



# WHAT'S NEW IN V-LAB

Robert Engle and Rob Capellini  
Volatility Institute of NYU Stern  
Volatility and Derivatives: The State of the Art  
April 27&8, NYU Stern


VOLATILITY INSTITUTE, NYU STERN

- 
1. VOLATILITY MAP
  2. CLIMATE PAGE
  3. DOMESTIC SYSTEMIC RISK

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Systemic Risk Analysis ▼

GMES ▼

Click 'Go' to see GMES Analysis page

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[Click here for an overview of our new Volatility Map](#)

**VOLATILITY OVERVIEW** [SEE MORE](#)

**VOLATILITY**

CORRELATION

SYSTEMIC RISK

LONG RUN VALUE AT RISK

LIQUIDITY

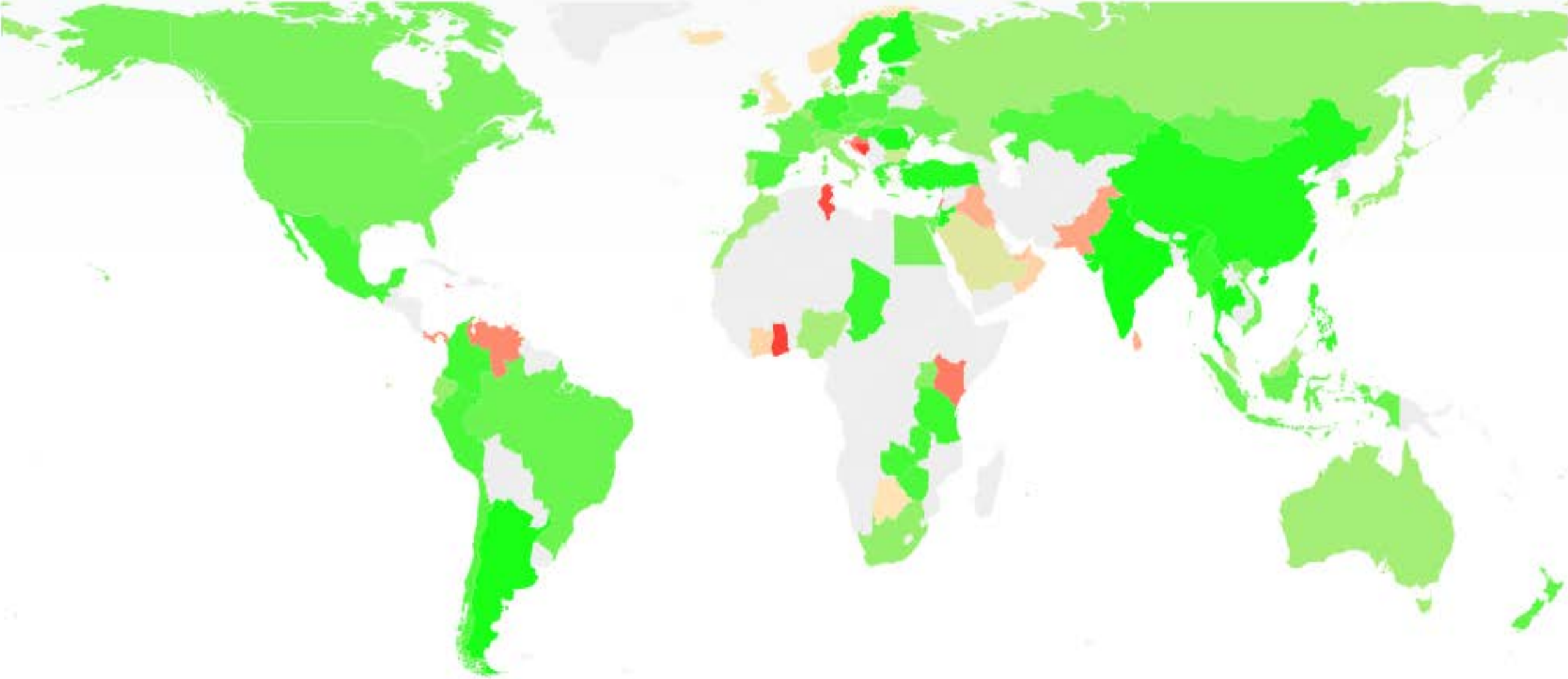


Global Volatility

April 22, 2017

Region: World

Now



# France Volatility Summary

Last Update: 2017-04-26 17:21:37 GMT

## Volatility by Industry

All	30.21%	
Basic Materials	36.48%	
Consumer Goods	30.68%	
Consumer Services	29.59%	
Financials	24.09%	
Health Care	37.25%	
Industrials	30.38%	
Oil & Gas	30.69%	
Technology	32.26%	
Telecommunications	27.61%	
Utilities	24.50%	

## Market Summary

### Equities

CAC 40 Index	13.77%	-0.30%
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### Currencies

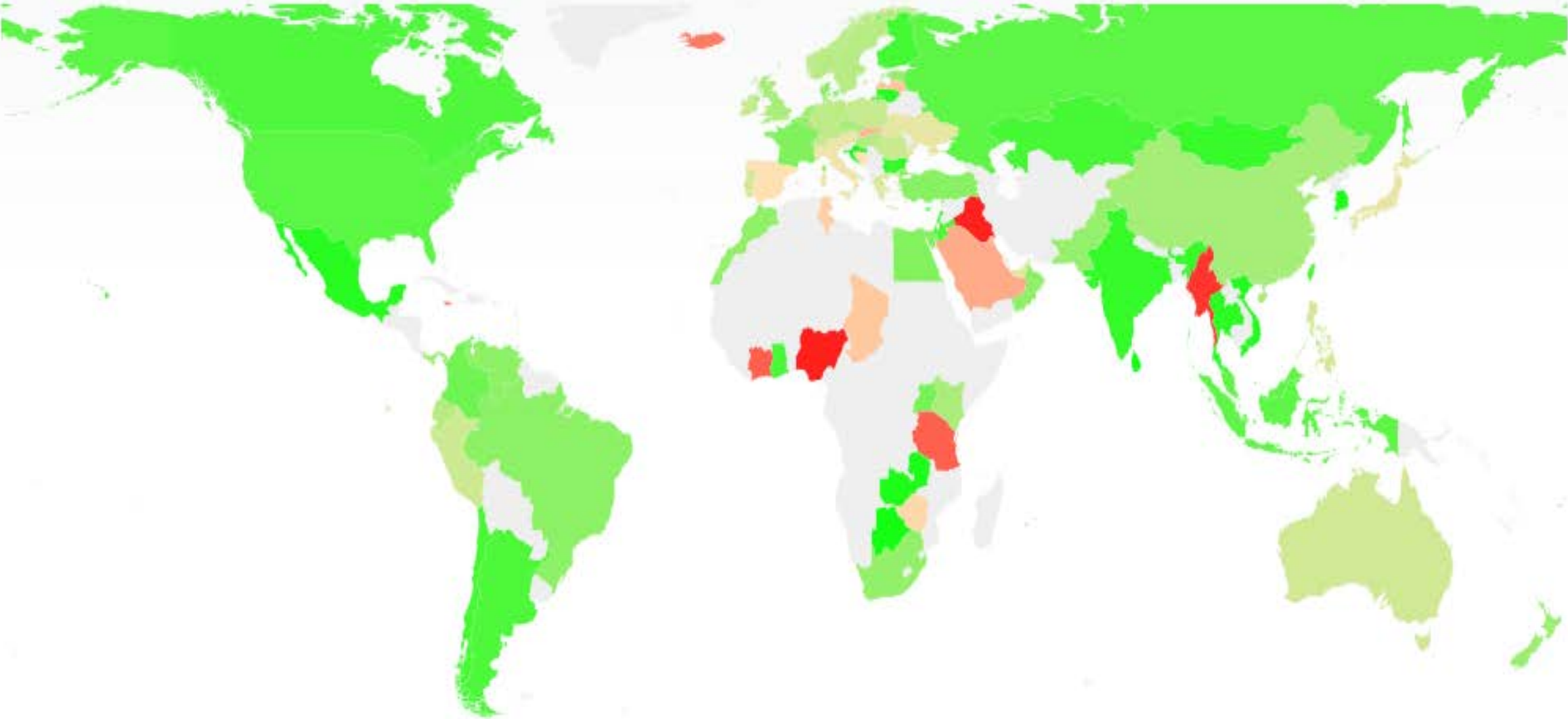
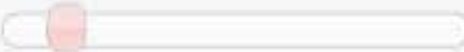
Euro	8.39%	+0.38%
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Global Volatility

JUNE 8, 2016

Region: World

22 Days Ago



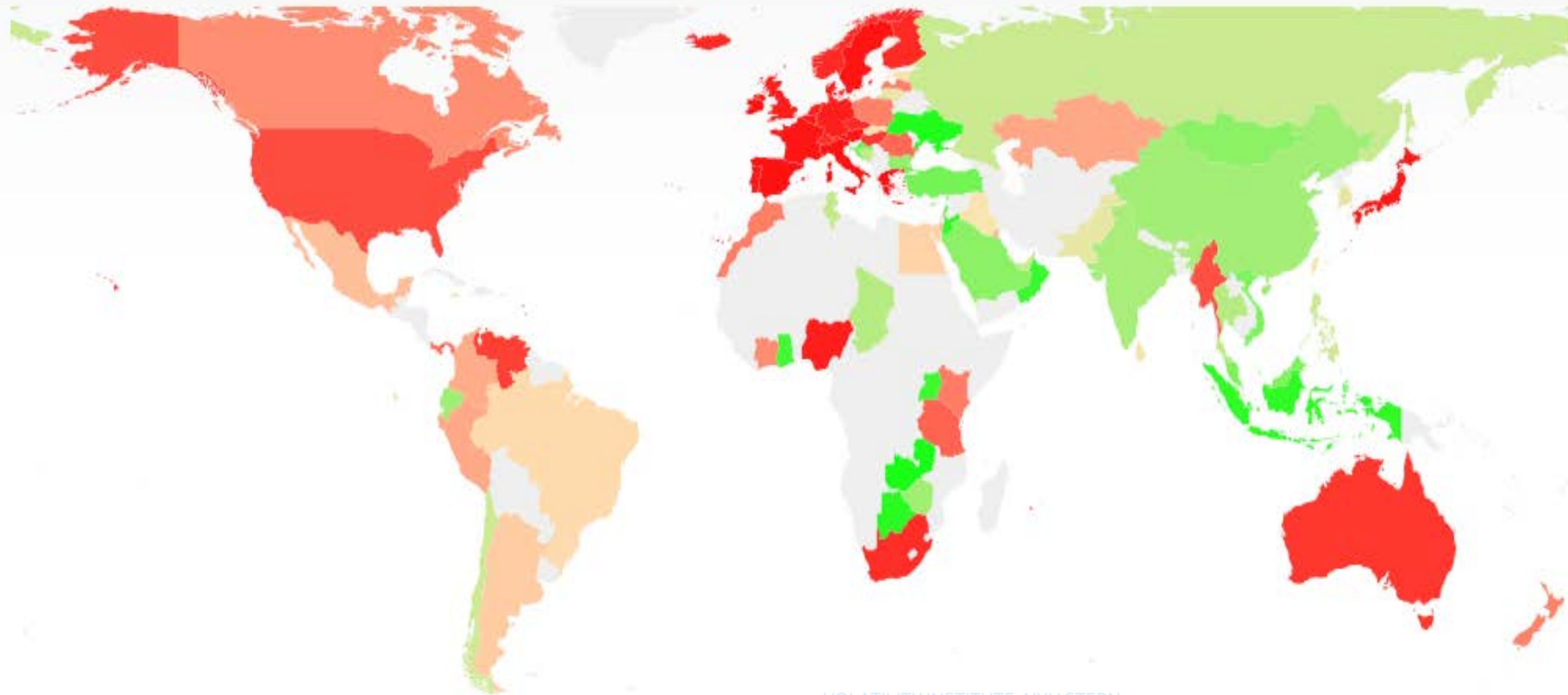


# Global Volatility

JUNE 28, 2016 ~BREXIT

Region: World

8 Days Ago

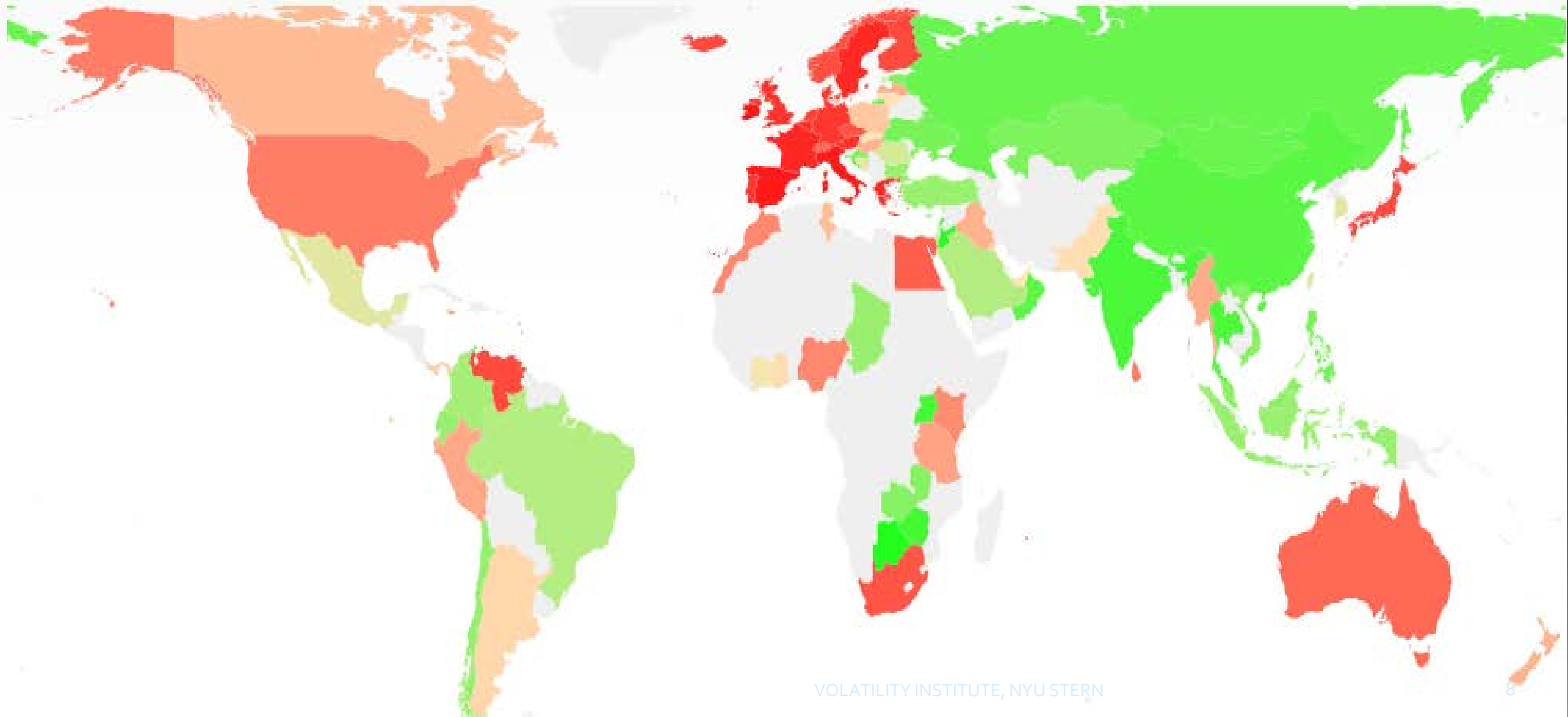


# Global Volatility

Region:

July 10, 2016

Now

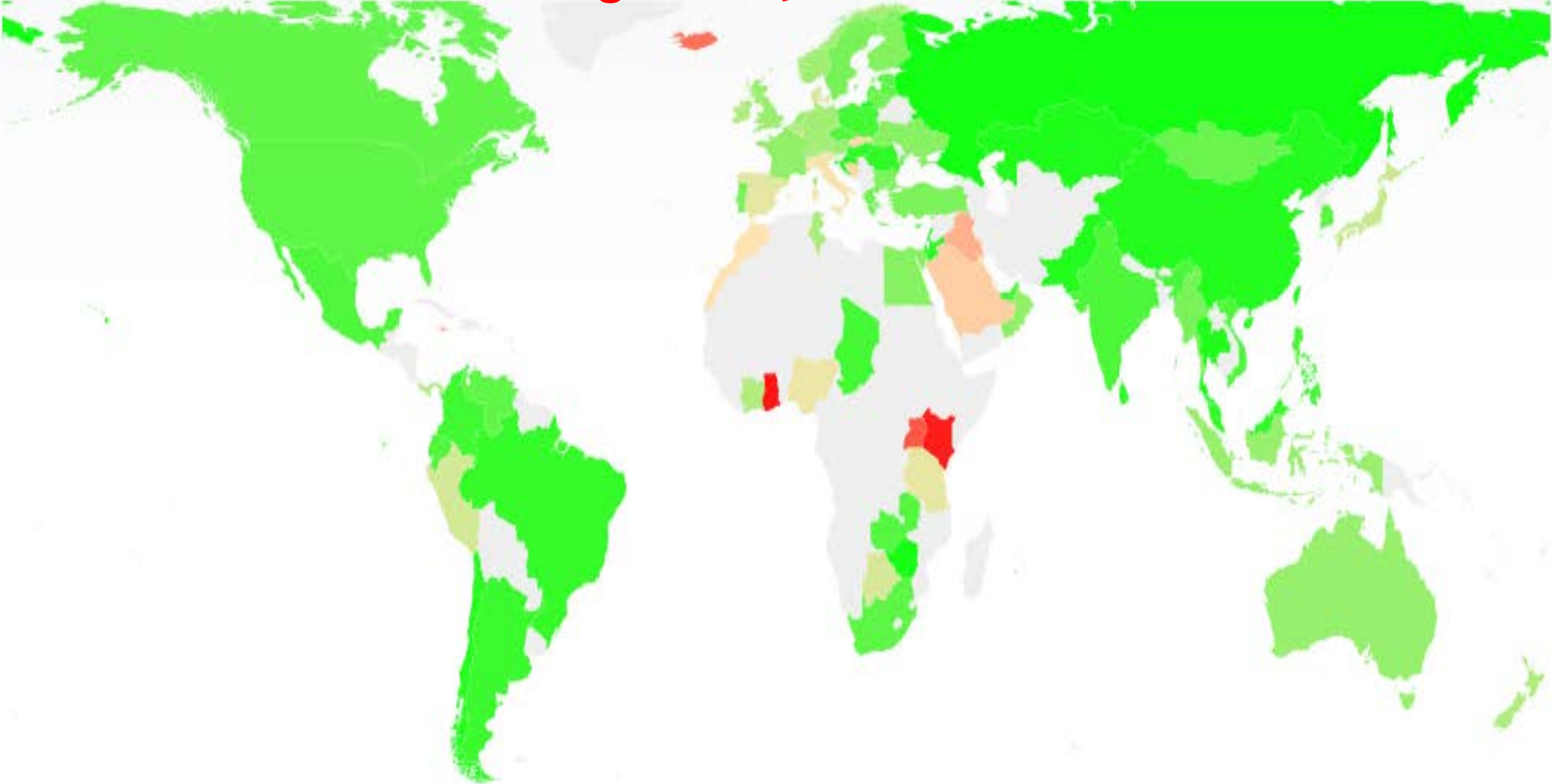




Region: World

Now

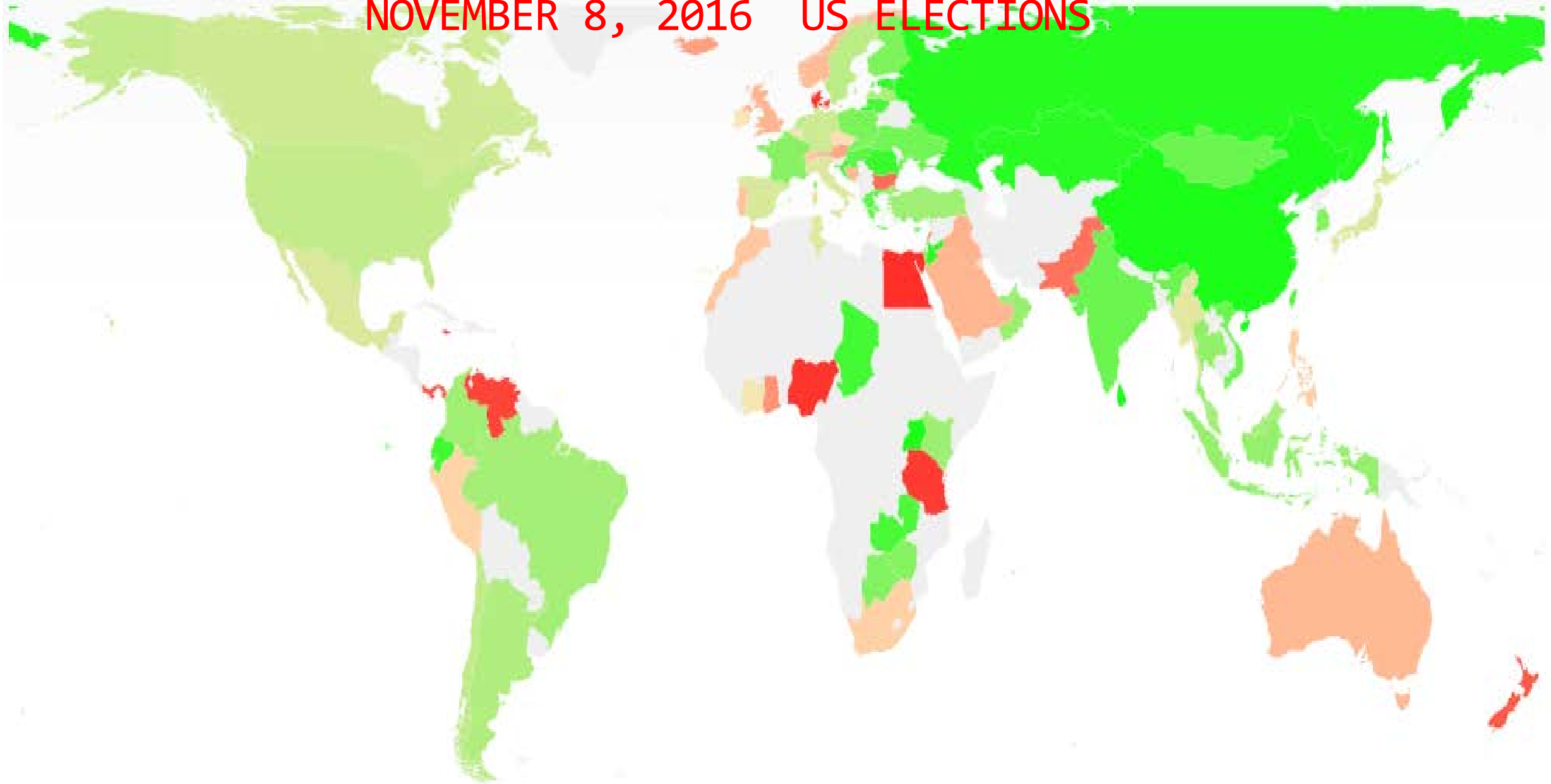
August 30, 2016



Region: World

Now

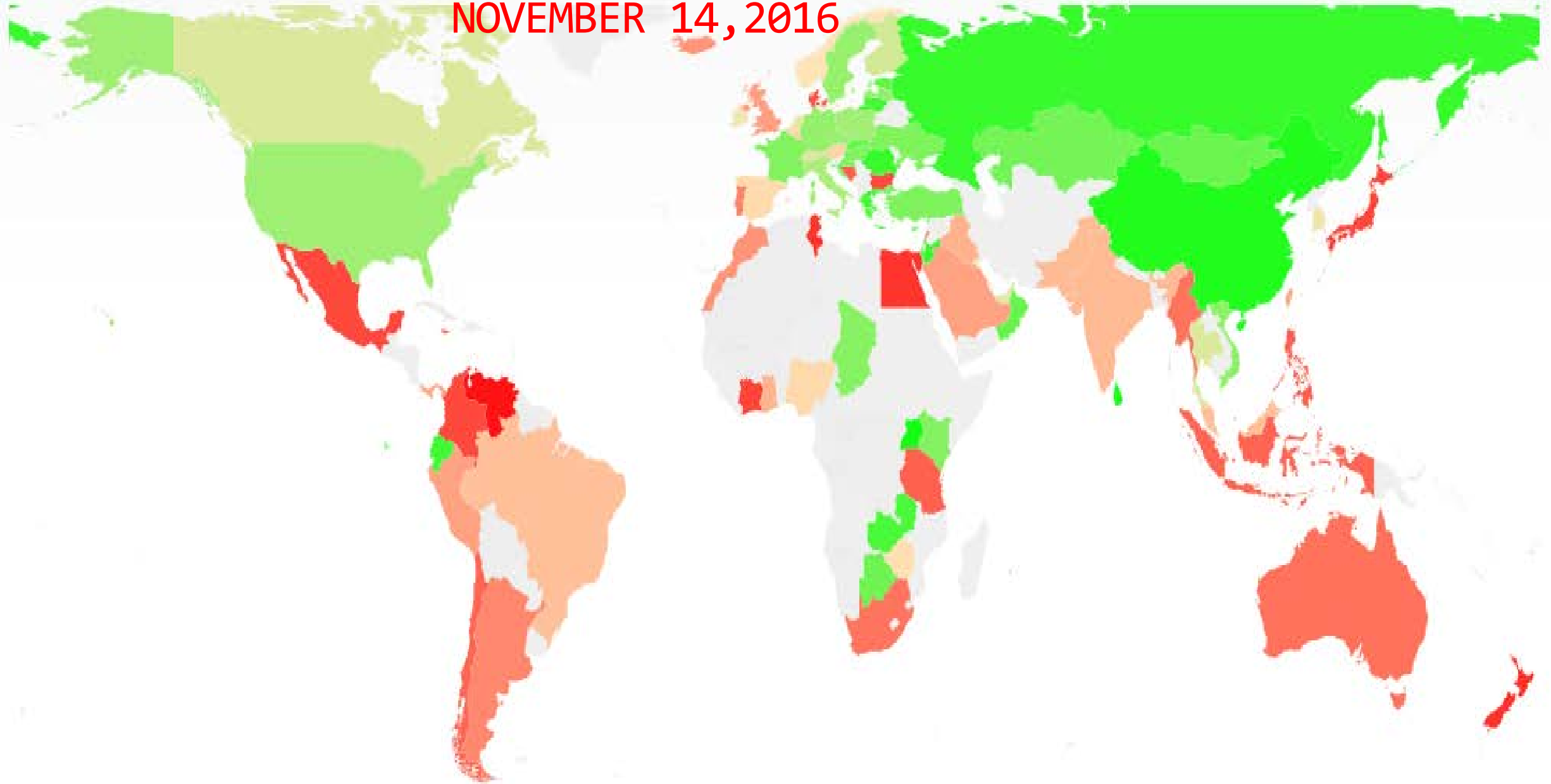
# NOVEMBER 8, 2016 US ELECTIONS



Region: World

Now

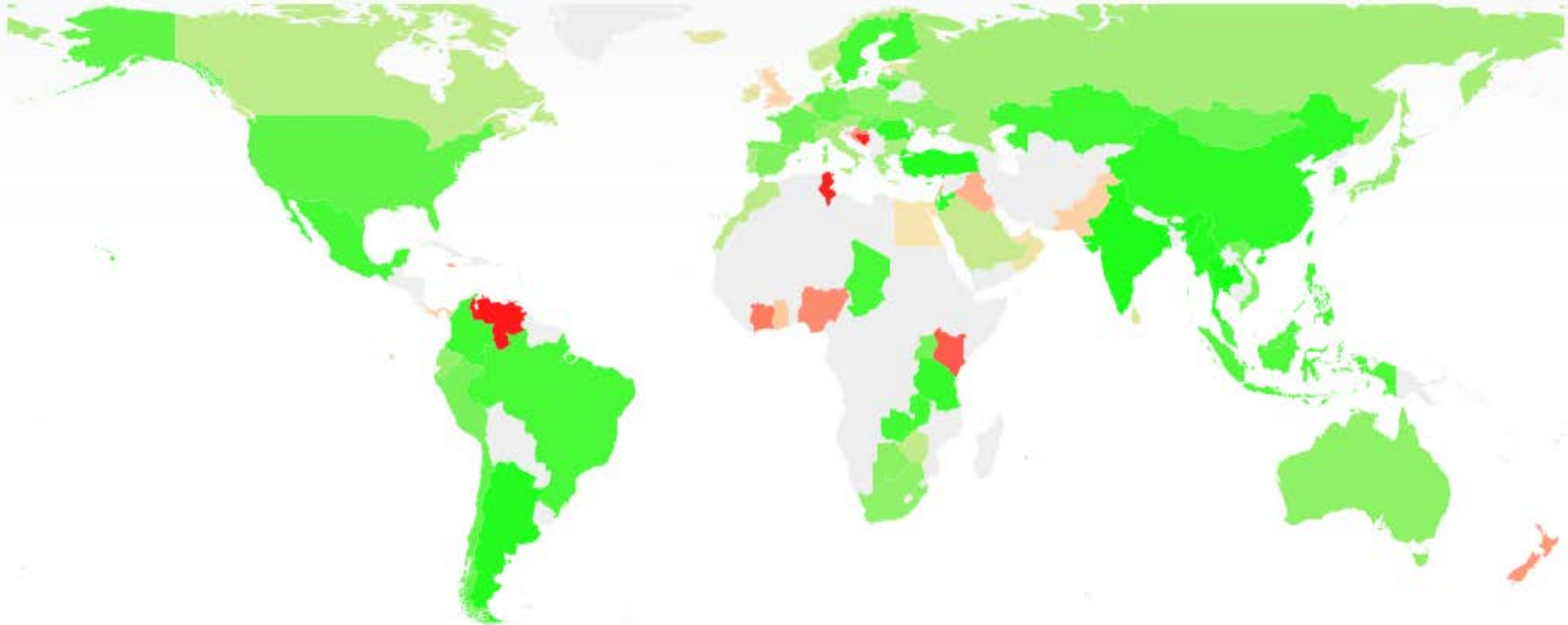
NOVEMBER 14, 2016



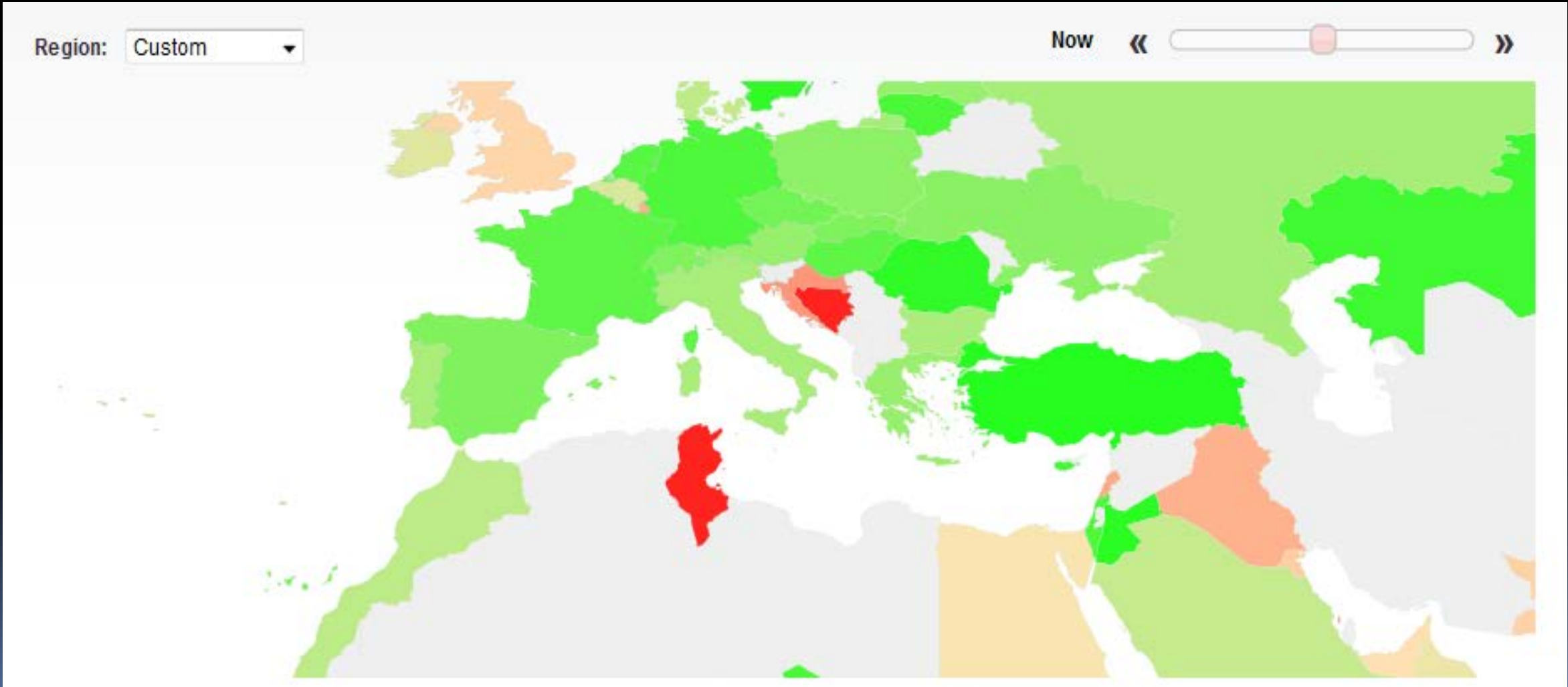
# APRIL 27 THE WORLD

Region: World

Now



# EUROPE TODAY





A sunset scene over a calm lake. The sun is low on the horizon, creating a bright glow and lens flare. The sky is filled with scattered clouds, some illuminated by the setting sun. The water in the foreground is still, reflecting the sky and the sun. The overall color palette is dominated by warm yellows, oranges, and blues.

# A FINANCIAL APPROACH TO ENVIRONMENTAL RISK





# NEW INITIATIVE

- Principle investigators: Johannes Stroebe and myself
- Collaboration with Bryan Kelly and Stefano Giglio at Chicago
- Supported by generous grants from
  - GLOBAL RISK INSTITUTE, Toronto
  - NORGES BANK under the NFI program, Oslo




# CLIMATE RISK

- Like many risks, individuals and companies may want to insure against losses.
- However no insurer is sufficiently well capitalized that such insurance can be offered.
- Instead individuals and firms must self insure and to meet this need may invest in climate hedge portfolios that should outperform in times of climate distress.
- Naturally, such portfolios will underperform in normal times as these deviate from the short horizon efficient portfolio.



