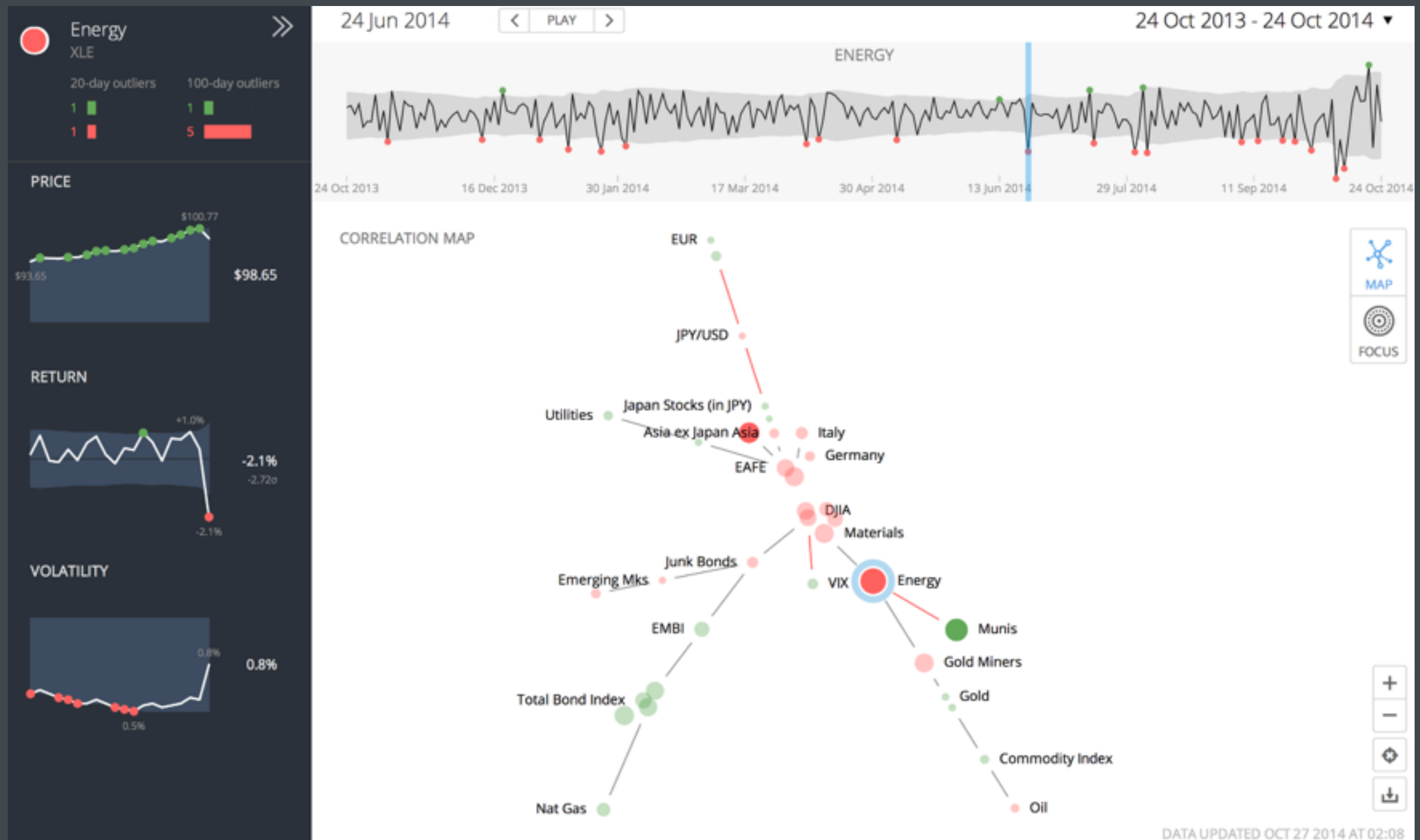


Systemic implications?



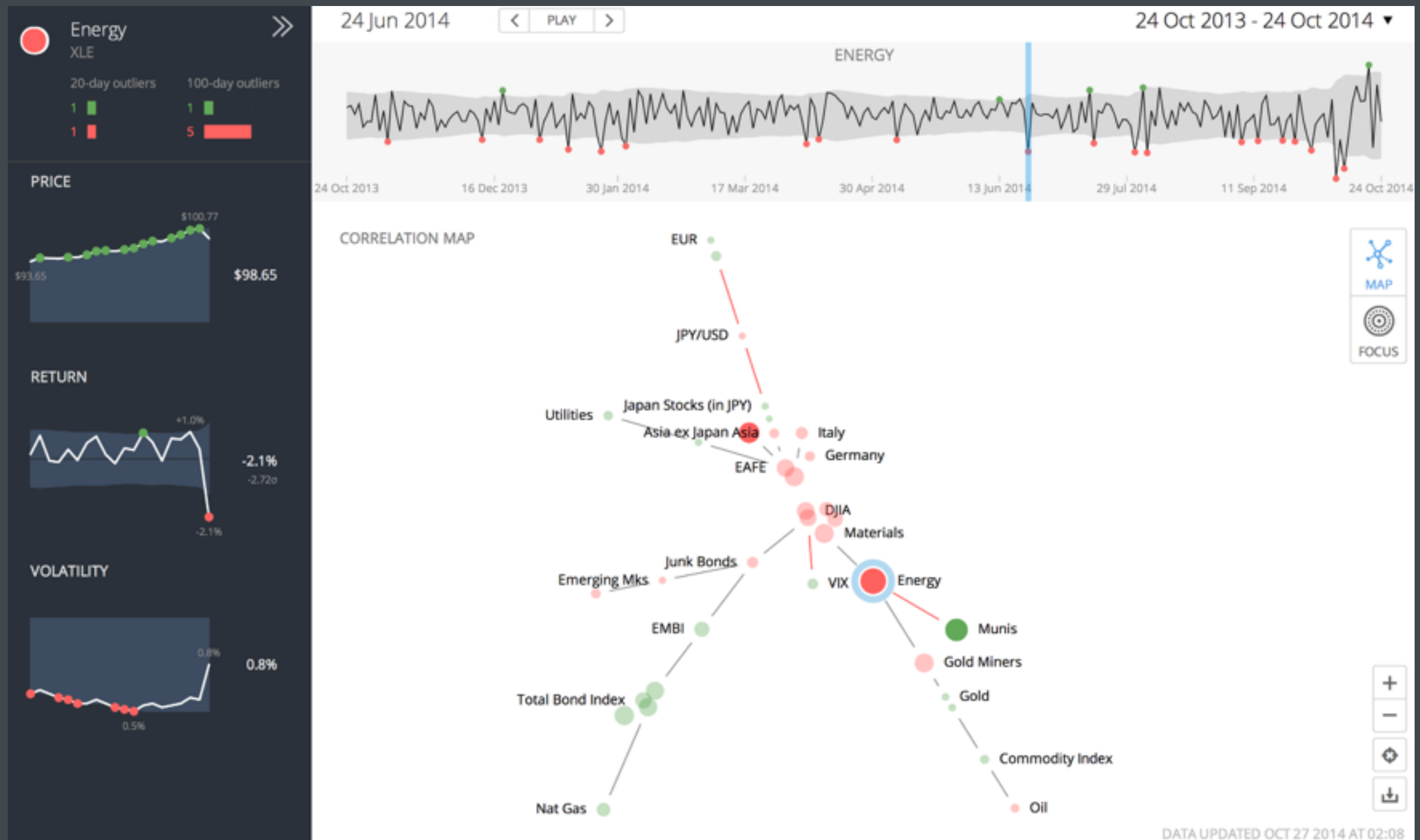


# Canary in the coal mine: Energy





# Canary in the coal mine: Energy



# Classic contrarian phase transition

## U.S. Stocks Decline Amid Tension in Middle East, Data

By Oliver Renick Jun 25, 2014 3:43 AM GMT+0700 104 Comments Email Print

U.S. **stocks** fell a second day, after equity benchmarks rose to record levels last week, as reports of escalating violence in the **Middle East** overshadowed data that boosted optimism in the world's biggest economy.

**Exxon Mobil** Corp. dropped 1.6 percent and Pioneer Natural Resources Co. slumped 4.8 percent as energy shares led declines. **Intercontinental Exchange** Inc. fell 4 percent after an analyst downgraded the stock. JPMorgan Chase & Co., Boeing Co. and United Technologies Corp. retreated at least 1.2 percent as the **Dow Jones Industrial Average** fell the most in a month and the **VIX (VIX)** index of volatility jumped the most since April.

The **Standard & Poor's 500 Index (SPX)** lost 0.6 percent to 1,949.98 at 4 p.m. in **New York**, erasing a morning gain of 0.3 percent. The Dow slid 119.13 points, or 0.7 percent, to 16,818.13. The VIX, as the Chicago Board Options Exchange Volatility Index is known, jumped 10 percent to 12.13

"With the stock market at or near all-time highs and yet with the GDP and earnings growth a little on the sluggish side, that has people a little nervous," Matt Maley, equity strategist at Boston-based Miller Tabak & Co., said in a phone interview. "There's a lot of complacency and people are not worried about major downside because the Fed has their back, but they are nervous about a short-term pullback."

Equities began to erase earlier gains in the afternoon as the Wall Street Journal



June 24 (Bloomberg) -- On today's "Insight & Action," Bloomberg's "Money Clip" Host Adam Johnson reports on the performance of the energy sector. (Source: Bloomberg)

### Related

▶ S&P 500 Has 'Many More' New Highs Coming: Stovall

# 24 June Risky Business Report

RISKY BUSINESS

The Economic Risks of Climate Change in the United States

About

Blog

Reports

Media

## Risky Business Report Finds That U.S. Regions and Business Sectors Face Significant Economic Risks From Climate Change

June 24, 2014

Press Release

[LIVE WEBCAST: A press conference announcing Risky Business results will be webcast live at 8:30 a.m. EST June 24. [Watch here.](#)]

Contact:

MATTHEW LEWIS

[media@riskybusiness.org](mailto:media@riskybusiness.org)

Twitter: @mateosfo

415-523-8029

**Ex-Treasury Secretaries Shultz, Rubin and Paulson Join Bloomberg, Steyer and other Leaders Urging Industry to Better Understand Risks to Economy**

*First-of-its-kind Risk Analysis Quantifies Potential for Economic Disruptions; Independent, Non-partisan Study Breaks New Ground in Climate Risk Assessment*

**New York, June 24** – The American economy could face significant and widespread disruptions from climate change unless U.S. businesses and policymakers take immediate action to reduce climate risk, according to a new report released today. The



### Archives

2015

[January](#)

2014

[November](#)

[August](#)

[July](#)

[June](#)

[April](#)

[February](#)

[January](#)

2013

[October](#)



# Divestment Tipping Point

## Ex Goldman risk chief: Stanford coal cut a 'tipping point'

Lawrence Delevingne | @ldelevingne

Wednesday, 14 May 2014 | 10:04 AM ET



Chip Chipman | Bloomberg | Getty Images

Hoover Tower, left, on the campus of Stanford University in Palo Alto, Calif.



