Cambridge Centre for Risk Studies

Wednesday, 9 September 2015

FINANCIAL RISK AND NETWORK THEORY CONFERENCE

Cambridge Centre for Risk Studies

Research Supporters and Academic Collaborators:

McKinsey&Company

HSBC

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E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

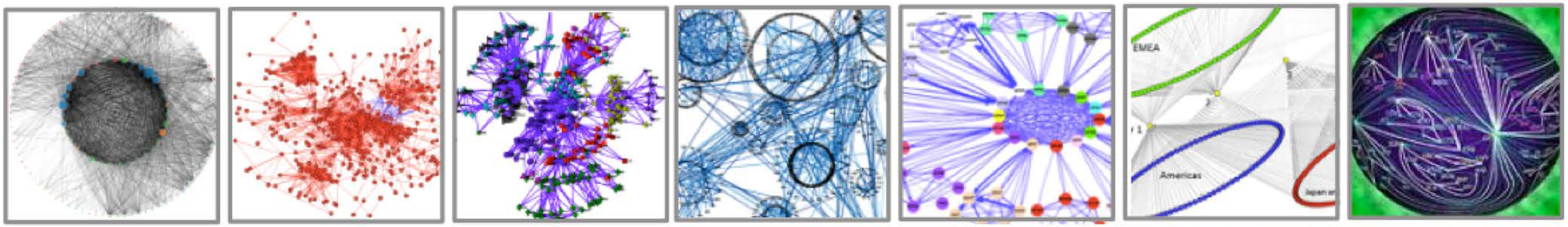
NANYANG TECHNOLOGICAL UNIVERSITY

Institute of Catastrophe Risk Management

COLUMBIA ENGINEERING

The Fu Foundation School of Engineering and Applied Science

The 2014 Financial Risk and Network Seminar



- **Welcome Back**
  - 2nd annual **Financial Risk and Network Seminar**

Rosario Mantegna
Professor, Central European University and Palermo University
Speaker bio

Rod Garratt
Vice President, Federal Reserve Bank of New York
Speaker bio

Iman van Lelyveld
Deputy Head of the International Data Hub, Bank for International Settlements
Speaker bio

Networks, Data & Policy

  - 1st birthday ***Journal of Network Theory in Finance***

UNIVERSITY OF CAMBRIDGE Judge Business School | Centre for **Risk Studies**

FNA

Cambridge Prize for Visualization of Financial Networks

- Stunning presentations at 2014 Financial Risk and Network Seminar

http://www.blogs.jbs.cam.ac.uk/risk-studies-viewpoint/2014/10/31/the-art-of-financial-network-science/

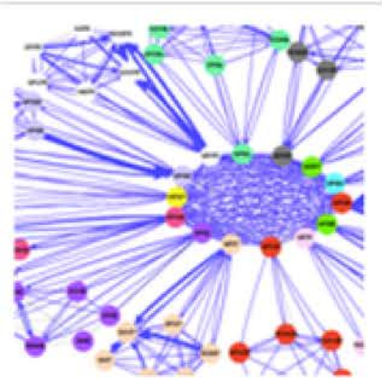
- This year we will award a prize, the

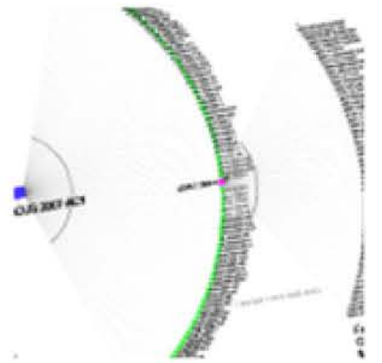
  Cambridge Centre for Risk Studies'

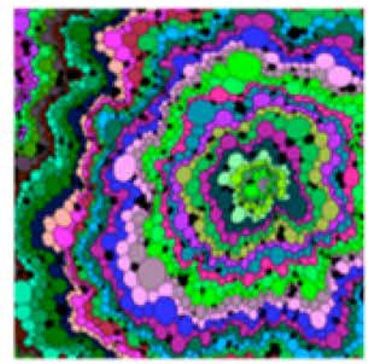
  Prize for Financial Network Visualization

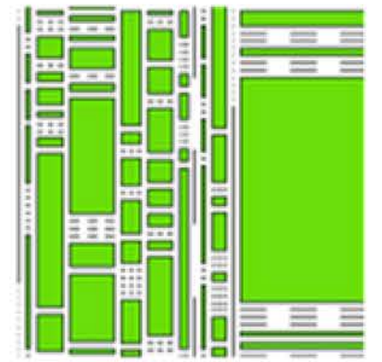
  for the best network visualization presented at the Conference on 9 September.

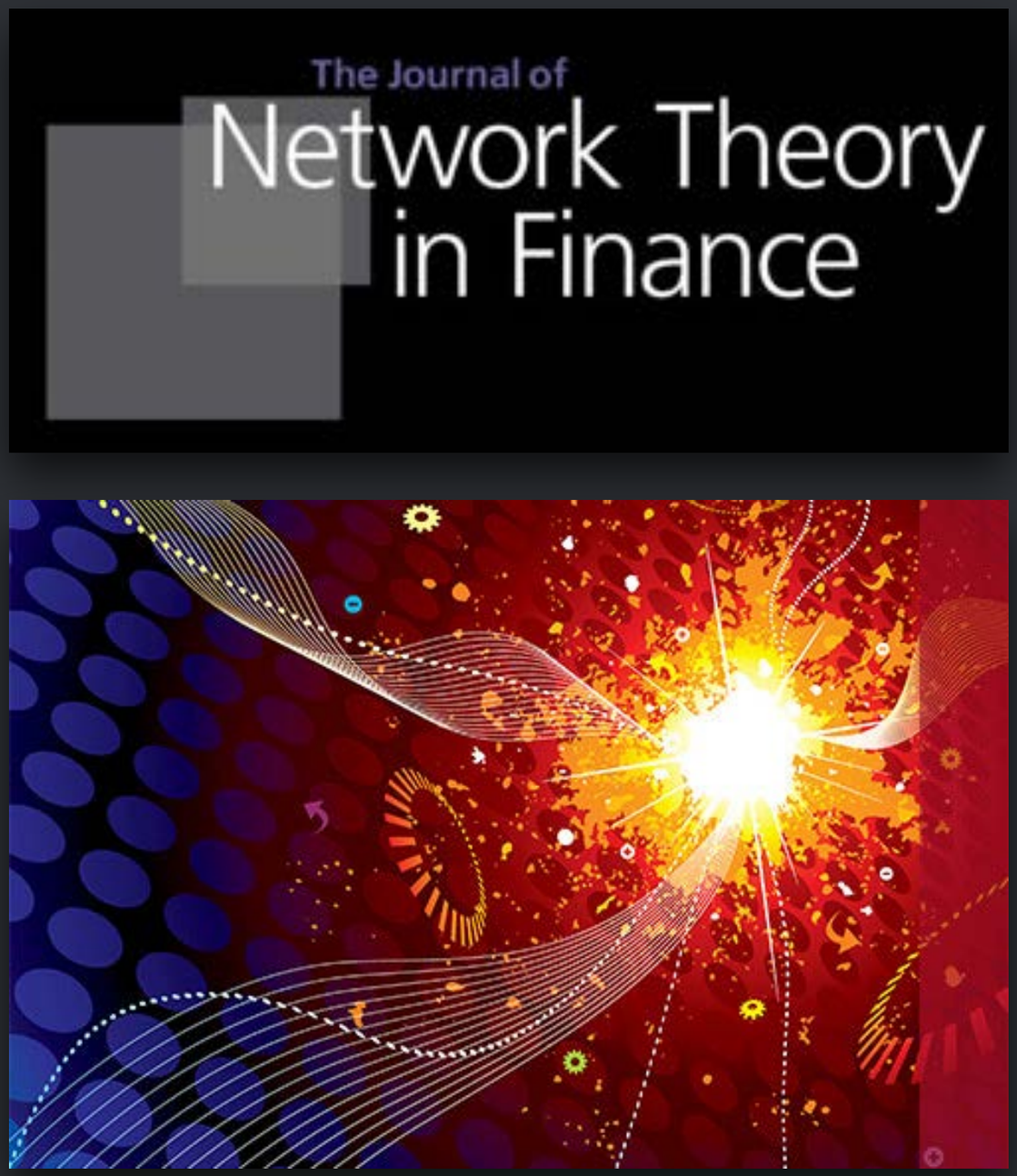
- Conference organizing committee will announce the winner in the coming days
  - Featured on conference website
  - Award a certificate to the winner
  - Winning image reproduced as a large scale framed poster for the presenter and their institution.











Journal '**Network Theory in Finance**' was launched in March 31, 2015

Editor in Chief: *Kimmo Soramäki*

"Journal of Network Theory in Finance is an interdisciplinary journal publishing rigorous and practitioner-focused research on the application of network theory in finance. The journal connects academia, regulators and practitioners in solving important issues around financial risk"

The Journal of Network Theory in Finance

Editorial Board

The Journal of Network Theory in Finance

Papers

Volume 1,
Number 1 (March 2015)

Emergence of the EU corporate lending network
by Grzegorz Hałaj, Urszula Kochanska and Christoffer Kok

Risk diversification: a study of persistence with a filtered correlation-network approach
by Nicoló Musmeci,Tomaso Aste and T. Di Matteo

Eccentricity in asset management
by Hakan Kaya

A multiplex network analysis of the Mexican banking system: link persistence, overlap and waiting times
by José-Luis Molina-Borboa, Serafin Martínez-Jaramillo, Fabrizio López-Gallo and Marco van der Leij

Transmission of shocks in the integrated accounting framework
by Olli Castrén and Ilja Kristian Kavonius

Volume 1,
Number 2 (June 2015)

Granger-causal nonlinear financial networks
by Paweł Fiedor

The global network of payment flows
by Samantha Cook and Kimmo Soramäki

Too Interconnected to Fail: A Survey of the Interbank Networks Literature
by Anne-Caroline Hüser

Group lending to a borrower network: a partial joint liability model
by Usha Sridhar and Sridhar Mandyam

Volume 1,
Number 3 (September 2015)

Network-based Measures as Leading Indicators of Market Instability: The case of the Spanish Stock Market
by Gustavo Peralta

The Journal of Network Theory in Finance

Program

9:30	Keynotes		
11:30	Keynotes		
14:15	I: Systemic Risk	II: Payment & Supply Networks	III: Financial History
16:15	IV: Network Theory	V: Correlation Networks	VI: Interbank Networks
18:30	Drinks and Dinner		

FNA

APPLICATIONS OF NETWORK THEORY IN FINANCE

www.fna.fi

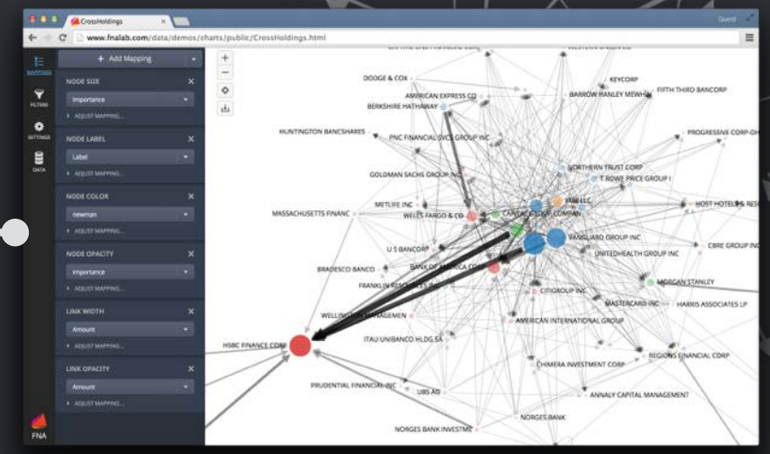
Kimmo Soramaki
Founder and CEO
kimmo@fna.fi

FNA Software

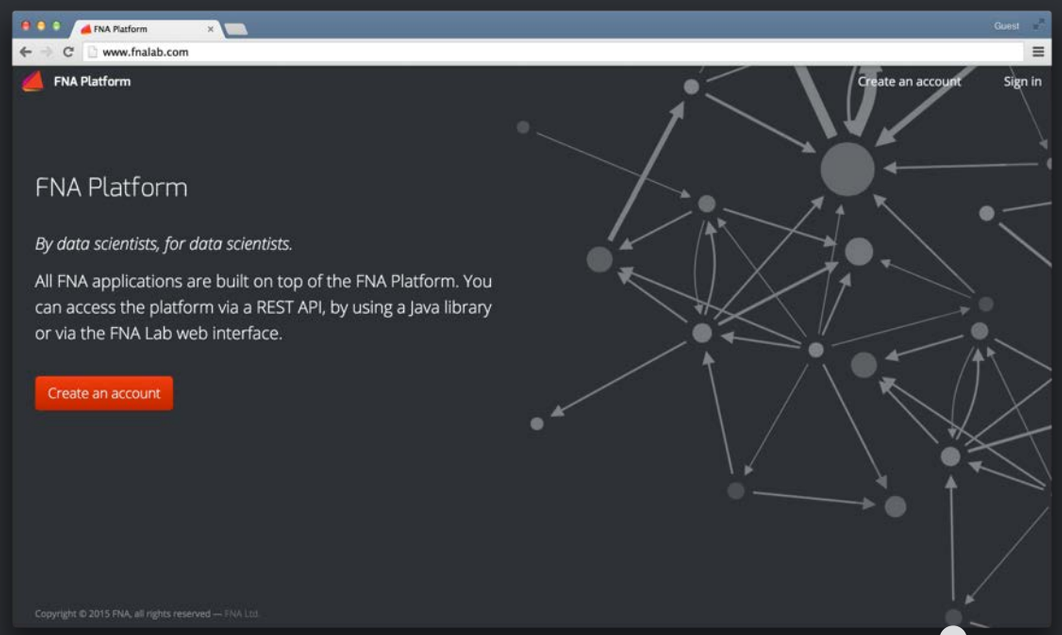
The FNA Software is available online and consists of FNA Platform and FNA Apps.

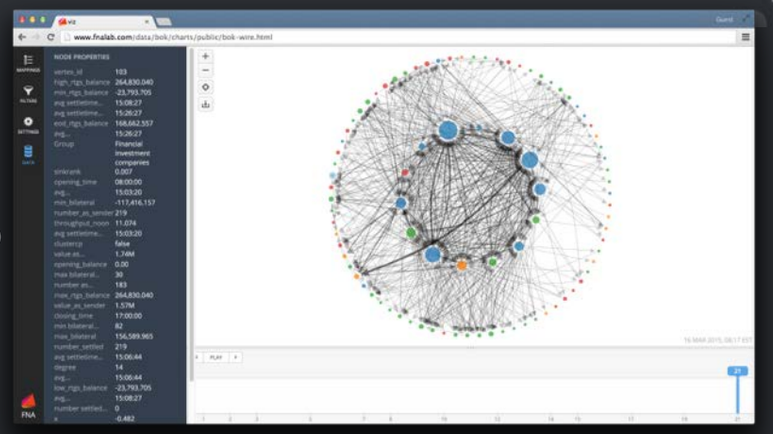
FNA Platform is the server side workhorse for analysis, simulation and visualization of financial networks used by all FNA Apps.

FNA Apps master particular uses cases with an interactive user experience.

