



The FCO Cockpit Global Bubble Status Report November 2019



A collaboration of the Chair of Entrepreneurial Risks,
ETH Zurich and Systematic Investment Management AG

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ETH FCO and SIMAG Join Forces

The Financial Crisis Observatory (FCO) is...

- **Part of** the Chair of Entrepreneurial Risks at the Department of Management, Technology and Economics at the **ETH Zurich**
- A **scientific platform** aimed at quantifying in a systematic way the hypothesis that financial markets exhibit a degree of inefficiency and a **potential for predictability**, especially during regimes when **bubbles** develop
- Aiming to **provide warnings** at different time scales (week, month, quarter) on the development of future financial instabilities

Systematic Investment Management AG (SIMAG) is ...

- A **Joint Venture** between **Credit Suisse Asset Management** and an **ETH Zurich spin off**
- A **FINMA-licensed Investment Manager** for collective investment schemes.
- Relying on a **proprietary machine learning engine** specifically designed for **financial markets**
- The first and only investment manager globally which can **systematically leverage ETH's Financial Crisis Observatory (FCO) research insights**

Together we are able to provide you with richer investment content and deeper research insights

Purpose and Benefits

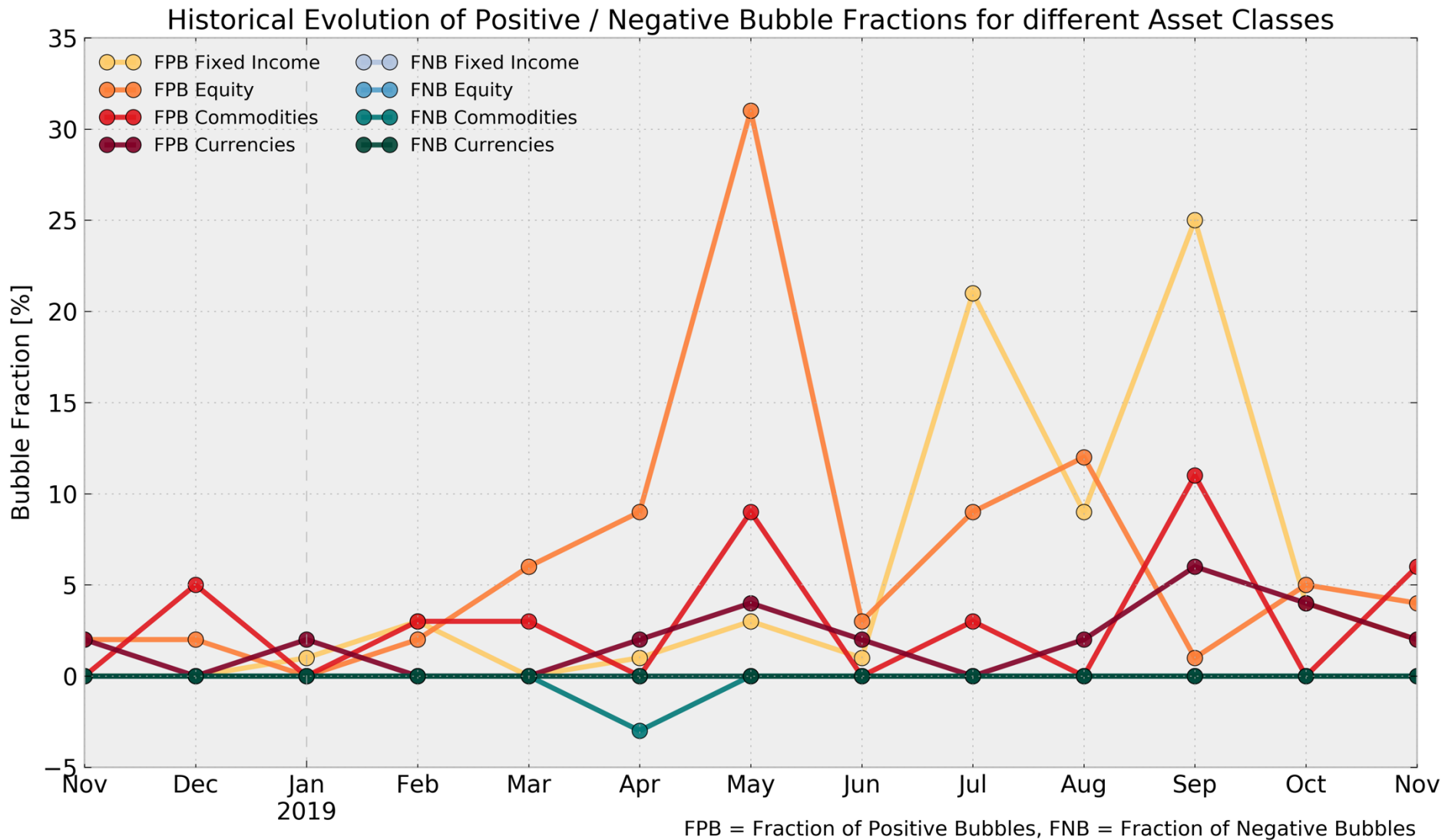
- ▶ The **Financial Crisis Observatory (FCO)** monthly report discusses the historical evolution of bubbles in and between different asset classes and geographies. The purpose of the FCO report is to ascertain which asset classes and sectors are deemed to be **crowded** and to what degree they can develop contagion risks.
- ▶ Today, the report is **used by 600+ institutions world-wide**, including universities, think tanks, sovereign wealth funds, hedge funds, family offices, private banks, pension funds.
- ▶ It delivers the big picture in terms of growing bubbles and instabilities in today's financial markets for **Chief Investment Officers, Senior Researchers, Fund Managers**, and **Independent Financial Advisors**, and all parties with **investment performance responsibility** or **managing financial risks**.
- ▶ The report is the result of an extensive analysis done on the historical time series of about 450 systemic assets and about 850 single stocks. The systemic assets are bond, equity and commodity indices, as well as a selection of currency pairs. The single stocks are mainly US and European equities. The data is from Thomson Reuters.
- ▶ To new readers, we recommend proceeding to the appendix for more detailed information about the methodology and procedures applied in this report.

Access to the FCO analysis data can be granted upon request. Please contact info@simag.com or visit <https://www.simag.com/insights/fco-cockpit/>

General Results – Key Take Aways

- ▶ At the beginning of November, we see **continued low bubble activity** amongst the various analyzed asset classes. We notice that many of the listed signals reappear from the previous report. There are no signals to show for the Forex and Cryptocurrency sectors, this month.
- ▶ In terms of **asset allocation**, no pronounced bubble activity is detected in major bond markets and commodities and we recommend to watch signals which could point to stress in the interbank lending market.
- ▶ In terms of **equities**, a strong new positive bubble activity is seen for the S&P 500 VIX Futures, which in our opinion means some volatility harvesting strategies could become more vulnerable to sudden volatility shocks.
- ▶ Within **equity sectors**, this month we find 4 industry groups with a positive bubble score: Food & Staples Retailing, Real Estate, Telecommunication Services and Utilities, 3 of which were already identified last month.
- ▶ Regarding single stocks, we see the following stocks with weak value score and expensive valuations where the strong bubble signals indicate herding and **overbought** conditions. In the US, such **contrarian sell candidates** are Nextera Energy, NVIDIA and Raytheon. In Europe, such examples are ASML Holdings, Brown-Forman or Elisa Oyi.
- ▶ The following stocks can be considered **oversold** and cheap relative to their financial performance and potential **contrarian buy candidates**: Viacom, Diamondback Energy.

General Results – The Big Picture



General Results – This Month's Overview

Category	Analyzed Assets	Fraction of Pos. Bubbles [%]	Fraction of Neg. Bubbles [%]
Fixed Income	155	2	0
Government Bonds	55	5	0
Finance and Insurance	21	0	0
Corporate Bonds	79	0	0
Equity	280	4	0
Country Indices	66	2	0
Europe	35	0	0
United States	179	6	0
Commodities	33	6	0
Forex	97	2	0

Macro environment – the big picture

As expected, the **Federal Reserve** lowered for the third time in four months the target for its benchmark rate by a quarter point on the back of slowing US economic growth. But **growth is slowing down** in other parts of the world as well, especially in China. China's economic growth has fallen to a 30-year low due to internal issues but also due to the slowdown in global trade. However, with such a large market slowing down, **export-oriented economies** such as Germany are coming under pressure as well. And from Germany, the contagion could easily spread to many Eastern European countries which are fully integrated into the German auto economy.

Central banks keep an **accommodative policy to stimulate borrowing** in the real economy. But the money is largely being spent on share buy backs or financial investments. The consequences are that the systems' leverage continues to grow as long as yields stay low or even negative. In a desperate attempt to generate returns in the fixed income space, increasingly more institutional investors are forced to move into illiquidity risks. These **illiquidity risks** seem not properly priced for a rapid decline in prices during an economic downturn. Today, most buying of real estate or financial products seems to be driven by expected price increases. But when prices stop rising, buyers disappear, and prices begin to fall.

But as long as the music plays, investors have to dance to the music of **continuous credit growth and asset inflation**. As the economy becomes oversaturated with debt, it becomes fragile and thus more and more **susceptible to shocks**. The music will ultimately stop when an event will erode the trust that is at the foundation of the whole financial edifice, freezing the willingness to trade and to provide credit to counterparties suddenly deemed untrustworthy.

A prolonged contraction in the credit or a contraction in the business investment are key factors that historically often led to a recession. This is not bad per se on the long term as the recession cleans the worst excesses of the previous credit binge and setting the stage for renewed more healthy economic growth.

On the short term however, this leads to bankruptcies and pain, motivating the investor and risk manager to be aware and prepared. In that sense, the **epicenter for contagion risk remains China**, the largest banking and shadow banking market of the world. It is no coincidence that **China's money market crisis in August** was followed some weeks later by **stress in the US repo market**. The stress in the funding market was also felt by many leveraged systematic investors and hedge funds which were forced to **deleverage crowded positions** such as momentum stocks at the same time.

Clearly, **problems in the global financial systems are mounting** and **illiquidity risks** are growing again, especially in **Emerging market equities** and currencies. South Korea's largest hedge fund had to halt redemptions on the back of a liquidity crisis. In India, Indiabulls Housing Finance Ltd shares lost more than 50% over the last months on the back of renewed fears of an escalation of the liquidity crunch within India's financial system. Investor fear that the **crisis in the shadow banks** could spark contagion among banks and real-estate companies and cause a broader financial crisis. India is facing such an economic downturn for the first time in decades with a massive contraction in liquidity as lenders have stopped funding business in the real economy, resulting in a situation where businesses have to survive on cash.

Macro environment – the big picture

Everywhere central banks are trying to reflate the economy and risk assets. And we should not underestimate governments when they decide to **stimulate consumer spending via tax cuts**. The question is whether all these stimuli will be able to create a sustainable bull market. Central banks have more difficulties to keep the last stage of the credit cycle from unfolding as their actions become less and less effective.