# THE RESEARCH PLAN

- Evaluate the performance of publicly traded environmental funds
  - Develop approaches to form portfolios that are highly correlated with environmental information.
  - Monitor all funds to see performance as environmental conditions change
- 



# PERFORMANCE OF “GREEN” ETFs

- STYLES
  - ALTERNATIVE ENERGY
    - WIND
    - SOLAR
    - NUCLEAR
  - LOW CARBON
  - OTHER



# SUSTAINABLE ETFs

- Powershares WilderHill Clean Energy Portfolio, **Clean Energy**
- Market Vectors Environmental Services ETF, **Waste Management**
- PowerShares WilderHill Progressive Energy Portfolio, **Clean Energy**
- PowerShares Cleantech Portfolio, **Clean Energy**
- First Trust NASDAQ Clean Edge Green Energy Index Fund, **Clean Energy**
- Market Vectors Global Alternative Energy ETF, **Clean Energy**
- Powershares Global Clean Energy Portfolio, **Nuclear**
- Guggenheim Solar ETF, **Solar**
- Market Vectors Solar Energy ETF, **Solar**
- First Trust Global Wind Energy ETF, **Wind**
- iShares Global Clean Energy ETF, **Clean Energy**
- AdvisorShares Global Echo ETF, **ESG**
- SPDR<sup>®</sup>, MSCI ACWI Low Carbon Target ETF, **Low Carbon**
- iShares MSCI ACWI Low Carbon Target ETF, **Low Carbon**

# TOP POSITIONS TODAY:

POWERSHARES GLOBAL CLEAN ENERGY PORTFOLIO

SPDR MSCI ACWI Low Carbon Target ETF

## Top 10 Holdings

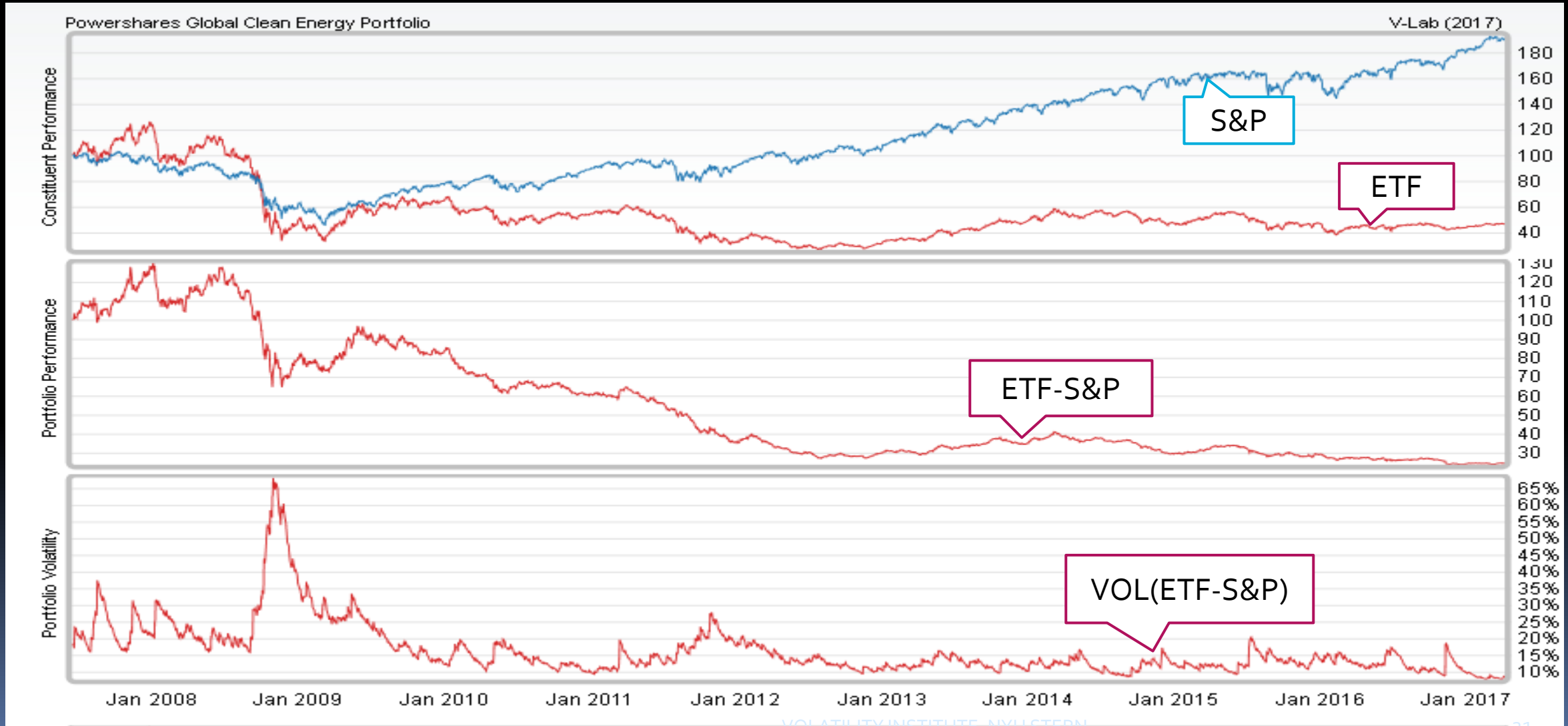
Tesla Inc	2.11%
Hannon Armstrong Sustainable Infrastructure Capital Inc	2.04%
Nibe Industrier AB	1.99%
Philips Lighting NV	1.96%
Osram Licht AG	1.95%
Caverion Oyj	1.91%
Kingspan Group PLC	1.85%
Universal Display Corp	1.85%
Itron Inc	1.82%
Veeco Instruments Inc	1.80%

## Top 10 Holdings

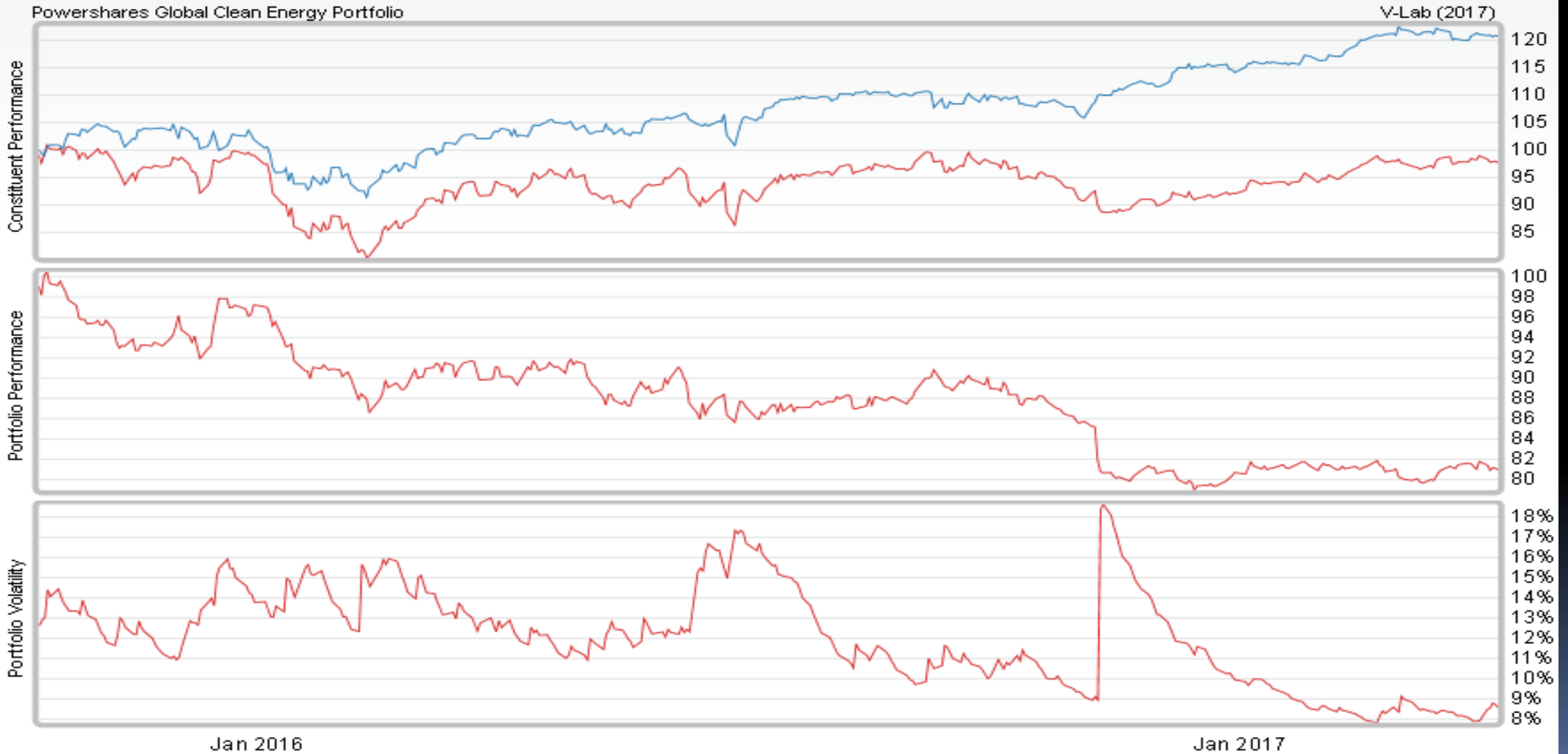
Cash	2.10%
Apple Inc	1.95%
Microsoft Corp	1.24%
Amazon.com Inc	0.93%
Johnson & Johnson	0.90%
Facebook Inc	0.84%
JPMorgan Chase & Co	0.82%
General Electric Co	0.71%
Wells Fargo & Co	0.67%
AT&T Inc	0.67%



# PERFORMANCE: POWERSHARES GLOBAL CLEAN ENERGY PORTFOLIO

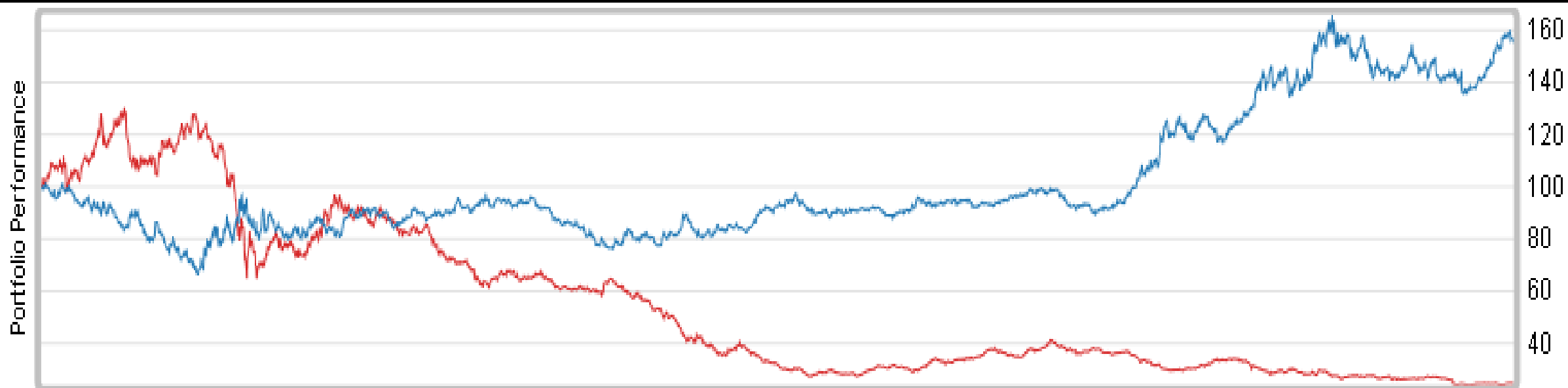


# SINCE ELECTION

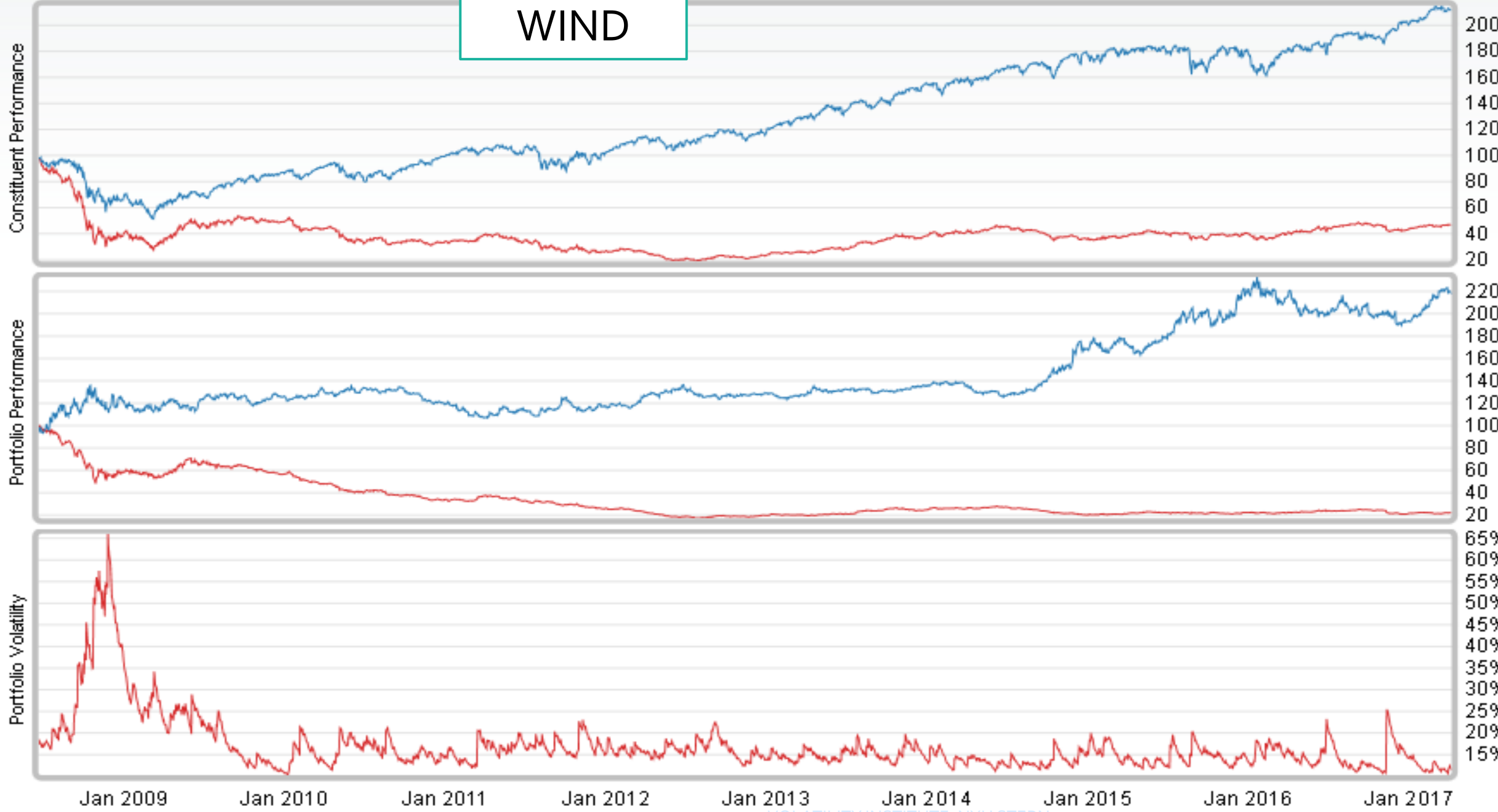


# PERFORMANCE RELATIVE TO SHORTING FOSSIL FUELS USING XLE (energy sector)

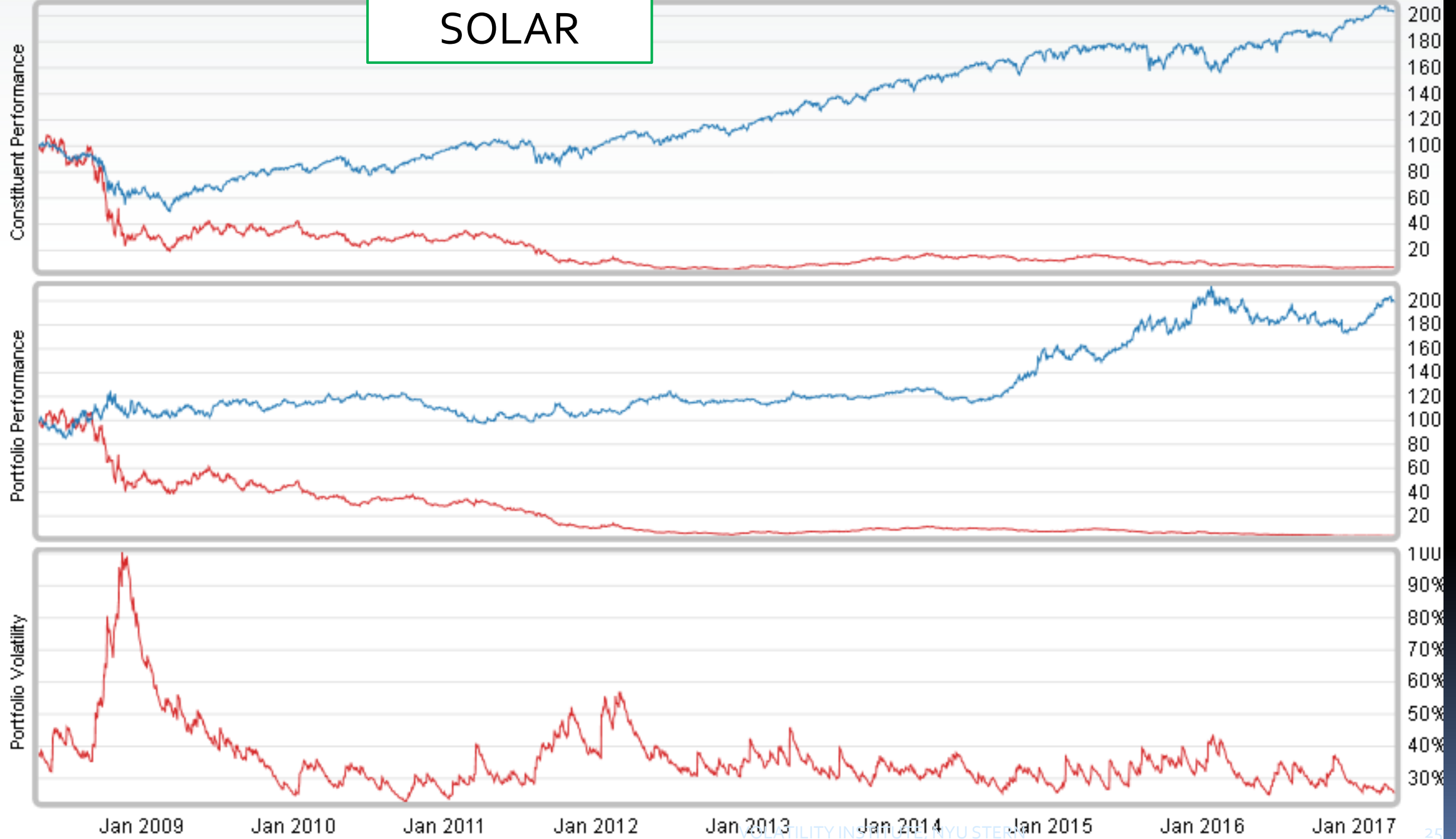
TWO ZERO COST PORTFOLIOS:  
LONG ETF AND SHORT S&P  
LONG S&P AND SHORT XLE, "STRANDED ASSETS"