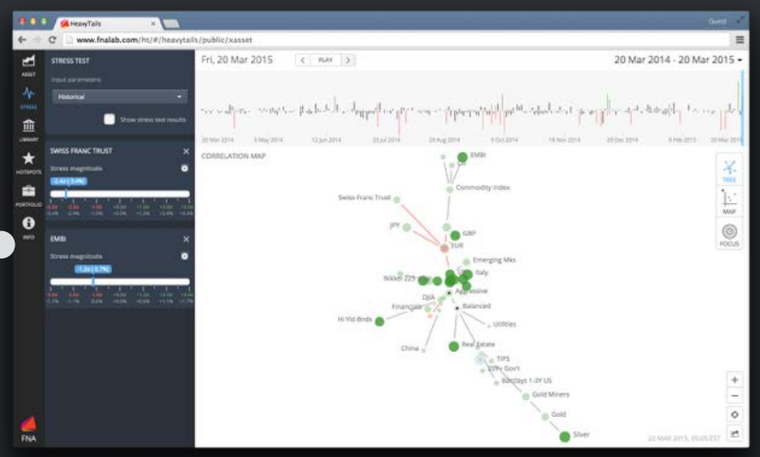


FNA Maps





FNA Payments



FNA HeavyTails

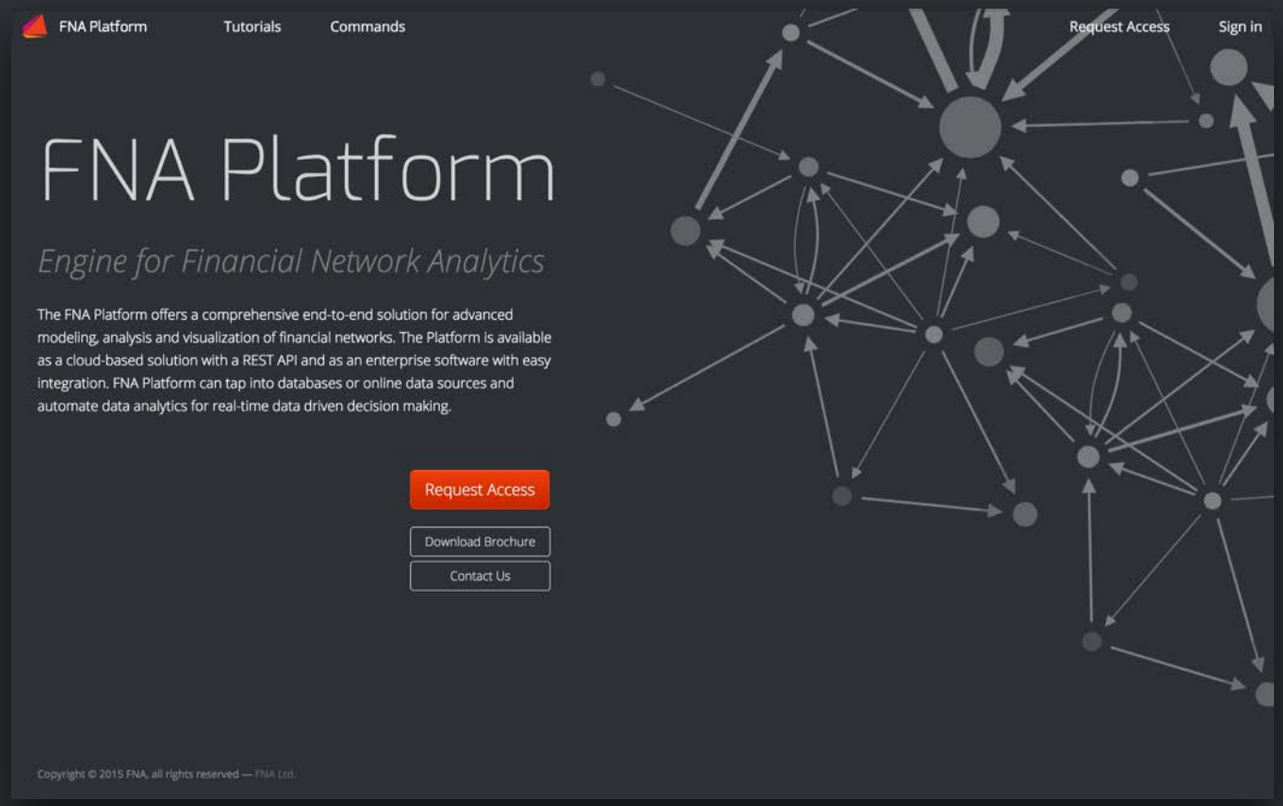
. . .

FNA Platform

Proud to release version 3.0 on 1 September!

The FNA Platform offers a comprehensive end-to-end enterprise solution for advanced analysis and visualizations of financial networks.

FNA Platform is the backbone of all FNA Apps and available as a cloud-based solution with a RESTful API, as an enterprise installation, as a Desktop software and as a Java library.



Cutting-edge analytics

Calculate hundreds of graph metrics, perform cluster analysis and carry out predictive stress tests and simulations.

Complete documentation

with over 500 pages of manuals describing the platform's functionality with examples, tutorials and real-life applications.

End-to-end automation

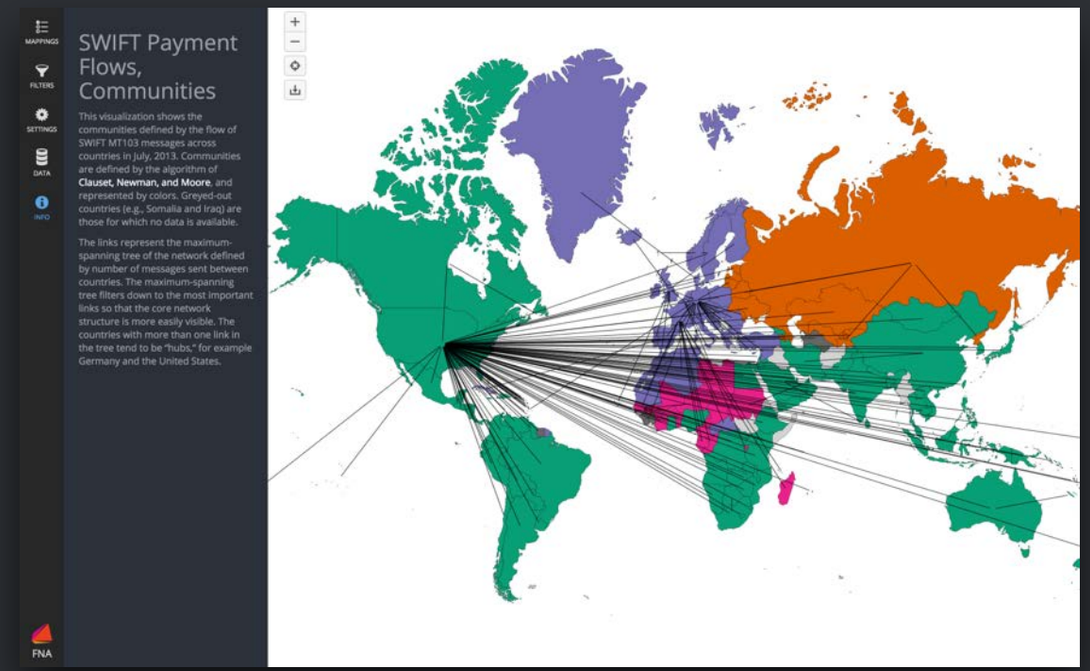
Develop scripts for fully automated and regular analytics or use FNA REST API from external applications.

Easy integration

tap to data most common online data sources and vendors directly, or from local databases.

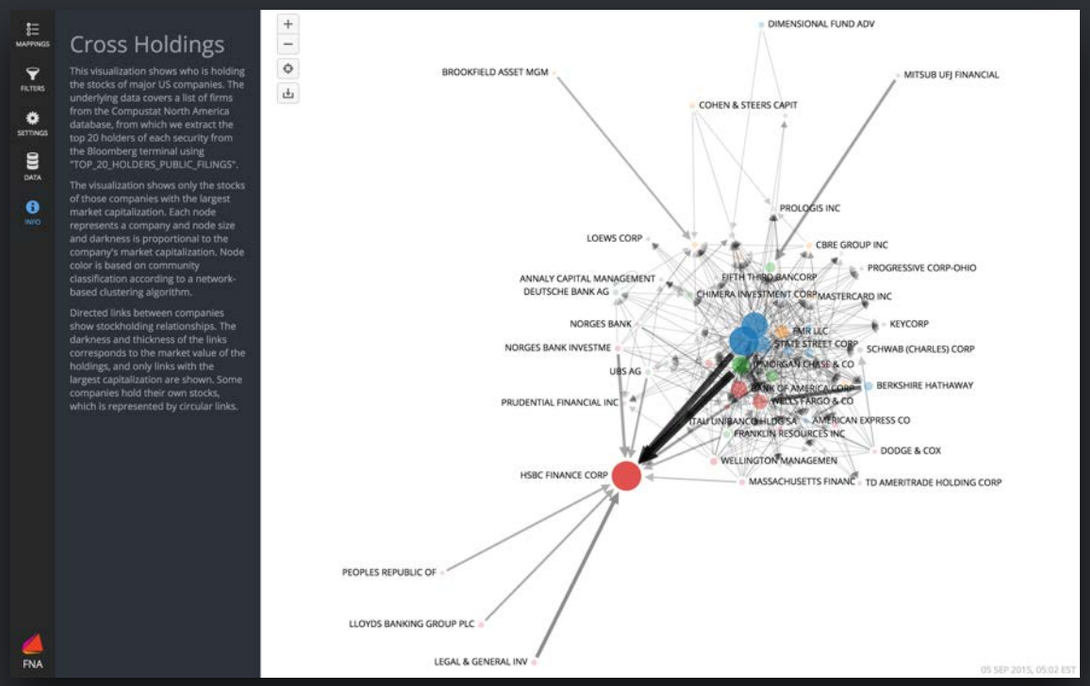
More at www.fna.fi/platform

Applications

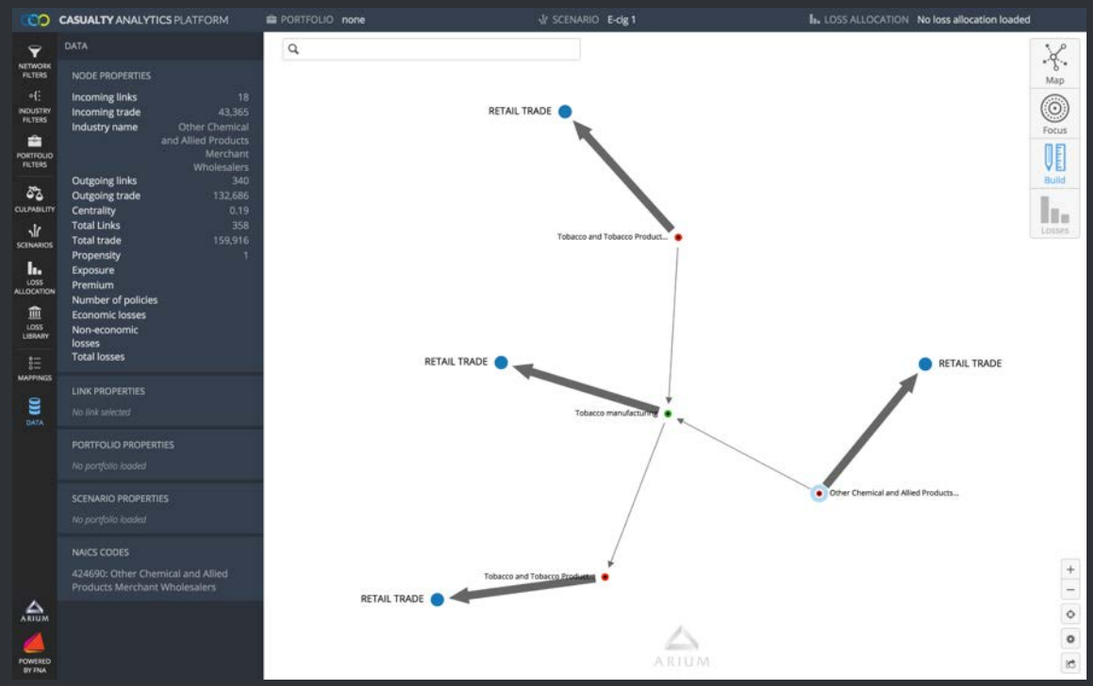


Payment Systems

Macro Economy



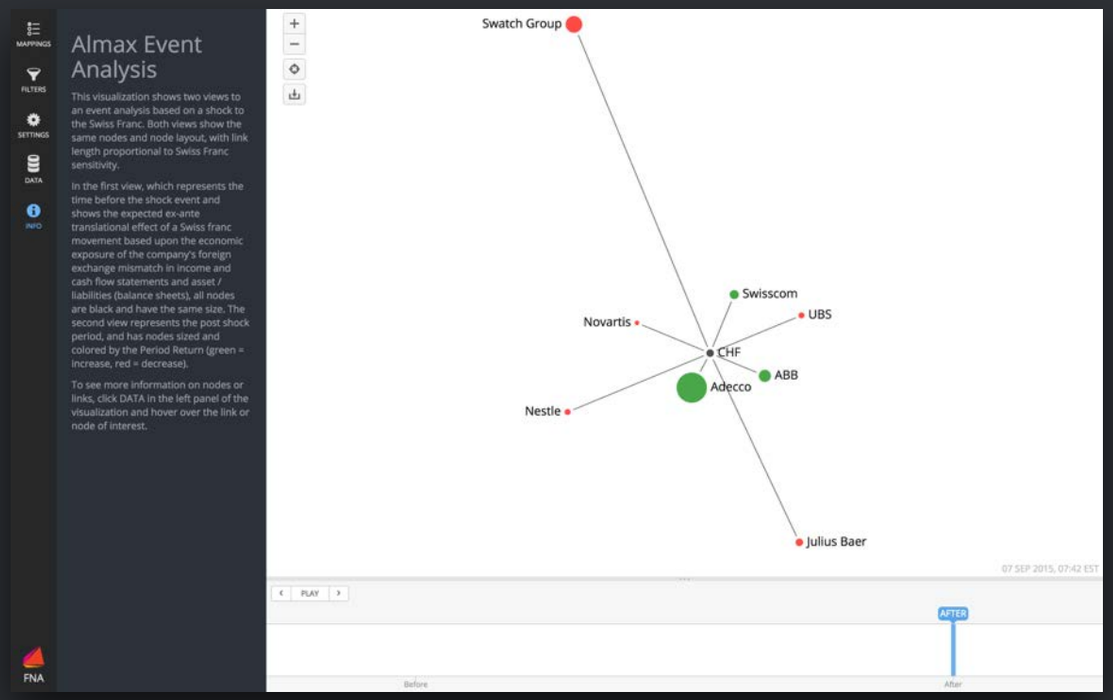
Exposure Networks



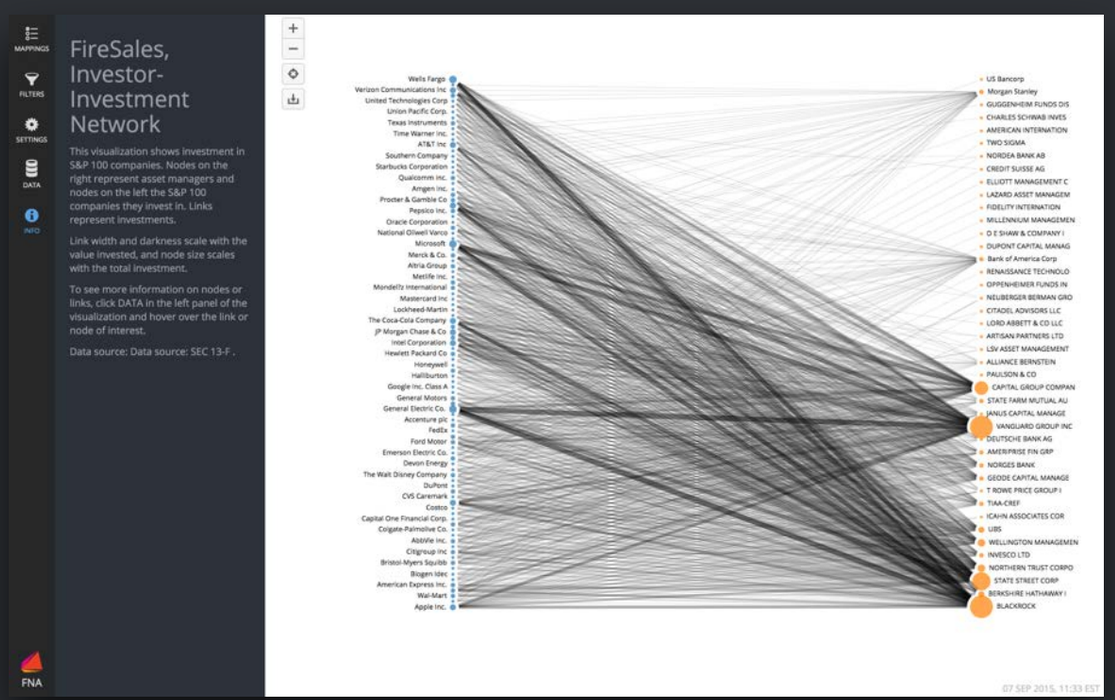
Casualty Insurance (with Arium)