On the other side, we see the long-term consequences of wealth inequality unfolding with the **rise of protests and populism** in Spain, France, Germany, Belgium and the Netherlands - not to mention the Brexit chaos. Elsewhere in the world, we saw riots in an expanding number of countries – including Lebanon, Egypt, Chile, Bolivia, Ecuador and last but not least Hong Kong. One should not underestimate the novel dynamics of these protests empowered and organized with the new tools of social media. Combined with the progressive on-going **impoverishment of the bottom 90% of the population** resulting from the “solutions” to the financial and economic crises unfolding since 2008, the investor and risk manager should be prepared to fully account for the novel social dynamics of decentralized social protests and movements.

Conclusion and looking ahead

On a positive note when looking ahead, chances are that next year will be a year where avoiding the most dangerous bubbles could make a difference. The **market resilience against the negative news flow** is remarkable: many **equity indices are at or near all-time highs**. But as stock indices are struggling to keep their upward momentum, we can expect to see **more performance dispersion between country and equity sector in the next months**. This year, US equities have clearly outperformed Emerging Market stocks. Some market observers believe that the **performance spread will continue to widen** and prefer US stocks over for example Latin American stocks, which historically used to be vulnerable to liquidity shocks. Within US stocks, it might be that especially tech monopolies such as Apple, Microsoft or Google continue drive most of the recent upside whereas many smaller companies are struggling to survive.

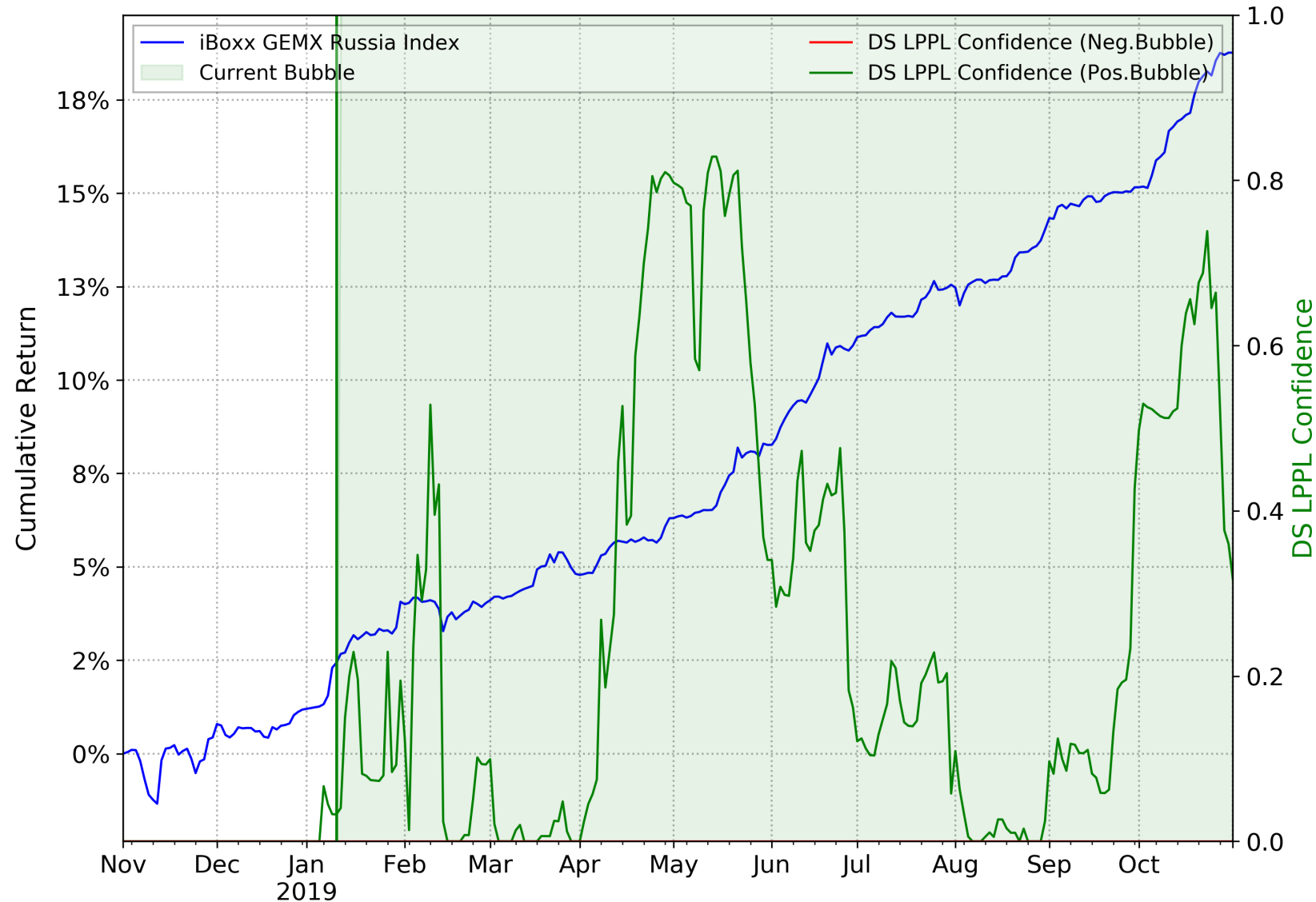
This might be **good news for active investors** because the higher the dispersion, the higher the reward for being right - the higher the alpha potential.

Fixed Income – Government Bonds

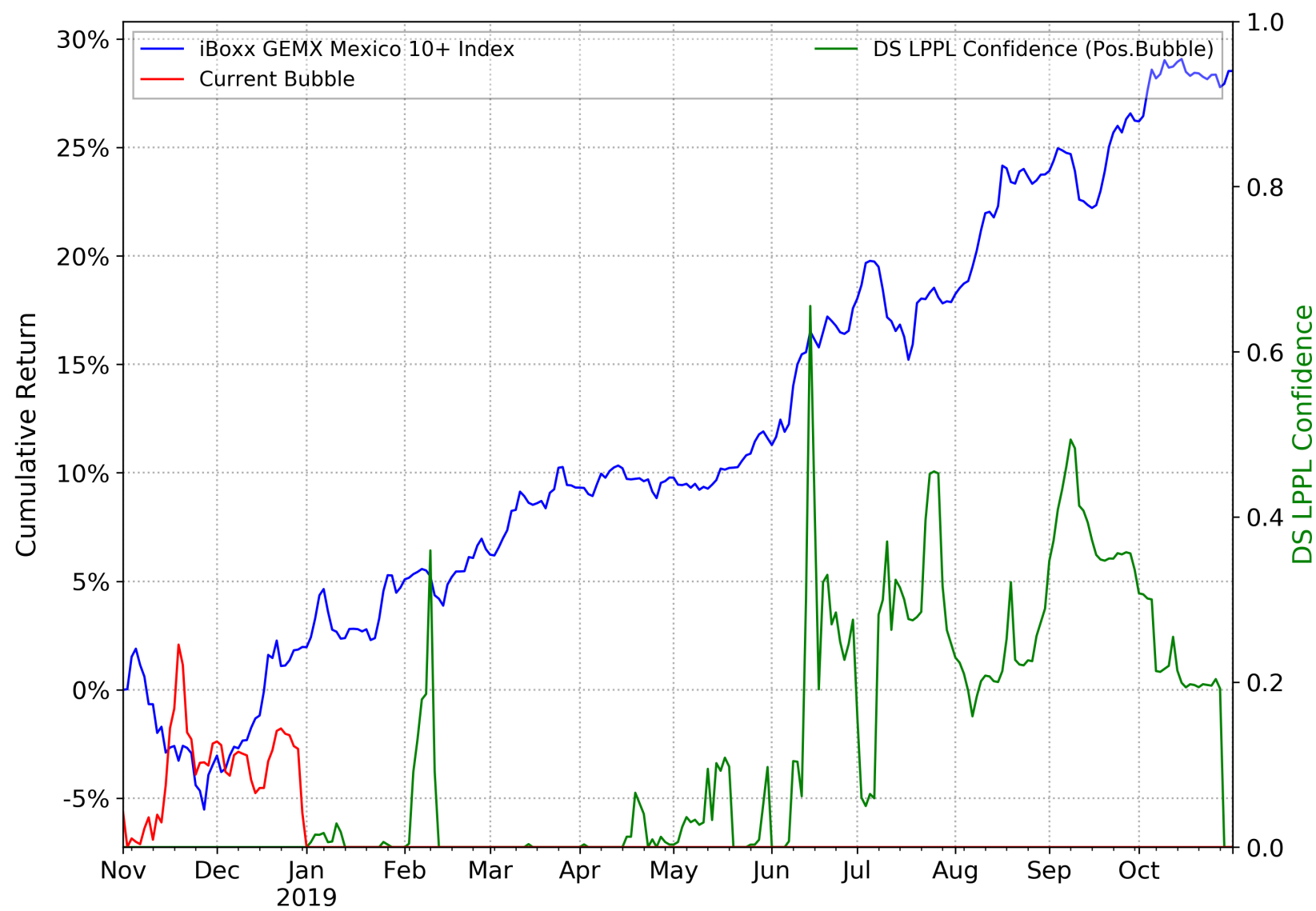
Bubble Data					Cluster Analysis			
	Name	Bubble Size bs [%]	Duration [days]	DS LPPL Confidence ci [%]	Geometric Average	Critical Time Prediction μ_{tc}	σ_{tc} [days]	Scenario Probability [%]
Positive Bubbles								
1	iBoxx GEMX Russia Index	16	294	32	22	2020-04-26	5	35
2	iBoxx Asia Thailand Government Index	16	365	28	21	2020-03-13	29	83

- ▶ As in the previous report, we detect positive bubble signals on the Russia iBoxx Fixed Income Index. The estimated bubble size has slightly increased from 12% to now 16%. The estimated duration has increased by one month (263 days to 294 days), which shows that the start of the bubble is robustly estimated at the same date as last month. The confidence indicator has decreased by 12% to now 32%. The corresponding time series of indicator signals is given on the following slide. We also show the further evolution of the indicator time series for other previously listed indices.