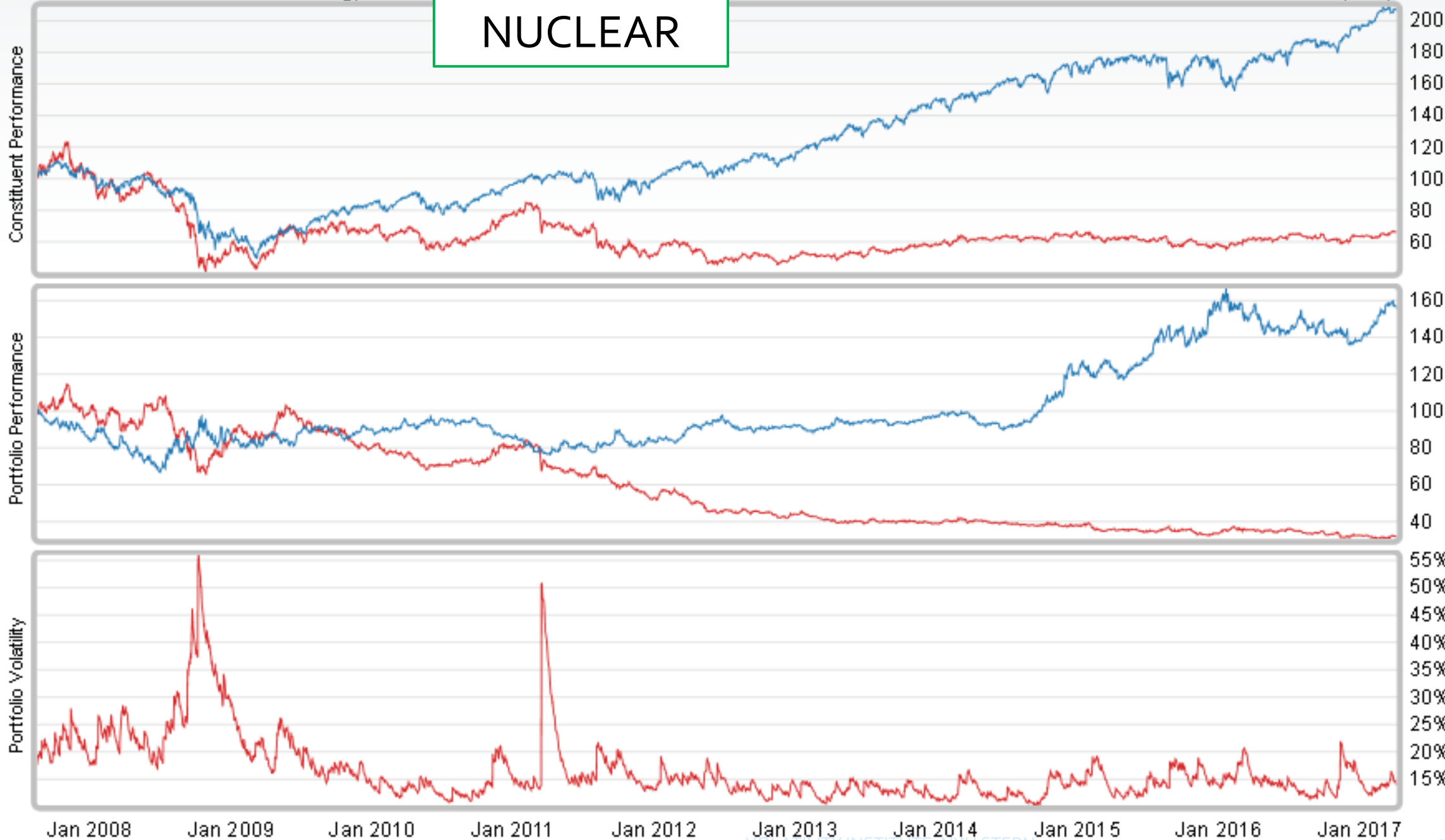
WIND



# SOLAR



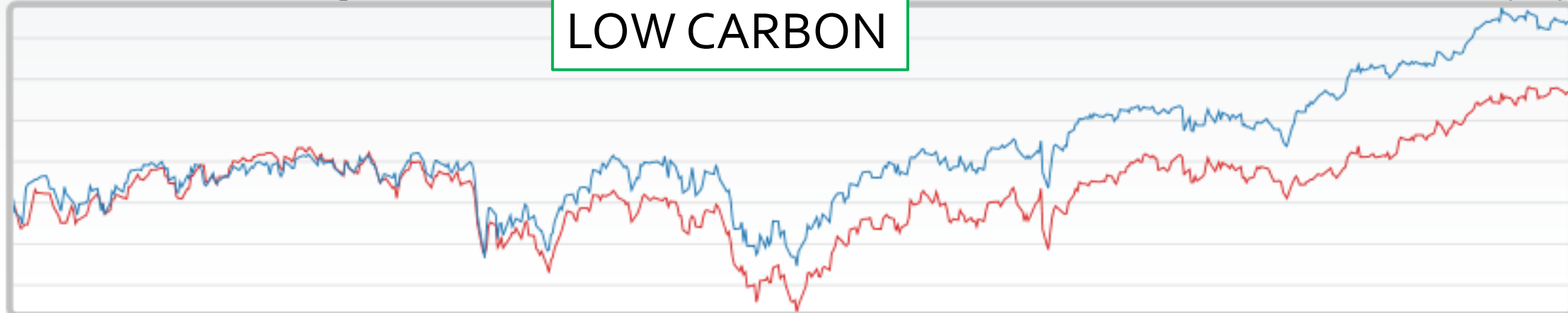
# NUCLEAR



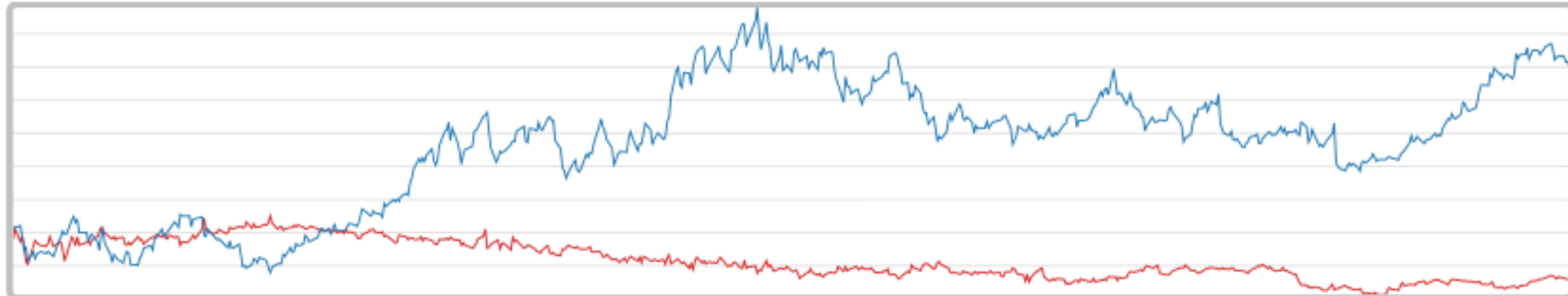


# LOW CARBON

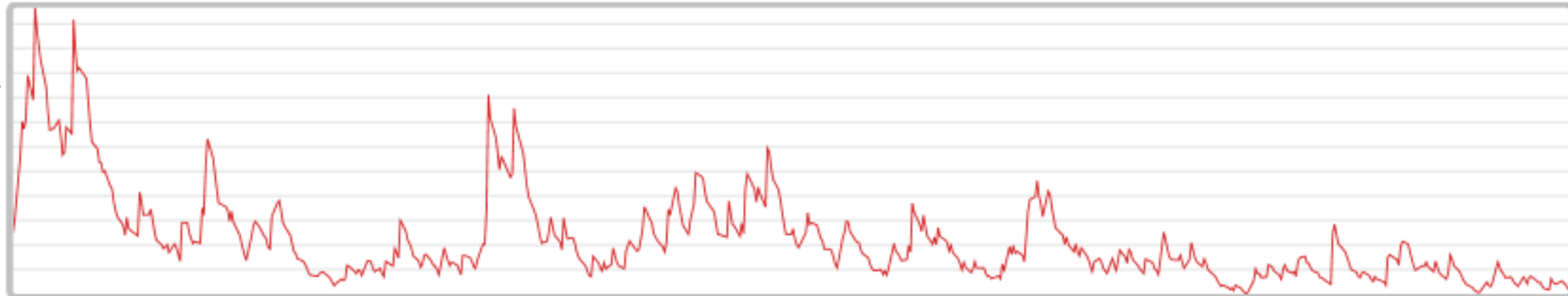
Constituent Performance



Portfolio Performance



Portfolio Volatility




# WHAT ARE THE ALPHAS FOR THESE ETFs?

as of 20170228		(annualized) mean return	(annualized) mean garchvol	Daily				Monthly				ANNUALIZED ALPHAS		
				alpha	beta	smb	hml	alpha	beta	smb	hml	Daily	Monthly	
Clean Energy	QCLN	1.14%	27.82%	-0.07	1.24	0.73	-0.10	-1.67	1.36	0.89	0.18	* from 2010-01-01	<b>-16.86</b>	-20.00
	PZD	5.77%	20.35%	-0.04	1.10	0.30	0.14	-0.96	1.16	0.35	-0.02		<b>-10.18</b>	-11.56
	PUW	2.39%	23.88%	-0.06	1.12	0.57	0.44	-1.49	1.38	0.44	0.44		<b>-13.99</b>	-17.91
	PBW	-11.55%	28.67%	-0.12	1.24	0.89	0.13	-2.88	1.42	0.86	0.01		<b>-30.57</b>	-34.60
	GEX	-3.18%	25.68%	-0.08	1.27	0.34	0.08	-1.92	1.33	0.27	0.09		<b>-21.34</b>	-23.00
Wind	FAN	-0.85%	23.11%	-0.07	1.12	-0.12	0.23	-1.53	1.26	-0.07	-0.18		<b>-16.53</b>	-18.35
Solar	TAN	-18.15%	38.89%	-0.17	1.51	0.65	0.16	-3.88	1.79	0.90	-0.10		<b>-41.81</b>	-46.57
	KWT	-20.55%	40.20%	-0.17	1.43	0.47	0.10	-4.14	1.79	0.75	0.05		<b>-43.50</b>	-49.70
Low-carbon	CRBN	5.97%	13.01%	-0.01	0.75	-0.03	0.08	-0.27	1.04	-0.18	-0.12	* from 2015-01-01	<b>-1.56</b>	-3.27
	LOWC	5.48%	13.48%	0.00	0.50	0.08	0.12	-0.31	1.02	-0.20	-0.11		<b>0.20</b>	-3.72
Index	SNP	11.08%	14.75%									* from 2010-01-01	0	



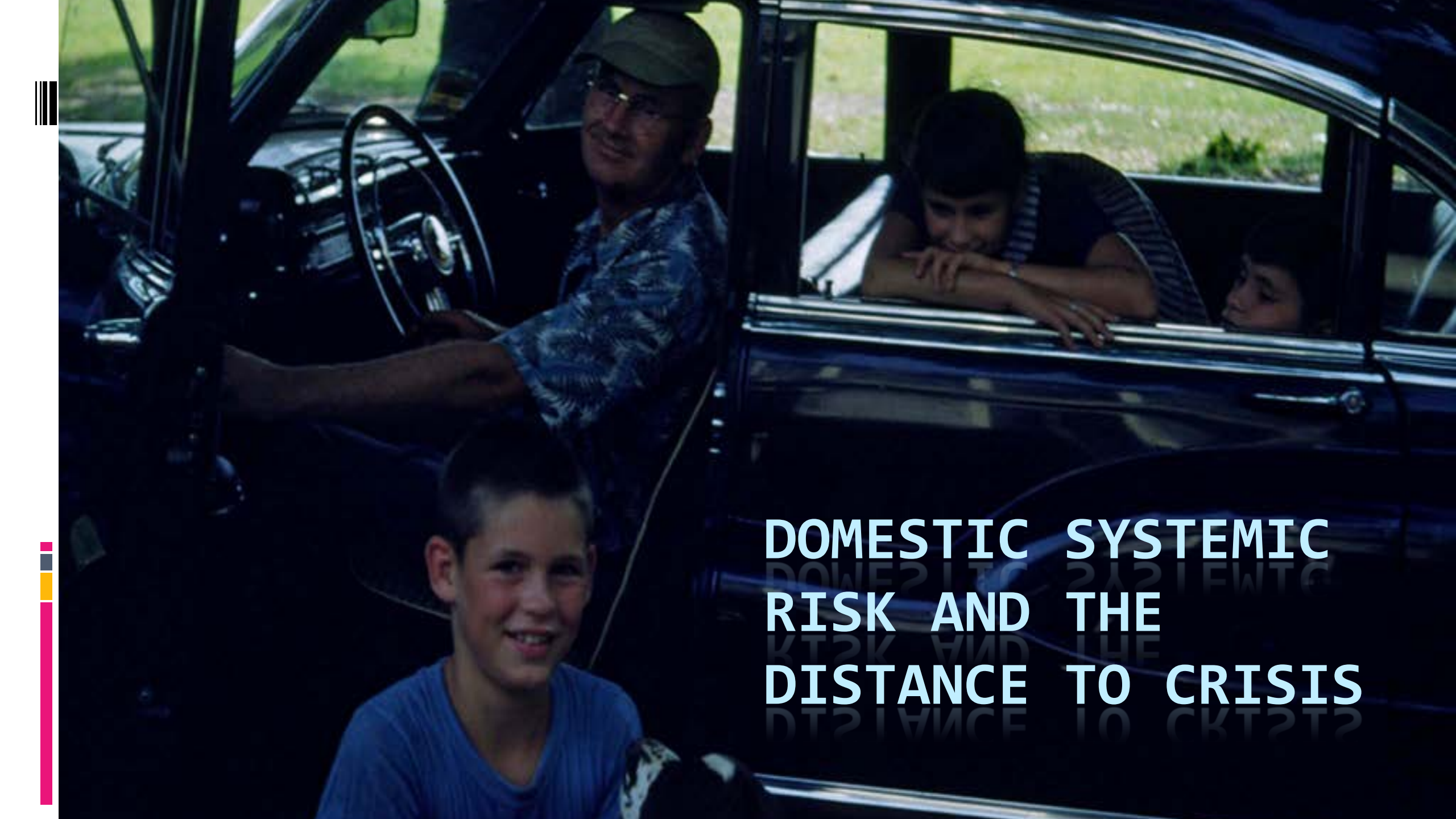
# WHAT IS GOING ON?