# Think About Dynamic Optimization

---

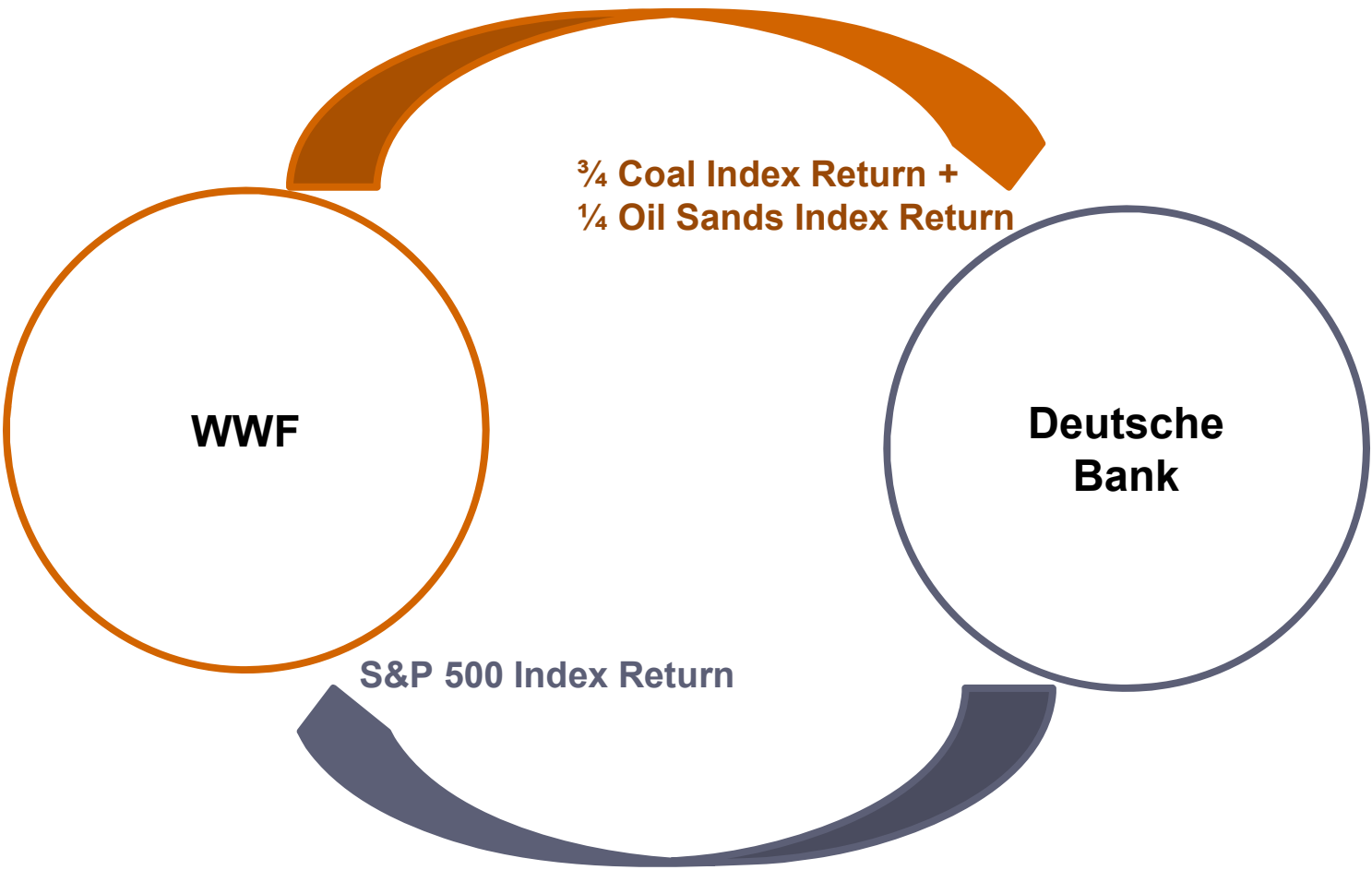
**With Uncertainty, Tipping Points And Nonlinear Responses**



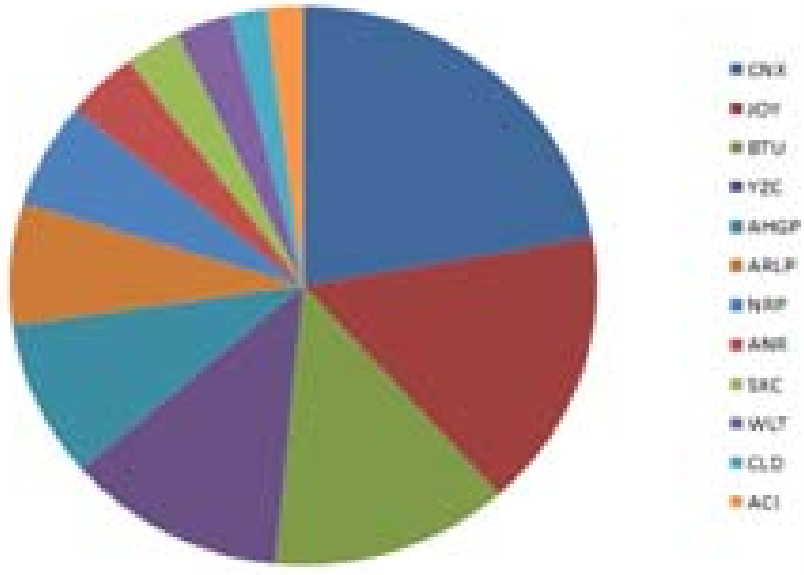
Source: Bob Litterman: The Price of Climate Risks

**Because we've wasted precious time; we need to immediately slam on the brake**

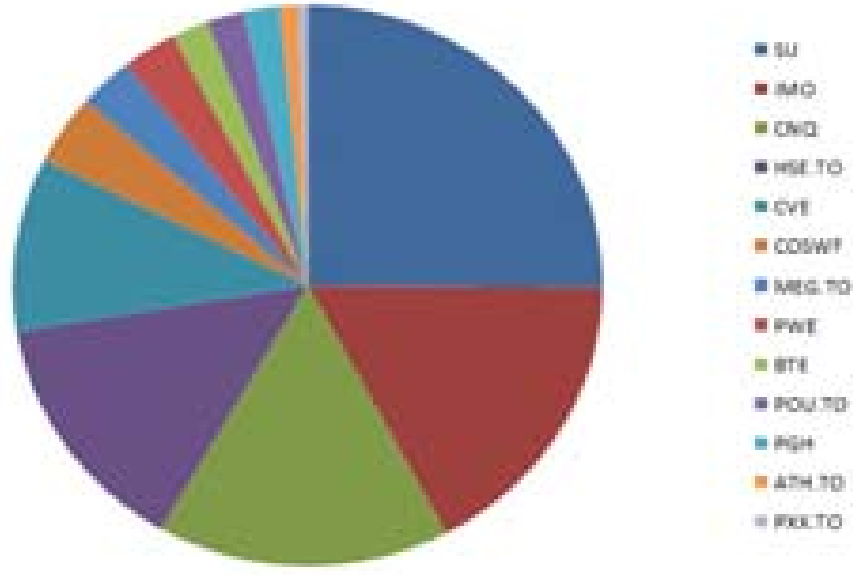
# Stranded Assets Total Return Swap



Coal index – 12 stocks  
market cap weights



Oil sands index – 13 stocks  
market cap weights



# Europe Equity Phase Transition

## TOP OUTLIERS

Indonesia	+2.58σ	+3.5%
France	-2.33σ	-1.4%
Italy	-2.29σ	-2.5%
Biotech	-2.11σ	-2.6%
Europe	-2.09σ	-1.1%
Germany	-2.08σ	-1.3%
Small Caps	-2.00σ	-1.7%
Social Media	-1.90σ	-2.3%
Solar	-1.83σ	-3.5%
EAFE	-1.75σ	-0.8%
Commodity Index	-1.74σ	-0.8%
South Korea	-1.70σ	-1.2%

Mon, 7 Jul 2014

< PLAY >



## CORRELATION MAP



# Europe Equity Phase Transition

The start of the negative systemic risk cascade...

## Europe Stocks Drop After Biggest Weekly Rally Since March

By Sofia Horta e Costa | July 07, 2014



European stocks fell the most in almost two weeks as investors assessed equity valuations following the biggest rally since March.

Sky Deutschland AG and Deutsche Boerse AG slipped at least 2.5 percent each after brokerages downgraded the shares. TeliaSonera AB and Tele2 AB advanced after the Swedish company agreed to buy Tele2's Norwegian business. PostNL NV (PNL) rallied the most in more than two years after boosting its profit forecast.

The Stoxx Europe 600 Index dropped 0.9 percent to 344.8 at the close of trading in London, with all 19 industry groups retreating. The equity gauge rose 1.8 percent last week as U.S. jobs data exceeded economists' forecasts and commodity producers rallied. The index traded at 15.6 times the estimated earnings of its members on July 4, near its highest valuation since 2009.

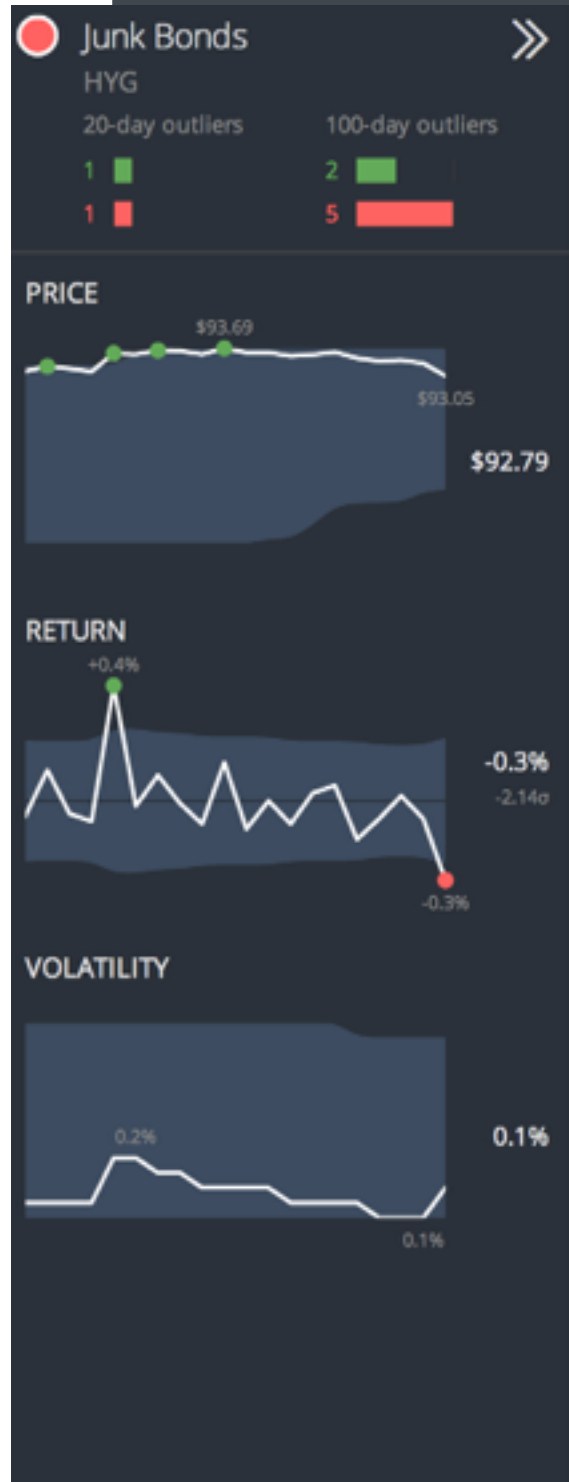
### VIDEO: U.S. Stocks Plunge on Concerns Over Global Growth

"What we need to see now is earnings growth," said Michael Kapler, a portfolio manager at Mittelbrandenburgische Sparkasse in Potsdam, Germany. "Companies have to really deliver this time because equities are not so cheap any more. We might have some sort of correction in Europe if this earnings season disappoints, and there will be bigger questions concerning valuations. Figures out of the U.S. will give investors an indication of how business is doing, although expectations are already quite high for this quarter."