Applications on Financial Markets

FNA HeavyTails



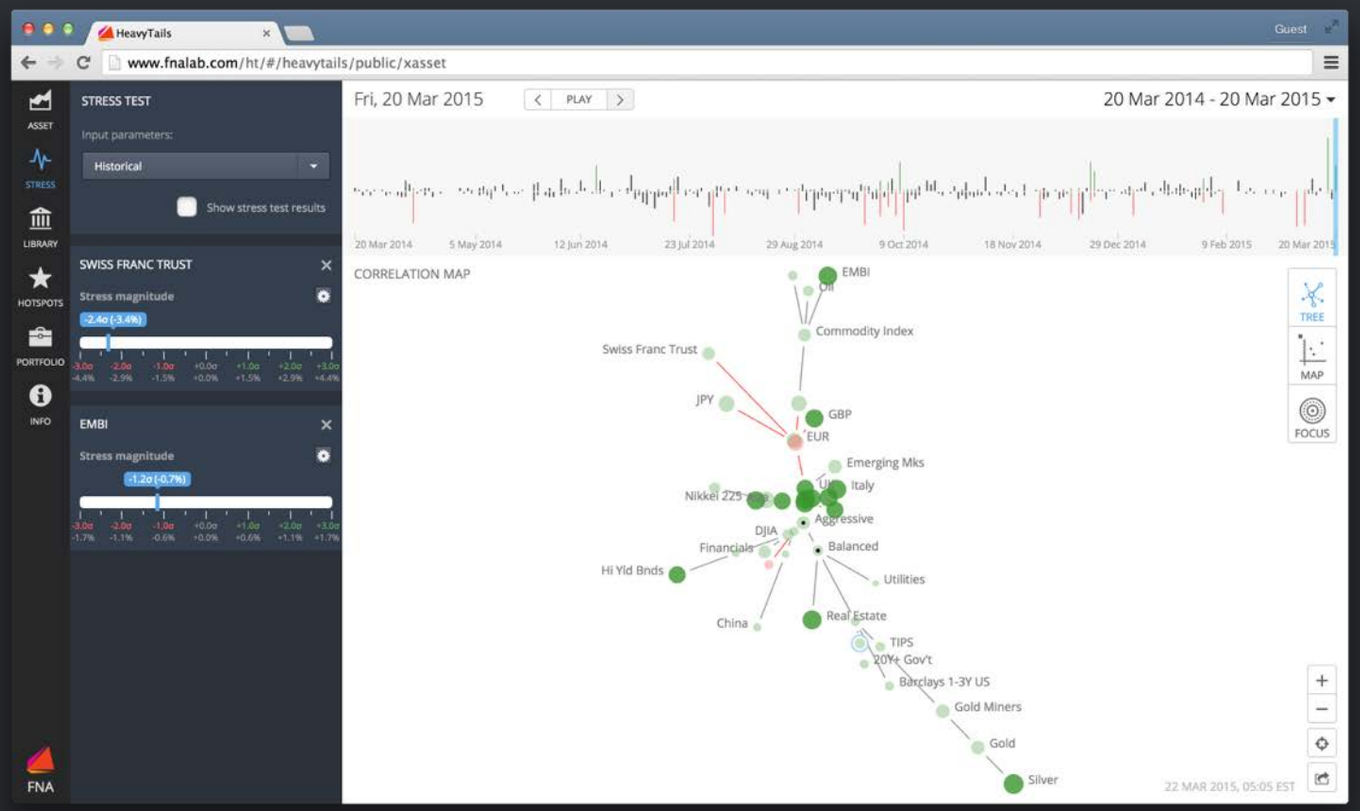
FNA-Almax Event Graphs



FNA-CRS Fire Sales

FNA HeavyTails

FNA HeavyTails helps risk managers and portfolio managers identify and communicate emerging risks and design adaptive stress tests.



Monitor systemic risk

with FNA's unique correlation maps, Value-at-Risk (VaR) analytics and outlier detection.

Stress test portfolios

with FNA's interactive 'Rapid stress testing' functionality and integrate them with your portfolio management and risk systems.

Identify emerging risks

with statistical and visual detection of outlier assets, days, and periods.

Evaluate investment strategies

with correlation and clustering analysis against benchmarks, and quickly identify hidden concentration risk.

More at www.fna.fi/heavytails

FNA HeavyTails

ASSET
NETWORK
STRESS
LIBRARY
ALERTS
PORTFOLIO
INFO

Global Multi-Asset dashboard

This dashboard gives a global view of systemic risk using liquid ETFs representing all asset classes.

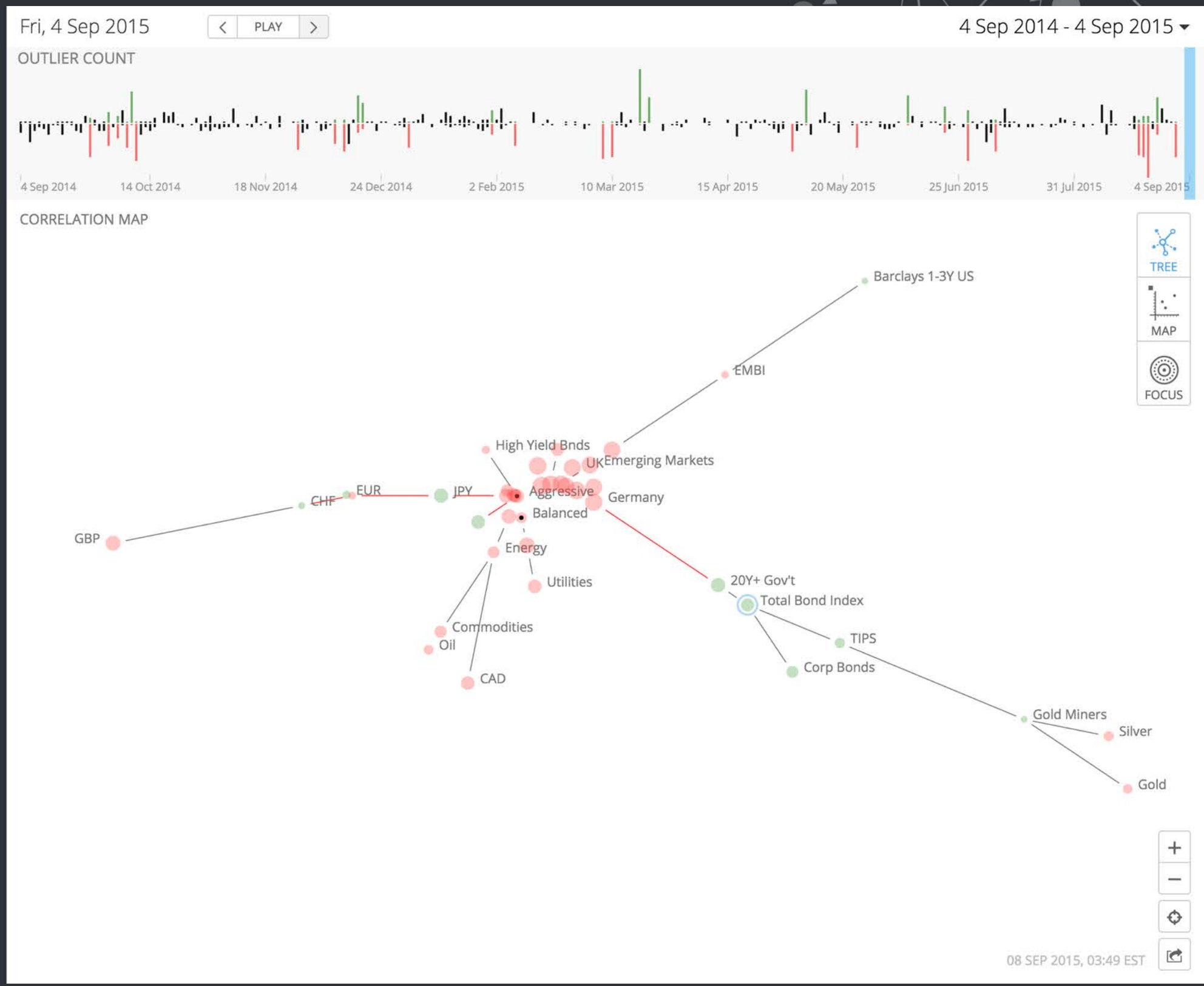
The central **Map** view shows a correlation Minimum Spanning Tree where each node is an ETF. Close links show strong correlations. Negative correlations are highlighted in red. The node size is scaled by the daily return and color is determined by the sign of the return (green=positive, red = negative).

Hotspots shows 95% Confidence Level VaR outliers. These were the biggest surprises of the day and helps us prioritize attention.

Assets panel provides a detailed view of specific nodes, summarizing 20 vs 100 trading day outlier activity as well as price and volatility graphs.

Standard daily volatility and correlation calculations are based on RiskMetrics EWMA methodology (0.94 decay).

The dashboard is updated daily at 5am EST using data from **Yahoo Finance.**



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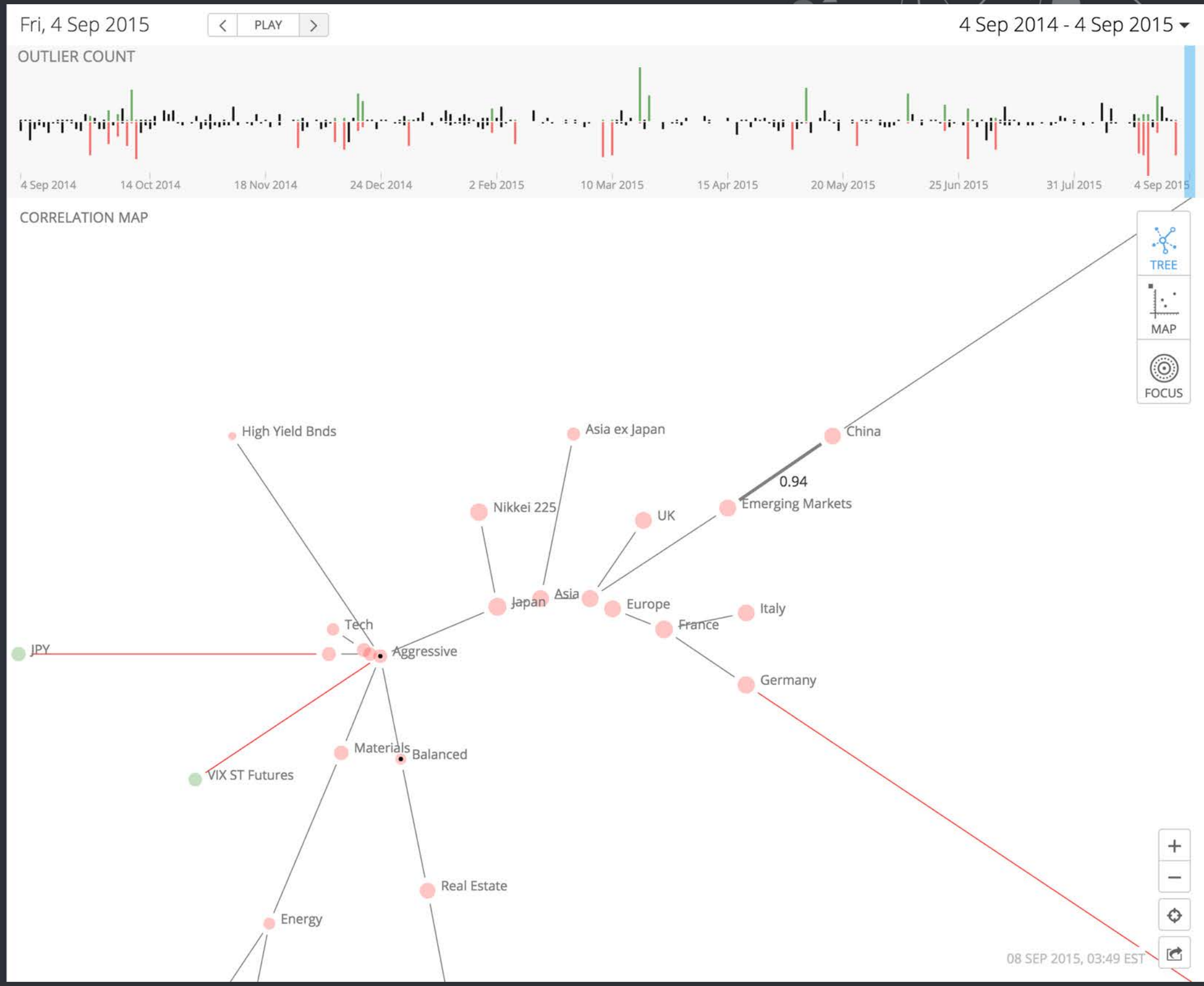

Greece announces referendum

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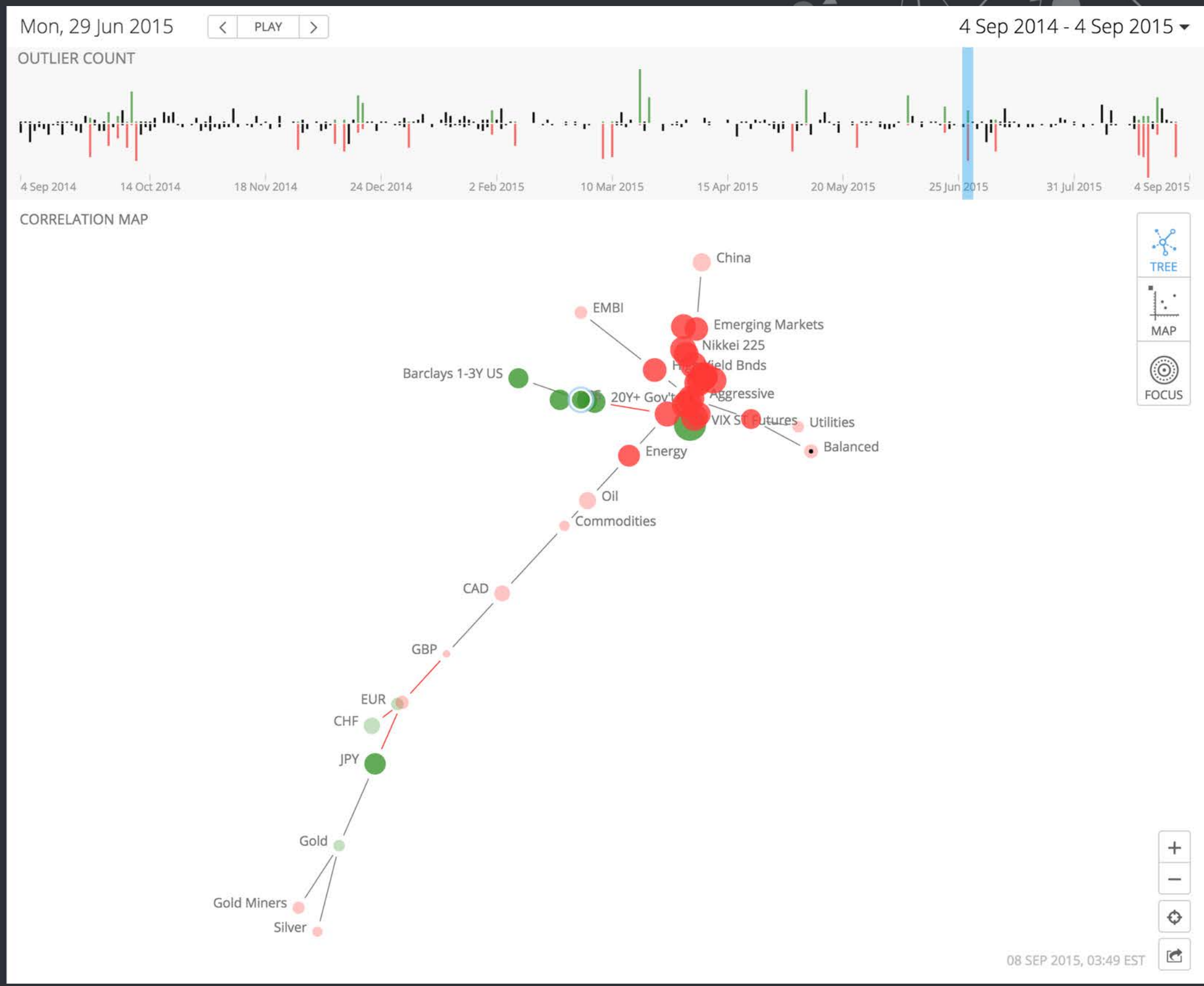