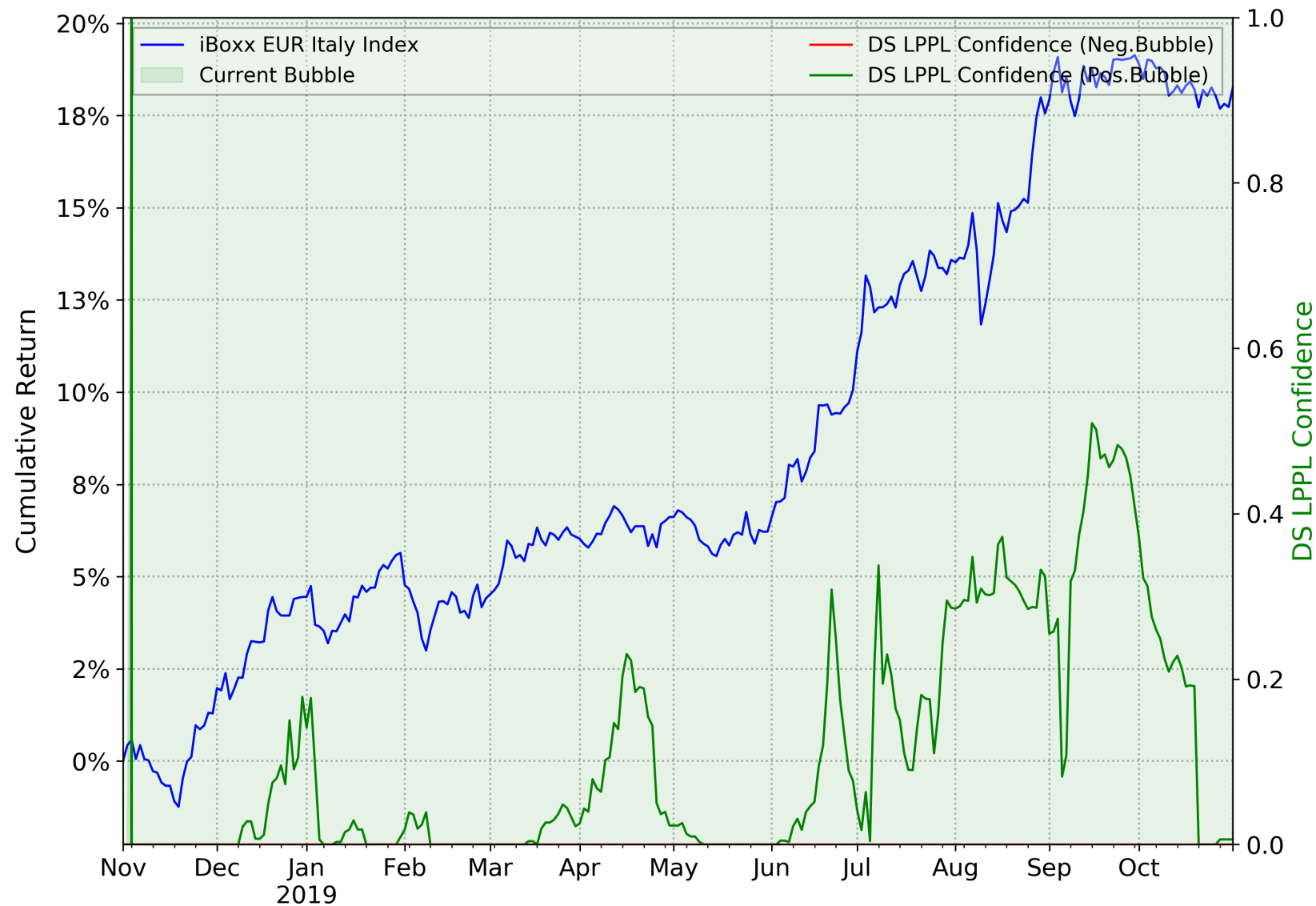
iBoxx GEMX Russia Index



iBoxx GEMX Mexico 10+ Index



iBoxx EUR Italy Index

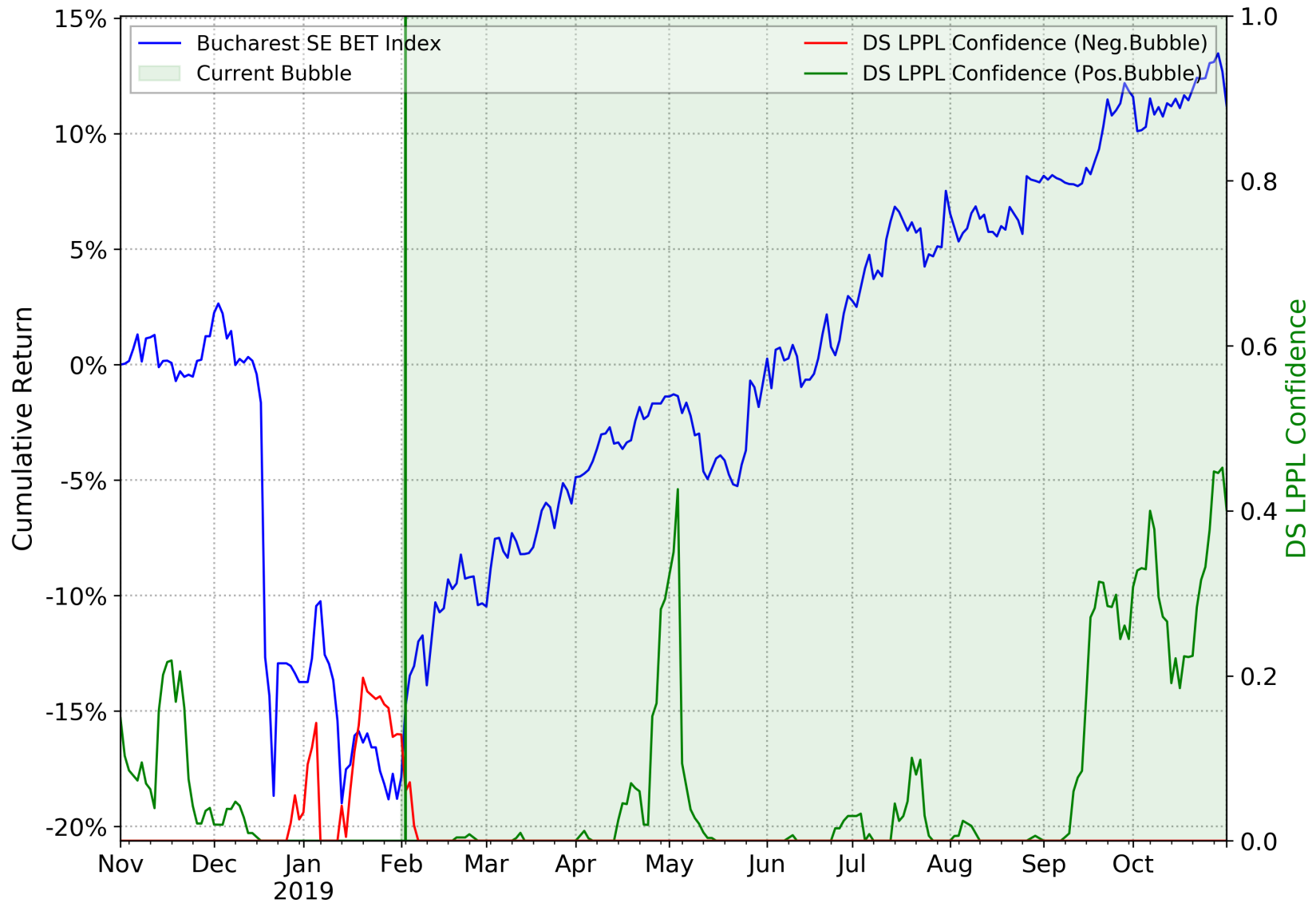


Equities – Country Indices

Bubble Data					Cluster Analysis			
Name	Bubble Size <i>bs</i> [%]	Duration <i>[days]</i>	DS LPPL Confidence <i>ci</i> [%]	Geometric Average	Critical Time Prediction μ_{t_c}	σ_{t_c} <i>[days]</i>	Scenario Probability [%]	
Positive Bubbles								
1	Bucharest SE BET Index	30	271	40	35	2019-11-16	14	74

- The Bucharest Equity Market Index is still found to be in a positive bubble. Bubble size and duration remain approximately the same as in the previous report, while the confidence indicator has risen from 24% to 40%.

Bucharest SE BET Index



Equities – United States Indices

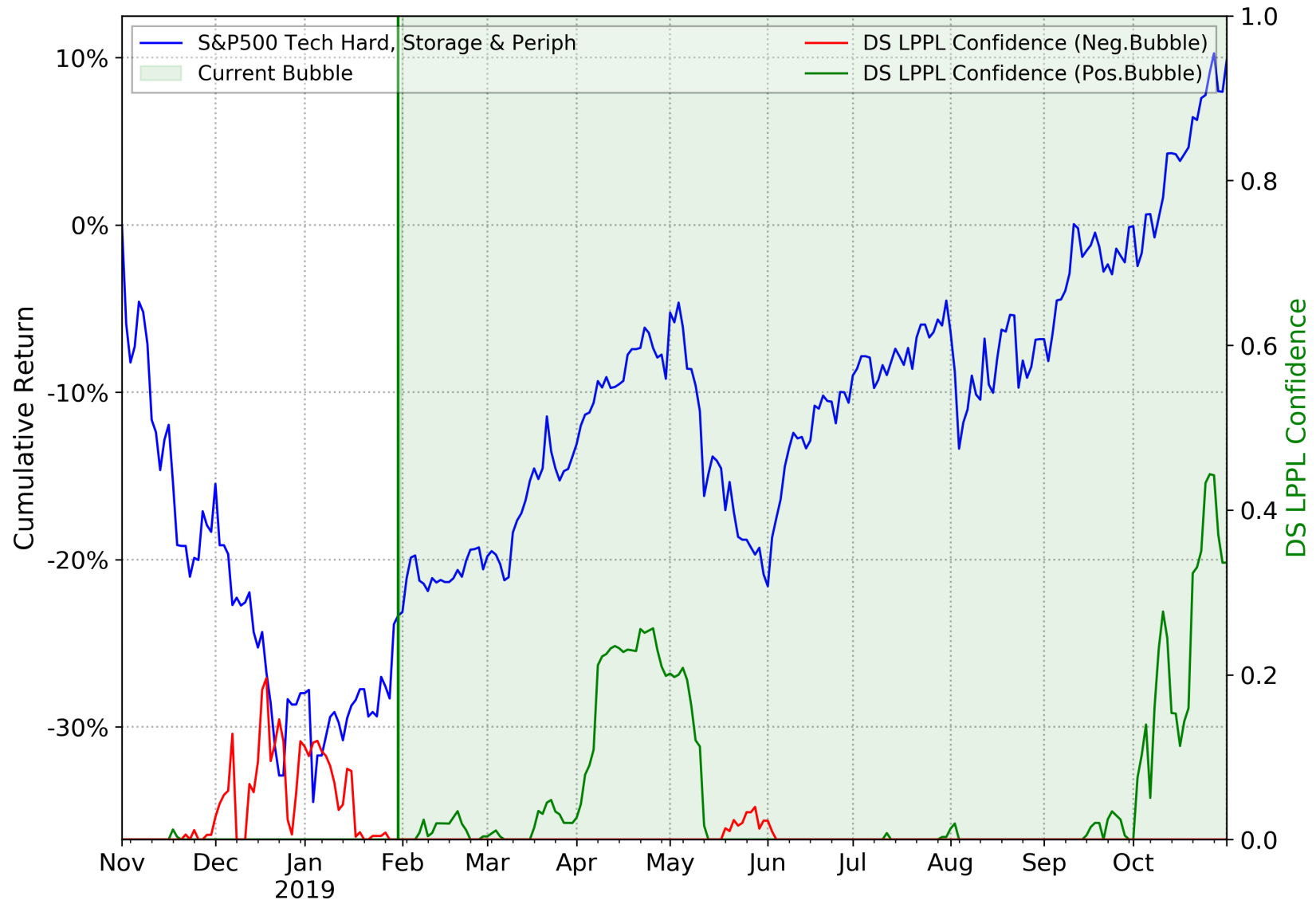
	Name	Bubble Size bs [%]	Duration [days]	DS LPPL Confidence ci [%]	Geometric Average	Critical Time Prediction μ_{tc}	σ_{tc} [days]	Scenario Probability [%]
Positive Bubbles								
1	S&P 500 Vix Futures T-S Index Er	20	145	95	43	2019-10-31		57
2	S&P500 Tech Hard, Storage & Periph	28	146	64	43	2019-11-03	3	65
3	S&P500 Fd/Staples Rtl	24	309	30	27	2019-12-01	10	85

- A new signal appears this month: we observe strong positive bubble activity for the S&P 500 VIX Futures T-S Index, with the confidence indicator reaching a level of 95%! Thus, super-exponential dynamics are detected for almost all analyzed timescales. We can in fact observe these trends in the plot on the next slide.