# Junk is next



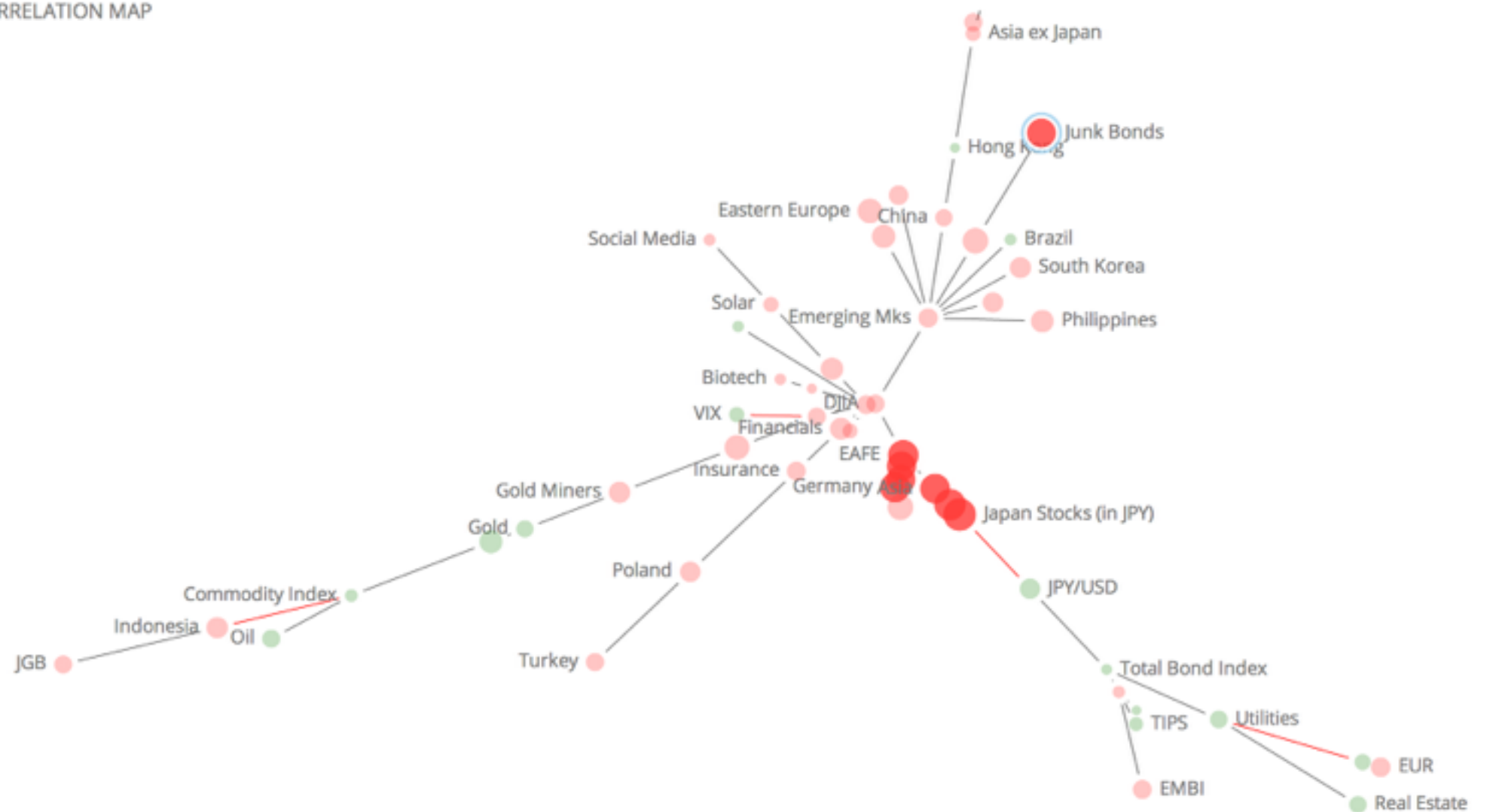
Thu, 10 Jul 2014

< PLAY >

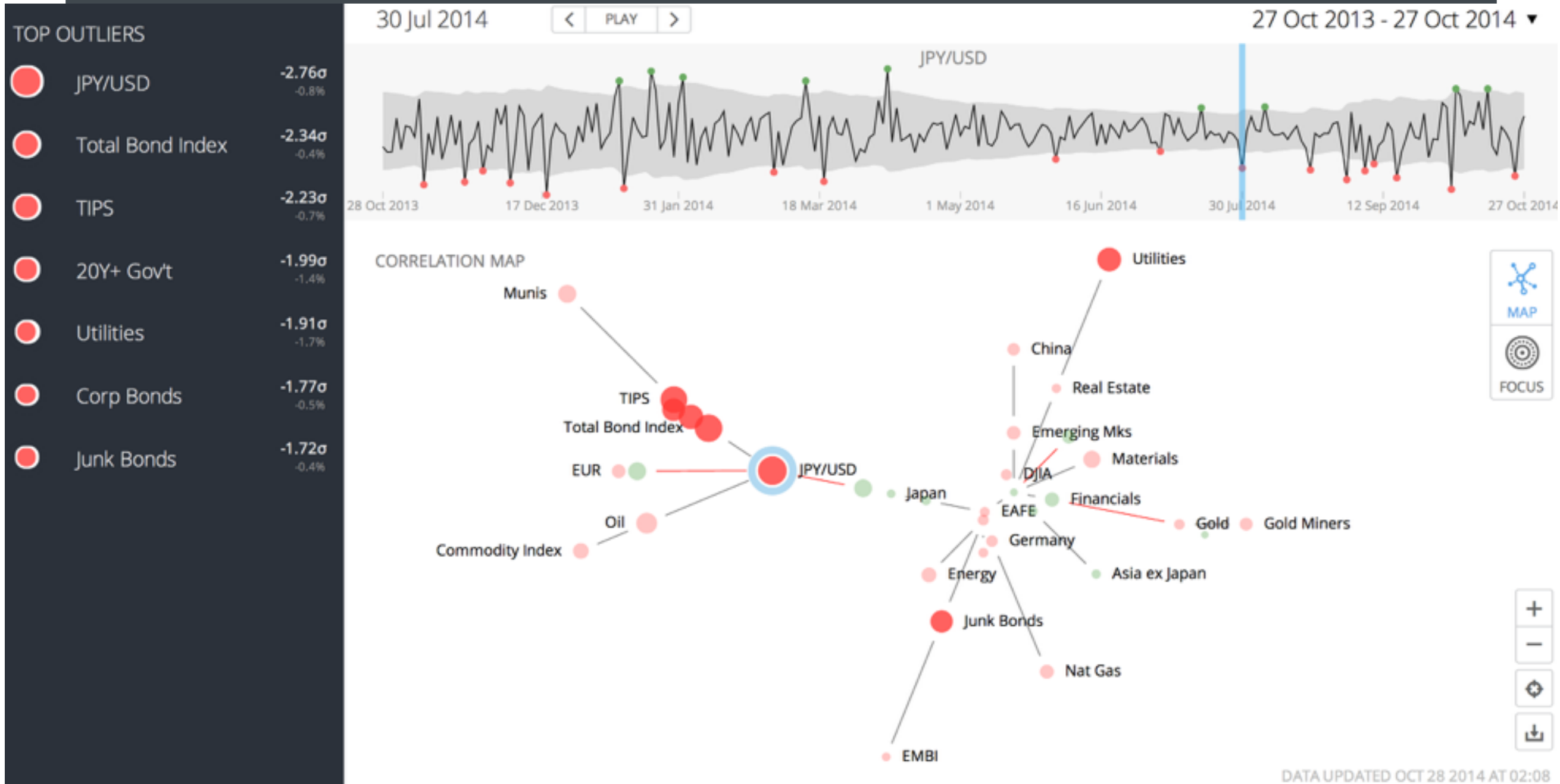
24 Oct 2013 - 24



CORRELATION MAP



# JPY/USD Phase Transition



# Japanese Yen devaluation

“The dollar rose 0.7 percent to 102.82 yen to cap a nine-day advance that marked its longest winning streak against Japan’s currency since March 2005. Japan’s currency fell 0.6 percent to 137.71 per euro.” Bloomberg, Bonds Drop as Dollar Gains on Fed; S&P 500 Little Changed, 31 July 2014

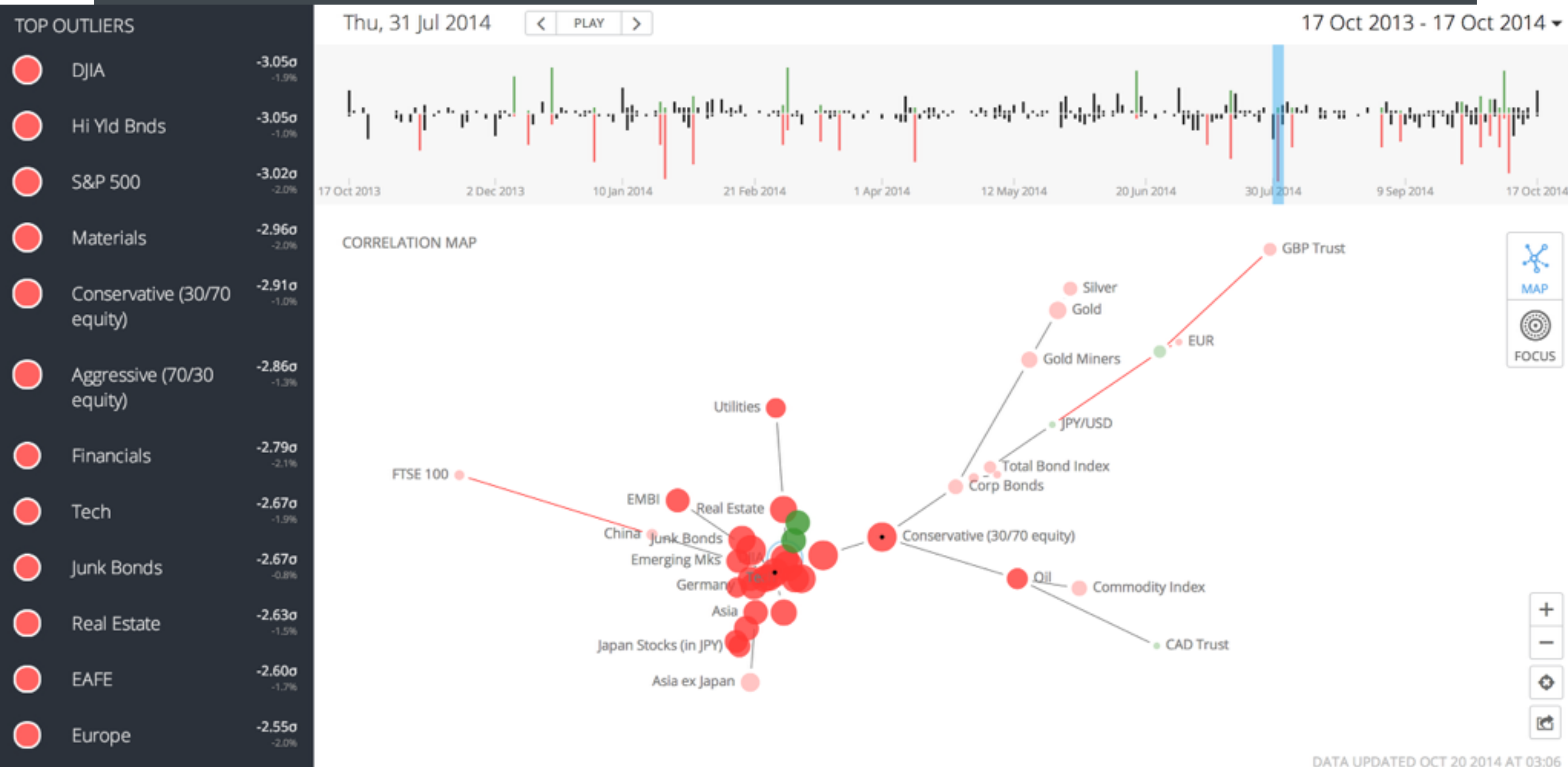
**1 USD = 107.8250 JPY** -0.01000 (-0.009%)

Oct 28, 12:53PM GMT



# 31 July 2014

## US Markets infected, equity & junk bonds





# Stocks, Oil Slide as Dow Erases 2014 Gains; Dollar Rises

By Jacob Barach and Joseph Ciolli | July 31, 2014



SEND TO **kindle**

Global stocks sank the most in almost six months and the Dow (INDU) Jones Industrial Average erased its gains for the year as corporate earnings disappointed and Argentina's default stoked concern credit markets will deteriorate. Oil slid with corn as the dollar strengthened.