OPEC does not cut oil production

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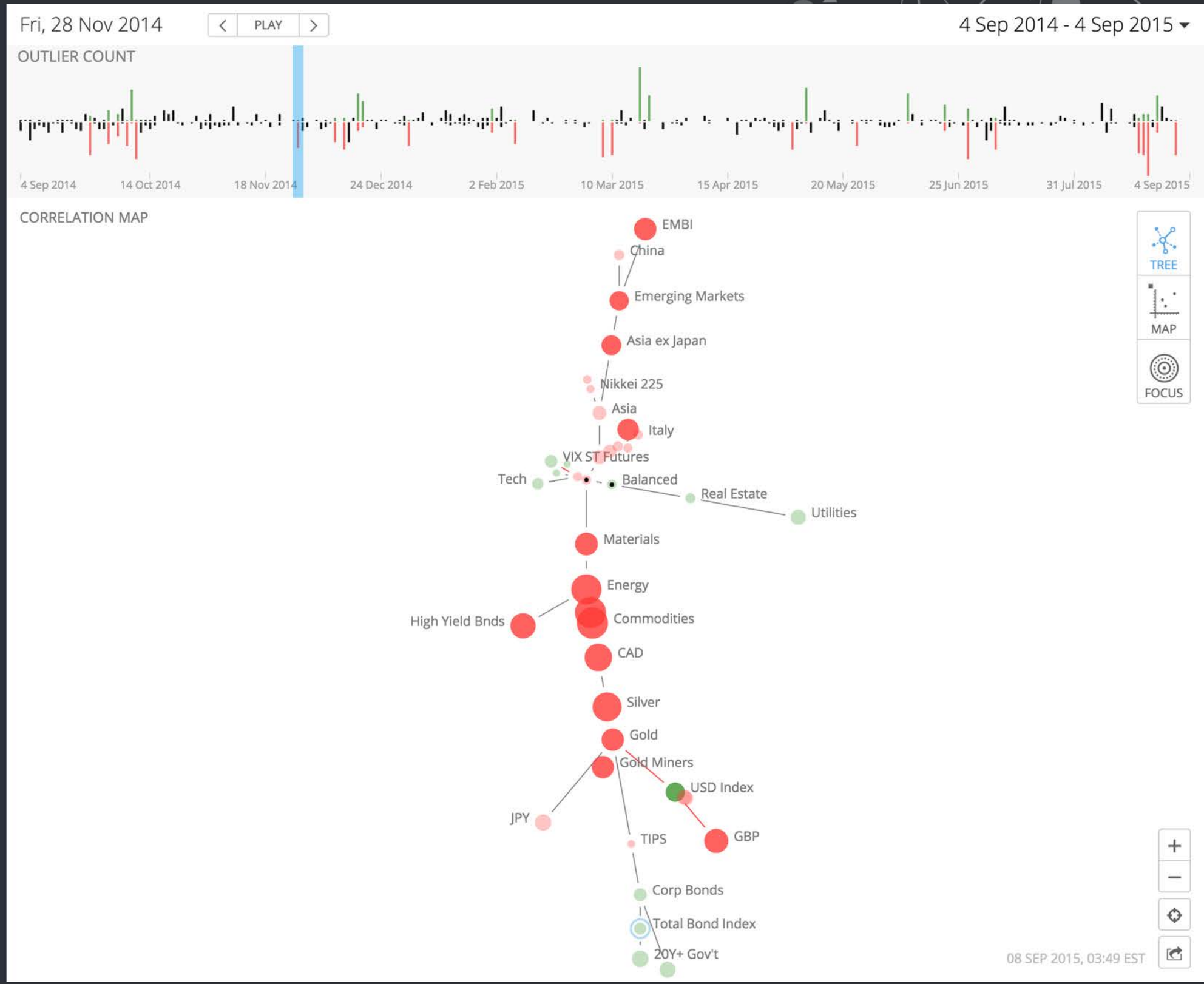

OPEC does not cut oil production

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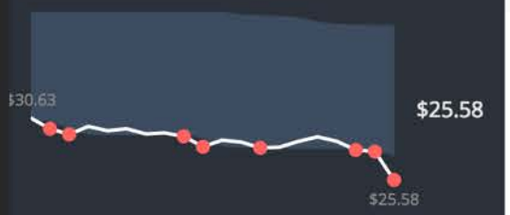
Oil
USO

20-day outliers: 0, 3
100-day outliers: 2, 10

PRICE

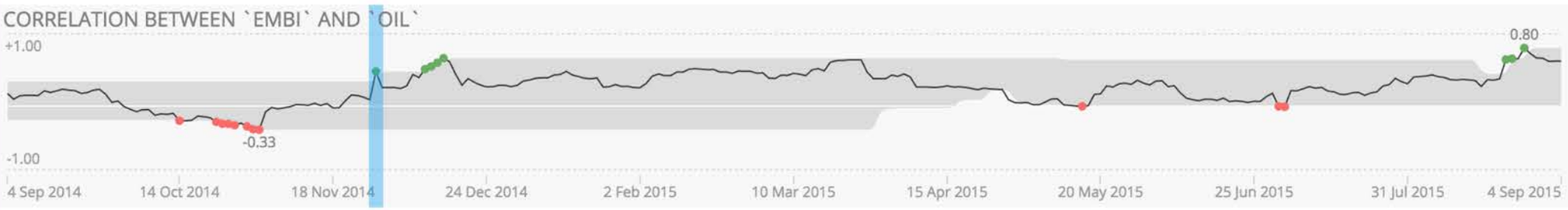


RETURN

VOLATILITY

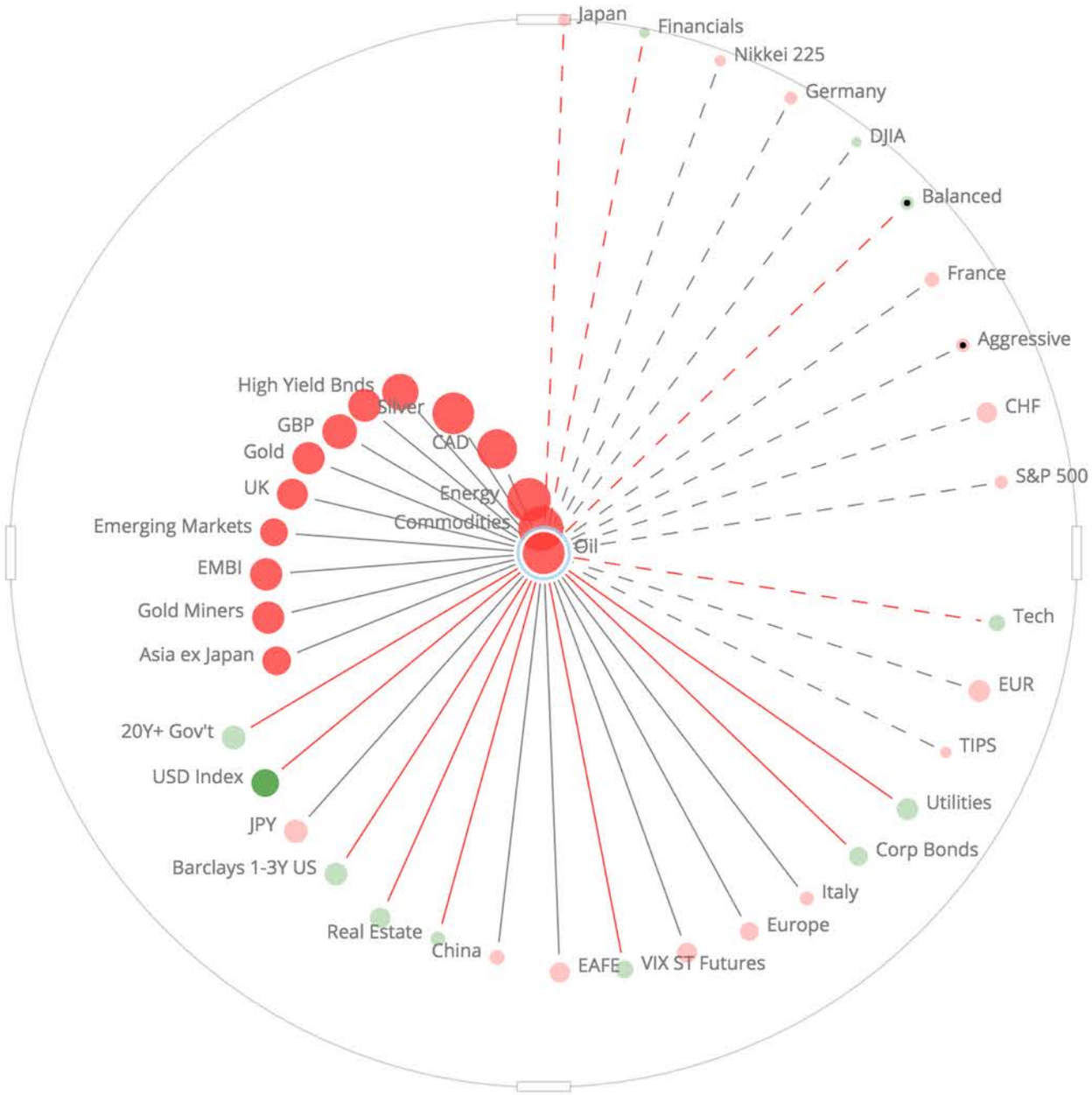
Fri, 28 Nov 2014 | PLAY | 4 Sep 2014 - 4 Sep 2015

CORRELATION BETWEEN `EMBI` AND `OIL`



FOCUS ON ASSET

Showing absolute correlations larger than 0.00



TREE
MAP
FOCUS

08 SEP 2015, 03:49 EST

Current oil correlations

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PORTFOLIO
INFO

Oil
USO

20-day outliers	100-day outliers
3	4
3	6

PRICE

$15.08

RETURN

-1.7%
-0.46σ

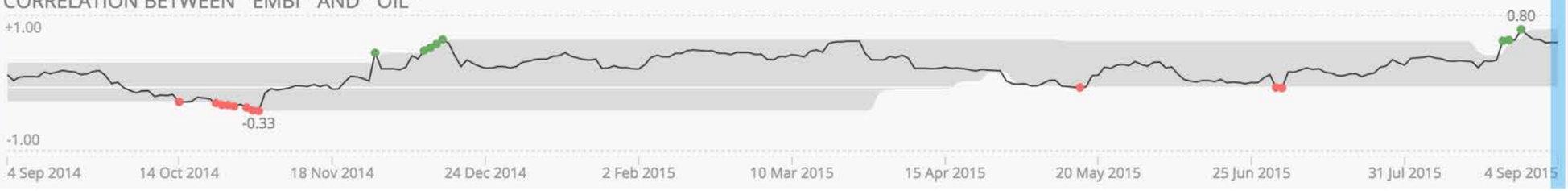
VOLATILITY

3.7%

FNA

Fri, 4 Sep 2015 PLAY 4 Sep 2014 - 4 Sep 2015

CORRELATION BETWEEN `EMBI` AND `OIL`



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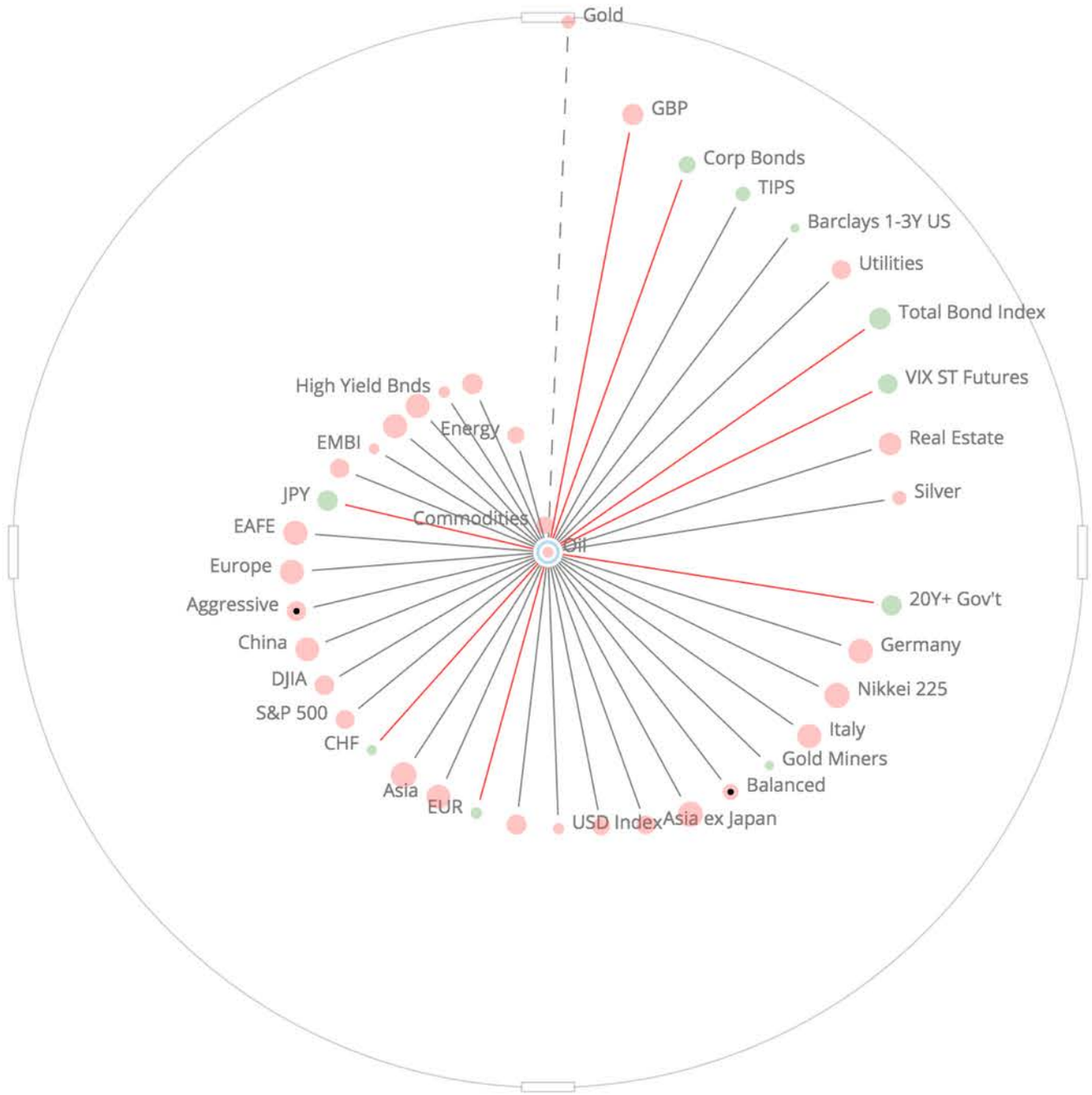

TREE
MAP
FOCUS

08 SEP 2015, 03:49 EST

And network level stats

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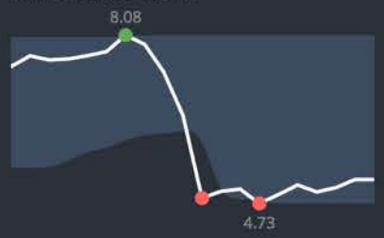
NETWORK
4 Sep 2015

Positive Outliers	0
Negative Outliers	0
Scale	341.00
Number of Assets	41
Arc Survival	98%
Length of Tree	5.21
Largest Eigenvalue (%)	60%

ARC SURVIVAL

98%

LENGTH OF TREE



5.21

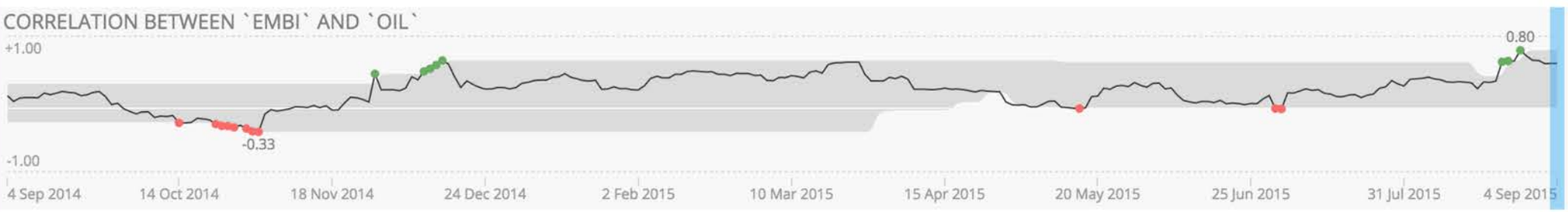
LARGEST EIGENVALUE (%)