S&P 500 Vix Futures T-S Index



S&P 500 Tech Hardware, Storage & Peripherals



S&P 500 Food & Staples Retailing



Commodities

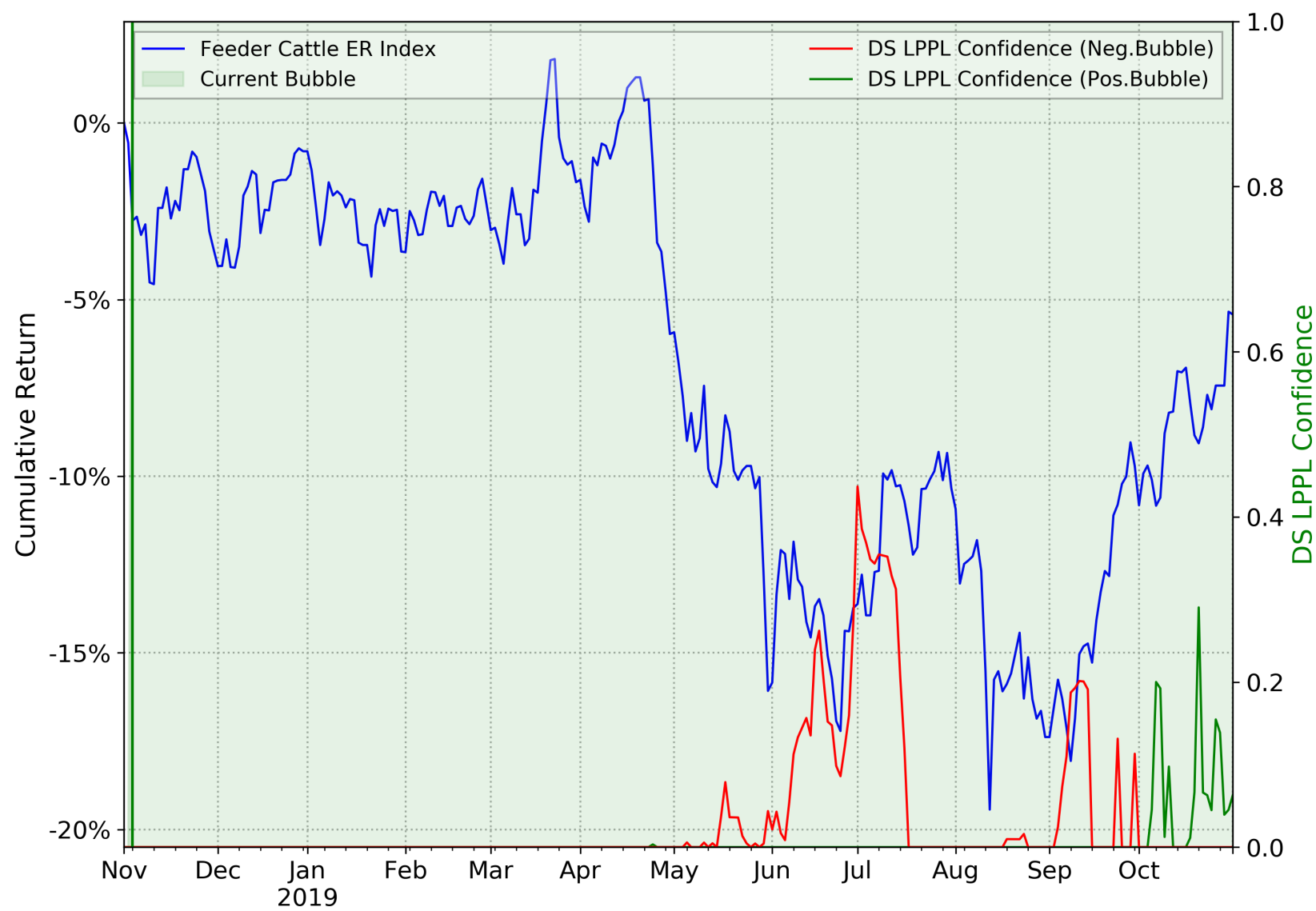
Bubble Data					Cluster Analysis			
	Name	Bubble Size <i>bs</i> [%]	Duration <i>[days]</i>	DS LPPL Confidence <i>ci</i> [%]	Geometric Average	Critical Time Prediction μ_{t_c}	σ_{t_c} <i>[days]</i>	Scenario Probability [%]
Positive Bubbles								
1	Palladium ER Index	32	166	50	40	2019-10-31		78
2	Feeder Cattle ER Index	11	133	20	15	2019-11-06	4	89

- We furthermore show two positive bubble signals for Palladium and the Feeder Cattle Index. The price of Palladium has strongly increased over the past year. The identified bubble is of size 32% at a confidence indicator level of 50%. Both plots are shown on the following slides.

Palladium ER Index



Feeder Cattle ER Index

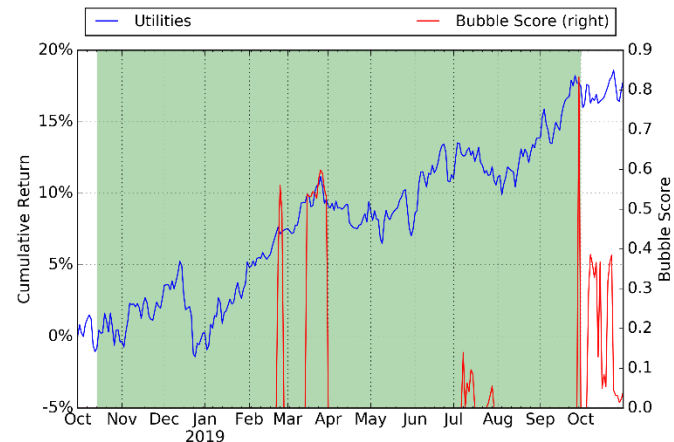
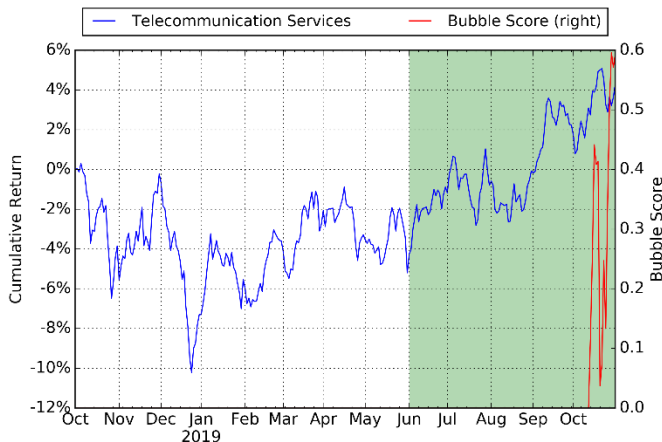
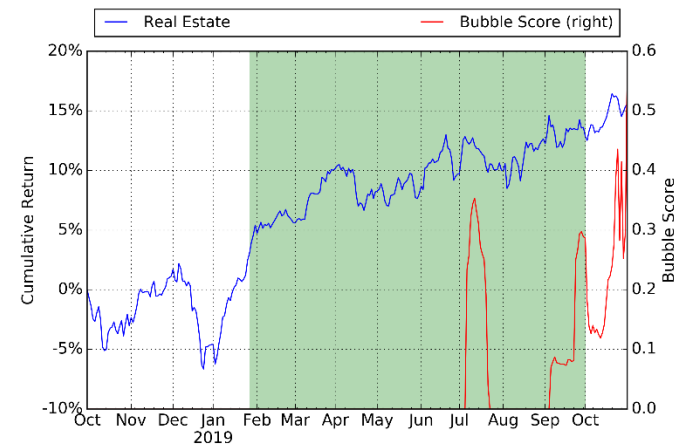
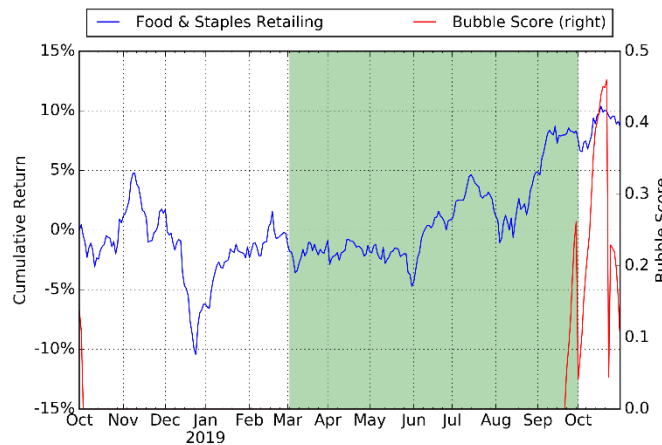


Sectors

GICS Industry Group Name	Yearly Return		Bubble Size		Bubble Score		Value Score		Growth Score	
	Nov 1st	Oct 1st	Nov 1st	Oct 1st	Nov 1st	Oct 1st	Nov 1st	Oct 1st	Nov 1st	Oct 1st
Pharmaceuticals, Biotechnology & Life Sciences	6.2%	0.7%	0.0%	0.0%	0.0%	0.0%	66.6%	69.3%	52.7%	51.8%
Consumer Services	12.3%	17.6%	0.0%	0.0%	0.0%	0.0%	33.5%	31.4%	49.7%	48.8%
Retailing	12.5%	4.1%	0.0%	0.0%	0.0%	0.0%	20.8%	19.2%	55.6%	55.7%
Transportation	6.1%	3.0%	0.0%	0.0%	0.0%	0.0%	53.3%	54.4%	49.4%	49.2%
Consumer Durables & Apparel	17.8%	11.7%	0.0%	0.0%	0.0%	0.0%	34.5%	33.1%	56.3%	56.2%
Semiconductors & Semiconductor Equipment	30.3%	16.1%	0.0%	0.0%	0.0%	0.0%	62.0%	60.4%	34.8%	35.1%
Technology Hardware & Equipment	21.4%	2.9%	0.0%	0.0%	0.0%	0.0%	61.3%	60.3%	41.1%	42.9%
Automobiles & Components	3.5%	-3.2%	0.0%	0.0%	0.0%	0.0%	75.1%	74.0%	57.3%	57.2%
Telecommunication Services	7.7%	5.5%	8.9%	0.0%	59.4%	0.0%	64.2%	64.9%	42.5%	42.1%
Energy	-8.8%	-16.0%	0.0%	0.0%	0.0%	0.0%	54.4%	54.5%	48.5%	49.2%
Software & Services	24.7%	16.6%	0.0%	0.0%	0.0%	0.0%	36.9%	34.4%	44.9%	46.2%
Materials	6.6%	1.4%	0.0%	0.0%	0.0%	0.0%	54.4%	54.9%	50.3%	50.1%
Health Care Equipment & Services	9.2%	2.9%	0.0%	0.0%	0.0%	0.0%	58.5%	58.8%	49.6%	49.6%
Capital Goods	12.3%	3.0%	0.0%	0.0%	0.0%	0.0%	49.4%	49.5%	47.9%	48.4%
Media & Entertainment	15.2%	15.9%	0.0%	0.0%	0.0%	0.0%	29.6%	30.4%	43.5%	43.4%
Commercial & Professional Services	24.0%	19.1%	0.0%	0.0%	0.0%	0.0%	30.6%	31.6%	53.6%	53.8%
Food & Staples Retailing	5.8%	10.9%	12.6%	12.3%	9.4%	26.2%	48.0%	50.8%	54.5%	53.8%
Household & Personal Products	18.4%	25.9%	0.0%	0.0%	0.0%	0.0%	33.2%	33.0%	47.0%	47.1%
Food, Beverage & Tobacco	6.7%	10.1%	0.0%	0.0%	0.0%	0.0%	46.5%	47.3%	53.4%	53.6%
Utilities	15.6%	19.0%	7.9%	7.7%	4.1%	83.3%	50.4%	50.7%	45.2%	44.0%
Insurance	12.0%	10.9%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Real Estate	15.7%	19.7%	11.1%	10.2%	59.6%	28.9%	-	-	-	-
Diversified Financials	6.9%	3.7%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Banks	2.1%	-3.1%	0.0%	0.0%	0.0%	0.0%	-	-	-	-

Sectors

- ▶ We use the MSCI World Industry Group Indices to calculate bubble size and bubble score of the corresponding sectors. To determine the value scores and growth scores of the sectors, we average over the corresponding values for each stock of a given sector, weighted by market cap.
- ▶ This month, we find 4 industry groups with a positive bubble score: Food & Staples Retailing, Real Estate, Telecommunication Services and Utilities, 3 of which were already identified last month.