The MSCI All-Country World Index slid 1.5 percent, its biggest decline since February, while the Dow fell 1.9 percent and the Standard & Poor's 500 Index dropped 2 percent, the most since April 10. Argentina's dollar bonds slid, while Portuguese debt fell as Banco Espirito Santo SA was told to raise capital after posting a net loss. U.S. oil lost 2.1 percent and corn futures sank as commodities capped the worst monthly drop since 2012. The dollar climbed against most of its major counterparts.

Today's losses sent the global gauge and the S&P 500 down at least 1.3 percent in July after five straight months of gains. Technology shares tumbled as Samsung Electronics Co., the world's biggest smartphone maker, posted a drop in net income, while European companies from Adidas AG to Lufthansa AG said the unrest between Russia and Ukraine was dimming prospects for growth. S&P said Argentina was in default after it missed a \$13 billion interest payment on debt and negotiations failed.

**VIDEO: Dow, S&P 500 Will Double in Five Years: Lee**

"Selling breeds selling," said Timothy Ghriskey, who helps oversee \$1.5 billion as chief investment officer for Bedford Hills, New York-based Solaris Asset Management LLC. "There's a lot of chatter about a correction, so I think that does cause some profit taking. When traders get a whiff of that, they join right along."



# September-Oct 2014 Wave

**JPY, GBP, Commod, Oil, Gold 2 Sep**

**AU, BRL, Asia 8 Sep**

**Real Estate 12 Sep**

**Asia 17 Sep**

**France, Junk 23 Sep**

**US Equities 25 Sep**

**Commod, Oil 30 Sep**

**Materials, Japan 1 Oct**

**USD (up), 3 Oct**

**Europe 7 Oct**

**Energy, JNK, JP, EU 9 Oct**

**Tech, JNK 10 Oct**

**Energy, Materials 13 Oct**



# 2 Sep 2014

## Next wave of outliers

### TOP OUTLIERS

JPY/USD	-2.83σ	-1.1%
Commodity Index	-2.60σ	-1.5%
GBP Trust	-2.60σ	-0.8%
Oil	-2.55σ	-2.8%
Japan Stocks (in JPY)	+2.49σ	+1.8%
Gold	-2.44σ	-1.8%
20Y+ Gov't	-2.38σ	-1.7%
Total Bond Index	-2.17σ	-0.3%
Gold Miners	-2.10σ	-3.4%
TIPS	-2.08σ	-0.5%
Conservative (30/70 equity)	-2.07σ	-0.7%
Corp Bonds	-1.98σ	-0.5%
Silver	-1.98σ	-1.6%

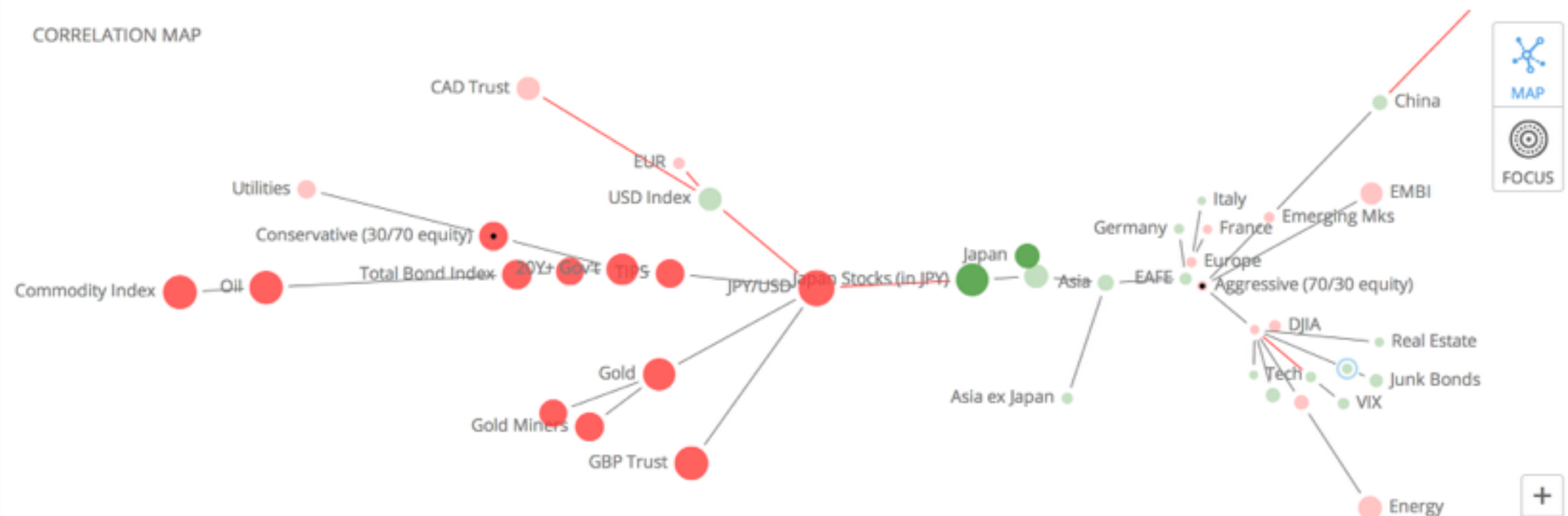
Tue, 2 Sep 2014

< PLAY >

17 Oct 2013 - 17 Oct 2014 ▼



### CORRELATION MAP



MAP  
FOCUS

+  
-  
⊗  
⊞

DATA UPDATED OCT 20 2014 AT 03:06

# U.S. Stocks Fall From Record as Energy Producers Tumble

By Joseph Ciolli | Sep 3, 2014 3:48 AM GMT+0700 [324 Comments](#) [Email](#) [Print](#)

U.S. **stocks** fell, after the Standard & Poor's 500 Index had its best month since February, as energy producers sank with the price of crude to offset data showing U.S. manufacturing expanded at the fastest pace in three years.

Newfield Exploration Co. slid 2.1 percent as energy companies dropped 1.3 percent as a group. Delta Air Lines Inc. and Southwest Airlines Co. rallied at least 2.8 percent to lead carriers higher. Home Depot Inc. dropped 2 percent after saying it was investigating a possible data breach. Staples Inc. jumped 8.1 percent after Credit Suisse Group AG raised its rating on the stock.

The S&P 500 lost 0.1 percent to 2,002.28 at 4 p.m. in **New York**, trimming earlier losses of 0.4 percent in afternoon trading. The **Dow Jones Industrial Average** slipped 30.89 points, or 0.2 percent, to 17,067.56. The Nasdaq Composite Index rose 0.4 percent, extending its highest level since March 2000. More than 5.7 billion shares changed hands on U.S. exchanges today, snapping an nine-day streak of volume below 5 billion shares.

"The 2,000 area is still in play, and we've yet to move past it convincingly as it remains a speed bump in the short-term," Joe Bell, senior equity analyst at Cincinnati-based Schaeffer's Investment Research Inc., said by phone. "The manufacturing index was better than expected, but after that strong rally we had through much of August, the market is taking a bit of a breather."

The **Institute for Supply Management's** manufacturing index unexpectedly climbed to 59, the highest level since March 2011, from July's 57.1, the Tempe, Arizona-based group reported today. Readings greater than 50 indicate growth. The median forecast in a Bloomberg survey of economists was 57.



Sept. 2 (Bloomberg) -- Chris Rupkey, chief financial economist at Bank of Tokyo-Mitsubishi, examines how geopolitical risks have impacted European economies and the reaction of bond and equity markets. He speaks on "Bloomberg Surveillance."

## Related

 **Taking Stock: Markets, Home Depot Breach, Family Dollar, JPM**

# Europe trades down with oil

... while US stays at peak levels for a while longer





# 22 Sep 2014: Rockefellers Divest

## Carbon divestment

### Heirs to Rockefeller oil fortune divest from fossil fuels over climate change

Heirs to Standard Oil fortune join campaign that will withdraw a total of \$50bn from fossil fuels, including from tar sands funds

● [US will not commit to climate change aid for poor nations](#)

Suzanne Goldenberg in New York

[@suzyji](#)