60%

FNA

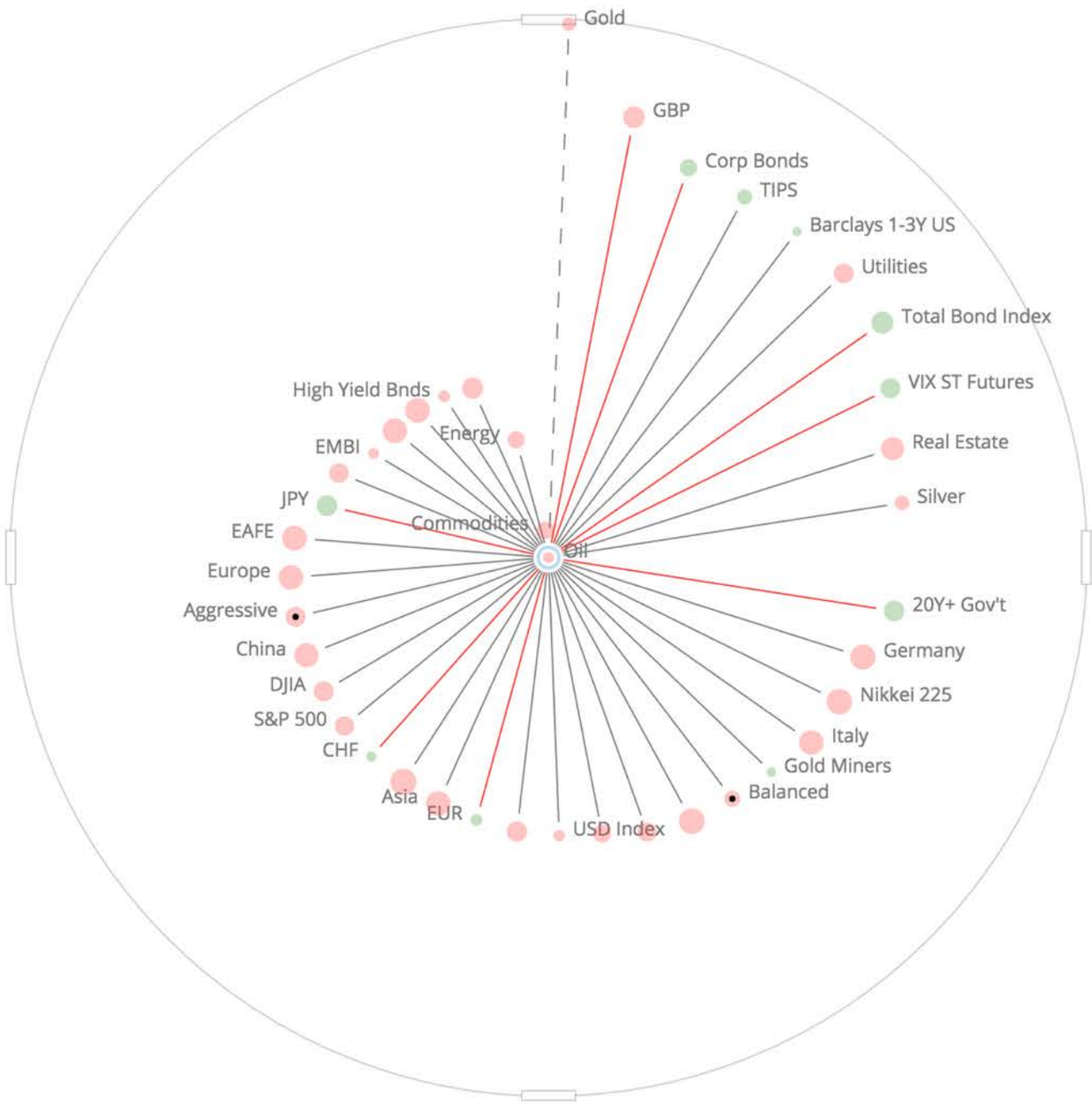
Fri, 4 Sep 2015 PLAY 4 Sep 2014 - 4 Sep 2015

CORRELATION BETWEEN `EMBI` AND `OIL`



FOCUS ON ASSET (STRESSED)

Showing absolute correlations larger than 0.00



TREE
MAP
FOCUS

08 SEP 2015, 03:49 EST

Stress testing oil shock

ASSET
NETWORK
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INFO
FNA

STRESS TEST

Input parameters:

Historical

Correlation Scale

+0.0%

-10.0% -6.7% -3.3% +0.0% +3.3% +6.7% +10.0%

Original correlation (mean): +0.54
Adjusted correlation (mean): +0.54

Show stress test results

OIL

Stress magnitude

-3.0σ (-11.0%)

-3.0σ -2.0σ -1.0σ +0.0σ +1.0σ +2.0σ +3.0σ
-11.0% -7.4% -3.7% +0.0% +3.7% +7.4% +11.0%

ENERGY

Stress magnitude

-3.0σ (-6.9%)

-3.0σ -2.0σ -1.0σ +0.0σ +1.0σ +2.0σ +3.0σ
-6.9% -4.6% -2.3% +0.0% +2.3% +4.6% +6.9%

Fri, 4 Sep 2015 PLAY 4 Sep 2014 - 4 Sep 2015

CORRELATION BETWEEN `EMBI` AND `OIL`

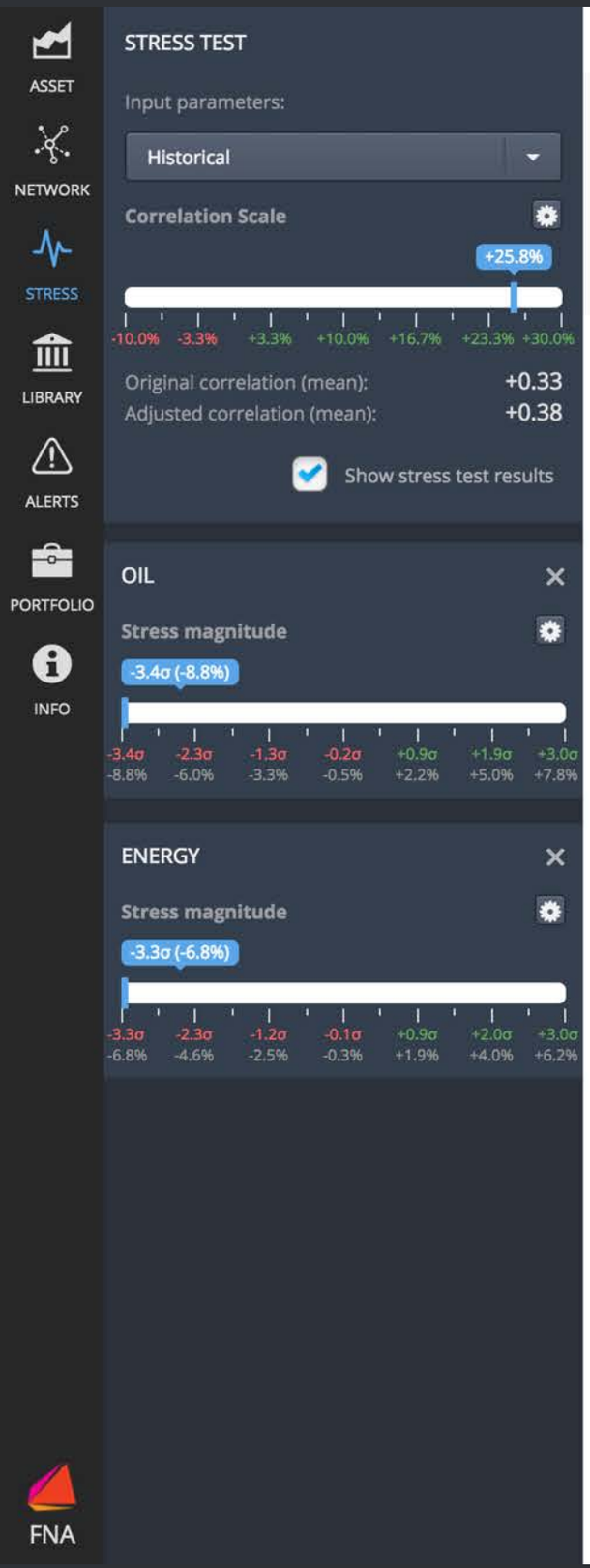
FOCUS ON ASSET (STRESSED)

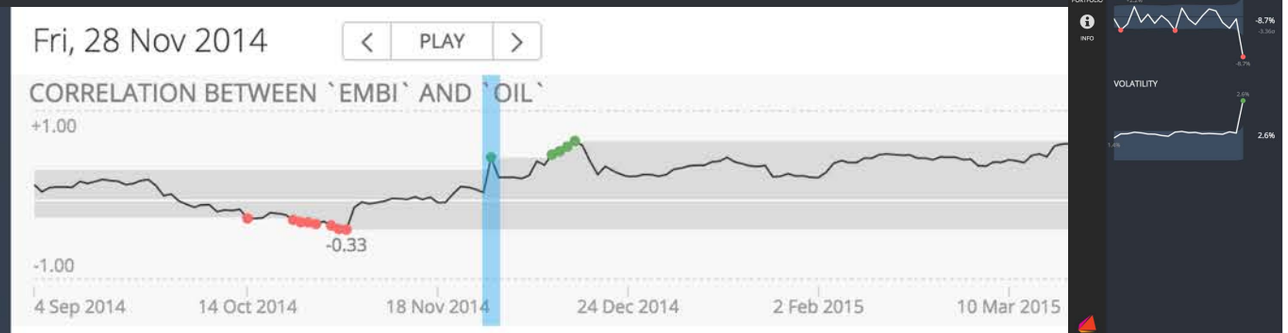
Showing absolute correlations larger than 0.00