Portfolio Construction & Performance

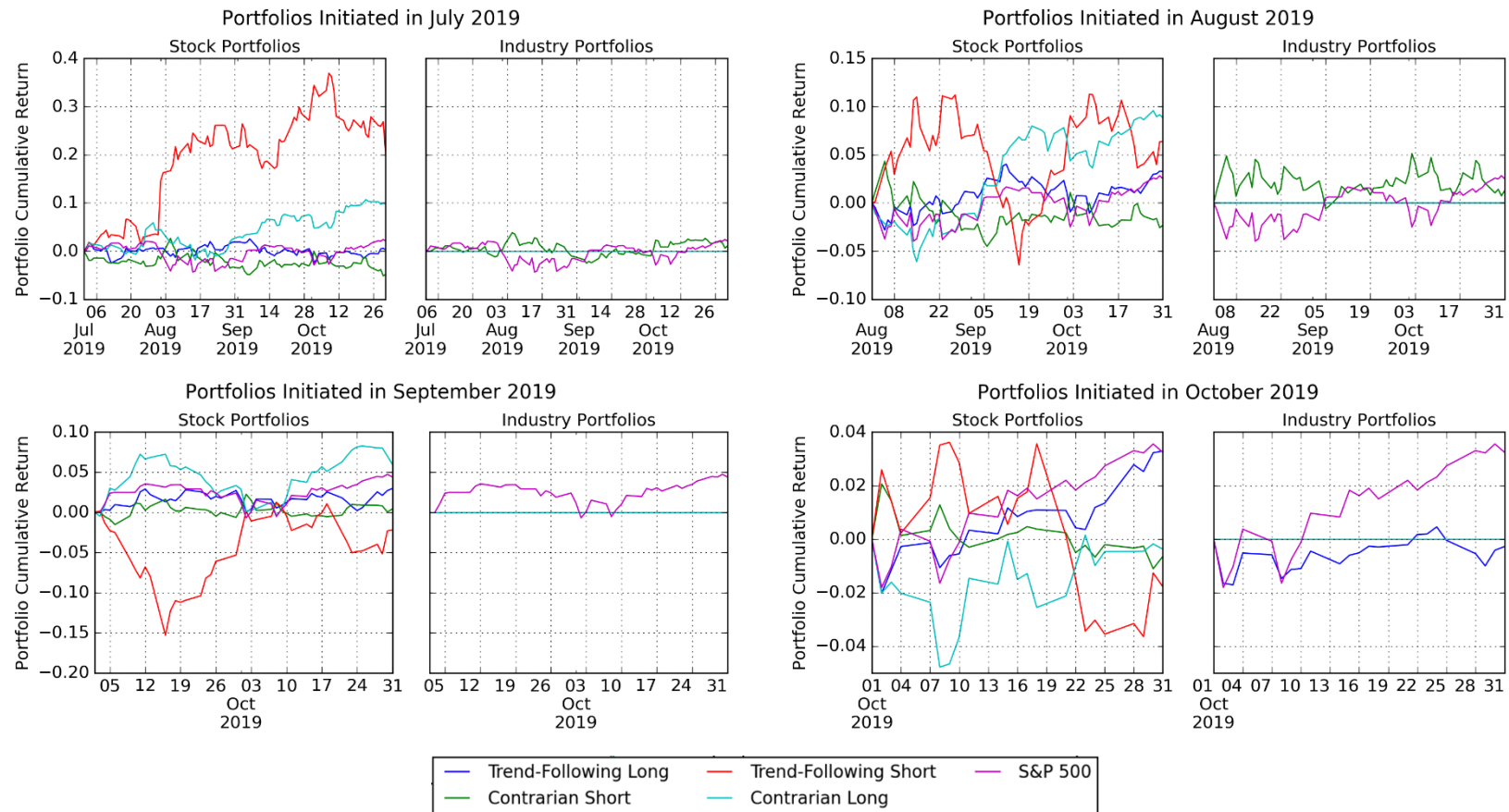
- ▶ Here we illustrate the methodology of the portfolio construction process based on the results of our previous analyses.
- ▶ For individual stocks that we identified in the 4 quadrants, we constructed 4 portfolios based on the 4 quadrants defined in the last report. Each portfolio consists of all the stocks listed in the corresponding quadrant.
 1. **Trend-Following Long Stock Portfolio (TFLSP)** is made of the stocks that have a **positive** bubble signal as well as a **strong** value score. For instance, TFLSP November consists of all the stocks listed in quadrant 1, identified in slide 37 of November 2017 FCO Report.
 2. **Trend-Following Short Stock Portfolio (TFSSP)** is made of the stocks that have a **negative** bubble signal as well as a **weak** value score.
 3. **Contrarian Long Stock Portfolio (CLSP)** is made of the stocks that have a **negative** bubble signal as well as a **strong** value score.
 4. **Contrarian Short Stock Portfolio (CSSP)** is made of the stocks that have a **positive** bubble signal as well as a **weak** value score.

Portfolio Construction & Performance

- ▶ At the same time, we also classified 20 industries into 4 quadrants, and constructed 4 type of industry portfolios based on the 4 industry quadrants. Each portfolio consists of all the stocks in the industries listed in the corresponding quadrant. Following the same definitions as above, we have Trend-Following Long Industry Portfolio (TFLIP), Trend-Following Short Industry Portfolio (TFSIP), Contrarian Long Industry Portfolio (CLIP), and Contrarian Short Industry Portfolio (CSIP).
- ▶ In each month, we initiated 8 new portfolios based on the updated results. The performance of every 8 portfolios we initiated since November 2017 are presented in the next slide. All of the stocks in our portfolios are weighted by their market capitalizations and we don't consider transaction cost in the portfolio performance.

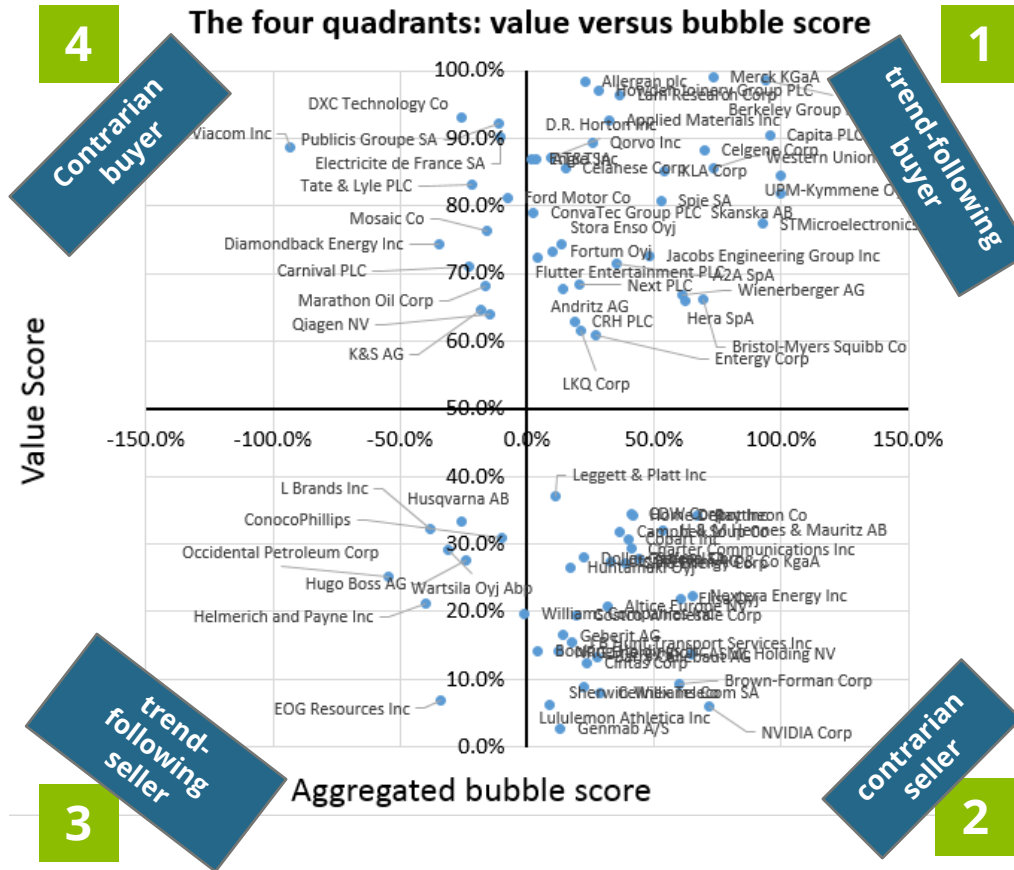
Portfolio Construction & Performance

- This month, we find that the Contrarian Long Stock Portfolios have outperformed most of the portfolios, while the Contrarian Short Portfolios have poor performances. Contrarian Portfolios are more delicate to use due to their sensitivity to timing the expected reversal and exhibit very volatile performances, indicating that most of bubbles in the market are still dominating and that fundamentals have not yet played out. We expect trend-following positions to perform in the months following the position set-up and then contrarian positions to over-perform over longer time scales as the predicted corrections play out.



Single Stocks

We can divide the stocks into four quadrants¹⁾



- **Quadrant 1:** Stocks with a strong value score are cheap relative to their earnings potential. The strong positive bubble signal should be interpreted as a momentum indicator possibly the consequence of a repricing based on the fundamentals. As an investor, one could be a **trend-following buyer**. E.g. Hera SpA
- **Quadrant 2:** Stocks with a weak value score are expensive relative to their earnings potential. The strong positive bubble signal is an indication of sentiment and herding increasing the price until it is not linked to fundamentals anymore. As an investor, one could be a **contrarian seller**. E.g. NVIDIA Corp
- **Quadrant 3:** These stocks are expensive relative to their earnings potential. On top of that, there are clear negative bubble signals. Such stocks should be considered as falling knives. As an investor, one could be a **trend-following seller**. E.g. Hugo Boss AG
- **Quadrant 4:** These stocks are cheap relative to their financial performance. The strong negative bubble signal is an indication of sentiment and herding. These stocks can be considered as over-sold. As an investor, one could be a **contrarian buyer**. E.g. Viacom Inc

¹⁾ A strong positive bubble signal is identified if bubble score is larger than 10%, and a strong negative bubble signal is identified if bubble score is smaller than -10%.