Monday 22 September 2014 17:19 BST



Shares  
51,343

Comments  
248

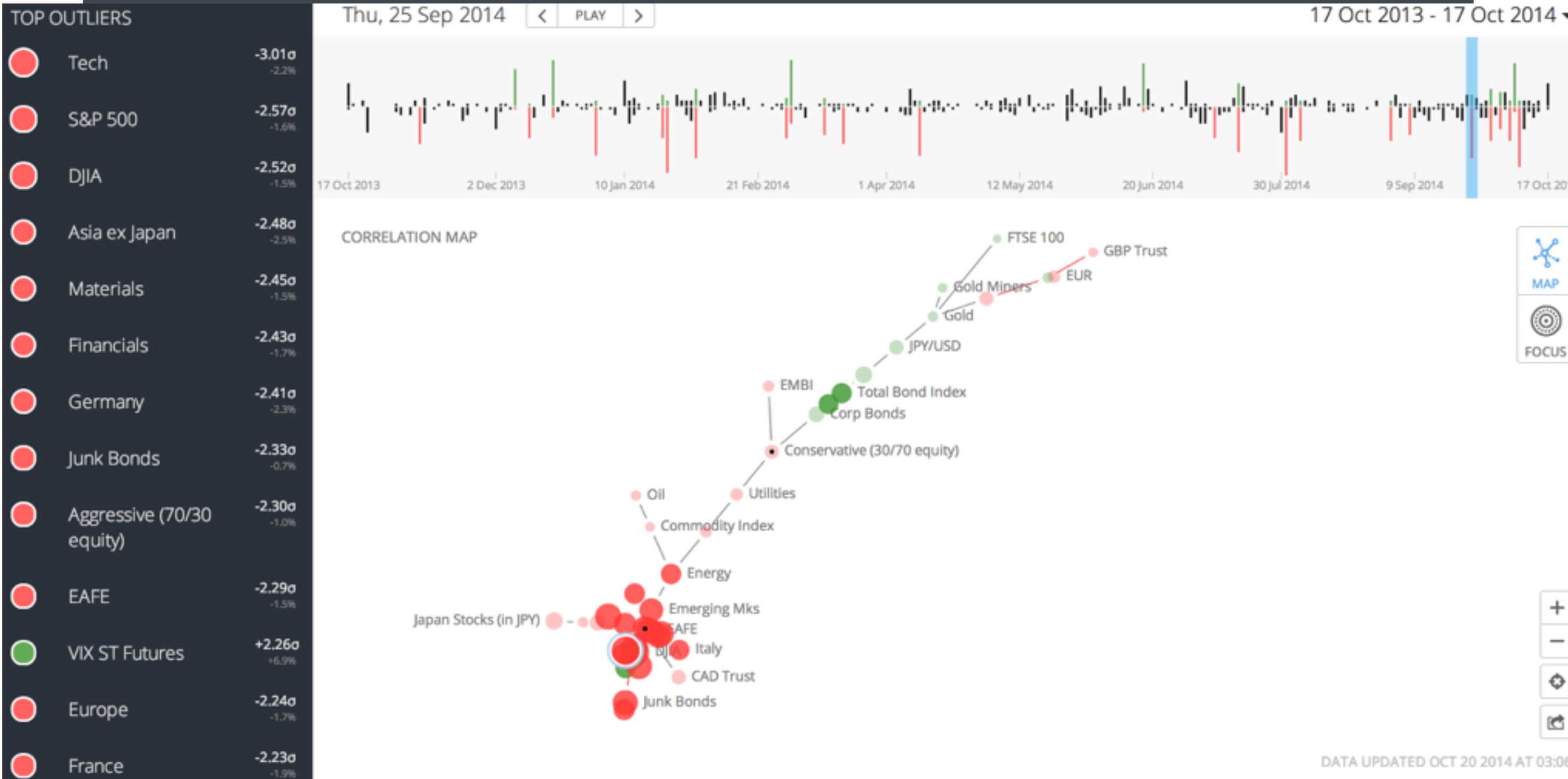


📷 Peter O'Neill, head of the Rockefeller family and great-great-grandson of John D Rockefeller, along with Neva Rockefeller Goodwin (second from the right, great-granddaughter of John D. Rockefeller, and Stephen B Heintz, president of the Rockefeller Brothers Fund. Photograph: Brendan McDermid/Reuters

The heirs to the fabled Rockefeller oil fortune withdrew their funds from fossil fuel investments on Monday, lending a symbolic boost to a \$50bn divestment campaign ahead of a [United Nations summit on climate change](#).

# 25 Sep 2014: US infected

Start of the most recent downside wave



# S&P 500 Tumbles as Apple Sinks While Dollar, Bonds Climb

By Oliver Renick, Joseph Ciolli and Lu Wang | Sep 26, 2014 4:14 AM GMT+0700 [9 Comments](#) [Email](#)  
[Print](#)

U.S. stocks fell the most in eight weeks as Apple Inc. tumbled and concern grew over tensions overseas. The dollar extended a **four-year high** as improving economic data fueled speculation the **Federal Reserve** is moving closer to raising **interest rates**.

The **Standard & Poor's 500 Index (SPX)** lost 1.6 percent at 4 p.m. in **New York**, falling below its average price for the past 50 days for the first time since August. The Nasdaq 100 Index tumbled 2.1 percent, the most since April, as Apple dropped 3.8 percent. The MSCI **Emerging Markets** Index declined to the lowest since May. The Bloomberg Dollar Spot Index climbed for a fifth day and the euro touched a 22-month low. The yield on 10-year Treasuries dropped 6 basis points to 2.51 percent. Gold rose, erasing a loss.

Equities fell and the dollar jumped early in the day as data on U.S. equipment orders and weekly jobless claims helped support the argument that the economy may be improving enough for the Fed to raise interest rates sooner than expected. Stocks extended losses on a report that Russian lawmakers are drafting legislation that would allow the government to seize foreign assets in response to sanctions.



Photographer: Luke Sharrett/Bloomberg

*A roofer works on a house under construction at a Norton Commons residential...* [Read More](#)

## Related

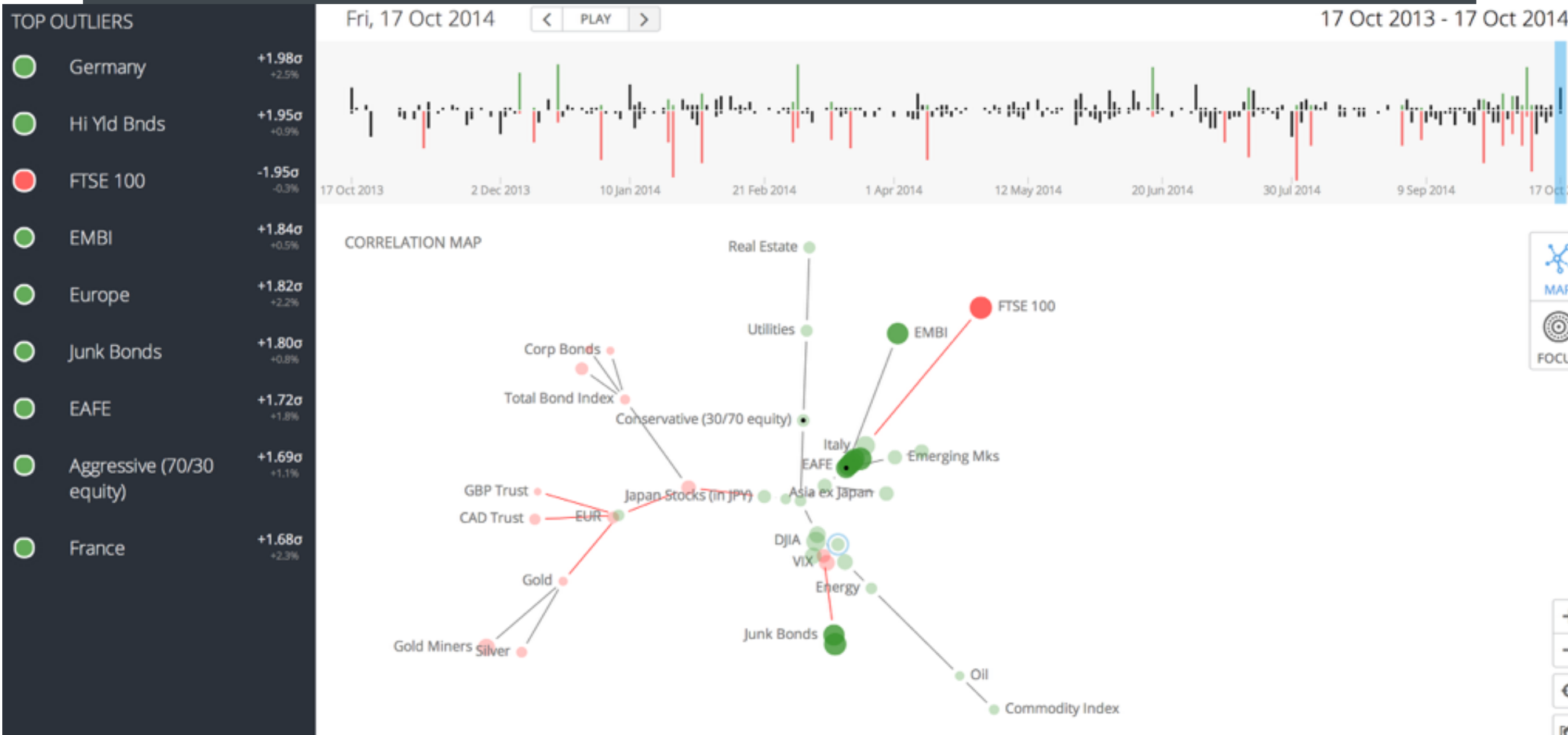
- ▶ **Jeremy Siegel: U.S. Stock Market 'Not in a Bubble'**
- ▶ **Fundstrat's Tom Lee Likes Macy's, Microsoft (Video)**
- ▶ **Naud Says Second-Half's Theme Is 'Dollar Strength'**
- ▶ **U.S. Equities Are Most Attractive: Delaney**

"There's a broad-based fear that things could turn negative -- the market has been short-term skittish," Tom Sudyka, president of Lawson Kroecker Investment Management in Omaha, Nebraska, said in a phone interview. His firm oversees about \$500 million. "Every time we get near or at a record, there's always a



# 17 Oct 2017 - Fed to the Rescue

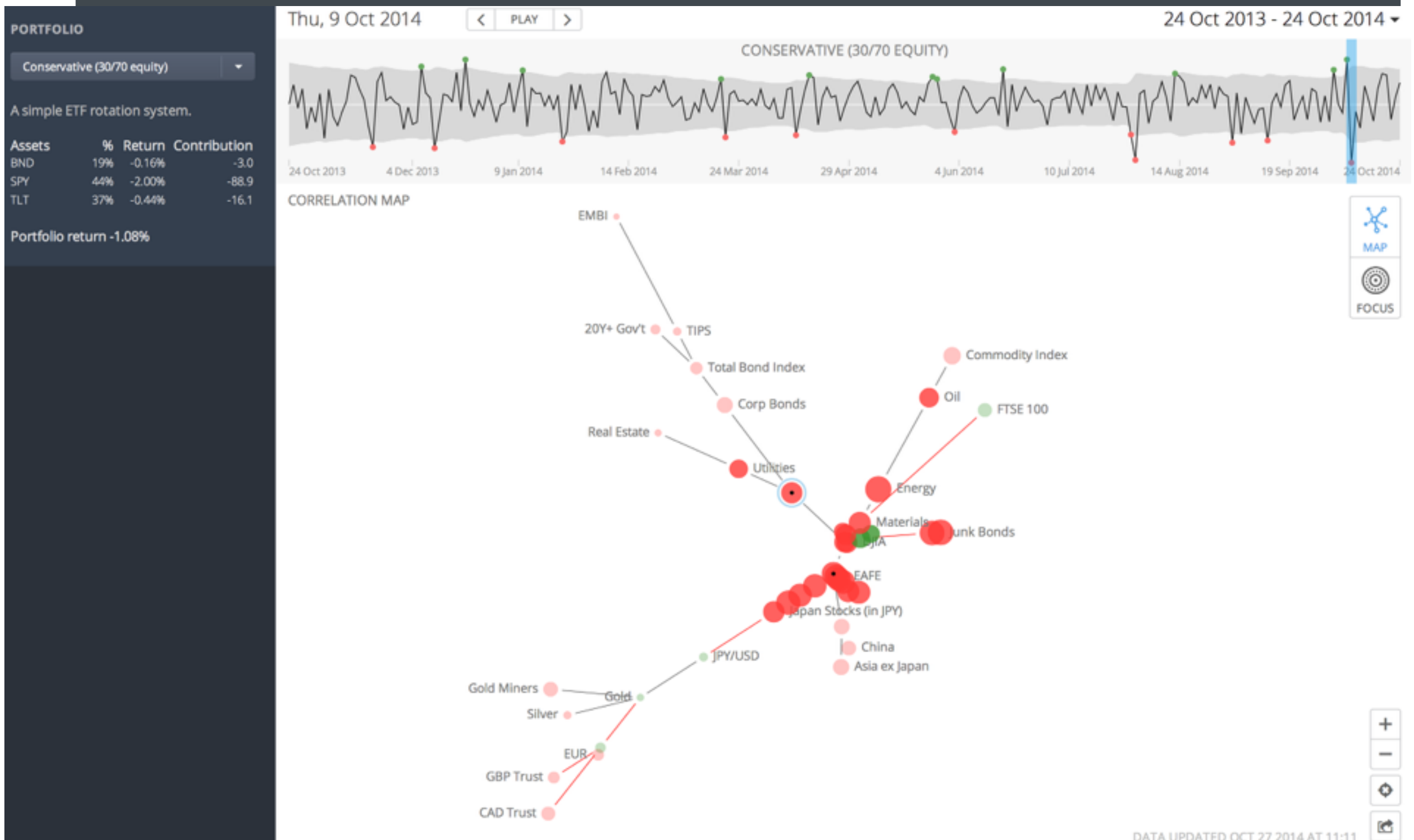
“... the markets’ impressive countermoves on Friday were widely attributed to a single factor -- reassuring words from Federal Reserve officials...” (El-Erian)





# Reverse Stress Testing

What conditions give rise to extreme portfolio losses?