- Investor demand for environmental insurance has led to many stocks being overvalued and hence underperforming. Is this worse than what was expected? Probably.
  - Dramatic technical progress in alternative energy has lowered prices causing falling profits to the sector. Chinese government intervention is often blamed for this miscalculation.
- 



CONCLUSIONS:

WE NEED BETTER WAYS TO SELECT and UPDATE HEDGE PORTFOLIOS  
WE NEED BETTER WAYS TO MONITOR PERFORMANCE



**DOMESTIC SYSTEMIC  
RISK AND THE  
DISTANCE TO CRISIS**





# DEFINITION of SRISK

- ▣ *How much capital would a financial institution need to raise in order to function normally if we have another financial crisis?*
- ▣ Principle investigators: Viral Acharya, Matt Richardson and me at the Volatility Institute at NYU's Stern School. Collaboration with HEC Lausanne and the Institute for Global Finance at University of New South Wales. Contributions by Christian Brownlees, Rob Capellini, Diane Perriet, Emil Siriwardane.
- ▣ References: Acharya, Pedersen, Phillipon, Richardson "Measuring Systemic Risk (2010); Acharya, Engle, Richardson "Capital Shortfall, A New Approach to Ranking and Regulating Systemic Risks, AEAPP (2012), Brownlees and Engle, "Volatilities, Correlations and Tails for Systemic Risk Measurement", 2010

# SRISK

$$\begin{aligned} SRISK_{i,t} &= \text{Median}_t \left( \text{Capital Shortfall}_i \mid \text{Crisis} \right) \\ &= \text{Median}_t \left( k \left( \text{Debt}_{t+n} + \text{Equity}_{t+n} \right) - \text{Equity}_{t+n} \mid \text{Crisis}_{t+n} \right) \\ &= k \text{Debt}_{t+n} - (1-k) \text{Median}_t \left( \text{Equity}_{t+n} \mid \text{Crisis}_{t+n} \right) \end{aligned}$$

- ▣ *And equity in a crisis is expected to fall by beta\*market decline*

$$\log \left( \text{Equity}_{t+n} / \text{Equity}_t \right) = \beta_t \log \left( \text{WEquity}_{t+n} / \text{WEquity}_t \right) + u_{t+n}$$

$$\text{Median}_t \left( \text{Equity}_{t+n} \mid \frac{\text{WEquity}_{t+n}}{\text{WEquity}_t} = 1 - \theta \right) = \text{Equity}_t \exp \left( \beta_t \log (1 - \theta) \right)$$

# ESTIMATE BETA WITH DCB

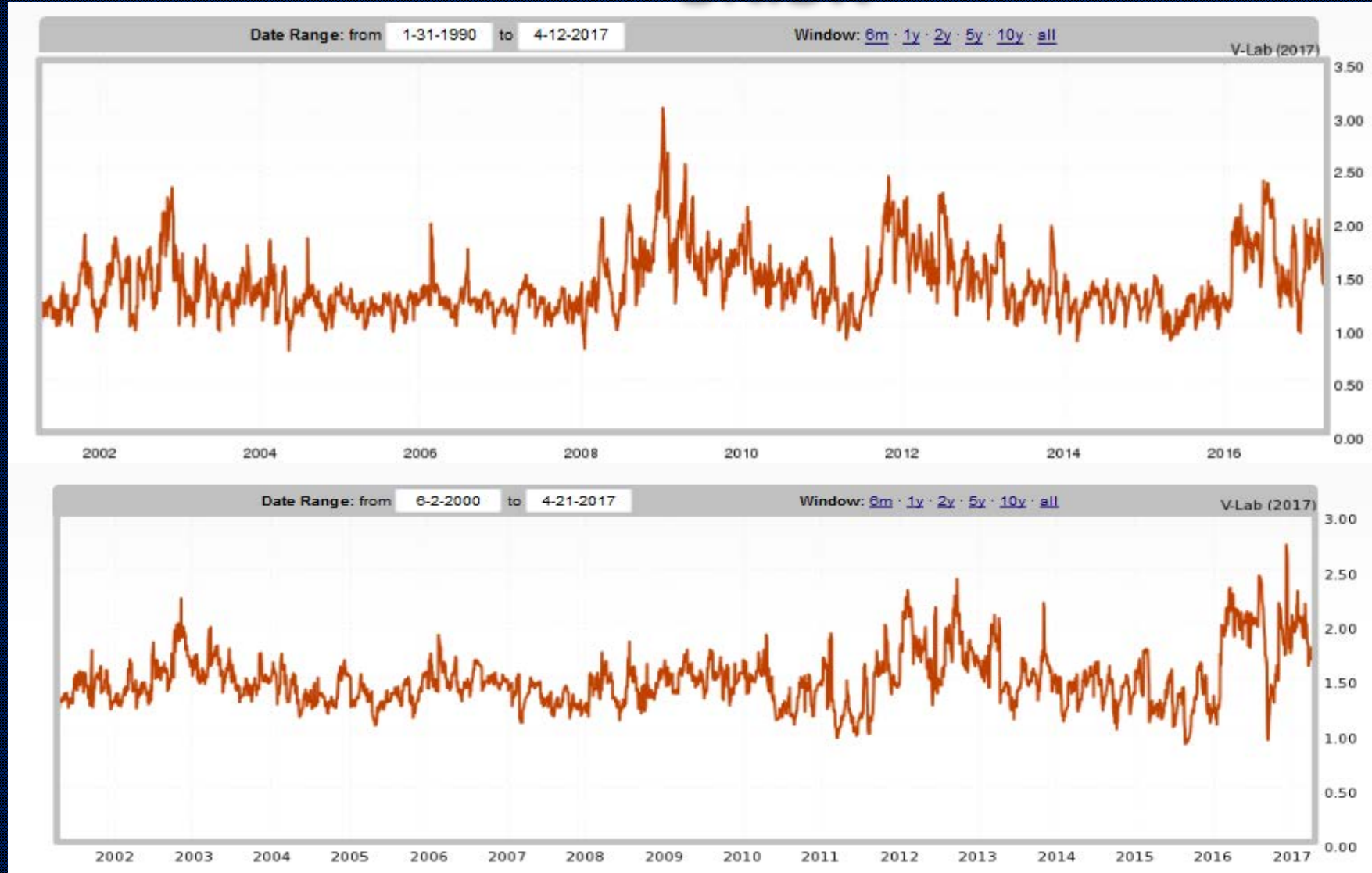
- ▣ The beta of a stock is commonly estimated by regressing return on one or more market factors. This assumes that beta is constant.
- ▣ Such a beta is a correlation with the market times the ratio of the standard deviation of the firm over the market.
- ▣ DCB estimates these inputs and adjusts for noise and for asynchronous returns.
- ▣ Beta is different every day and is forecast from day  $t-1$ .



# D-SRISK or DOMESTIC SRISK

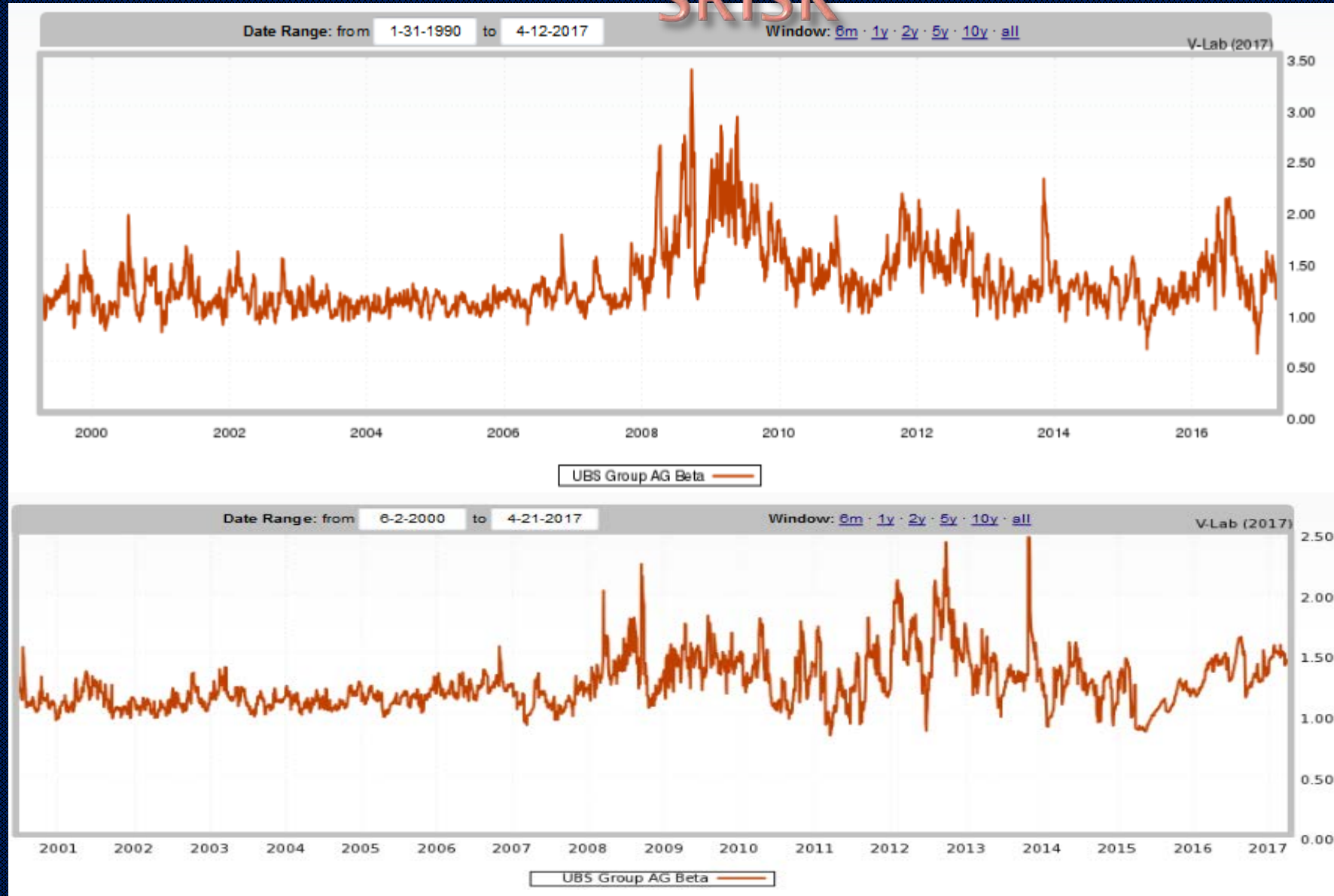
- ▣ A crisis is now defined as a collapse of the domestic stock market index. For example, assume that the domestic index falls 45% over the next six months and that we ignore the fall in the global index.
- ▣ As a result, we cannot compare D-SRISK across countries.
- ▣ We can do the analysis in local currency and without adjusting for time zones.
- ▣ We still use DCB to estimate beta.
- ▣ We can ask how big a decline in the domestic market would lead to aggregate D-SRISK of some value.

# SWIZERLAND BETAS: CREDIT SUISSE, D-SRISK, SRISK

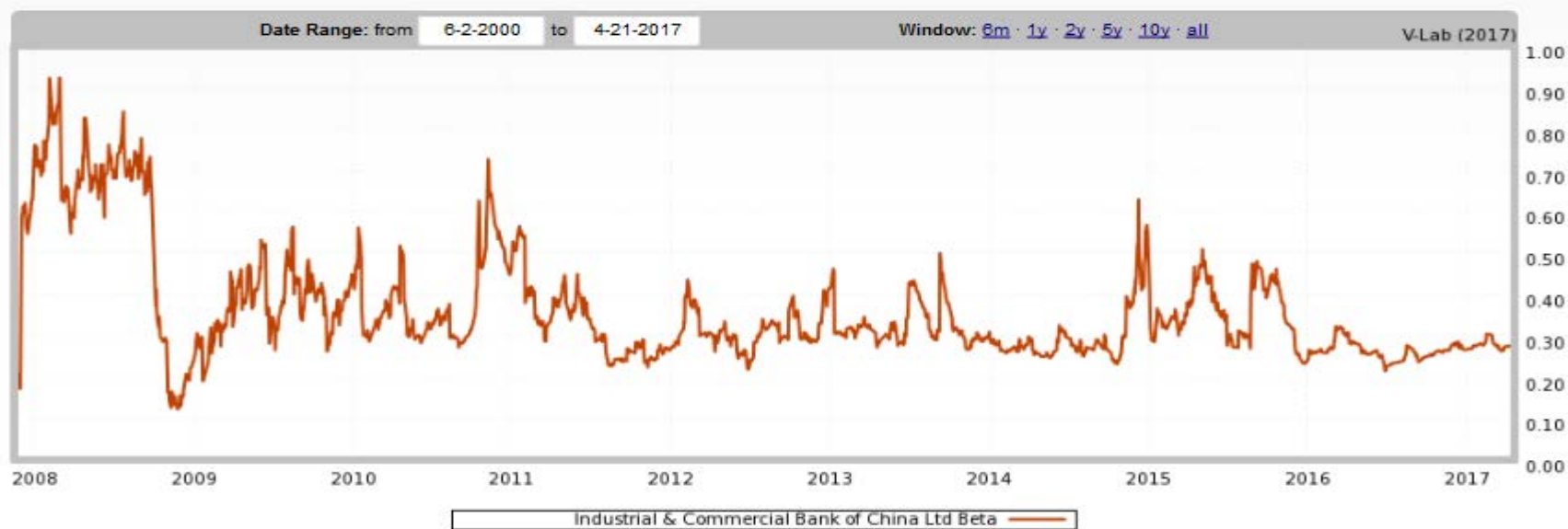
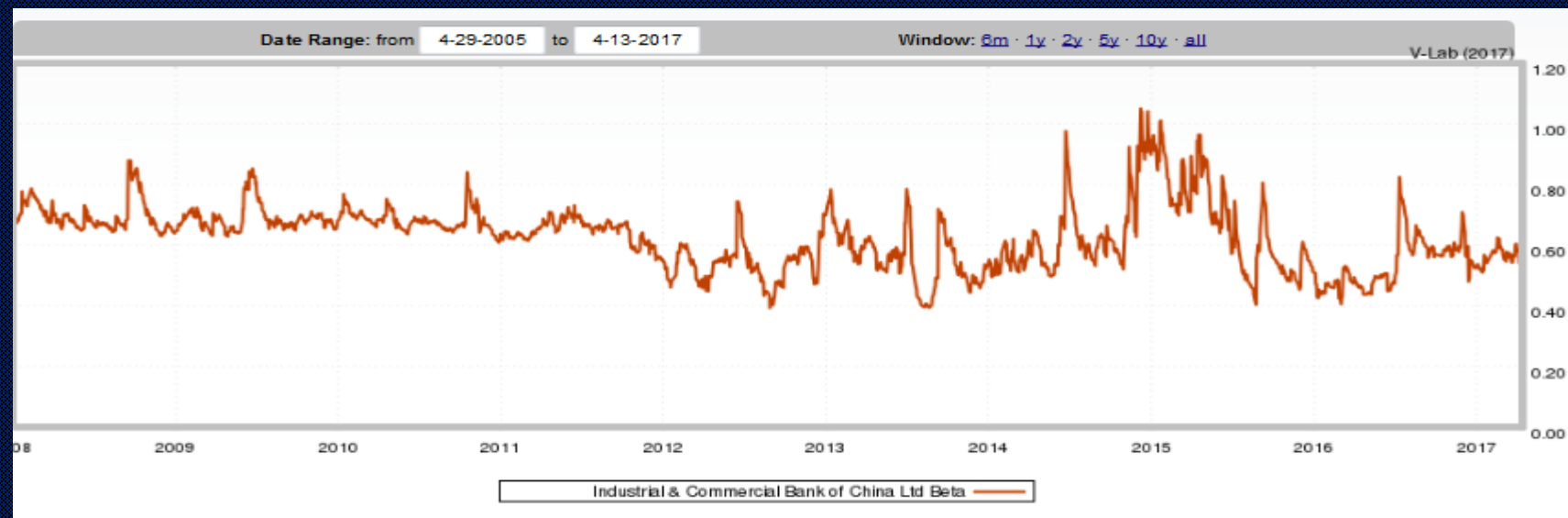


# SWITZERLAND BETAS: UBS SRISK

# D-SRISK AND

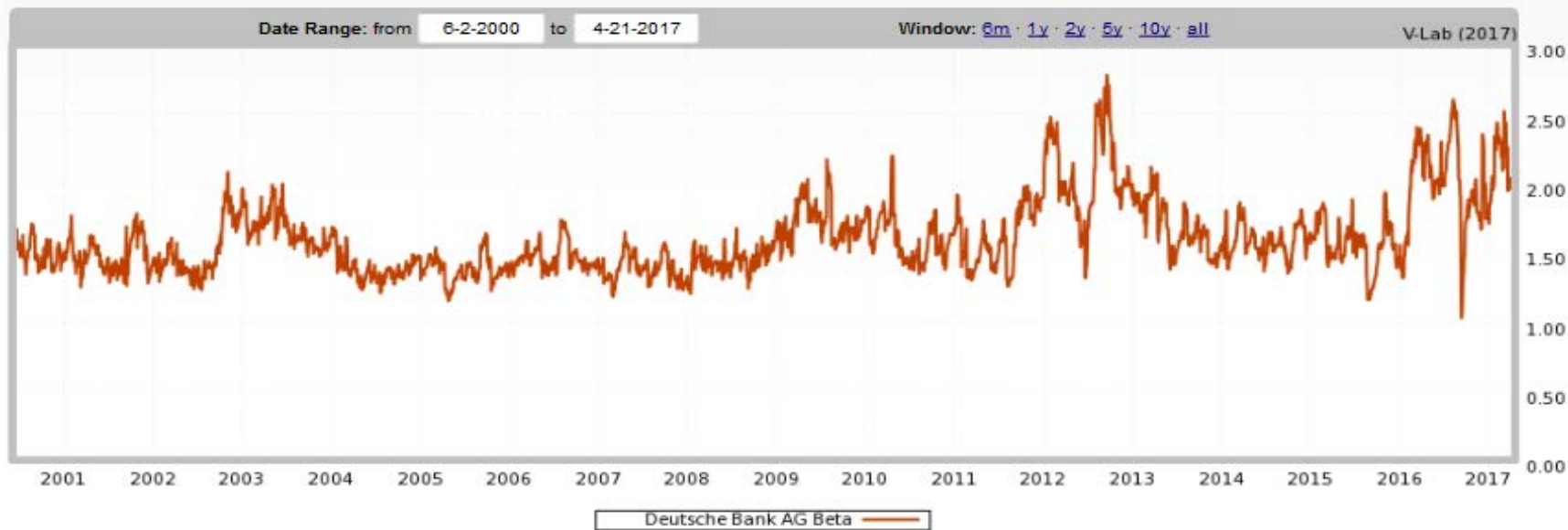
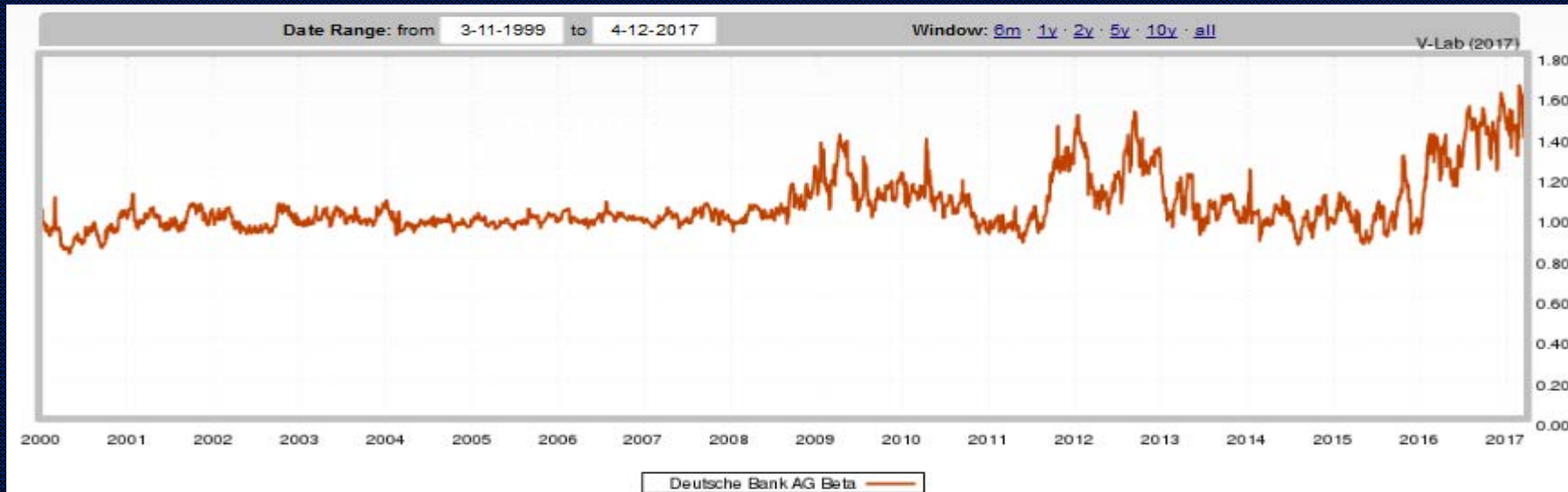