A strong value score is identified if value score is larger than 60%, and a weak value score is identified if value score is smaller than 40%.

Single Stocks

- ▶ For 824 stocks, we calculate the **bubble warning indicators** as well as two financial strength indicators, which indicate the **fundamental value** of the stock and the **growth capability** respectively.
- ▶ To analyze the **financial strength of individual stocks**, we have two indicators. Both scores give a value between zero and one, one being the best of the set and zero the worst, so the higher the score, the higher the financial strength.
 - A **value score** that is based on the ROIC (Return on Invested Capital) taking into account the EV (Enterprise Value) to normalize for high/low market valuations and/or high/low debt; Value scores are calculated by comparing ROIC level versus EV/IC in each industry.
 - A **growth score** that has characteristics similar to the PEG ratio, which is the Price to Earnings ratio normalized by the expected growth of the EPS (Earnings per Share).
- ▶ The stocks are the constituents of the Stoxx Europe 600, the S&P 500 and the Nasdaq 100 indices. From these, all doubles and stocks with incomplete data are removed. Because our financial strength indicators are specifically designed for corporates, all financial institutions are taken out of the set as well.

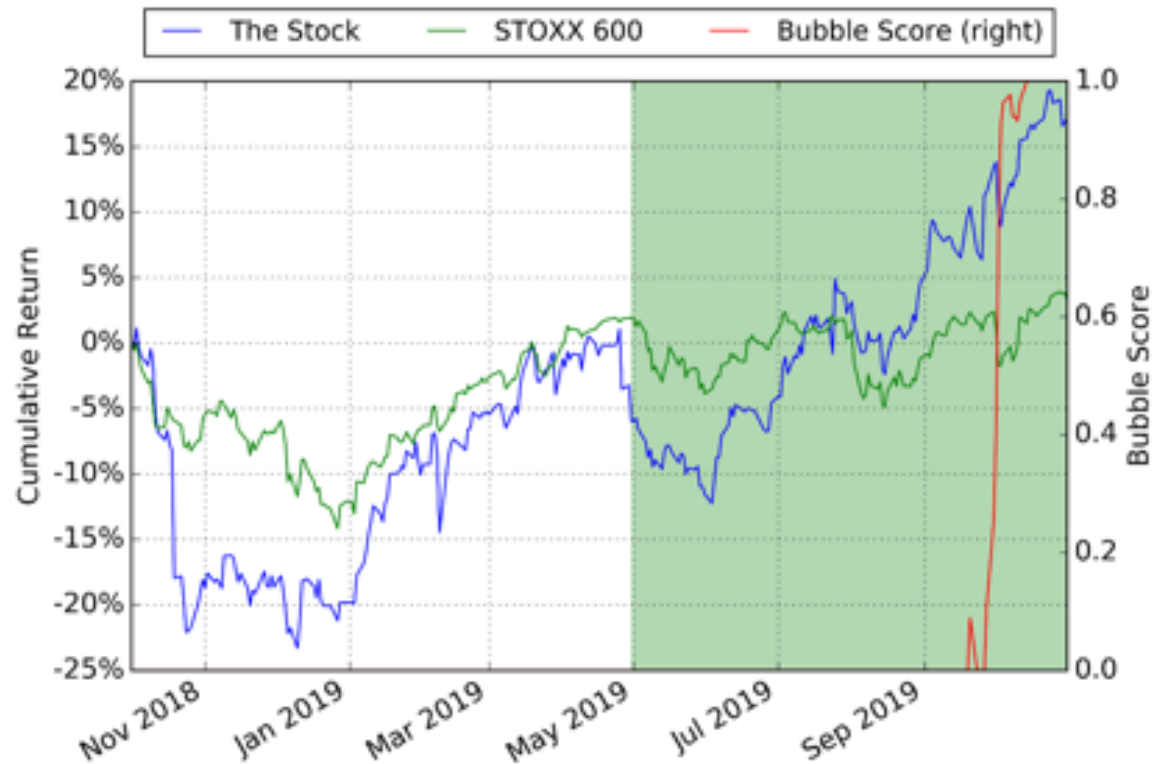
Single Stocks

Quadrant 1 stocks: strong positive bubble signals with strong fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Andritz AG	Austria	Capital Goods	-6.5%	17.4%	May-19	14.3%	67.8%	98.3%
Wienerberger AG	Austria	Materials	18.8%	17.2%	Feb-19	61.3%	66.8%	8.8%
Merck KGaA	Germany	Pharmaceuticals, Biotechnology & Life Sciences	12.7%	19.2%	May-19	73.1%	99.0%	81.8%
Stora Enso Oyj	Finland	Materials	-9.7%	23.8%	May-19	13.6%	74.4%	6.7%
UPM-Kymmene Oyj	Finland	Materials	8.8%	28.0%	May-19	100.0%	84.4%	29.0%
Fortum Oyj	Finland	Utilities	13.3%	16.7%	Apr-19	10.2%	73.3%	8.9%
Engie SA	France	Utilities	22.6%	16.3%	Feb-19	1.9%	87.0%	12.9%
Spie SA	France	Commercial & Professional Services	34.2%	20.5%	May-19	52.8%	80.7%	11.8%
Howden Joinery Group PLC	United Kingdom	Capital Goods	19.2%	12.0%	Apr-19	28.2%	97.1%	56.0%
Next PLC	United Kingdom	Retailing	21.3%	43.9%	Jan-19	20.3%	68.3%	60.9%
Berkeley Group Holdings PLC	United Kingdom	Consumer Durables & Apparel	20.9%	23.7%	May-19	93.6%	98.7%	2.7%
Capita PLC	United Kingdom	Commercial & Professional Services	23.5%	41.8%	May-19	95.5%	90.4%	6.3%
ConvaTec Group PLC	United Kingdom	Health Care Equipment & Services	26.0%	33.8%	Dec-18	2.6%	79.0%	9.5%
CRH PLC	Ireland; Republic of	Materials	24.7%	19.6%	Feb-19	18.8%	62.9%	7.9%
Flutter Entertainment PLC	Ireland; Republic of	Consumer Services	21.5%	32.4%	May-19	4.3%	72.4%	48.2%
Allergan plc	Ireland; Republic of	Pharmaceuticals, Biotechnology & Life Sciences	6.4%	29.0%	Dec-18	22.6%	98.4%	38.7%
AzA SpA	Italy	Utilities	22.7%	16.6%	Apr-19	35.0%	71.5%	97.8%
Hera SpA	Italy	Utilities	50.2%	20.0%	Mar-19	62.4%	66.0%	18.4%
STMicroelectronics NV	Switzerland	Semiconductors & Semiconductor Equipment	56.6%	48.2%	May-19	92.8%	77.3%	19.4%
Skanska AB	Sweden	Capital Goods	39.6%	24.3%	Apr-19	100.0%	81.7%	96.3%
AT&T Inc	United States of America	Telecommunication Services	25.4%	28.5%	Mar-19	3.3%	86.8%	26.1%
Applied Materials Inc	United States of America	Semiconductors & Semiconductor Equipment	58.3%	42.5%	Mar-19	32.1%	92.6%	54.4%
Bristol-Myers Squibb Co	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	7.5%	22.8%	Apr-19	69.2%	66.2%	33.2%
Celanese Corp	United States of America	Materials	17.9%	20.7%	Mar-19	15.1%	85.6%	64.1%
Celgene Corp	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	45.9%	27.2%	Jan-19	69.8%	88.2%	43.5%
D.R. Horton Inc	United States of America	Consumer Durables & Apparel	52.2%	38.4%	Jan-19	9.1%	87.1%	79.4%
Entergy Corp	United States of America	Utilities	42.0%	28.7%	Apr-19	27.2%	61.0%	17.7%
Jacobs Engineering Group Inc	United States of America	Capital Goods	21.1%	29.5%	Mar-19	48.2%	72.6%	32.6%
KLA Corp	United States of America	Semiconductors & Semiconductor Equipment	77.4%	94.4%	Dec-18	53.9%	85.1%	49.0%
LKQ Corp	United States of America	Retailing	22.6%	30.5%	May-19	21.3%	61.5%	76.2%
Lam Research Corp	United States of America	Semiconductors & Semiconductor Equipment	83.3%	47.6%	May-19	36.7%	96.3%	34.5%
Qorvo Inc	United States of America	Semiconductors & Semiconductor Equipment	18.7%	26.5%	May-19	25.9%	89.3%	25.5%
Western Union Co	United States of America	Software & Services	33.2%	41.6%	43466	73.1%	85.5%	56.1%

Single Stocks

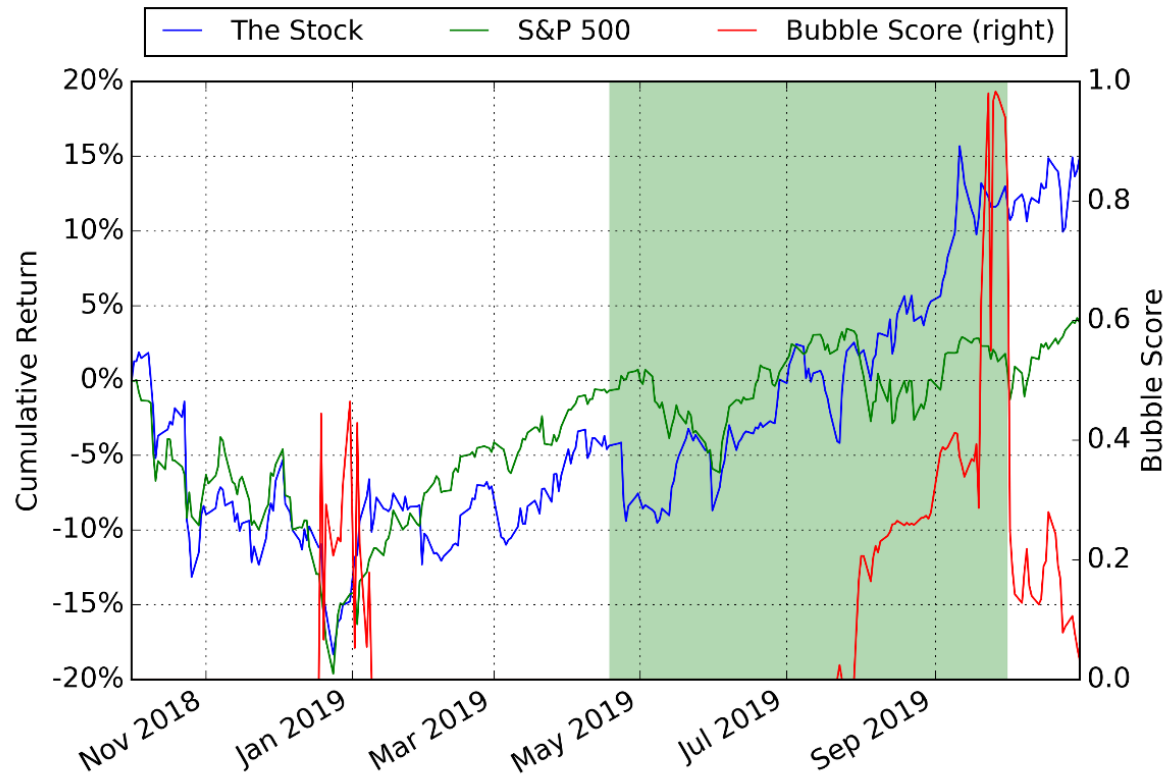
Quadrant 1 Stocks Current Month Example – Skanska AB



- The above graph shows the one year cumulative return of the stock in blue (left hand scale), STOXX 600 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period delineates the time interval within which the strong positive bubble is identified. The Bubble Score of this six month bubble has reached 100% with a bubble size 24.3%.