# 9 Oct 2014

## S&P 500 Erases Year's Best Rally as Oil Sinks, Gold Jumps

By Oliver Renick and Joseph Ciolli Oct 10, 2014 3:32 AM GMT+0700 | [4 Comments](#) [Email](#) [Print](#)

The Standard & Poor's 500 Index wiped out its biggest rally of the year as small-caps tumbled with oil amid concern over Europe's economy. Gold rose on bets the largest economies will keep **interest rates** low.

The **S&P 500 (SPX)** fell 2.1 percent at 4 p.m. in New York, the biggest drop since April, after rallying 1.7 percent yesterday. The Russell 2000 Index of smaller companies tumbled 2.7 percent, the also most since April. West Texas Intermediate crude dropped 1.8 percent, falling into a bear market. The euro slid 0.4 percent against the dollar. The Treasury 10-year **yield** was little changed at 2.33 percent, while rates in Germany, France and Spain fell to records. Gold jumped 1.6 percent and the **VIX (VIX)** soared to the highest since February.



Oct. 9 (Bloomberg) -- Berenberg Bank economist Christian Schulz says the domestic U.S. economy is "well on track" and that the Federal Reserve will commence increasing interest rates in April. He talks with Anna Edwards, Mark Barton and Manus Cranny on Bloomberg Television's "Countdown." (Source: Bloomberg)

### Related

- ▶ **U.S. Jobless Claims Fall, Pushing Average to 8-Year Low**
- ▶ **UBS Likes U.S. Stocks.**

## Stealth Bear Markets in U.S. Stocks Are Hiding in Bushes

By Michael P. Regan Oct 9, 2014 11:45 PM GMT+0700 | [0 Comments](#) [Email](#) [Print](#)

While the Standard & Poor's 500 Index is still less than 4 percent below its September record, other gauges of U.S. stocks are revealing where risk has been taken off the most in front of an eventual "normalization" of monetary policy.

Most conspicuous are the 88 energy **companies** represented in the **SPDR S&P Oil & Gas Exploration & Production ETF (XOP)**, a \$1.1 billion fund. The ETF managed to rebound yesterday after falling 24 percent from its June record, though today it's reversing those gains and setting a new 13-month low. Crude oil is down 22 percent from its high in September 2013 as the rallying U.S. currency lowers prices of dollar-denominated commodities.

While lower **oil prices** are good for many parts of the economy, keep in mind that crude and the S&P 500 are usually positively **correlated**, meaning they tend to move in the same direction. The correlation diminished in recent years, and even went negative for a short time in late July and early August. The last time it went negative for any significant period was around the bankruptcy of

# 9 Oct Risk Crescendo

## TOP OUTLIERS

Energy	-2.85σ
Junk Bonds	-2.65σ
Japan	-2.60σ
EAFE	-2.56σ
Europe	-2.54σ
France	-2.51σ
Asia	-2.47σ
Solar	-2.42σ
Italy	-2.41σ
Germany	-2.28σ
Materials	-2.28σ
Small Caps	-2.20σ
Japan Stocks (in JPY)	-2.18σ
S&P 500	-2.10σ

Thu, 9 Oct 2014

< PLAY >

30 Jan 2014 - 30 Jan 2015



## CORRELATION MAP



MAP



FOCUS

+

-



DATA UPDATED FEB 1 2015 AT 09:15

# Oct 9 Energy as worst performer



Thu, 9 Oct 2014

< PLAY >

30 Jan 2014 - 30 Jan 2015



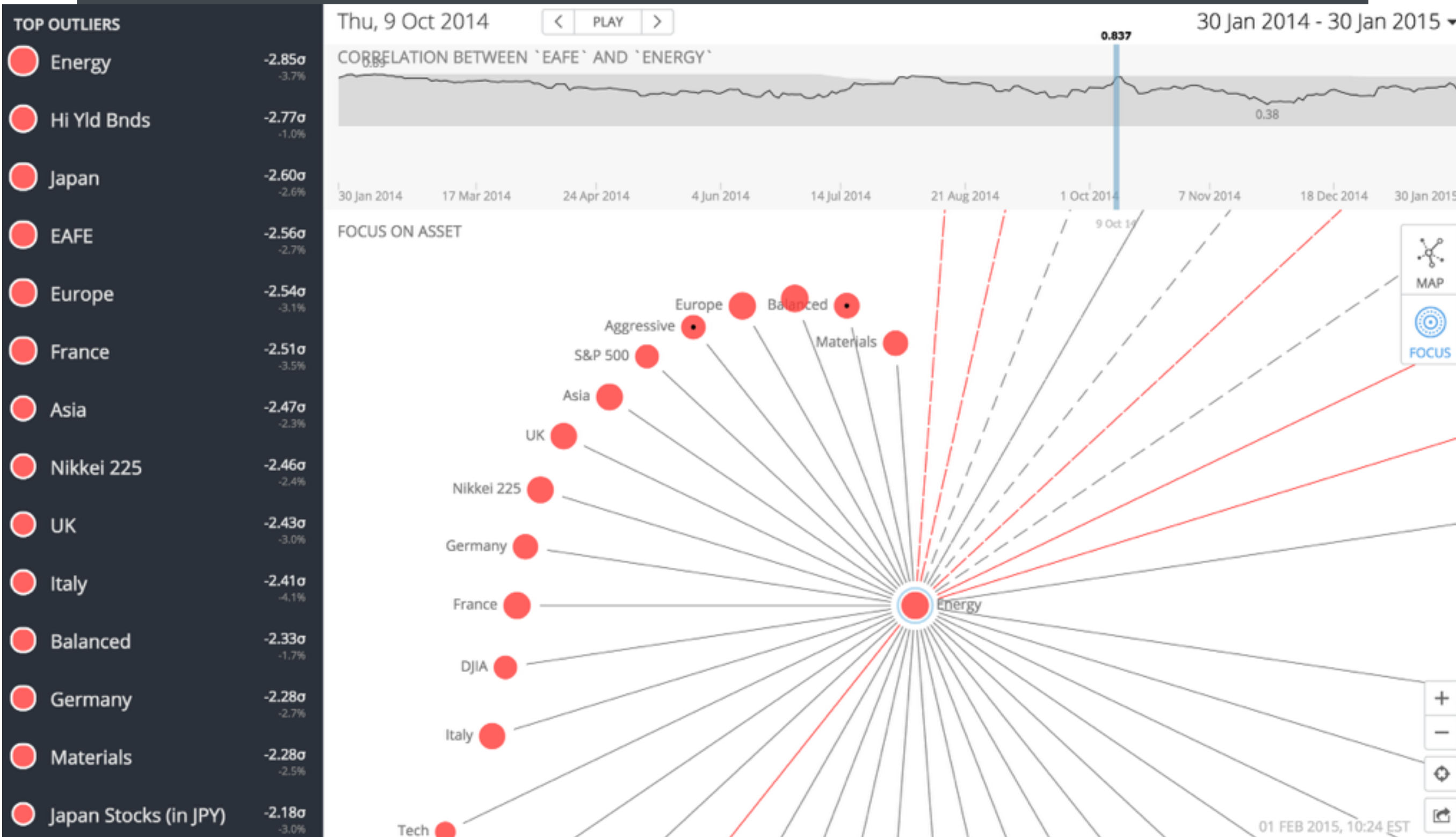
**CORRELATION MAP**



DATA UPDATED FEB 1 2015 AT 09:15



# Oct 9 Energy EAFE correlation



# 28 Nov Black Friday

## TOP OUTLIERS

Commodity Index	-3.37σ
Oil	-3.36σ
Energy	-3.22σ
Silver	-3.06σ
Russia	-2.60σ
Junk Bonds	-2.43σ
Eastern Europe	-2.39σ
Mexico	-2.29σ
Materials	-2.23σ
EMBI	-2.18σ
Gold	-2.17σ
Solar	-2.16σ
Gold Miners	-2.15σ
South Africa	-1.99σ

Fri, 28 Nov 2014

< PLAY >

30 Jan 2014 - 30 Jan 2015 ▾



## CORRELATION MAP



DATA UPDATED FEB 1 2015 AT 09:15

# 28 Nov Black Friday

## TOP OUTLIERS

Commodity Index	-3.37σ
Oil	-3.36σ
Energy	-3.22σ
Silver	-3.06σ
CAD Trust	-2.86σ
Hi Yld Bnds	-2.54σ
GBP Trust	-2.39σ
Materials	-2.23σ
EMBI	-2.18σ
Gold	-2.17σ
Gold Miners	-2.15σ
UK	-2.03σ
Asia ex Japan	-1.83σ
Emerging Mks	-1.75σ
USD Index	+1.73σ

Fri, 28 Nov 2014

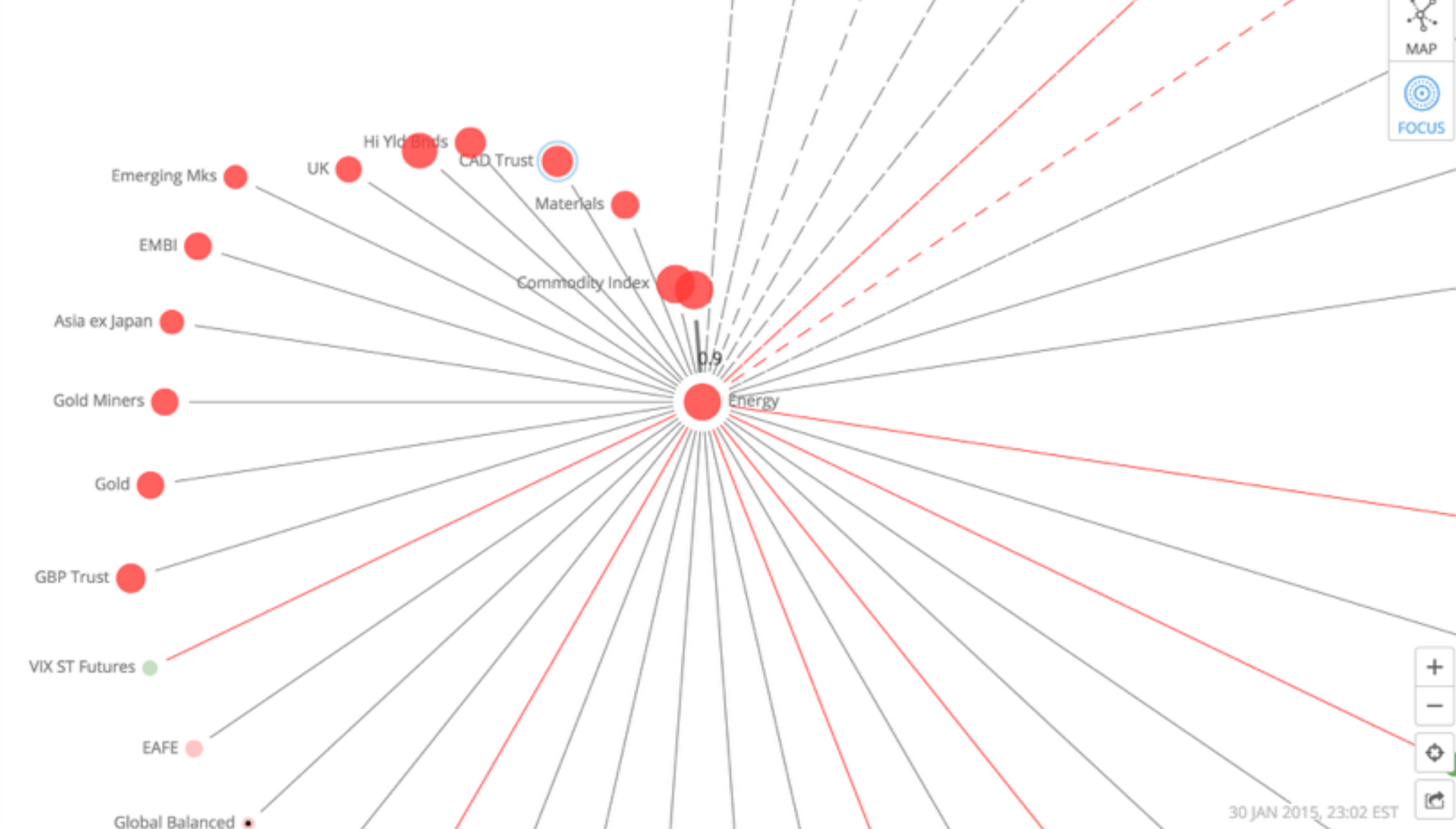
< PLAY >

30 Jan 2014 - 30 Jan 2015

CORRELATION BETWEEN 'OIL' AND 'ENERGY'