# CHINA BETAS: ICBC

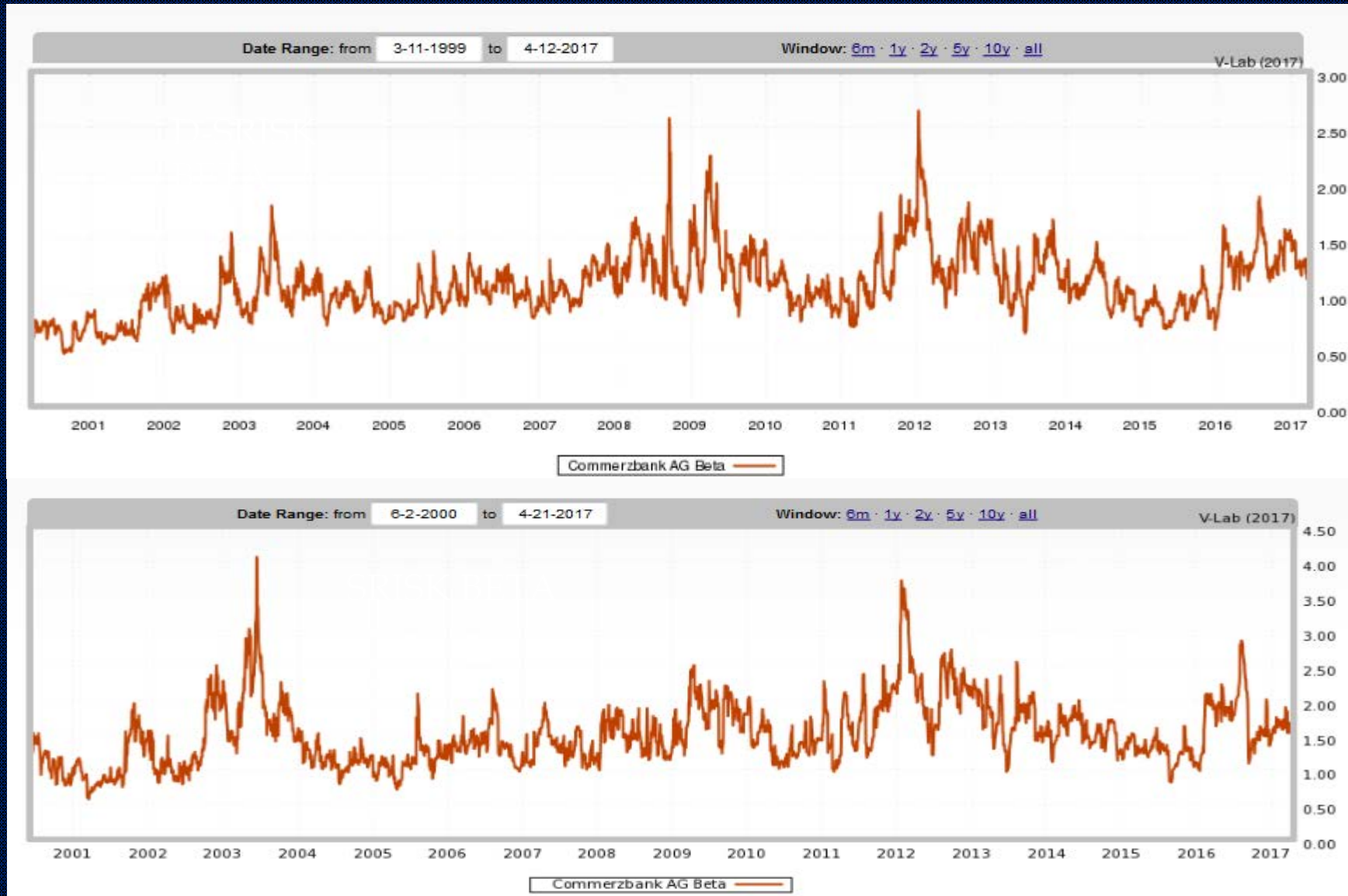




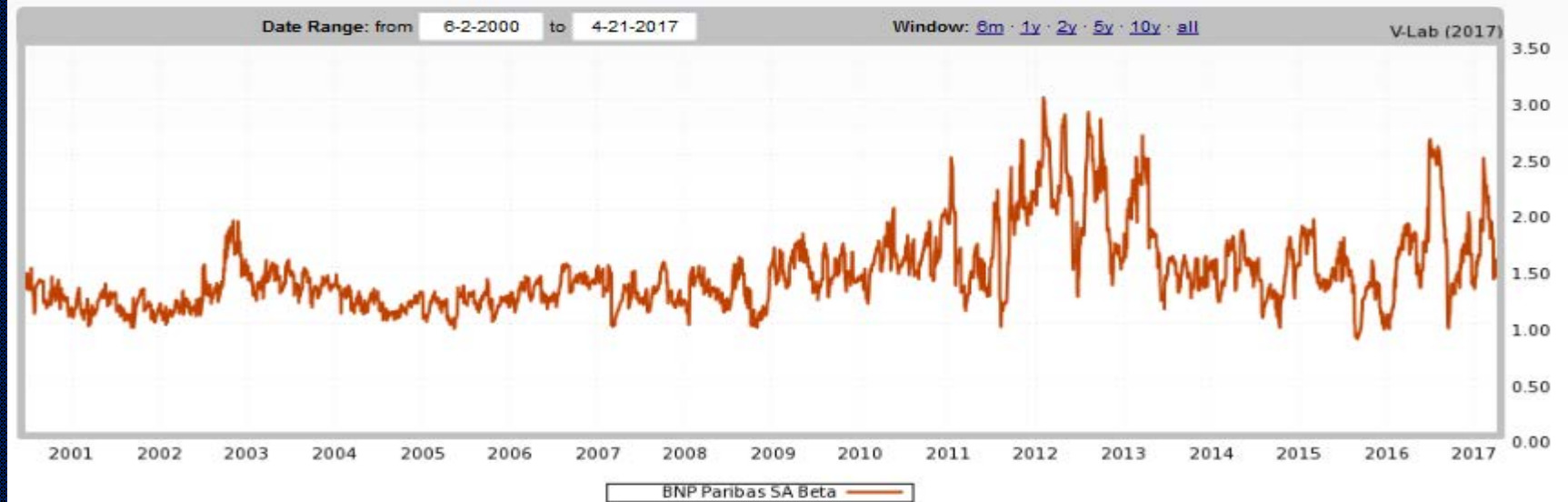
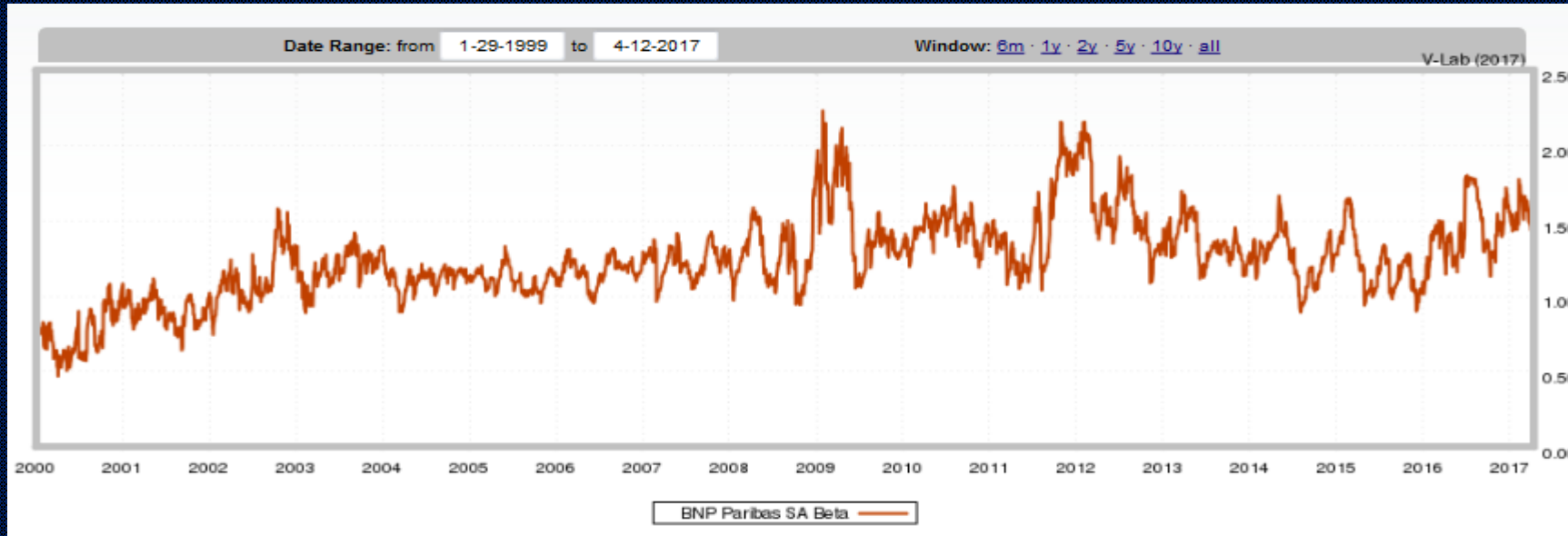
# GERMANY BETAS: DEUTSCHEBANK



# GERMANY BETA: COMMERZBANK

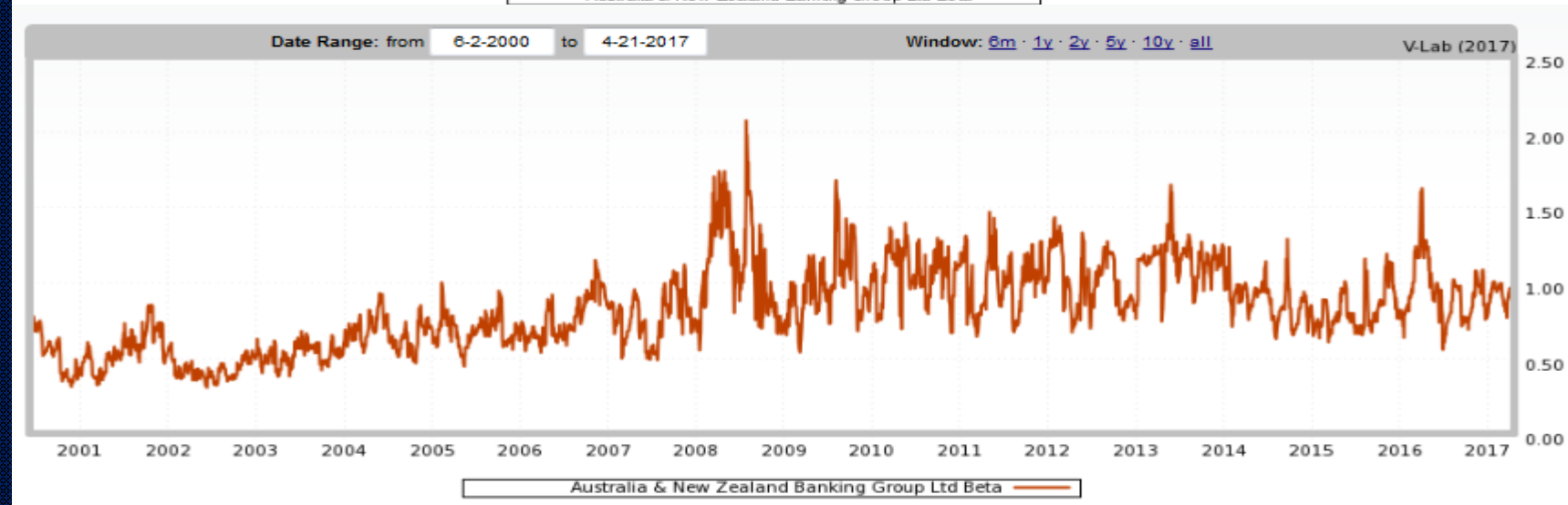
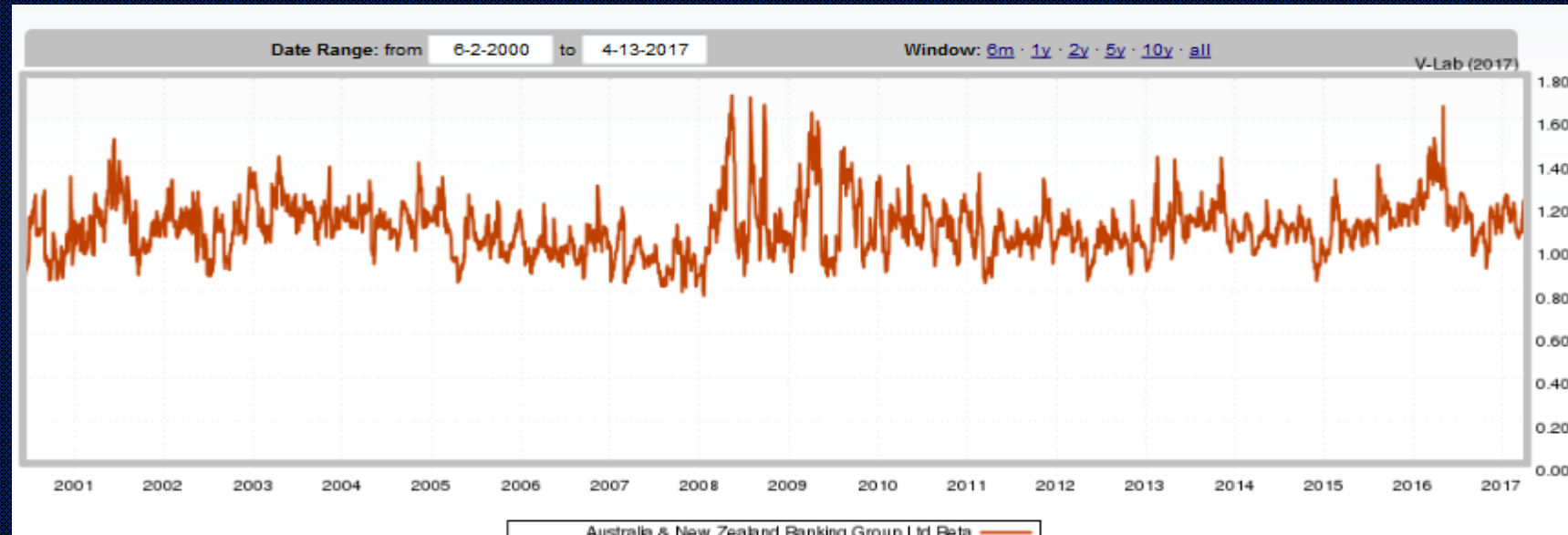


# FRANCE BETA: BNP PARIBAS D-SRISK,SRISK





# AUSTRALIA BETA: ANZ D-SRISK, SRISK



# REGULATORY CHALLENGE

- ▣ Ensure banks have  $D\text{-SRISK}=0$
- ▣ But what to do when  $D\text{-SRISK}>0$ ?
  - Require compliance over some time period
  - Apply a tax or penalty
  - Restrict policy options such as paying dividends
  - Supply the needed capital from government sources
- ▣ This requires firms to raise capital after a negative shock which may be costly.
- ▣ If aggregate  $D\text{-SRISK}\gg 0$ , then it may be extremely costly.