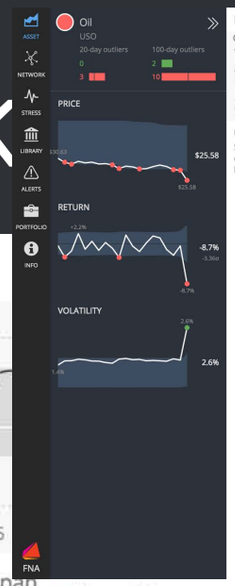
TREE
MAP
FOCUS

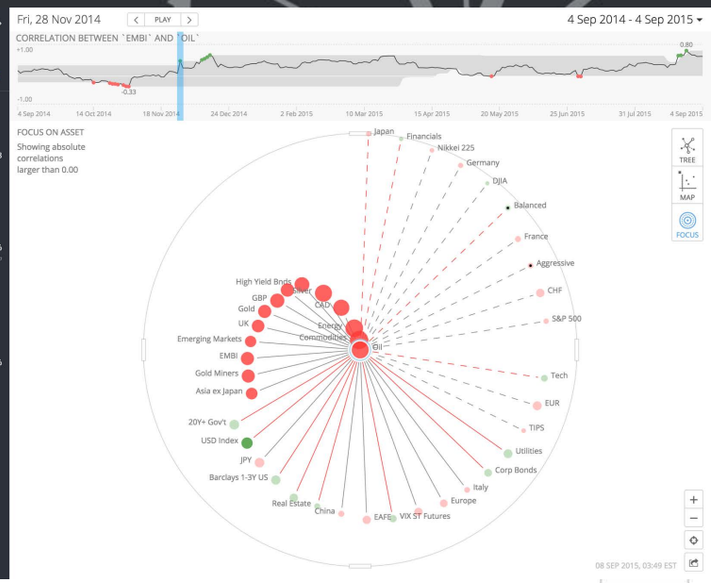
08 SEP 2015, 03:49 EST

Stress testing oil shock

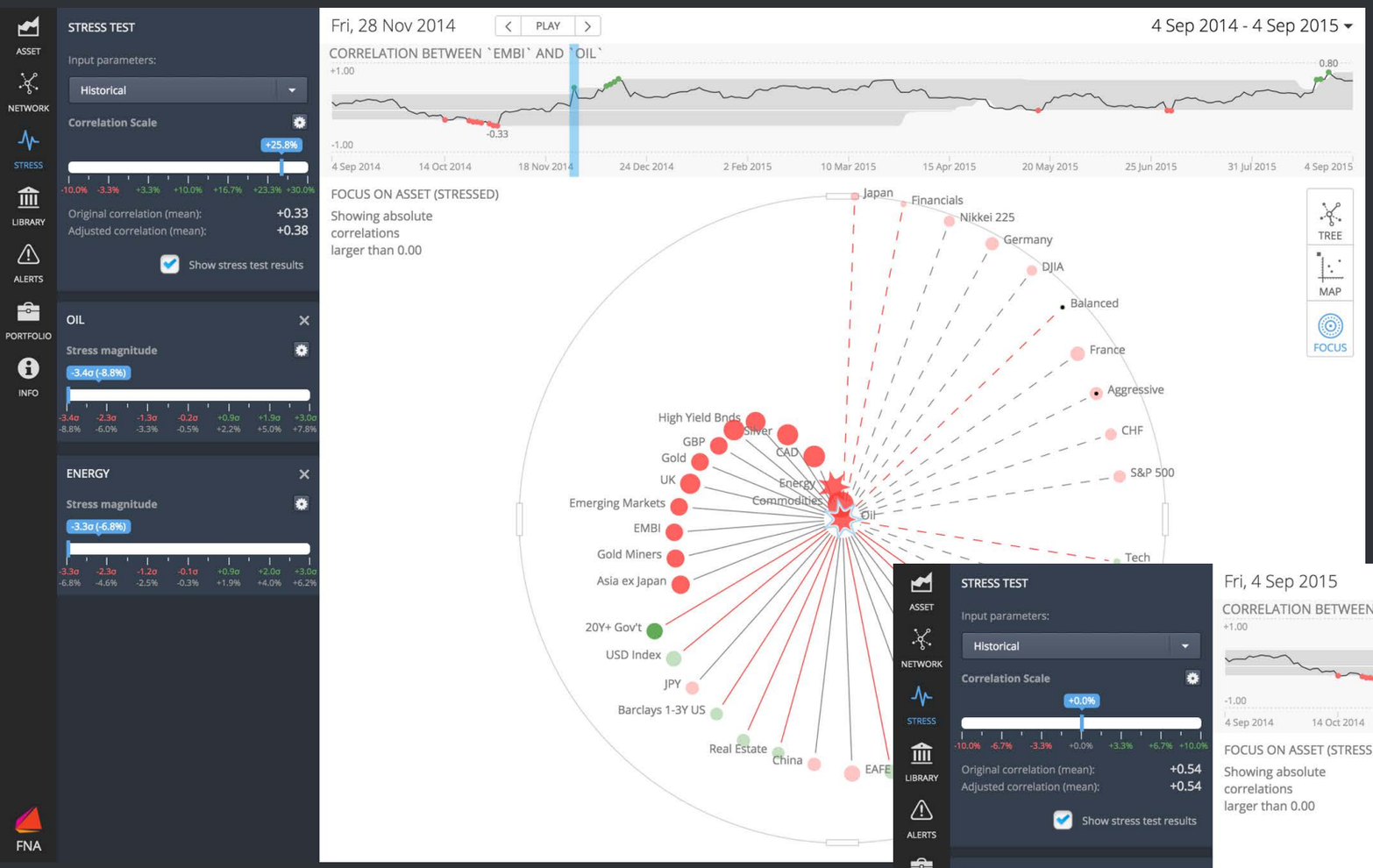


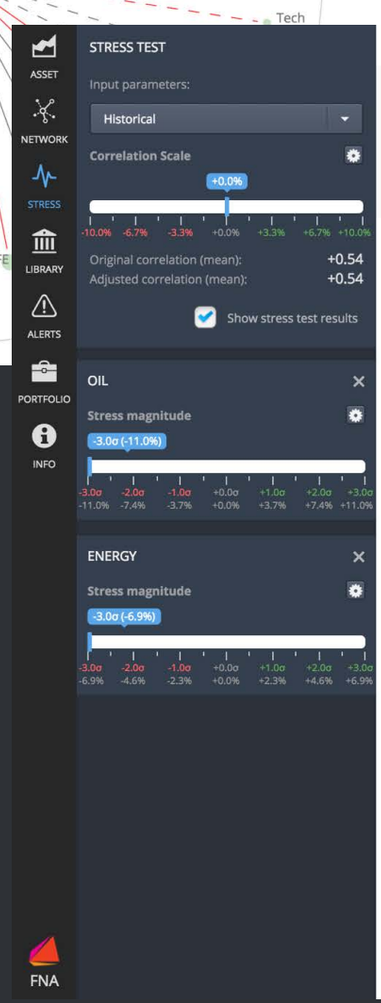


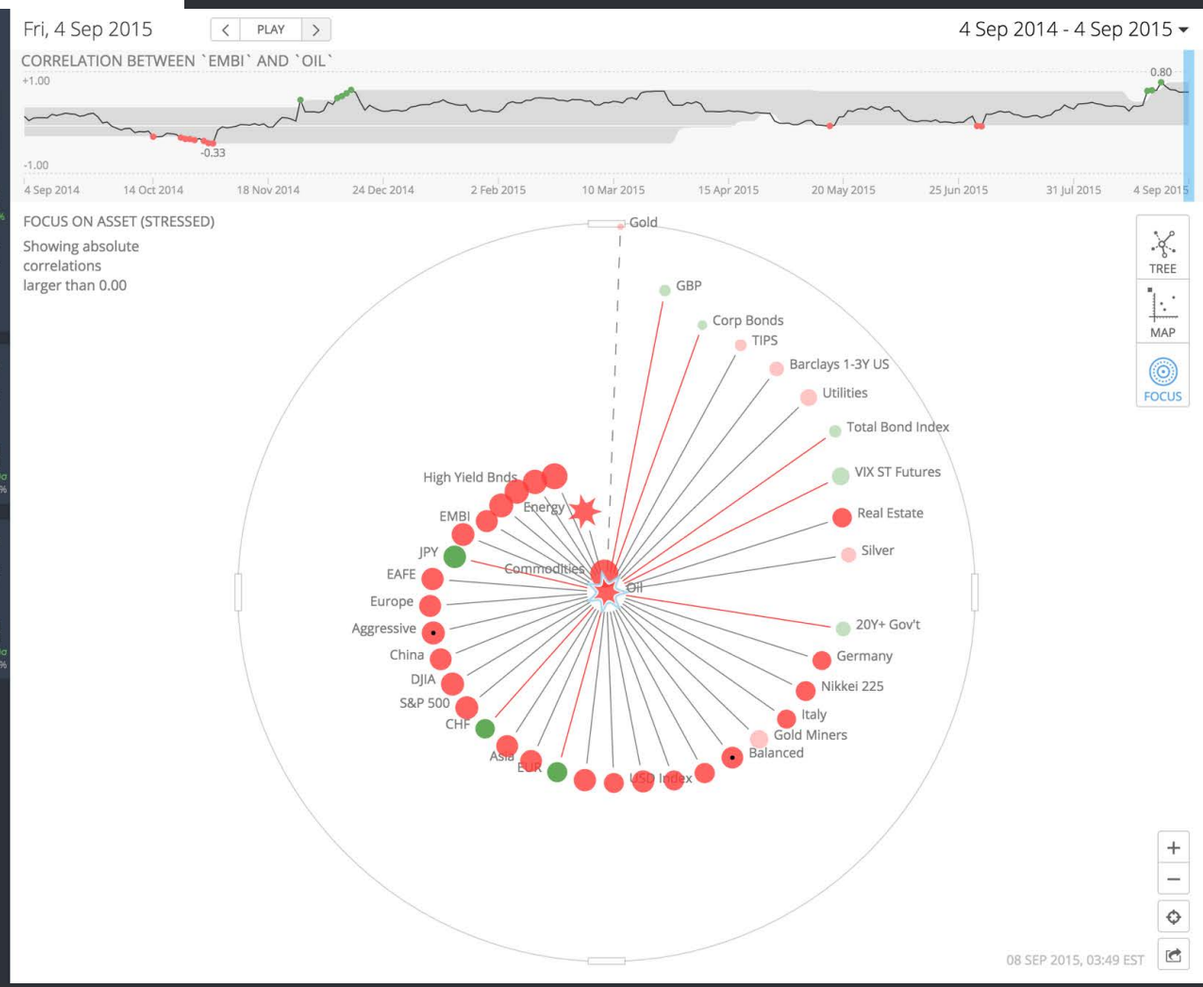




Stress testing oil shock





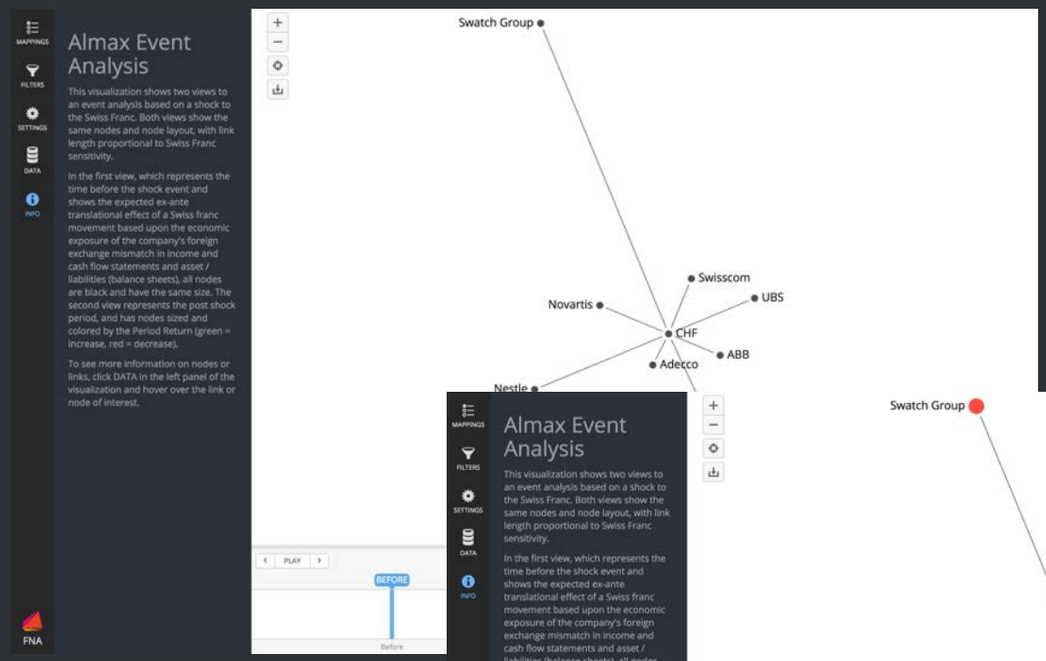


FNA-Almax EventGraphs

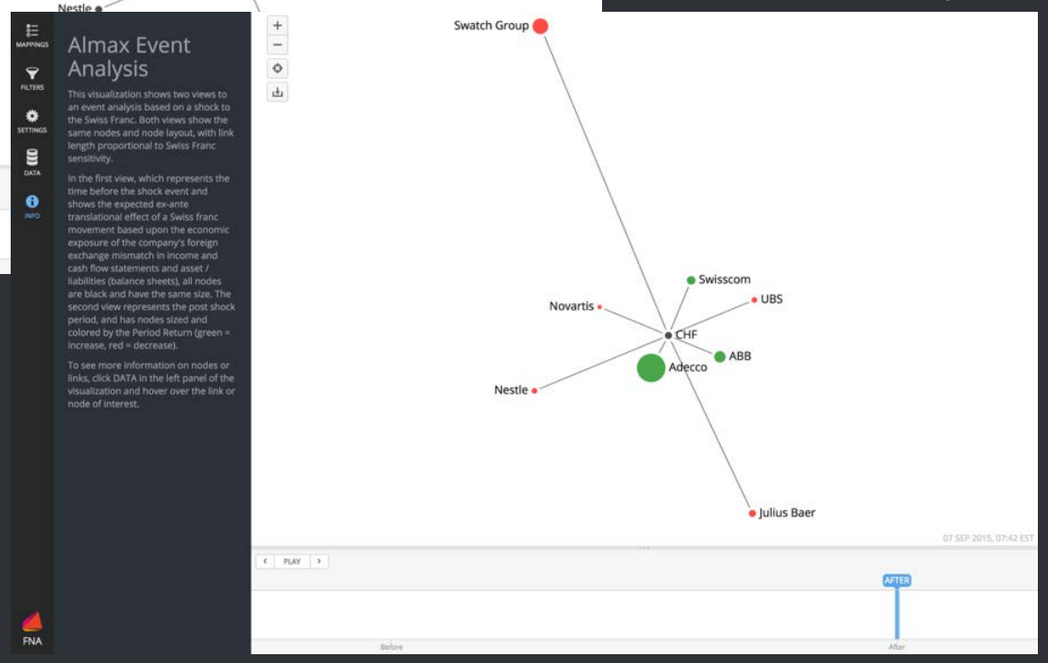
FNA Almax Event Graphs help financial institutions assess impact of market events in an interconnected world in real time.

Event Graphs are created from the synthesis of

- statistical analysis
- semantic news analysis
- expert judgement.



Ex Ante



Ex post

Event Graphs encode a view on causal market relationships and give first-mover advantage when the scenario is realized.

All pre-defined events are monitored on a continuous basis and any potential trigger (news) is identified.

FNA-Almax EventGraphs

MAPPINGS
FILTERS
SETTINGS
DATA
INFO

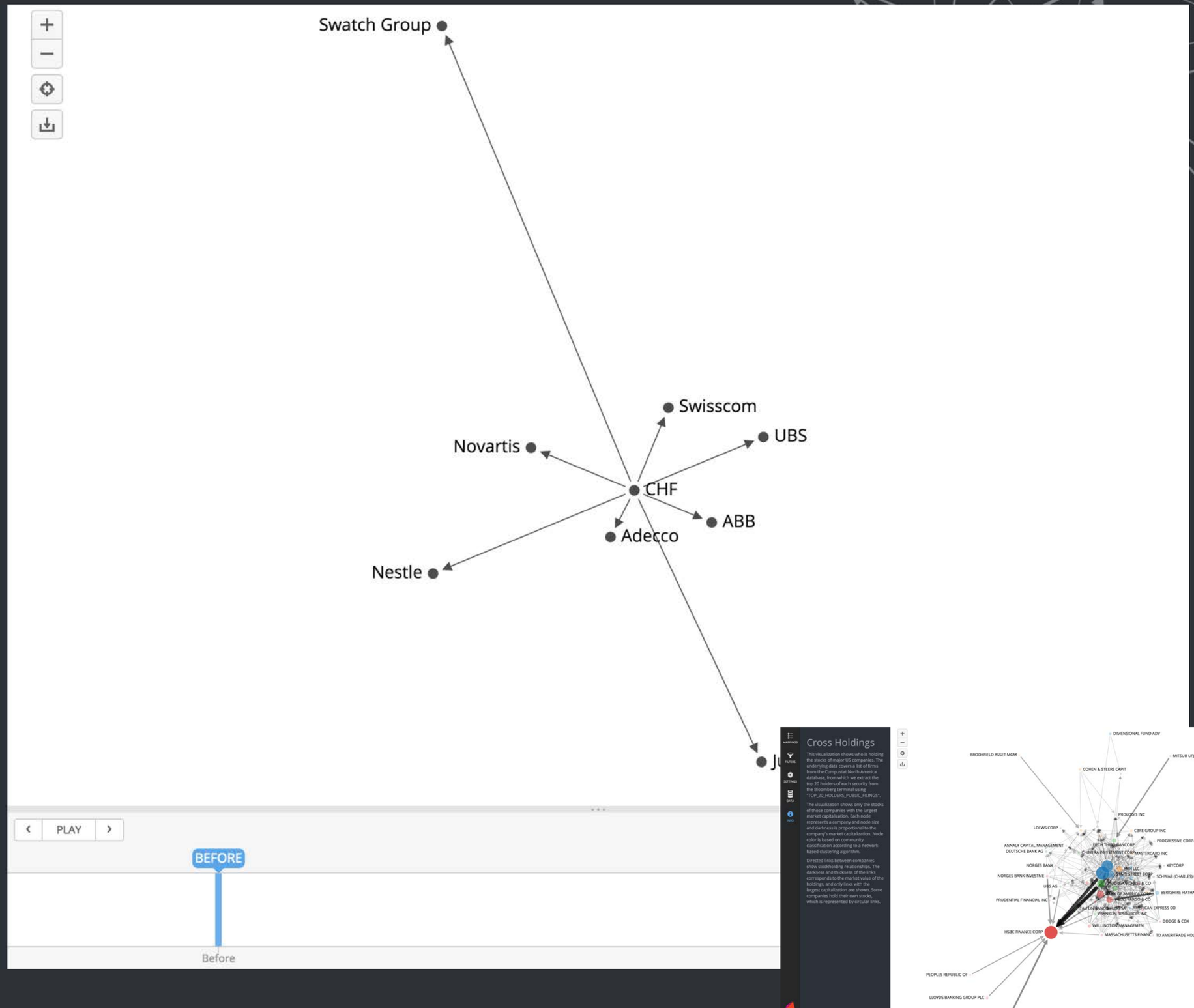
Almax Event Analysis

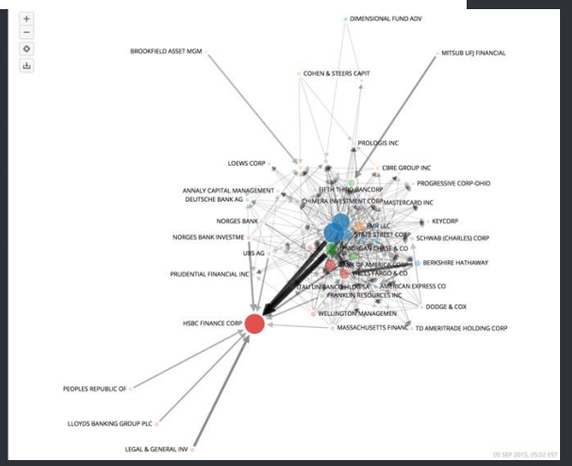
This visualization shows two views to an event analysis based on a shock to the Swiss Franc. Both views show the same nodes and node layout, with link length proportional to Swiss Franc sensitivity.

In the first view, which represents the time before the shock event and shows the expected ex-ante translational effect of a Swiss franc movement based upon the economic exposure of the company's foreign exchange mismatch in income and cash flow statements and asset / liabilities (balance sheets), all nodes are black and have the same size. The second view represents the post shock period, and has nodes sized and colored by the Period Return (green = increase, red = decrease).

To see more information on nodes or links, click DATA in the left panel of the visualization and hover over the link or node of interest.

FNA





FNA-Almax EventGraphs

MAPPINGS
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Almax Event Analysis

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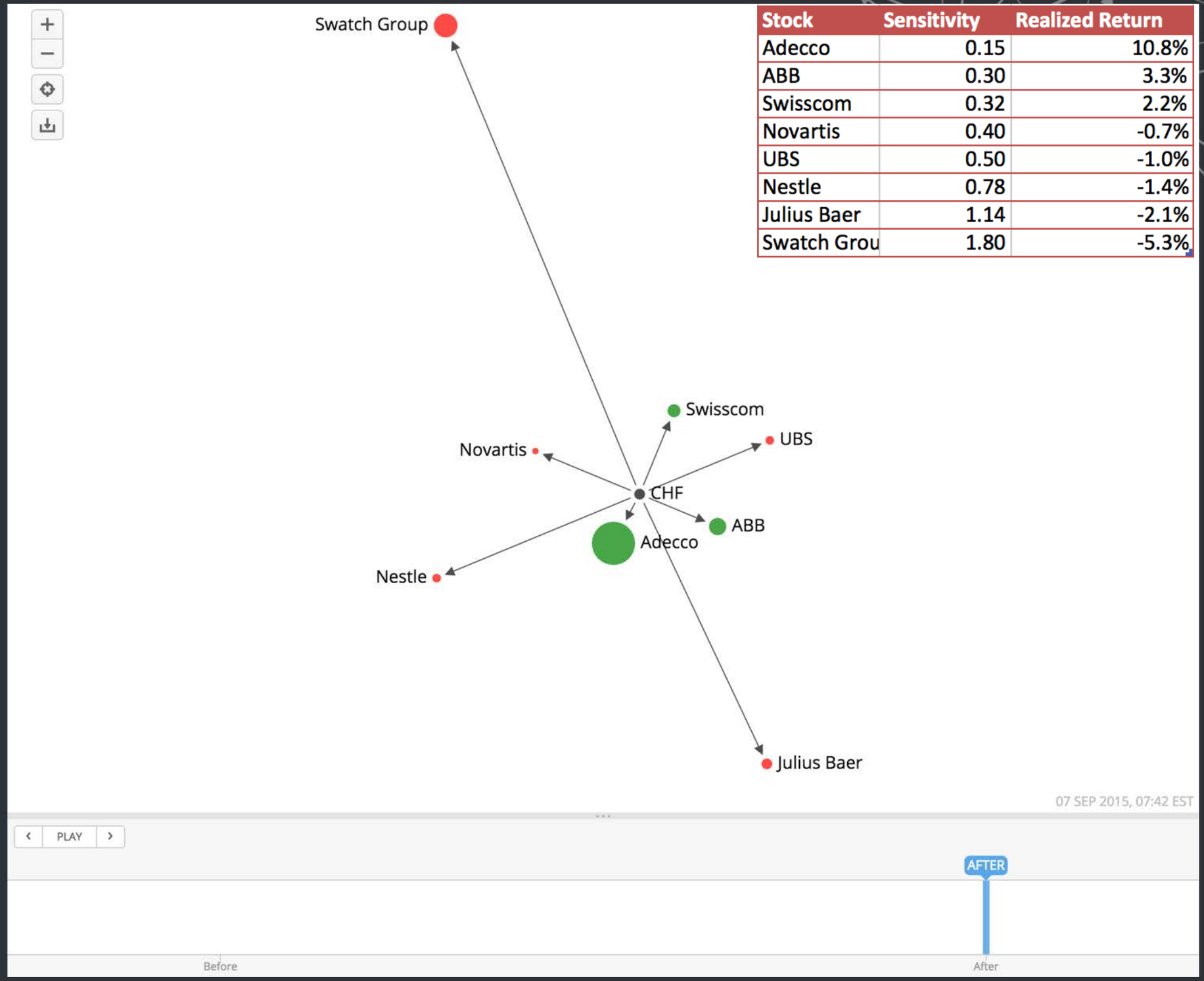
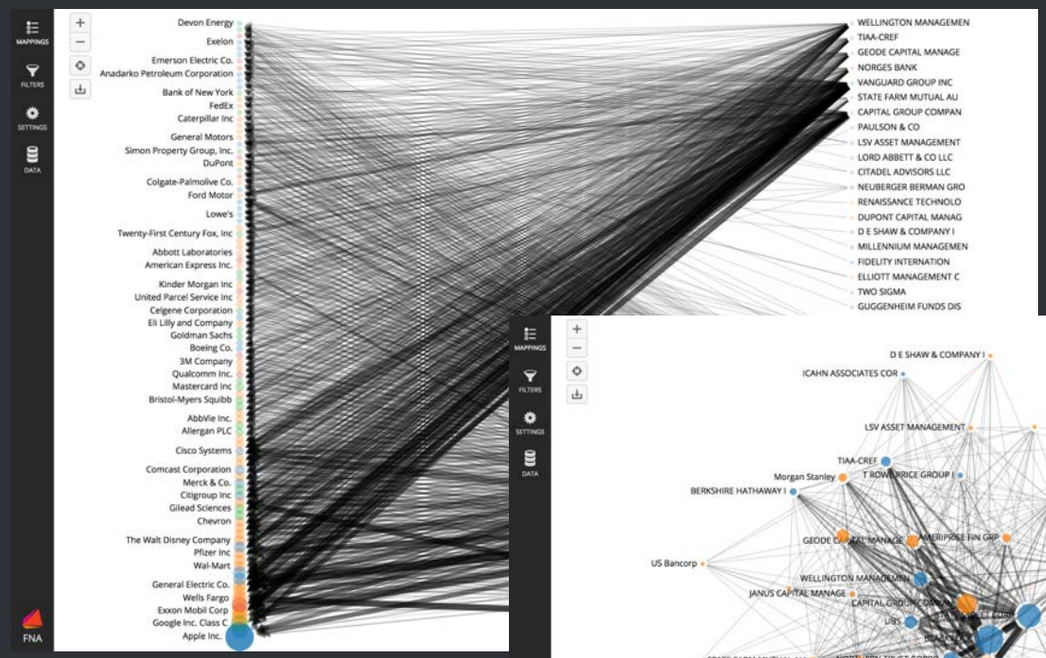