FOCUS ON ASSET



# Given inevitability of carbon pricing, was OPEC's move surprising?

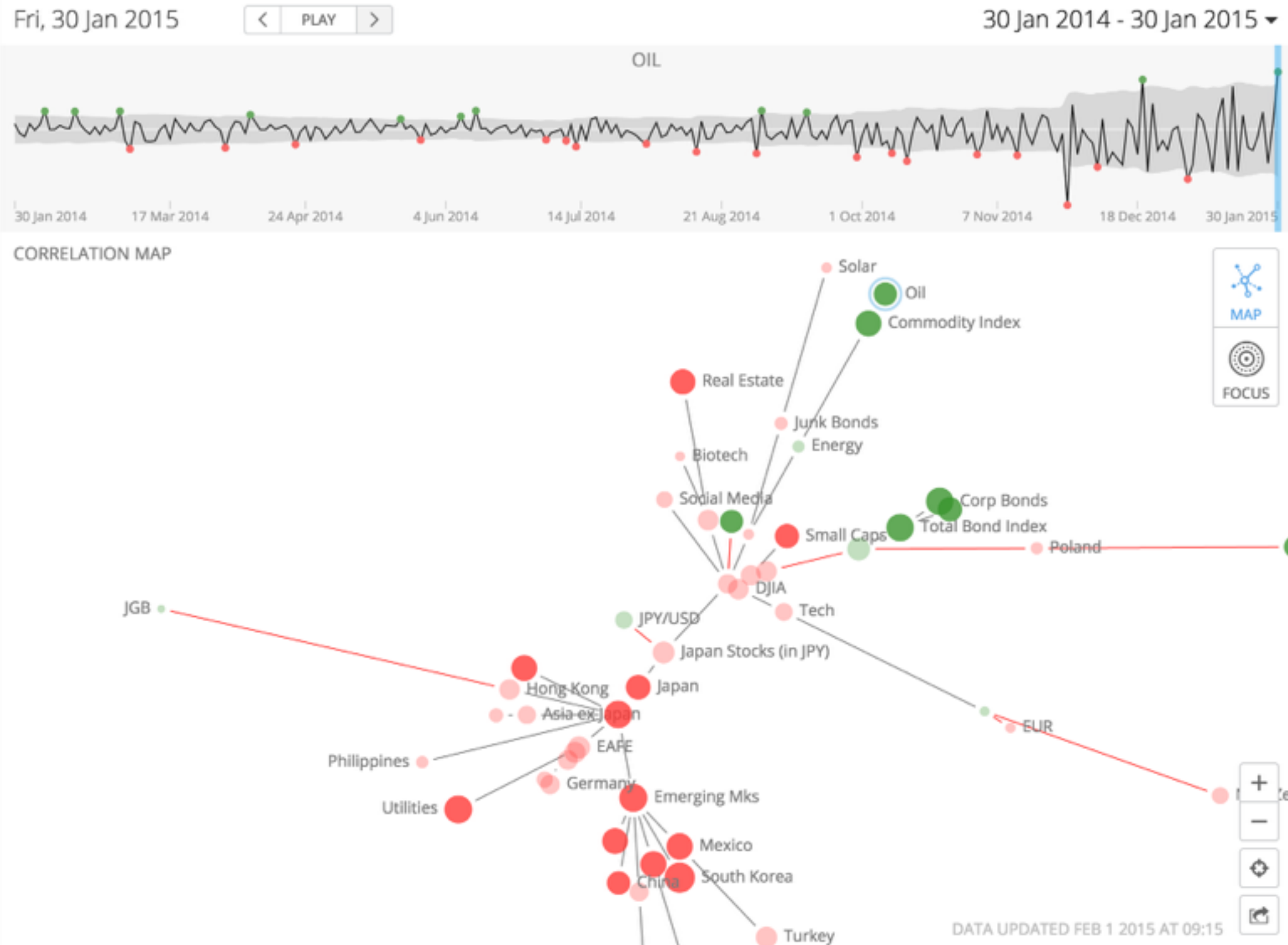
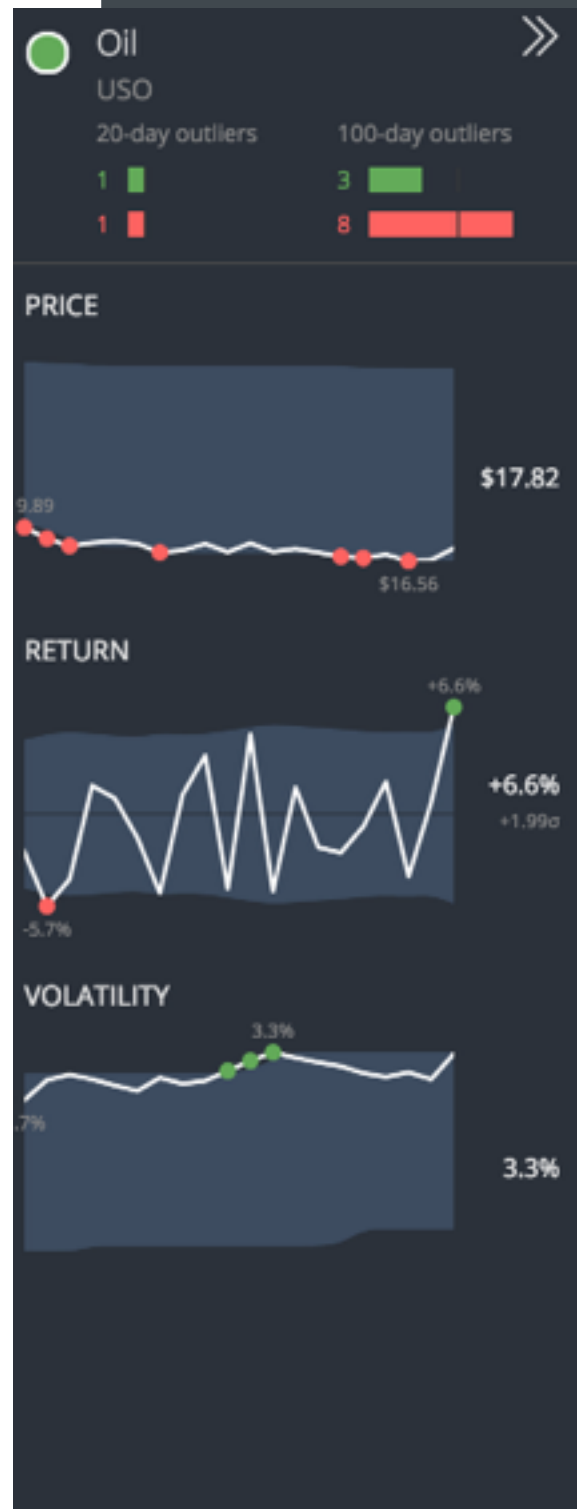
## Oil stocks and oil-related currencies slammed by OPEC move

Friday, 28 Nov 2014 | 7:08 AM ET





# 30 Jan: Oil + 6.6%



# 30 Jan 2015 Outliers

## TOP OUTLIERS

South Korea	-2.46σ
Emerging Mks	-2.22σ
Utilities	-2.20σ
Asia	-2.17σ
Total Bond Index	+2.16σ
Corp Bonds	+2.16σ
Mexico	-2.04σ
Brazil	-2.02σ
Oil	+1.99σ
India	-1.99σ
Commodity Index	+1.98σ
Indonesia	-1.97σ
Real Estate	-1.91σ
Japan	-1.85σ

Fri, 30 Jan 2015

< PLAY >

30 Jan 2014 - 30 Jan 2015

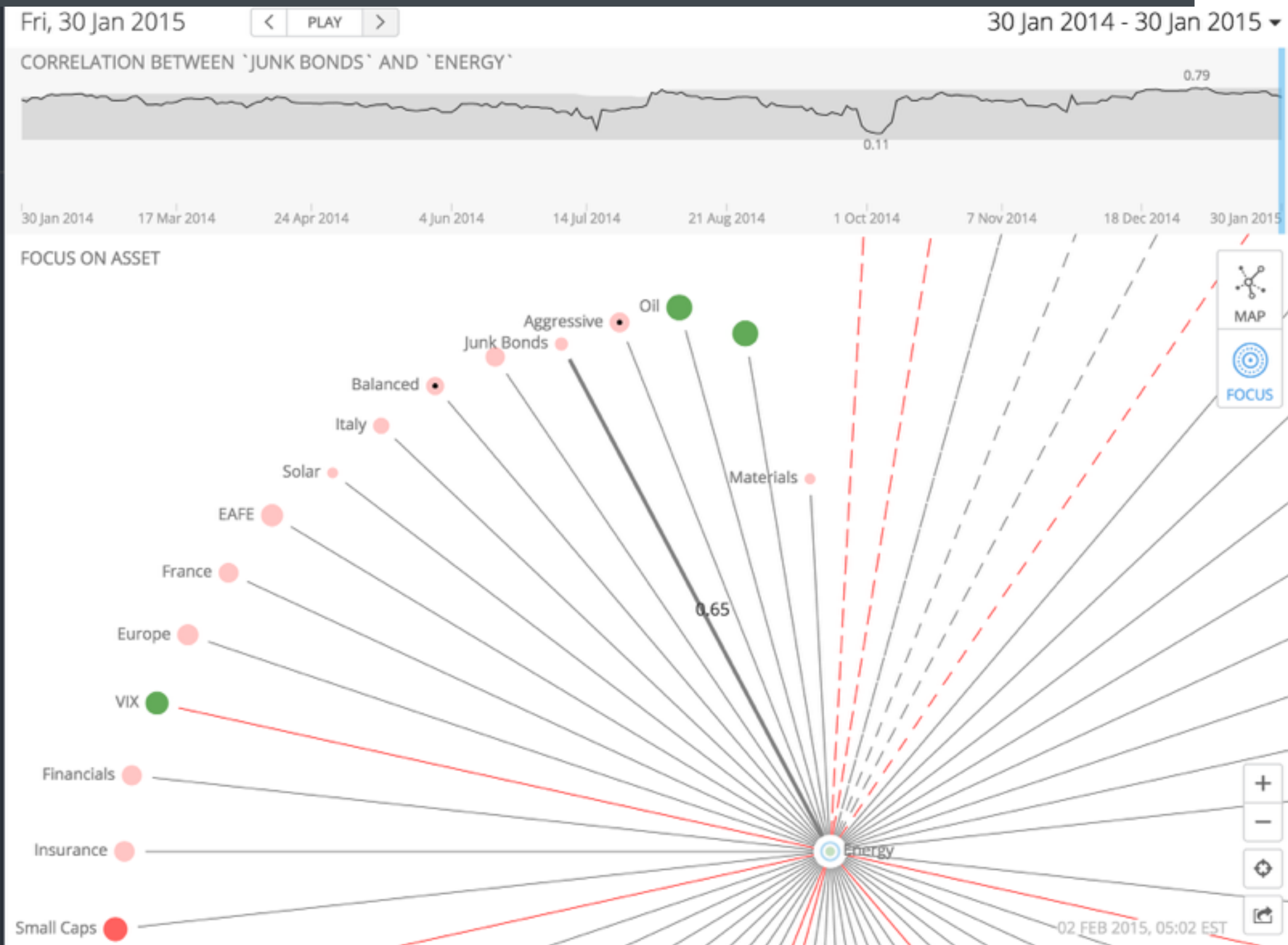


## CORRELATION MAP



DATA UPDATED FEB 1 2015 AT 09:15

# Energy correlation to Junk still high



# Predictive Stress 30 Jan 2014: -3sd Oil & Energy shock

## TOP OUTLIERS

Commodity Index	-2.98 $\sigma$
	-3.6%
Oil	-2.98 $\sigma$
	-9.9%
Energy	-2.95 $\sigma$
	-5.4%
Materials	-1.92 $\sigma$
	-2.3%
Solar	-1.90 $\sigma$
	-3.6%
Junk Bonds	-1.65 $\sigma$
	-0.8%