# WHY IS HIGH D-SRISK DANGEROUS?

- ▣ Because the financial sector is fragile and will be unable to survive a shock to the domestic market.
- ▣ Because high D-SRISK leads to deleveraging that can induce the crisis endogenously within the country.
- ▣ If some value of D-SRISK is sufficient to create a crisis, we can compute what decline in the domestic equity market would induce a crisis. We call this the “distance to crisis.”



# ENDOGENOUS FINANCIAL CYCLES

- Firms with high SRISK will begin to delever – and *cause* the macro shock
  - Either because risk managers insist
  - Or because regulators insist
- They may either sell stock or sell assets and retire debt. Most commonly they sell assets.
- This starts the leverage spiral. Lets see how it works.
- This is builds on Cont and Schaanning, Greenwood et al, and Cont and Wagalath among others.

# MODELING THIS SPIRAL

- If a firm has  $D\text{-SRISK} > 0$ , it would have to sell  $D\text{-SRISK}/k$  in assets to bring  $D\text{-SRISK} = 0$ .
- If there are many firms with positive  $D\text{-SRISK}$ , then they must all sell so  $(\text{Total } D\text{-SRISK})/k$  will hit the market.
- If this is large relative to normal loan transactions, then the price impact will reduce the value of the assets sold as well as the assets that remain on firm books requiring even more sales.
- *The market value of equity will likely decline before the asset sales are completed as investors are forward looking.*

# DELEVERAGING SPIRAL



SPIRAL REDUCES CREDIT TO REAL ECONOMY AND CAUSES AGGREGATE MARKET DECLINES

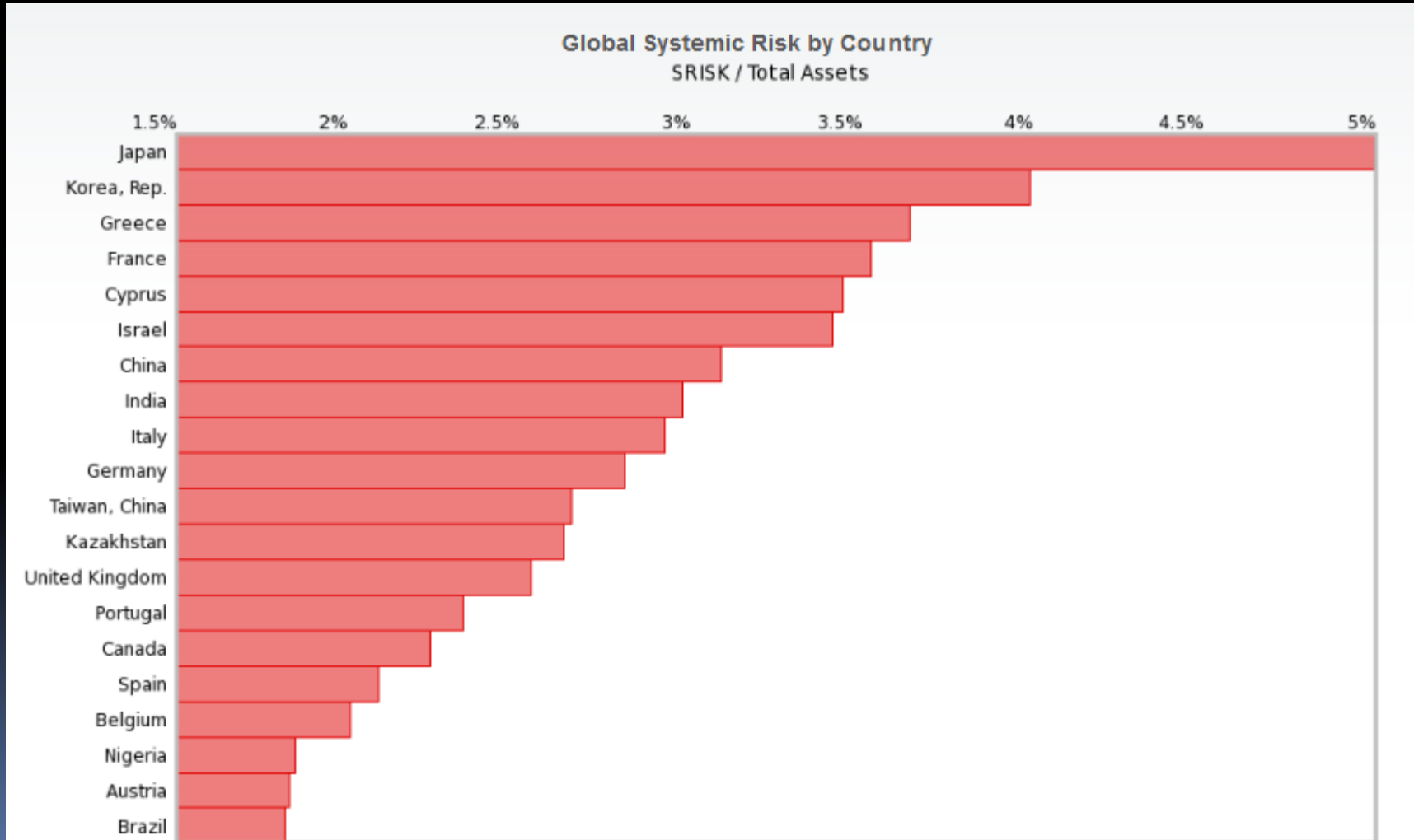


# HOW MUCH DELEVERAGING IS POSSIBLE?

- If too many assets must be sold, the spiral will end in bankruptcies rather than a new lower equilibrium.
- The amount of assets that can be sold must be related to the stock of assets in this economy.
- Bank assets are liabilities primarily of the real economy and the sovereign. These are focus of Basel research, Amir and Sufi, and Acharya, Drechsler and Schnabl and many others.
- Excessive credit growth means that capital cushion is inadequate to absorb losses.
- *Crisis occurs when  $SRISK/ASSETS$  is high!*

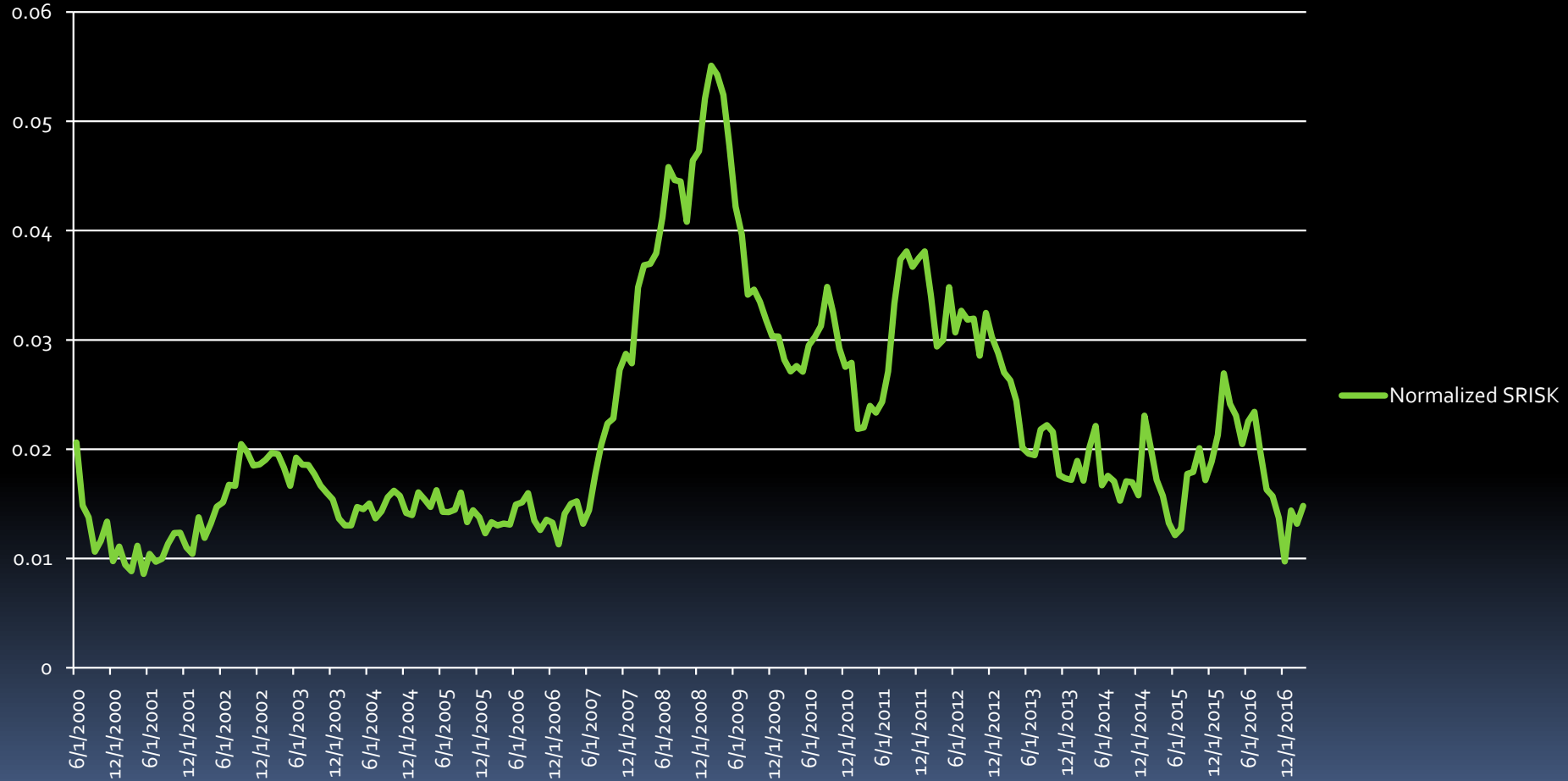
# SRISK/ASSETS

# APRIL 2017



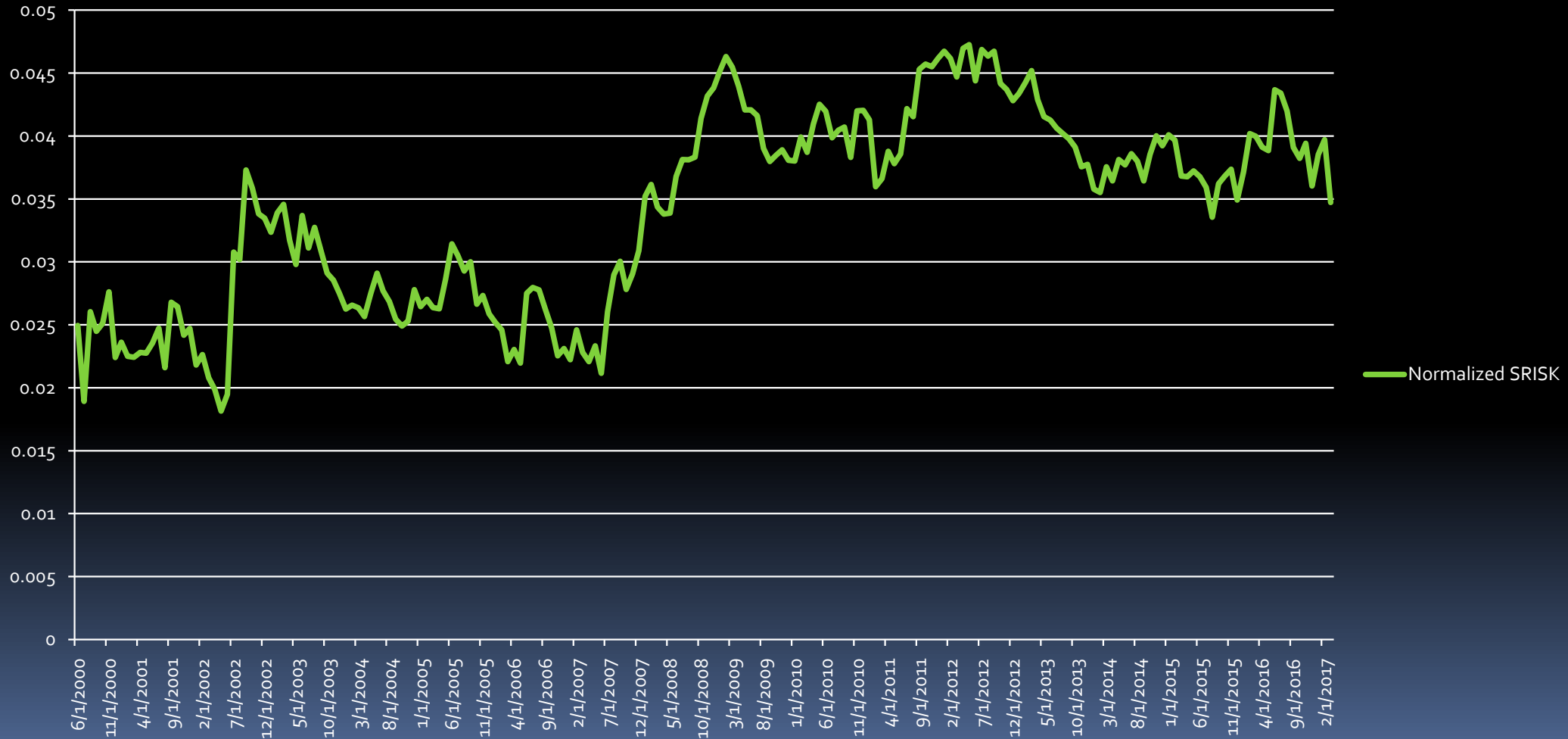
# US: SRISK/ASSETS

## Normalized SRISK



# FRANCE: SRISK/ASSETS

## Normalized SRISK

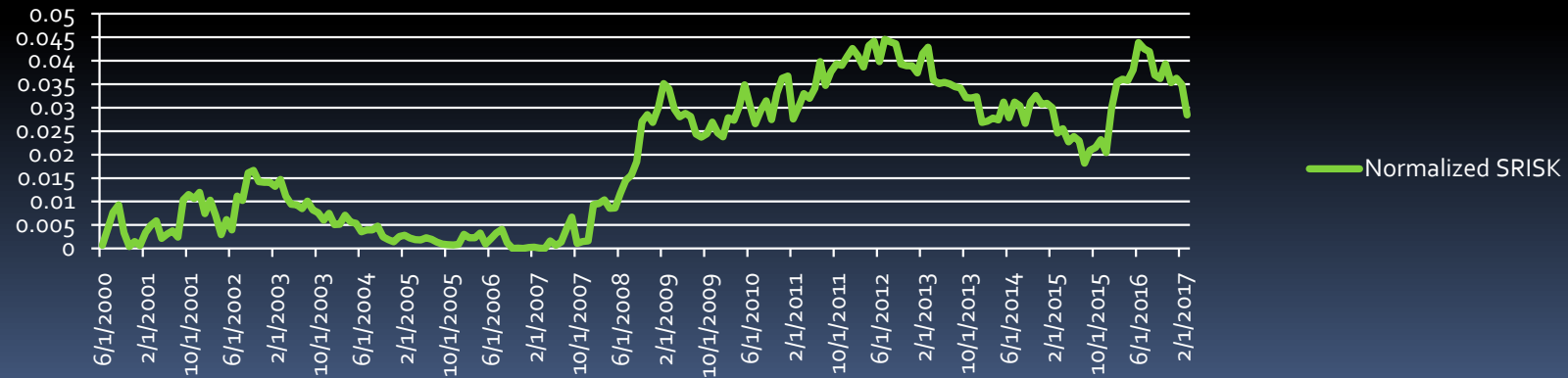




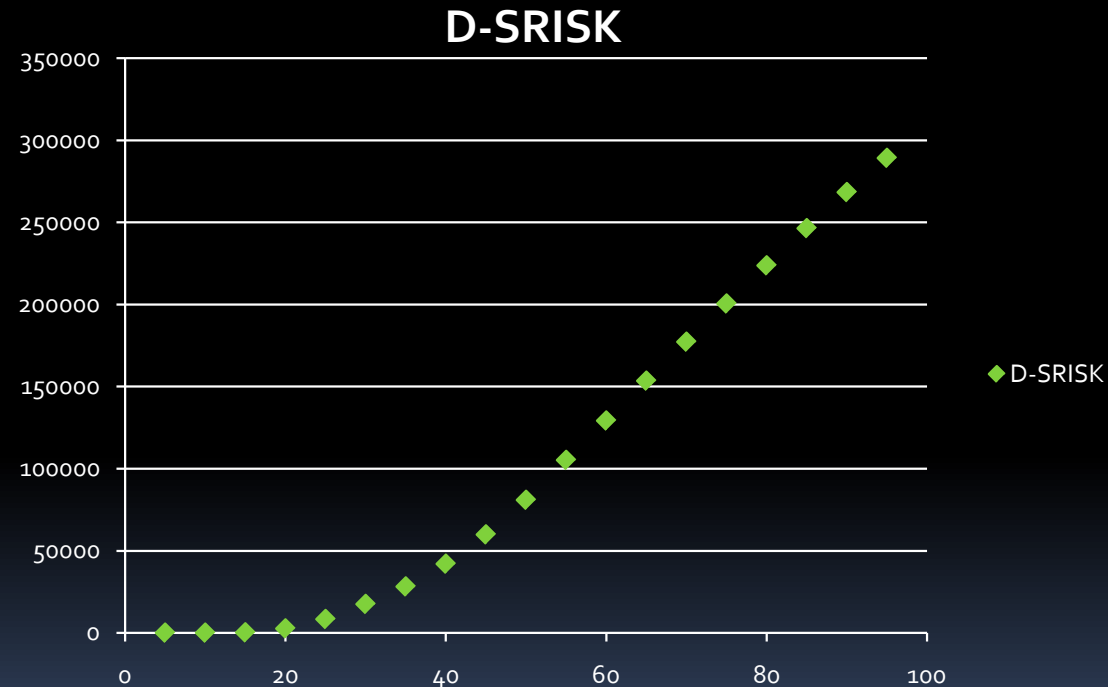
## Ireland Normalized SRISK



## Italy Normalized SRISK




# D-SRISK and market STRESS AUSTRALIA





# DISTANCE TO CRISIS

- WHAT DECLINE IN DOMESTIC EQUITY INDEX WOULD GIVE D-SRISK THAT IS 4.5% OF TOTAL FINANCIAL ASSETS?
    - US Distance to Crisis is 49%
    - Australia is infinite
    - France is 74%
    - Korea is 46%
    - Japan is 20%
- 