Single Stocks

Quadrant 1 Stocks Last Month Example – AT & T Inc.



- The figure above plots the one year cumulative return of the stock (blue), S&P 500 (green) and LPPLS Bubble Score (red lines on the right y-axis). The green shaded period delineates the time interval within which a strong positive bubble has been identified and reported last month. The peak of the DS LPPLS indicator (bubble score) coincided with the change of regime to a plateau.

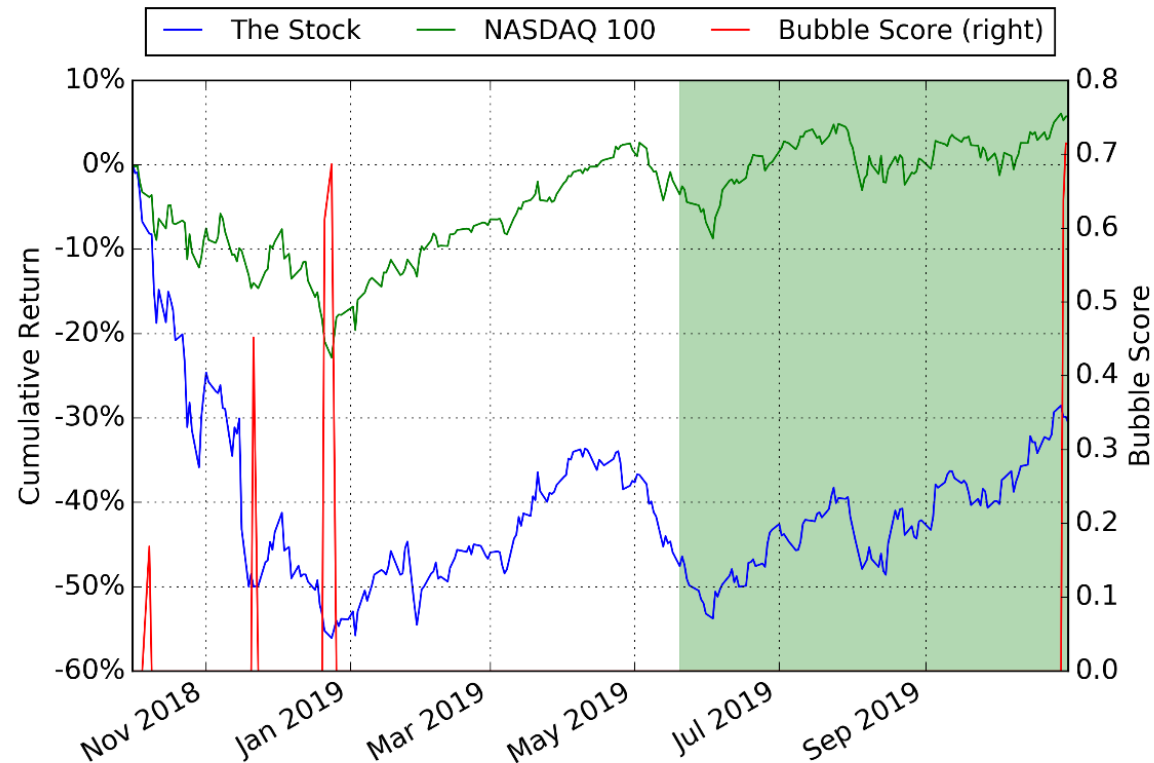
Single Stocks

Quadrant 2 stocks: strong positive bubble signals with weak fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Barry Callebaut AG	Switzerland	Food, Beverage & Tobacco	4.6%	15.7%	Mar-19	27.6%	13.3%	79.1%
Geberit AG	Switzerland	Capital Goods	29.9%	29.9%	Nov-18	14.1%	16.5%	78.0%
Cts Eventim AG & Co KgaA	Germany	Media & Entertainment	64.5%	52.6%	Jan-19	33.1%	27.3%	81.6%
Genmab A/S	Denmark	Pharmaceuticals, Biotechnology & Life Sciences	47.1%	52.2%	Nov-18	13.2%	2.7%	21.8%
Cellnex Telecom SA	Spain	Telecommunication Services	99.4%	42.7%	May-19	29.0%	8.0%	80.7%
Huhtamaki Oyj	Finland	Materials	67.3%	27.7%	Feb-19	17.0%	26.5%	27.2%
Elisa Oyj	Finland	Telecommunication Services	31.0%	26.9%	Apr-19	60.7%	22.0%	20.5%
Safran SA	France	Capital Goods	26.1%	28.4%	Jan-19	44.3%	27.8%	78.8%
ASML Holding NV	Netherlands	Semiconductors & Semiconductor Equipment	54.4%	46.0%	Mar-19	64.6%	13.7%	35.6%
Altice Europe NV	Netherlands	Media & Entertainment	130.2%	78.1%	Jun-19	31.7%	20.7%	0.0%
H & M Hennes & Mauritz AB	Sweden	Retailing	26.9%	27.1%	May-19	53.6%	32.1%	56.2%
Booking Holdings Inc	United States of America	Retailing	5.7%	20.7%	Feb-19	4.3%	14.1%	26.8%
Brown-Forman Corp	United States of America	Food, Beverage & Tobacco	33.9%	35.7%	Nov-18	60.0%	9.4%	61.7%
CDW Corp	United States of America	Technology Hardware & Equipment	40.4%	22.9%	Apr-19	41.1%	34.5%	46.8%
CMS Energy Corp	United States of America	Utilities	27.5%	32.5%	Dec-18	38.7%	27.1%	71.2%
Campbell Soup Co	United States of America	Food, Beverage & Tobacco	18.8%	35.5%	Jan-19	36.5%	31.8%	28.7%
Charter Communications Inc	United States of America	Media & Entertainment	45.7%	37.2%	Feb-19	40.8%	29.3%	62.0%
Cintas Corp	United States of America	Commercial & Professional Services	49.9%	24.5%	Apr-19	23.7%	12.3%	61.0%
Copart Inc	United States of America	Commercial & Professional Services	64.4%	30.8%	Apr-19	39.9%	30.6%	68.4%
Costco Wholesale Corp	United States of America	Food & Staples Retailing	25.0%	16.1%	Jun-19	19.6%	19.4%	60.5%
Dollar General Corp	United States of America	Retailing	38.1%	30.8%	Apr-19	22.2%	27.9%	66.3%
Home Depot Inc	United States of America	Retailing	26.1%	28.5%	Mar-19	41.4%	34.3%	51.0%
J B Hunt Transport Services Inc	United States of America	Transportation	10.2%	24.4%	Apr-19	17.6%	15.4%	29.1%
Leggett & Platt Inc	United States of America	Consumer Durables & Apparel	36.5%	36.7%	May-19	11.1%	37.0%	44.1%
Lululemon Athletica Inc	Canada	Consumer Durables & Apparel	48.5%	21.9%	Mar-19	9.0%	6.1%	52.2%
NRG Energy Inc	United States of America	Utilities	4.8%	17.0%	May-19	12.1%	14.0%	98.5%
Nextera Energy Inc	United States of America	Utilities	35.0%	19.9%	May-19	65.1%	22.3%	75.0%
NVIDIA Corp	United States of America	Semiconductors & Semiconductor Equipment	-2.3%	36.5%	May-19	71.4%	6.0%	30.2%
Raytheon Co	United States of America	Capital Goods	12.9%	19.6%	Apr-19	67.1%	34.1%	61.5%
Sherwin-Williams Co	United States of America	Materials	38.0%	36.0%	43525	22.4%	8.8%	54.0%

Single Stocks

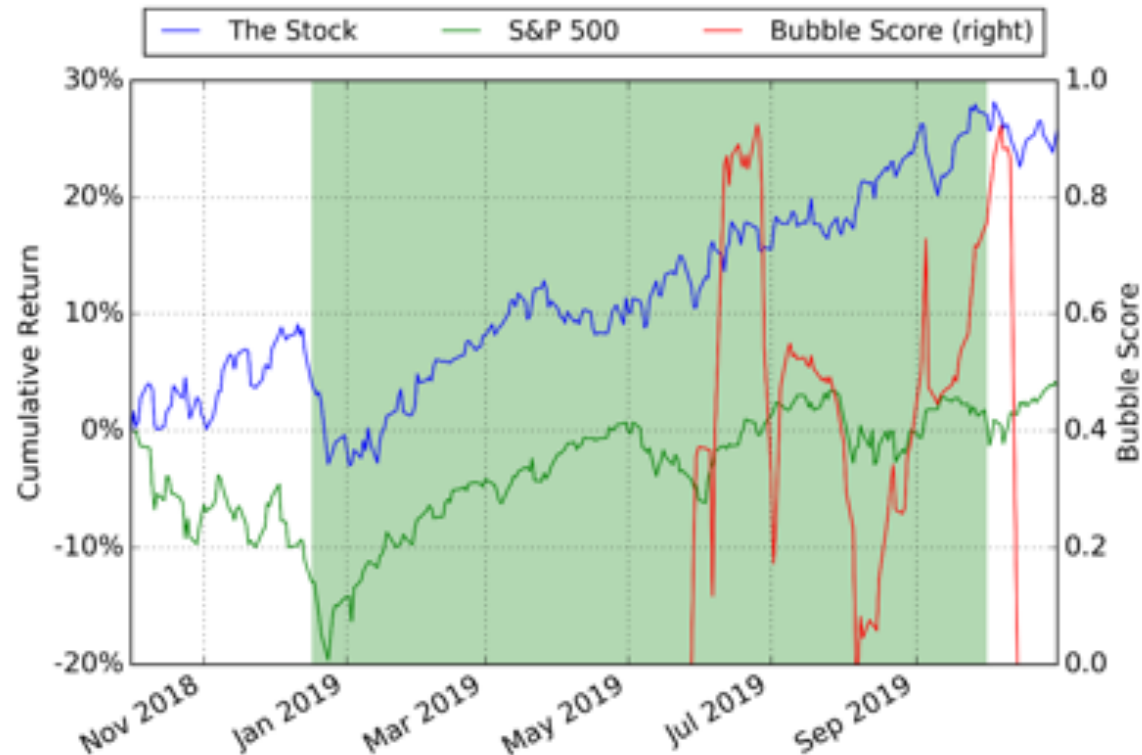
Quadrant 2 Stocks Current Month Example – NVIDIA Corp.