## CORRELATION MAP





# Predictive Stress Black Friday 28 Nov 2014: -3sd Oil & Energy shock



# Predictive Stress 9 Oct 2014: -3sd Oil & Energy

## TOP OUTLIERS

Energy	-3.00σ	-3.9%
Oil	-3.00σ	-4.3%
Commodity Index	-2.73σ	-2.0%
Materials	-2.45σ	-2.7%
Europe	-2.29σ	-2.8%
South Korea	-2.27σ	-2.3%
EAFE	-2.24σ	-2.4%
France	-2.23σ	-3.1%
Germany	-2.17σ	-2.5%
Small Caps	-2.16σ	-2.7%
Asia	-2.09σ	-1.9%
Italy	-2.05σ	-3.5%
S&P 500	-2.02σ	-1.9%
South Africa	-1.97σ	-3.3%

## Stress test results

Close

## CORRELATION MAP

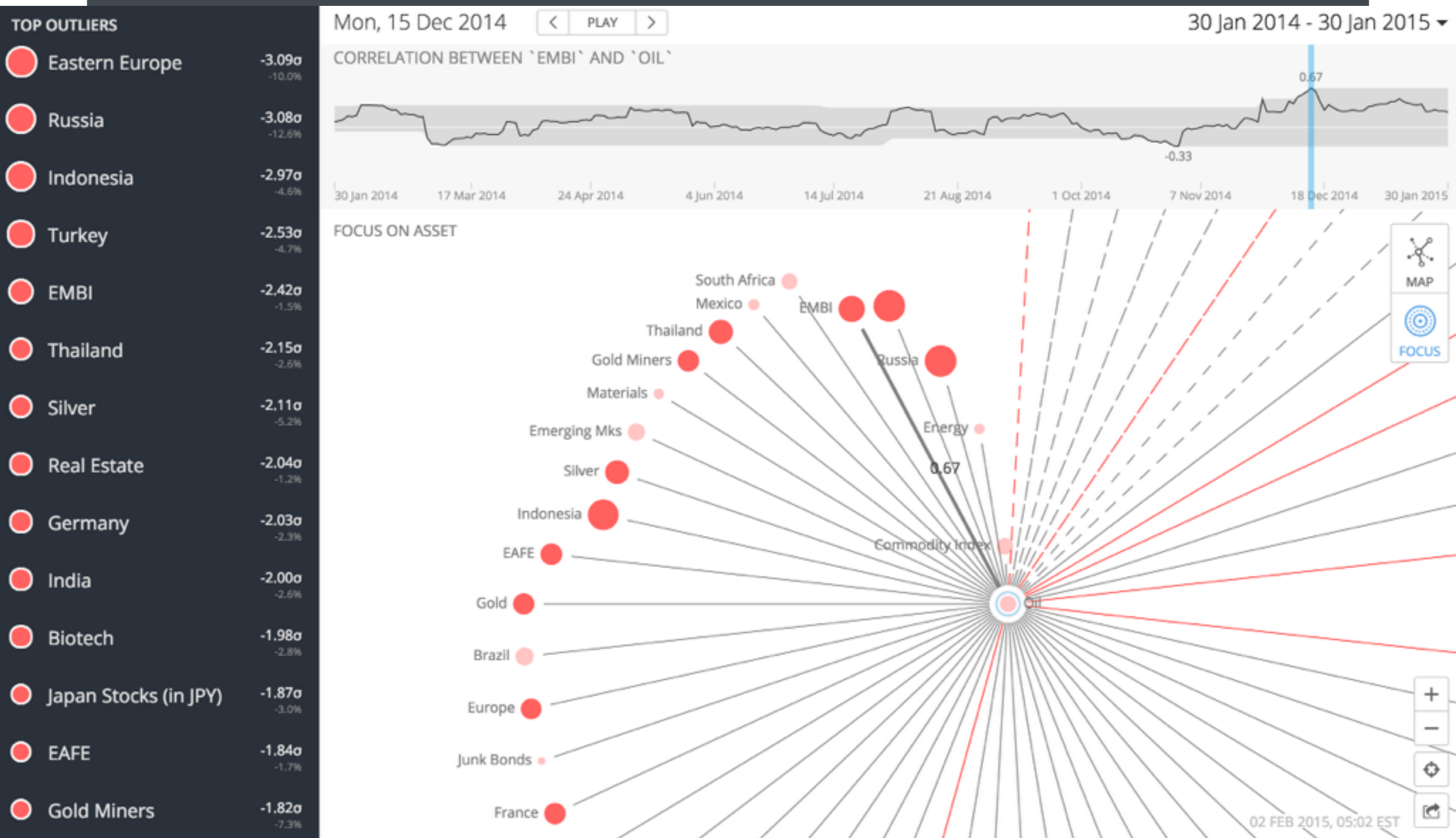


DATA UPDATED FEB 1 2015 AT 09:15

# 10-15 Dec EM & Russia Crisis



# 15 Dec Oil & EMBI correlation peaks





# Summary: Financial Cartography

---

Improve risk models by representing interconnectivity

Simplify complexity by filtering signal from noise

## **Key steps:**

What's a relevant map for you?

Where are you on the map?

Where do you want to go?



# Summary & Conclusions



# Adaptive Stress Testing: harness social intelligence

## 1. Stress Library from Thought Leaders

- Create StressIndex with key driving factors
- Use Financial Cartography to build intuition on connected risks

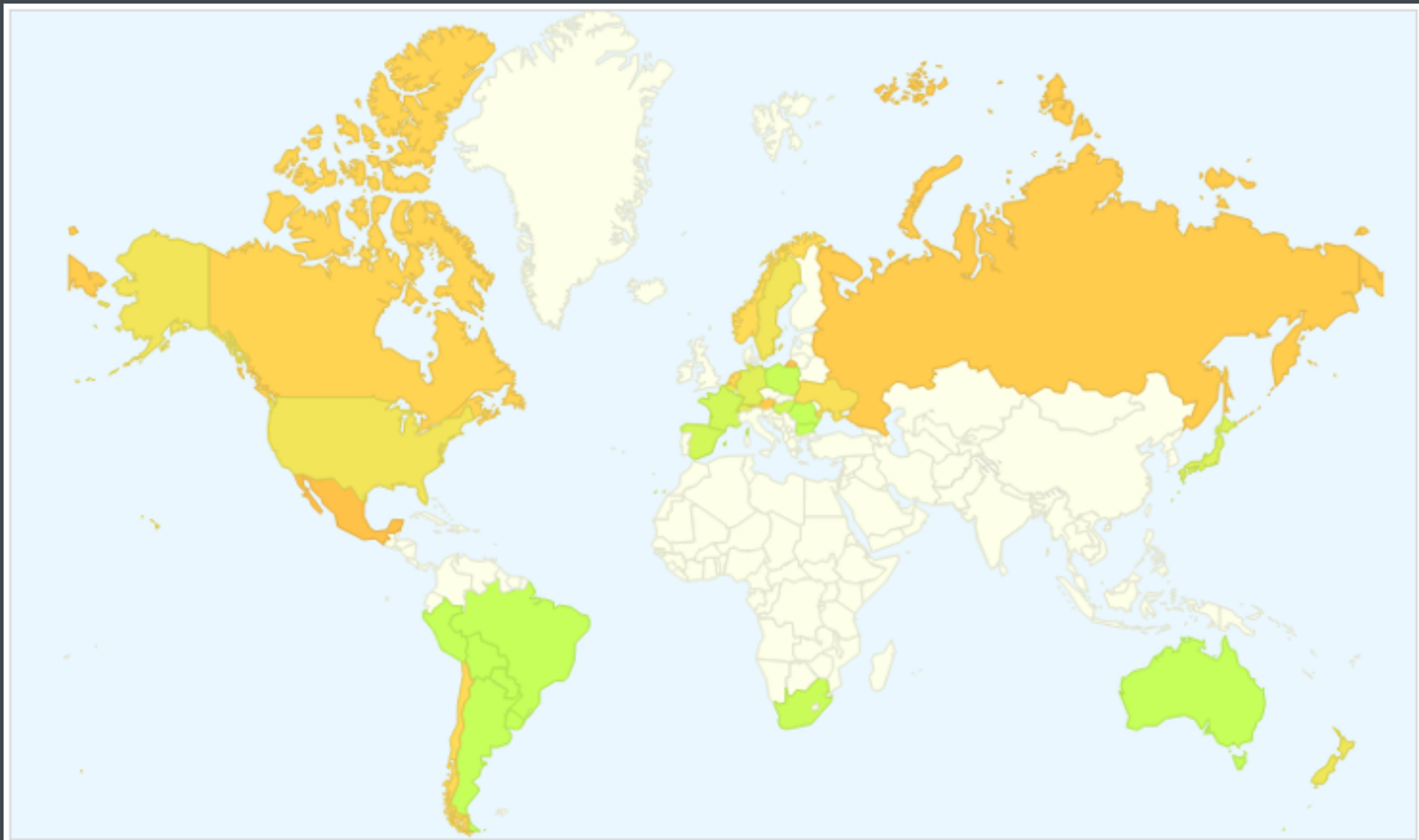
## 2. Monitor Early Warning Signals (Outliers)

- Focus on key systemic fault lines: what nodes are most likely to be affected by cascading risk?
- Apply severe predictive shocks to key nodes



Maps are essential for any Command Center: amplify intelligence, build intuition, and manage systemic risk

Google Flu Trends (2013)





# Mass collaboration platforms empower social intelligence



# Conclusions

- An era of systemic risk: everything is connected
- Develop visual intuition with Financial Cartography
- Spark an evolutionary leap in risk culture with collaborative intelligence platforms

*The future is already here. It's just not very evenly distributed. - William Gibson*



# Questions?

Alan Laubsch  
Director & VP of Risk Products  
[alan@fna.fi](mailto:alan@fna.fi)

**FNA**



[www.fna.fi](http://www.fna.fi)