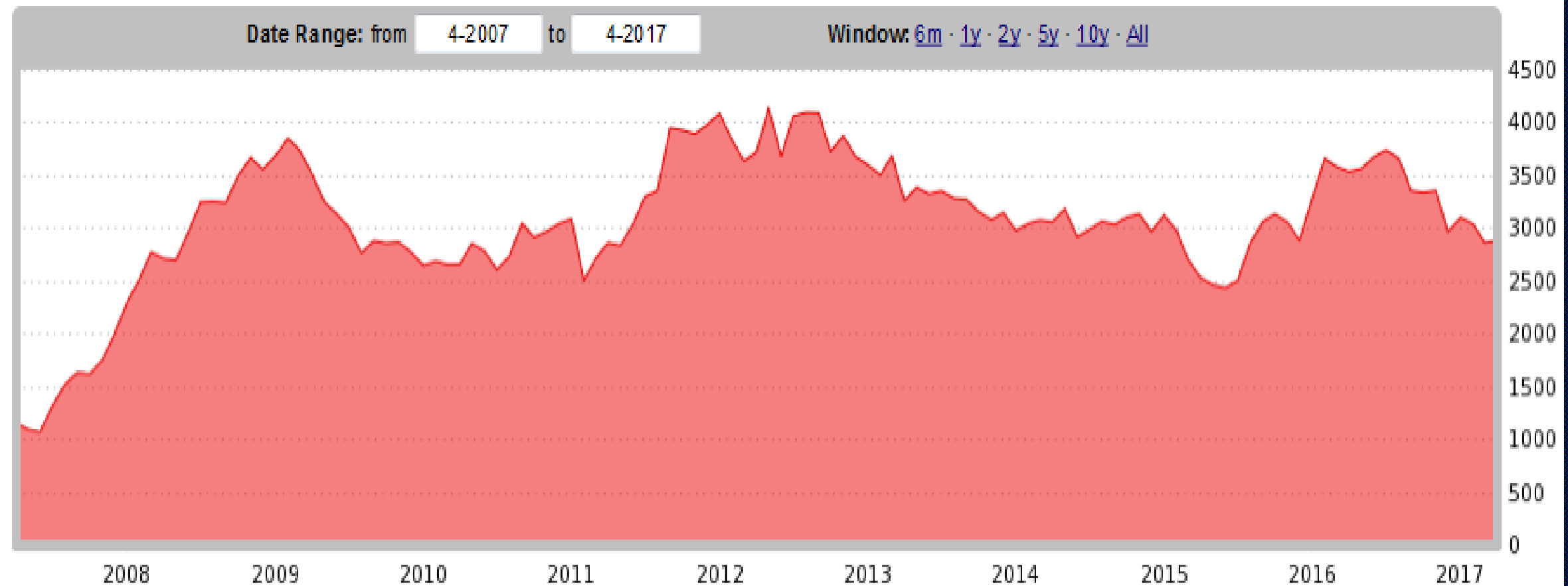




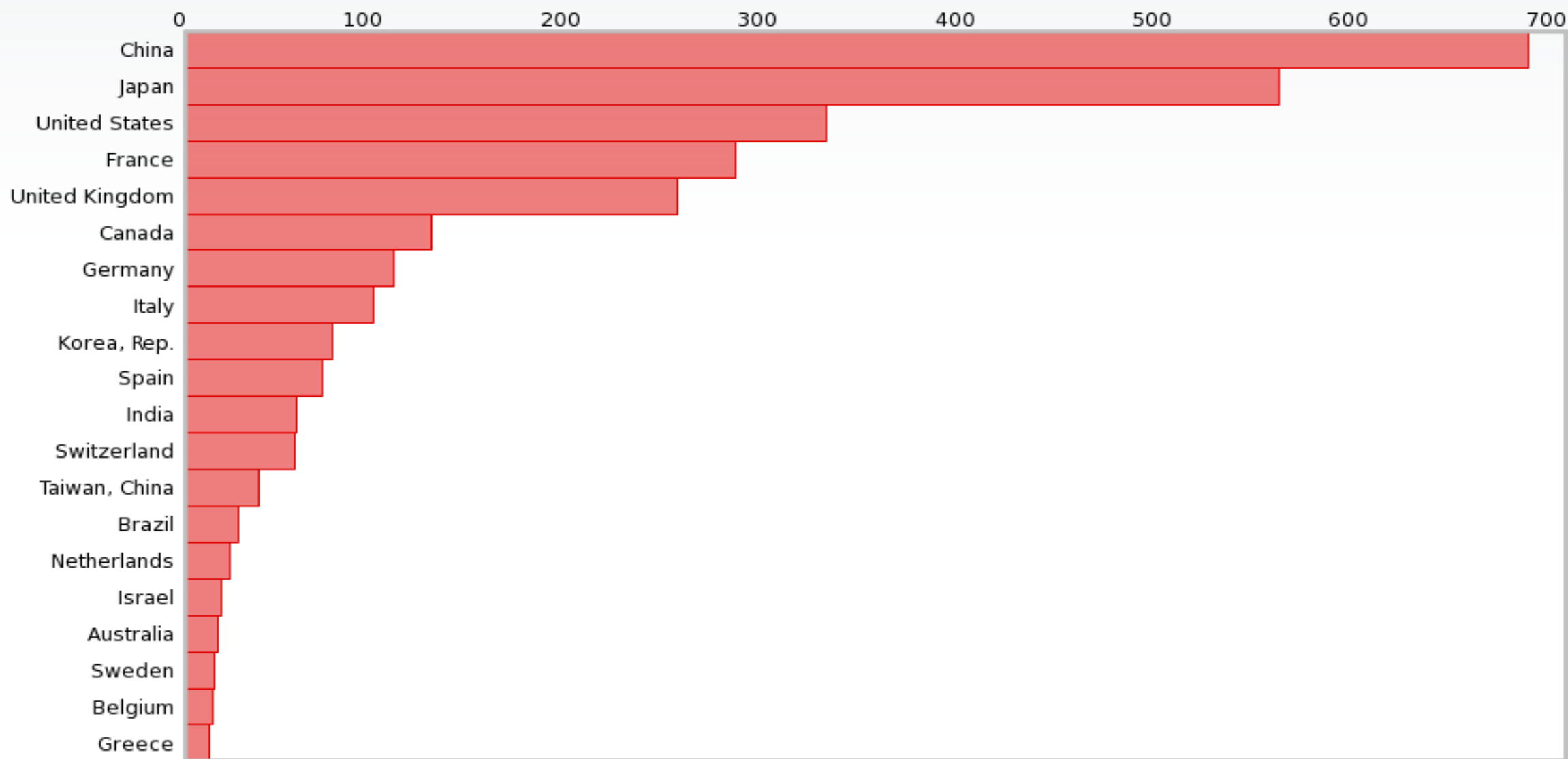
WHERE IS THE SRISK?

# WORLD SRISK – LAST 10 YEARS

Risk Analysis Overview - All Financials Total SRISK (US\$ billion)

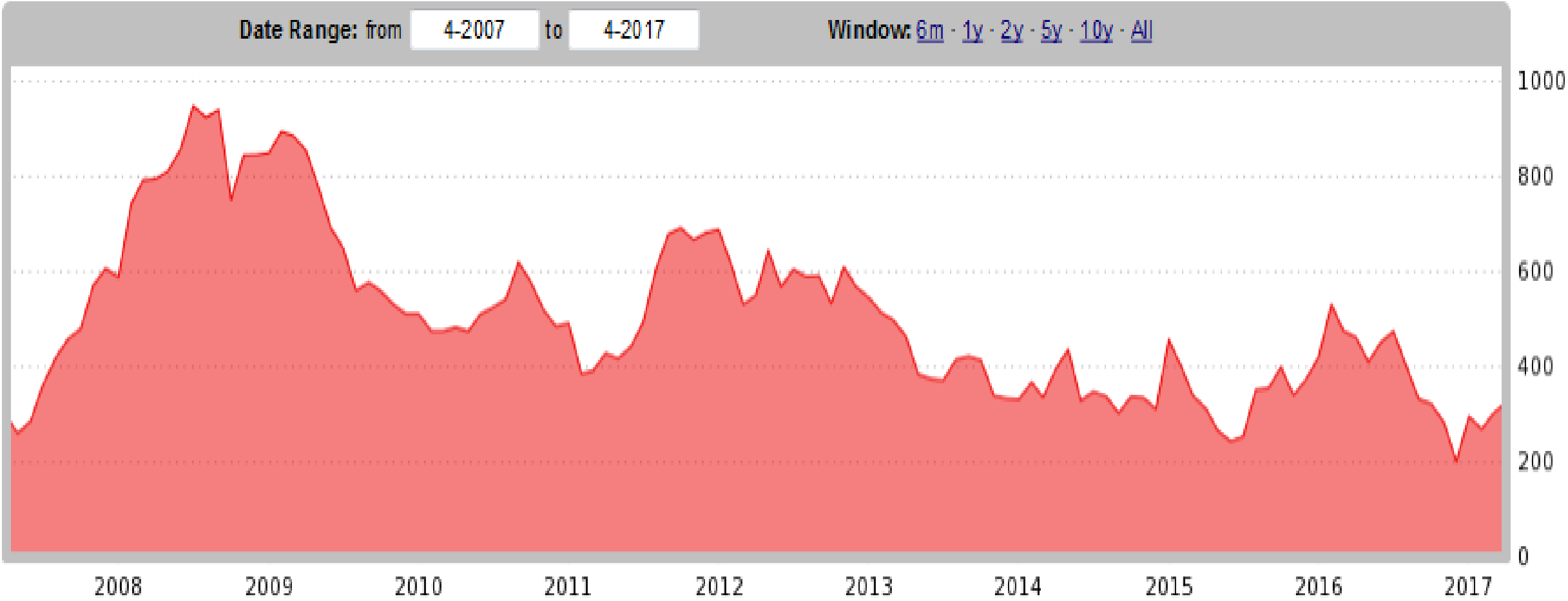


# WHERE IS THE WORLD SRISK?



# US SRISK

Risk Analysis Overview - United States Financials Total SRISK (US\$ billion)

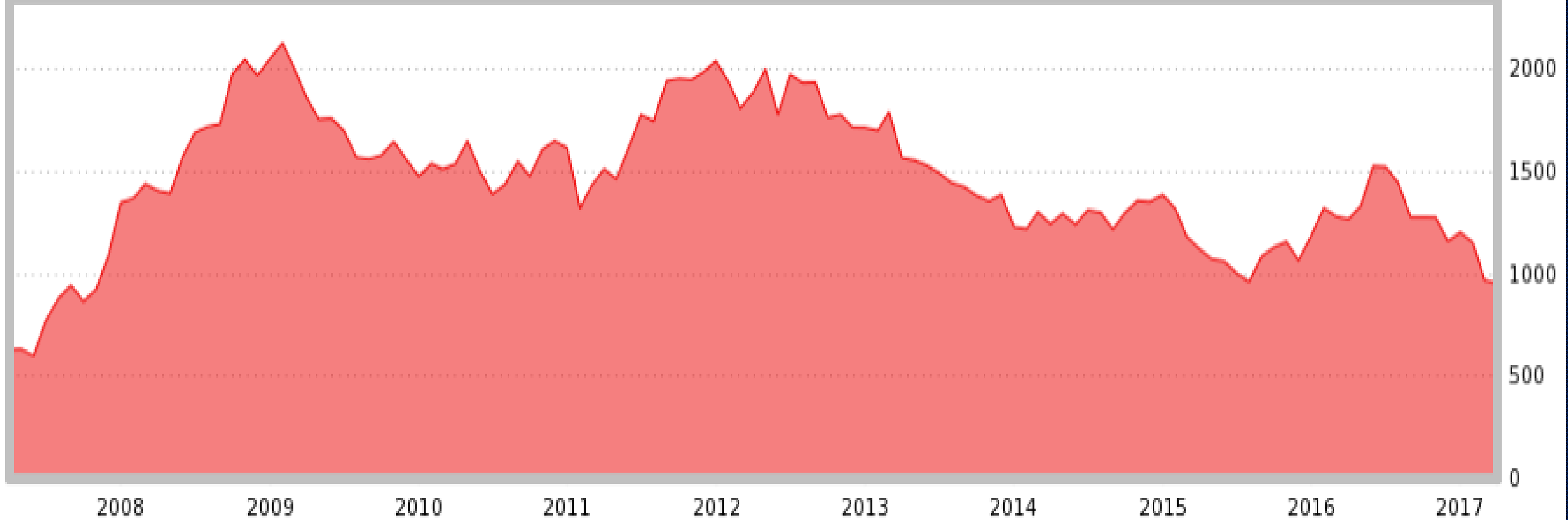


# EUROPE SRISK

Risk Analysis Overview - Europe Financials Total SRISK (US\$ billion)

Date Range: from  to

Window: [6m](#) · [1y](#) · [2y](#) · [5y](#) · [10y](#) · [All](#)



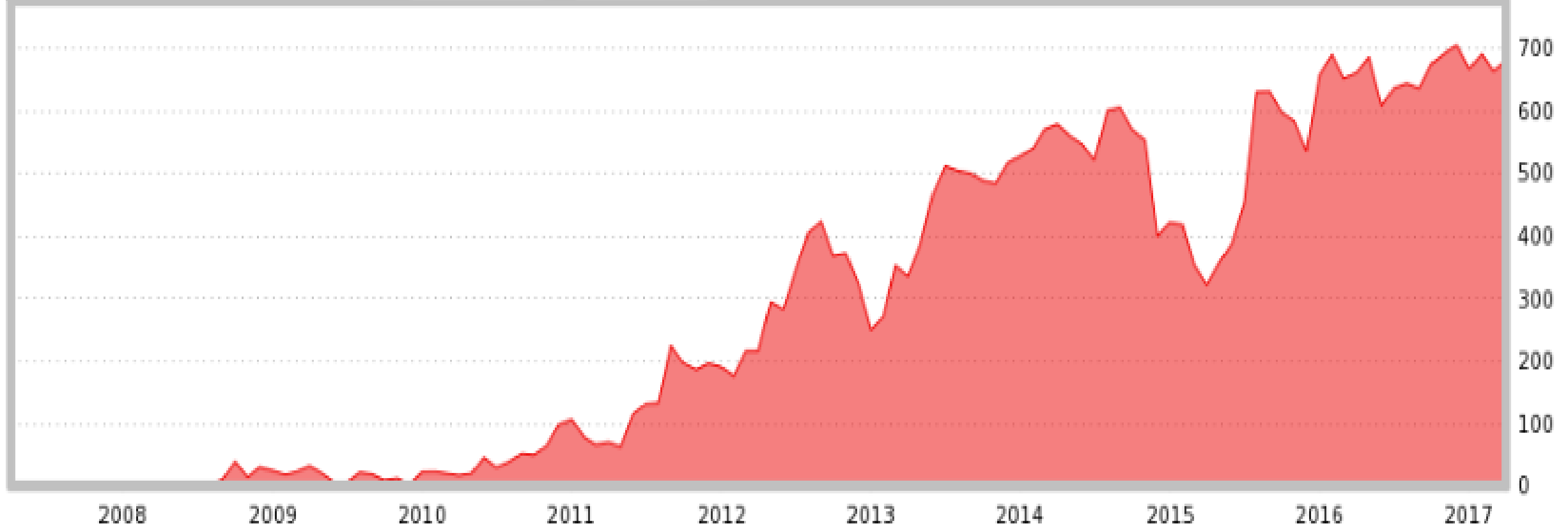


# CHINA SRISK

Risk Analysis Overview - China Financials Total SRISK (US\$ billion)

Date Range: from 4-2007 to 4-2017

Window: [8m](#) · [1y](#) · [2y](#) · [5y](#) · [10y](#) · [All](#)





**DOES THIS MODEL APPLY TO CHINA?**



# MANY FACTORS ARE SIMILAR IN CHINA

- State owned banks are surely “too big to fail”.
- Government guarantees distort risk taking, particularly of state owned enterprise and local government debt.
- Lending to SMEs and rapidly growing private companies is crowded out by SOEs.
- Shadow banking is growing and could fund SMEs but has typically invested in real estate and stock market margin.
- Sovereign has plenty of capacity to recapitalize banks and does so when needed. Hence
- **The risk in my view is stagnation, not collapse. I think China today may already be in a slow financial crisis.**





# DEREGULATION?

- What happens when regulations are relaxed?
- President Trump has called for financial deregulation in the US and dismantling the Dodd Frank Act.
- Some of this has now been done by executive order and more is expected.
- Similar features preceded GFC.
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- Spiral works in reverse. Ruan calls this “race to the top”.
- Equity market rises in advance of leverage increases.
- **Short run risk is reduced but long run risk is increased.**

What is in their future?