Stock	Sensitivity	Realized Return
Adecco	0.15	10.8%
ABB	0.30	3.3%
Swisscom	0.32	2.2%
Novartis	0.40	-0.7%
UBS	0.50	-1.0%
Nestle	0.78	-1.4%
Julius Baer	1.14	-2.1%
Swatch Grou	1.80	-5.3%

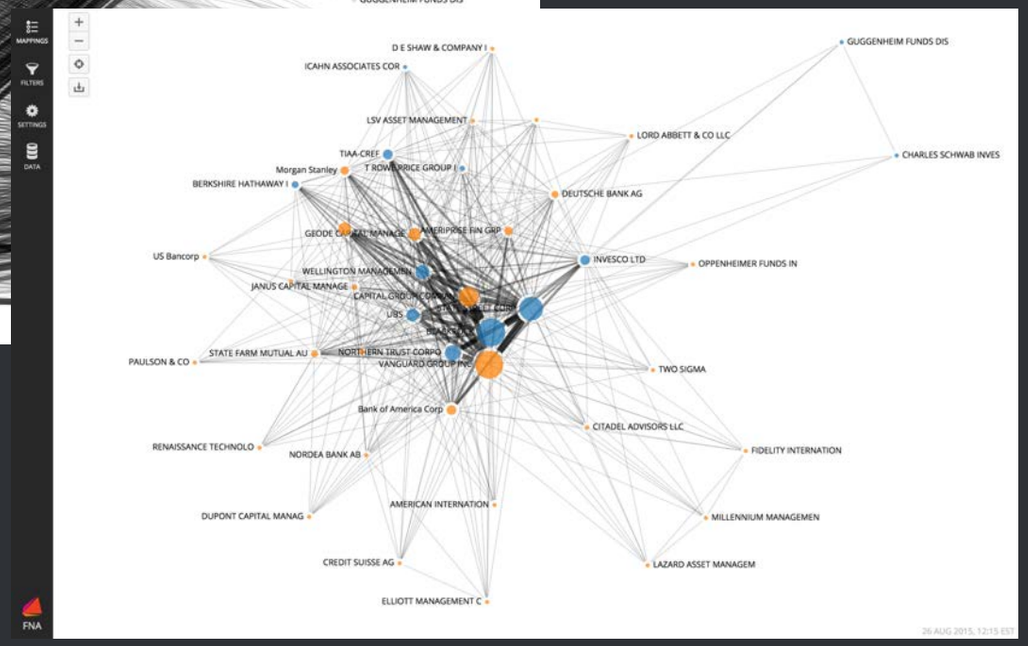
FNA-CRS FireSales

FNA FireSales helps asset managers identify investors investing in same assets, to identify vulnerable assets and to model the impact of fire sales on a particular investment portfolio.

The data is based on SEC 13F filings of asset holdings by institutional asset managers with presence in the US and with over $100M investments, and is updated quarterly.



Asset-Investor Network



Co-investment Network

Who is my portfolio overlapping with?

Visually explore and identify asset managers holding same assets in the co-investment network

Which assets are most vulnerable

Which managers are holding which assets, and which assets are held by many vs few investors.

How would a fire sale impact my portfolio?

Model fire sales with various modeling parameters taking into account feedback loops with the Cambridge Banking Model.

Investor-Asset Network

Which managers invest in which assets?

MAPPINGS
FILTERS
SETTINGS
DATA
INFO

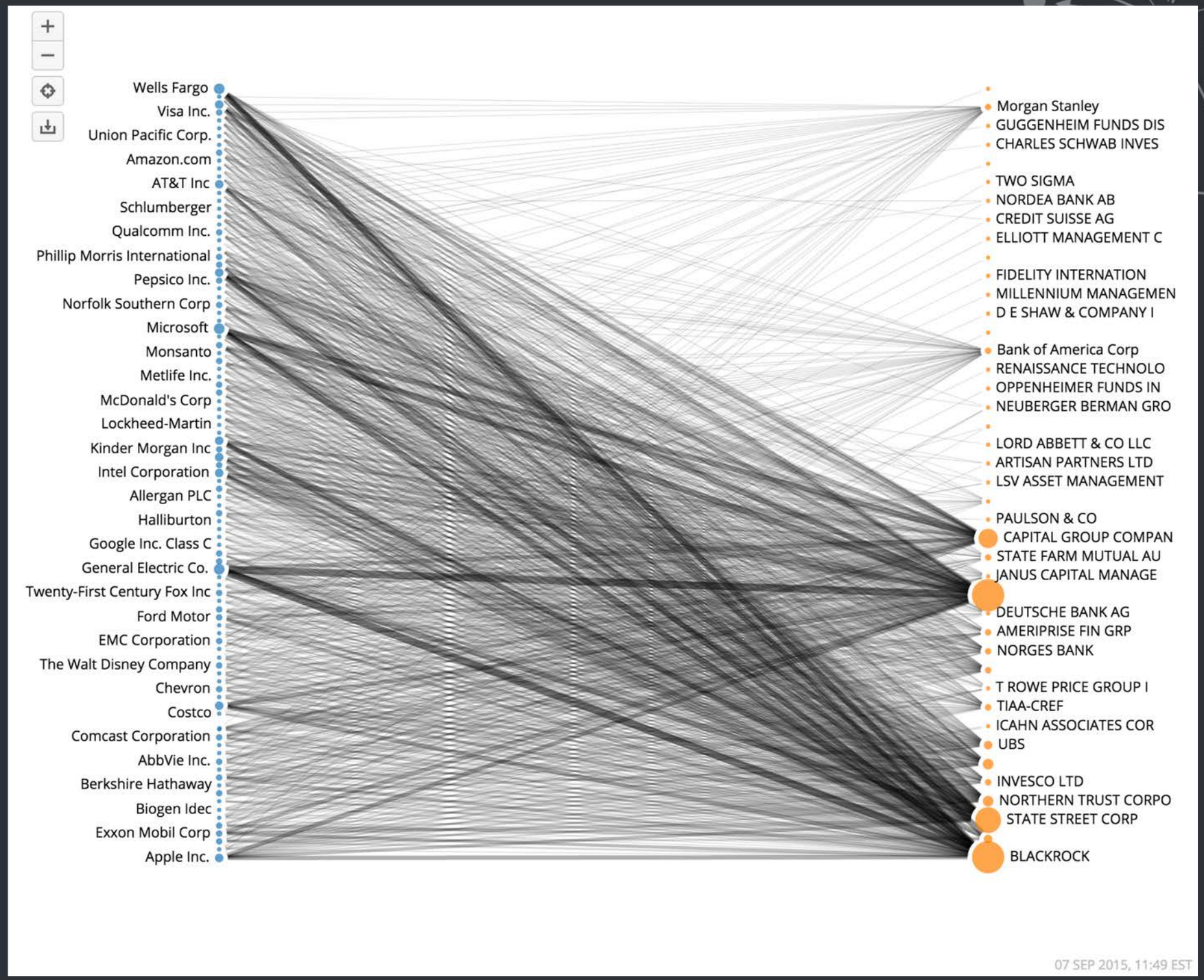
FireSales, Investor-Investment Network

This visualization shows investment in S&P 100 companies. Nodes on the right represent asset managers and nodes on the left the S&P 100 companies they invest in. Links represent investments.

Link width and darkness scale with the value invested, and node size scales with the total investment.

To see more information on nodes or links, click DATA in the left panel of the visualization and hover over the link or node of interest.

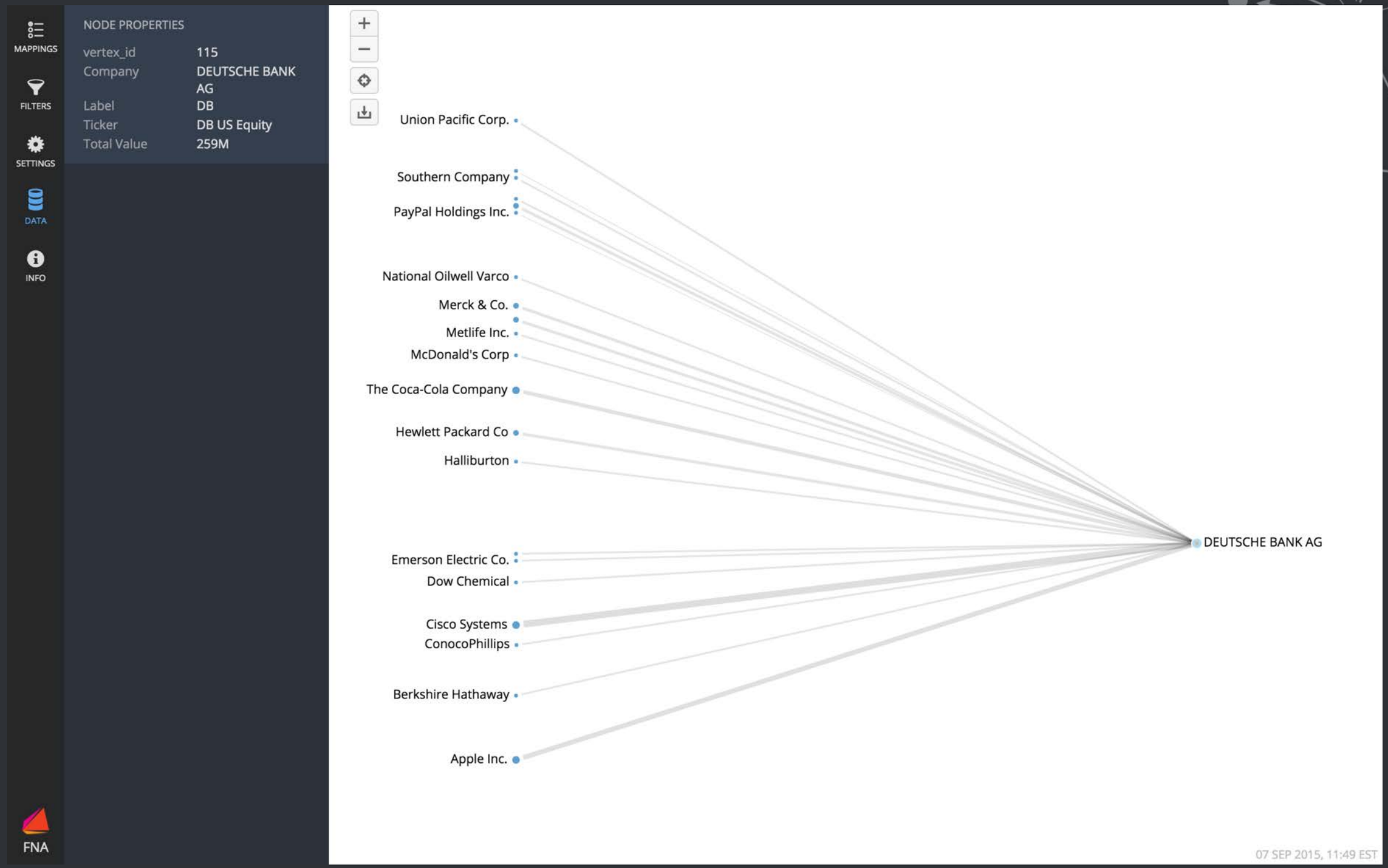
Data source: Data source: SEC 13-F .



FNA

Investor-Asset Network

What are the investments of a particular manager?



Co-investor Network

Which managers have similar portfolios?

MAPPINGS
FILTERS
SETTINGS
DATA
INFO

Firesales, Co-Investor network

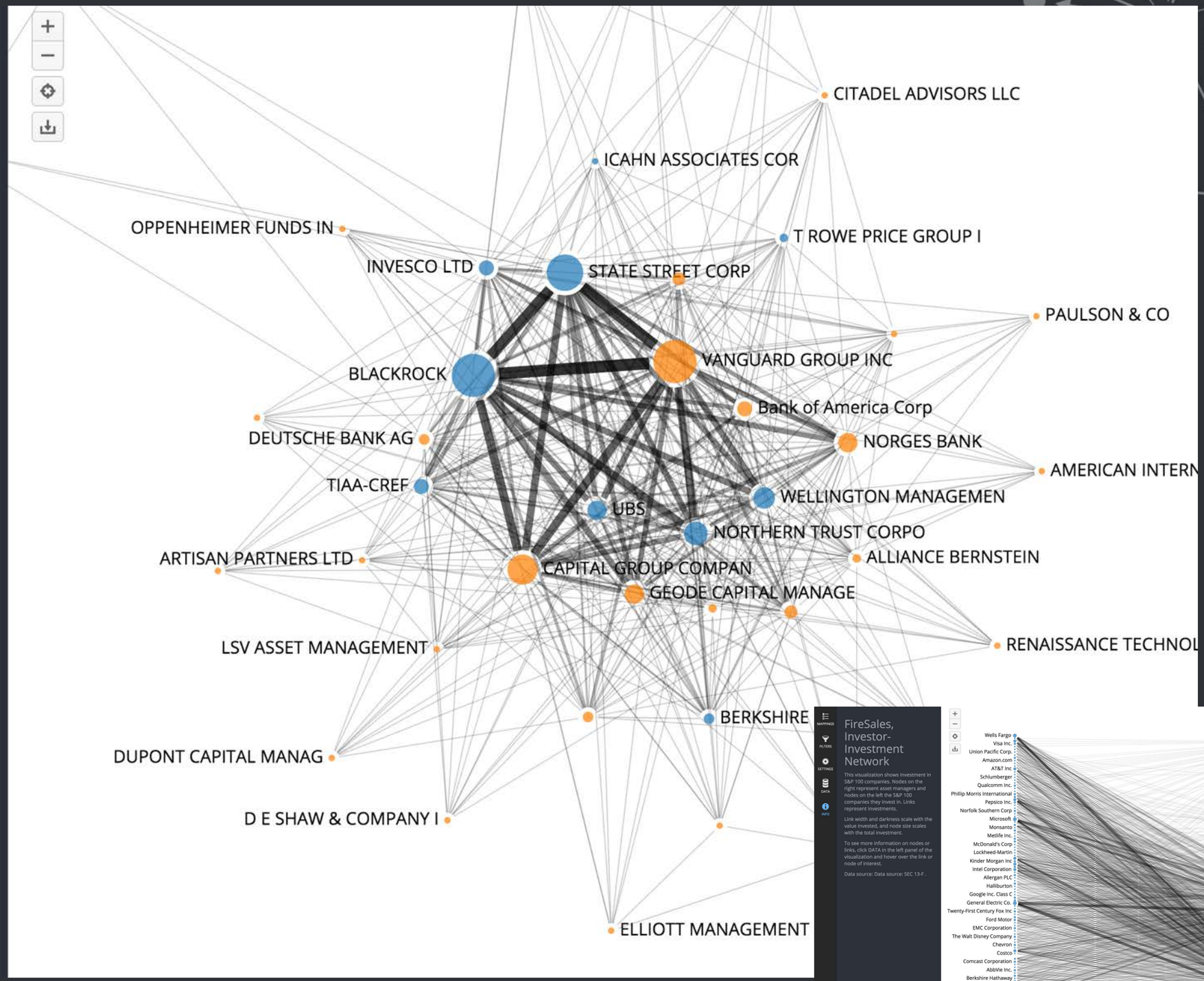
The nodes in this visualization represent asset managers that invest in S&P100 companies, and the links show the value invested by the linked investors in the same companies. That is, all linked nodes invest in at least one common company, and link values represent the sum of investments by both firms in the common companies.

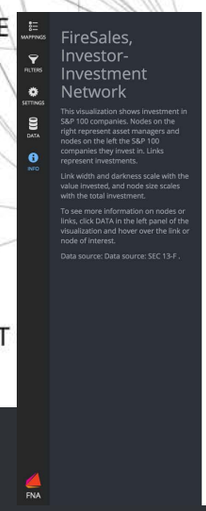
Link width and darkness scales with the value invested and node size scales with the total value invested. Nodes are colored by their category, based on a community detection algorithm.

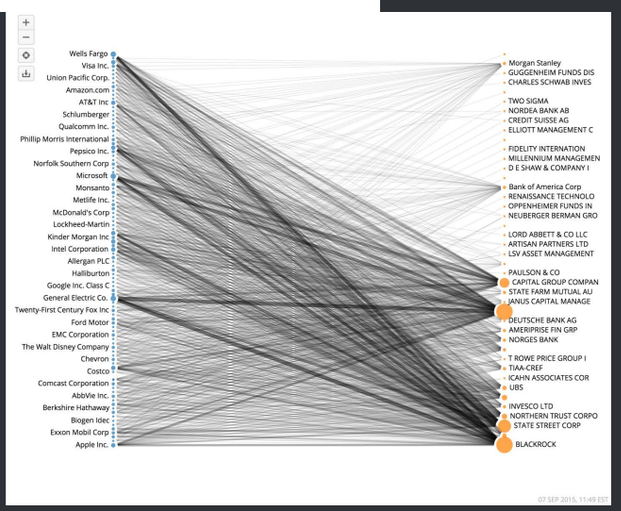
To see more information on nodes or links, click DATA in the left panel of the visualization and hover over the link or node of interest.

Data source: SEC 13-F.

FNA

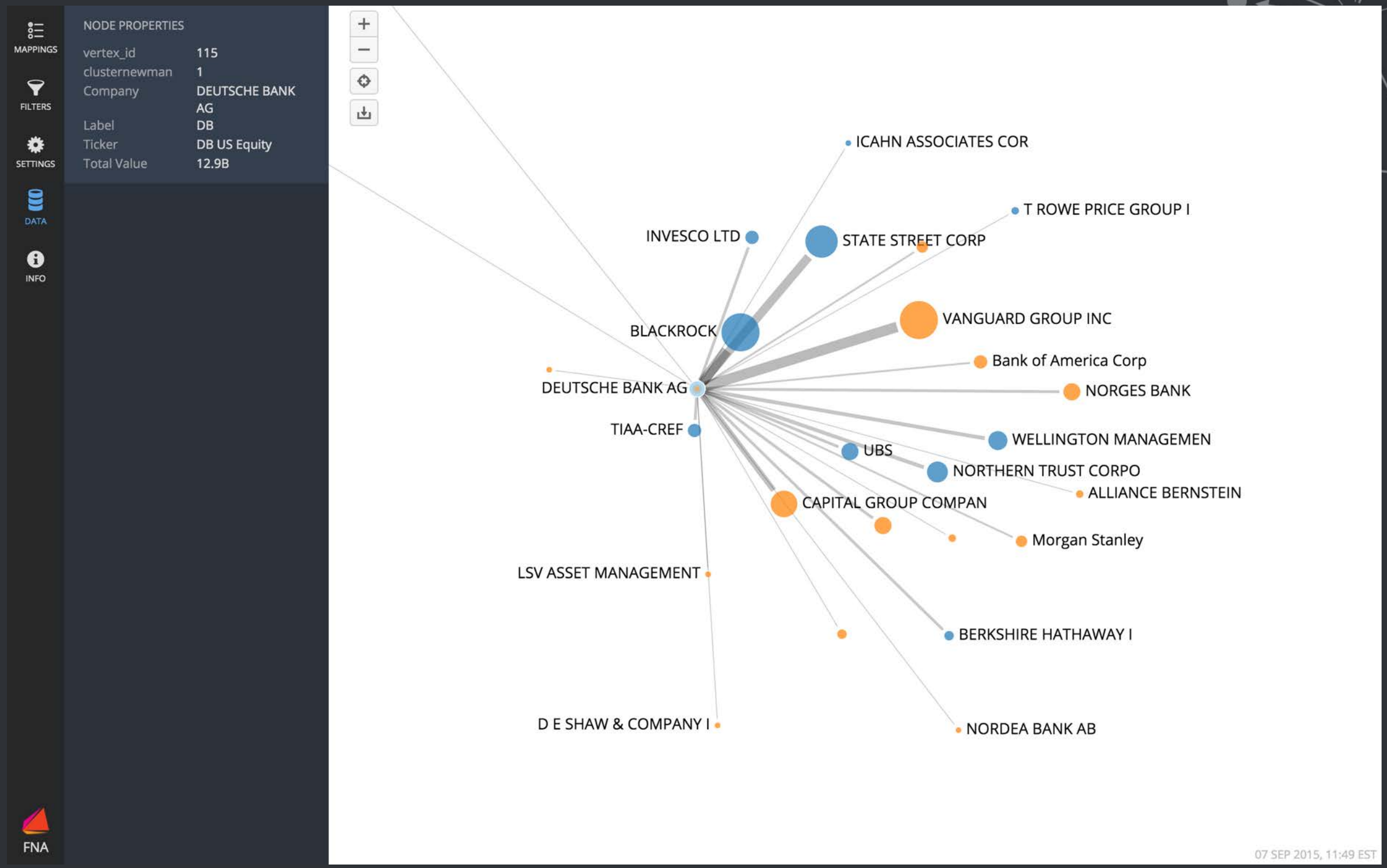






Co-investor Network

Who has similar portfolios to me?



Co-investor Network

How am I co-invested with another asset manager?

MAPPINGS
FILTERS
SETTINGS
DATA
INFO

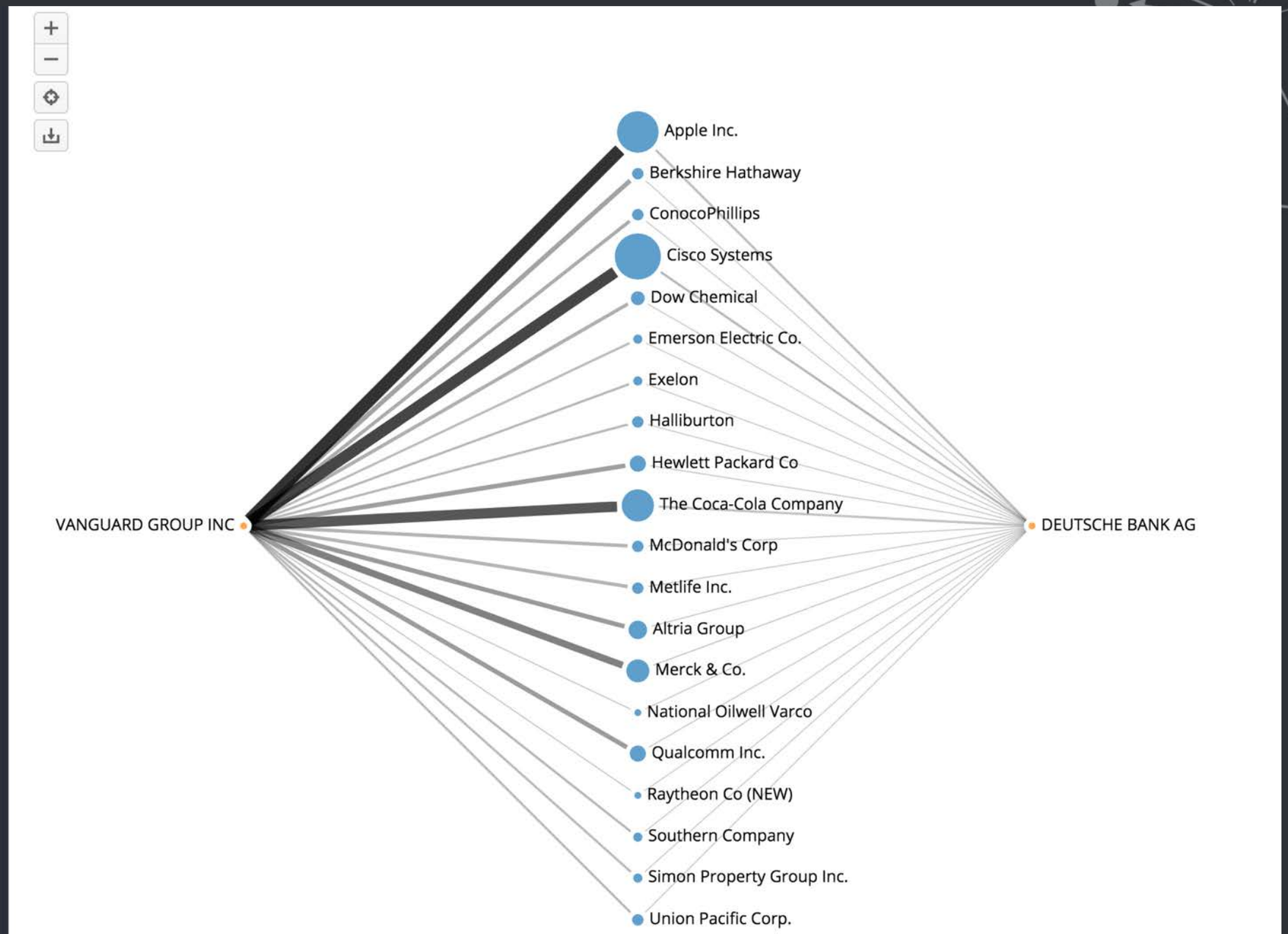
Firesales, Vanguard and Deutsche Bank Co-Investor Network

This visualization shows investments by Vanguard and Deutsche Bank in SYP100 companies. Only companies that both Vanguard and Deutsche Bank invest in are shown.

Link width and darkness scale with the investment value. Company node size scales with the square root of the product of the two investment values.

To see more information on nodes or links, click DATA in the left panel of the visualization and hover over the link or node of interest.

Data source: SEC 13-F.



07 SEP 2015, 12:30 EST

FNA

Co-investment Network

How is my portfolio diversified across the two asset groups?

MAPPINGS
FILTERS
SETTINGS
DATA
INFO

Firesales, Co-Investment network

The nodes in this visualization represent S&P100 companies, and the links show the value invested by common investors. That is, all linked nodes have at least one common investor, and link values represent the sum of investments by the common investors.

Link width and darkness scales with the value invested and node size scales with the total value invested. Nodes are colored by their category, based on a community detection algorithm.

To see more information on nodes or links, click DATA in the left panel of the visualization and hover over the link or node of interest.

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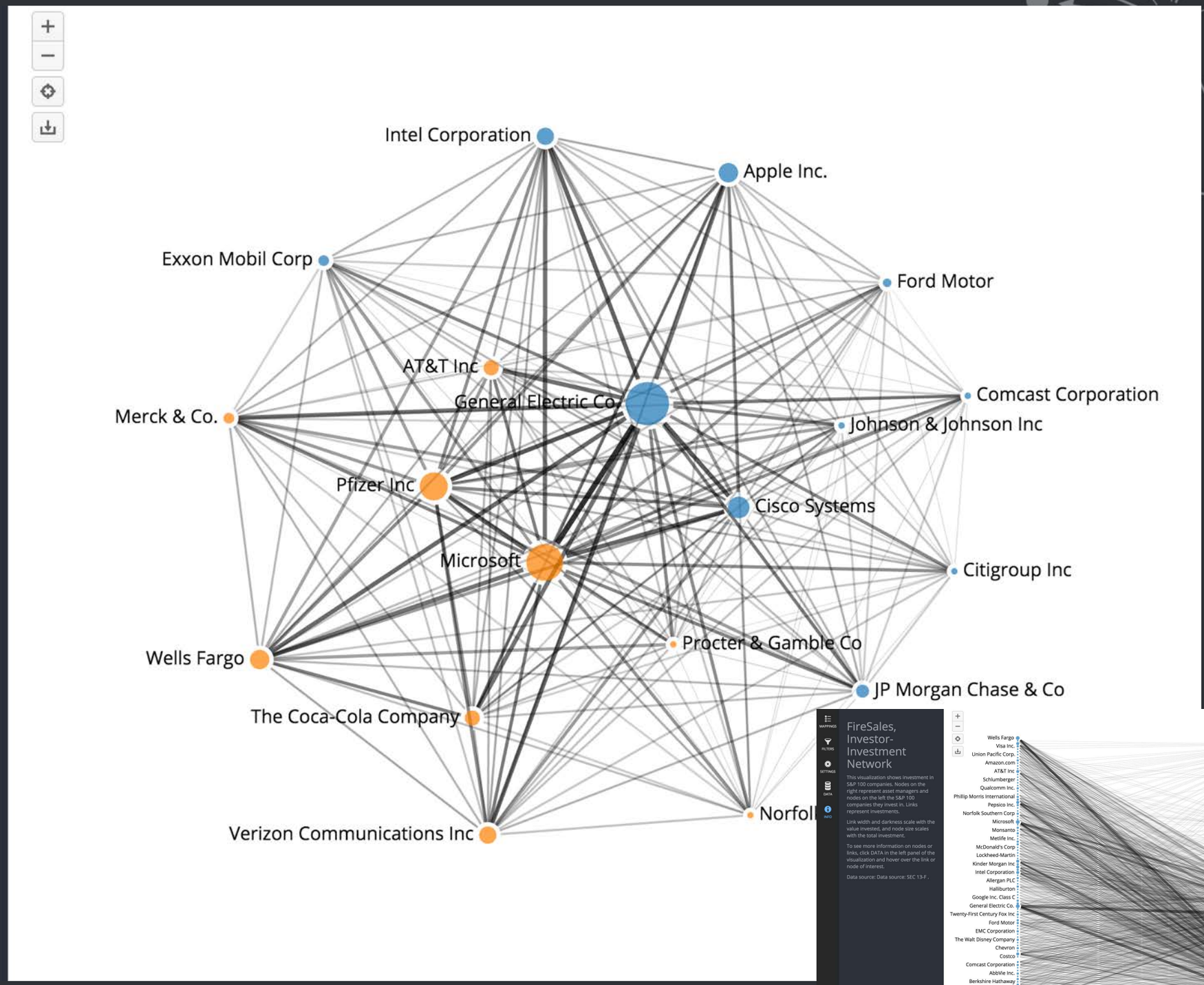
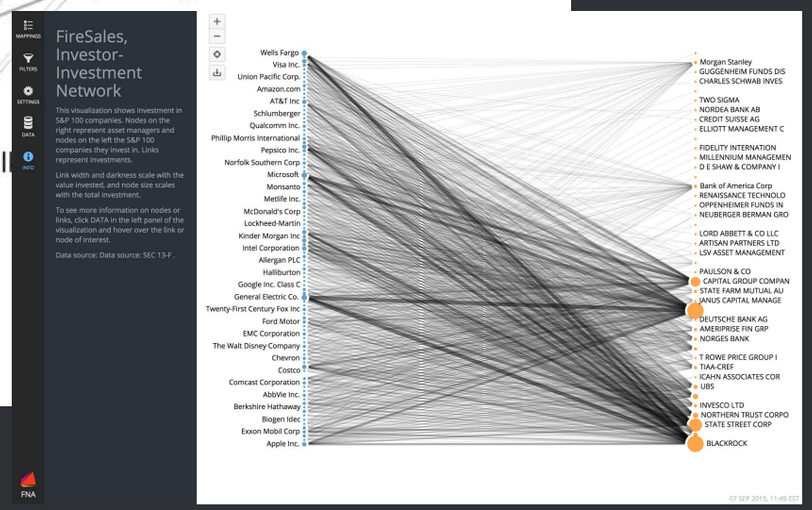
FNA





Final thoughts

We are on the cusp of a **revolution** for financial risk modeling.

We can now **mathematically model and visualize** something that was already taken into account by decision makers - but only intuitively.

The **challenge** we have is to inform decision makers how the model results can be **implemented into** effective **decisions**.

Dr. Kimmo Soramäki
Founder and CEO
kimmo@fna.fi