- The above graph shows the one year cumulative return of the stock in blue (left hand scale), NASDAQ 100 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period delineates the time interval within which the positive bubble is identified. The Bubble Score of this six month bubble has reached 71.4% with a bubble size 36.5%. The strong positive bubble signals and weak fundamentals indicate a high probability of correction in the future.

Single Stocks

Quadrant 2 Stocks Last Month Example – Alliant Energy Corp.



- The figure above plots the one year cumulative return of the stock (blue), S&P 500 (green) and LPPLS Bubble Score (red lines on the right y-axis). The green shaded period delineates the time interval within which the strong positive bubble was identified and reported last month. Note that the stock price has switched into a new market regime, which is in agreement with the weak fundamentals and our DS LPPLS indicator.

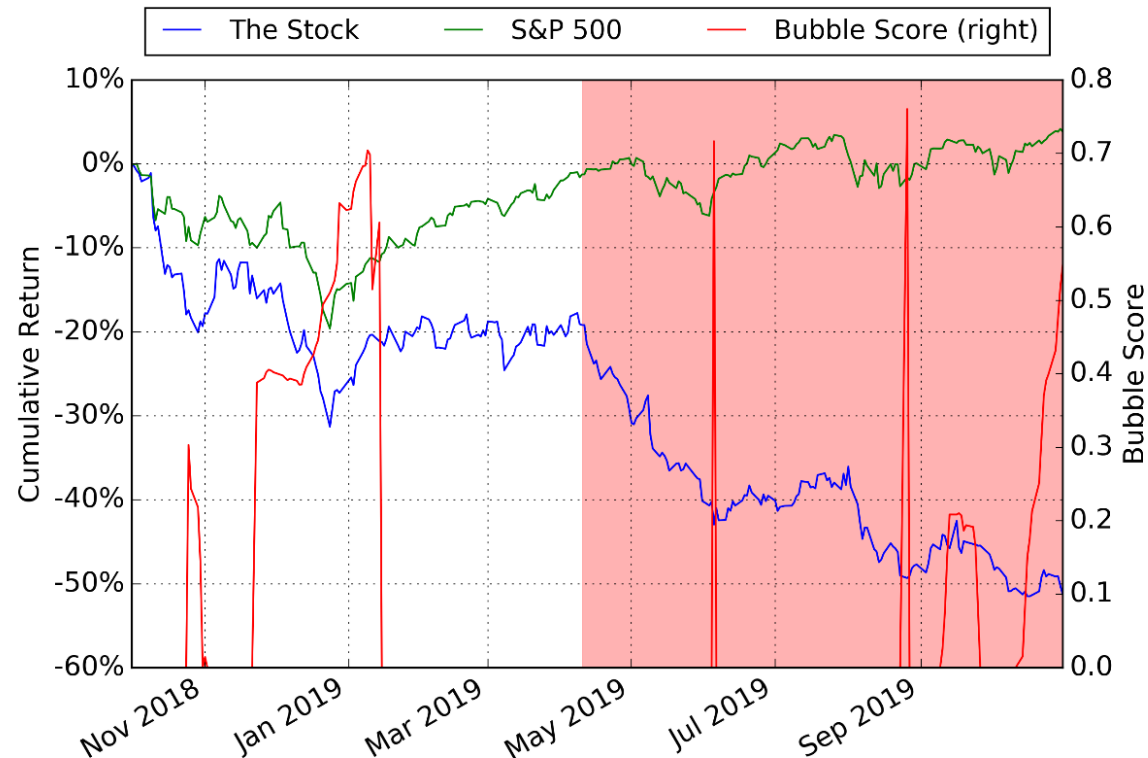
Single Stocks

Quadrant 3 stocks: strong negative bubble signals with weak fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Hugo Boss AG	Germany	Consumer Durables & Apparel	-39.4%	-38.4%	Apr-19	-24.3%	27.6%	96.1%
Wartsila Oyj Abp	Finland	Capital Goods	-39.0%	-27.7%	May-19	-31.4%	29.0%	78.9%
Husqvarna AB	Sweden	Consumer Durables & Apparel	7.0%	-17.0%	Apr-19	-25.6%	33.4%	94.4%
ConocoPhillips	United States of America	Energy	-17.3%	-11.3%	Dec-18	-10.0%	31.0%	24.6%
EOG Resources Inc	United States of America	Energy	-34.3%	-34.2%	Apr-19	-34.2%	6.8%	57.8%
Helmerich and Payne Inc	United States of America	Energy	-40.1%	-34.0%	Jan-19	-40.1%	21.2%	40.5%
L Brands Inc	United States of America	Retailing	-53.3%	-41.3%	Dec-18	-38.0%	32.3%	6.8%
Occidental Petroleum Corp	United States of America	Energy	-44.9%	-36.1%	Apr-19	-54.8%	25.1%	34.4%
Williams Companies Inc	United States of America	Energy	-11.9%	-23.8%	43556	-1.1%	19.6%	87.6%

Single Stocks

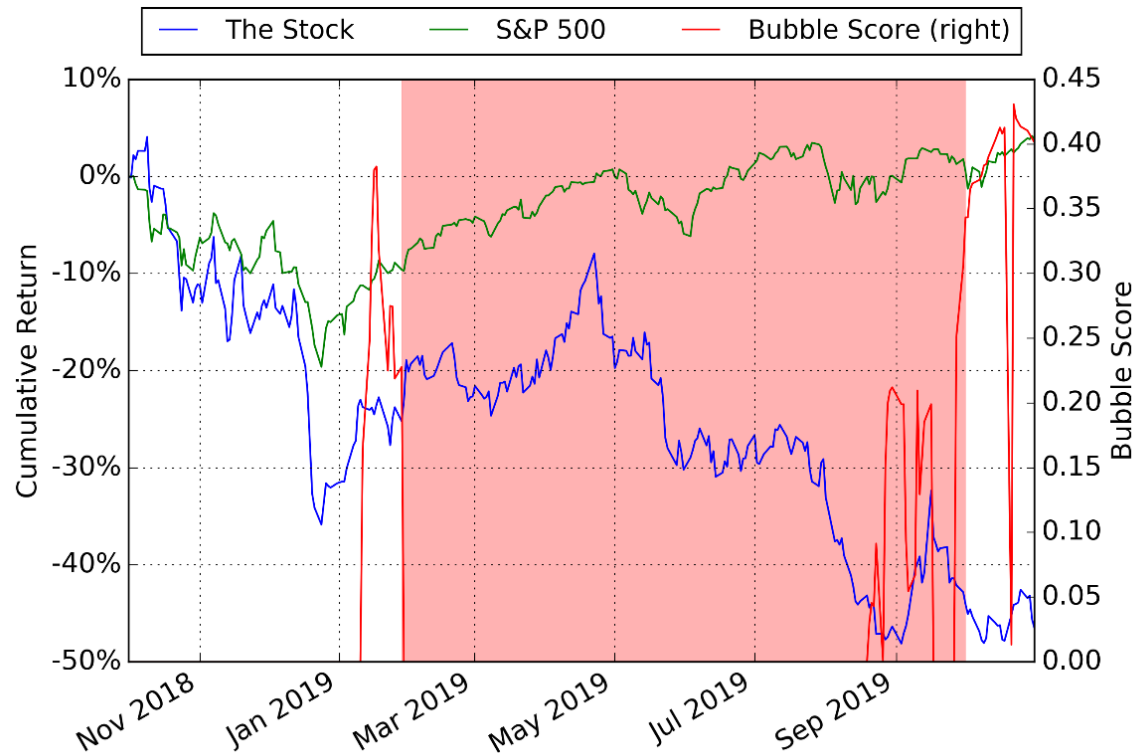
Quadrant 3 Stocks Current Month Example – Occidental Petroleum Corp.



- The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period delineates the time interval within which the negative bubble is identified. The Bubble Score of this seven month bubble has reached 54.8% with a bubble size -36.1%.

Single Stocks

Quadrant 3 Stocks Last Month Example – Helmerich and Payne Inc.



- The figure above plots the one year cumulative return of the stock (blue), S&P 500 (green) and LPPLS Bubble Score (red line on the right y-axis). The red shaded period delineates the time interval within which the strong negative bubble was identified and reported last month. The stock is still a negative bubble regime, identified by the strong bubble score this month. One should be cautious as the negative (downward trending) bubble may continue to develop.

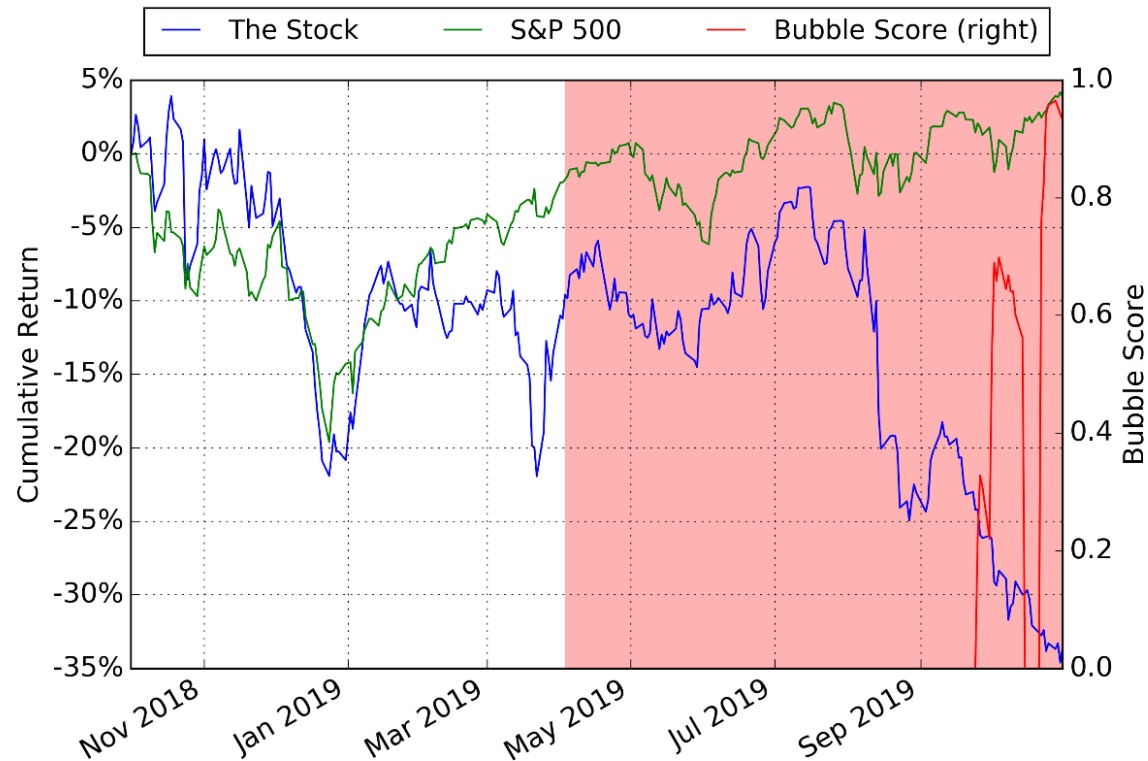
Single Stocks

Quadrant 4 stocks: strong negative bubble signals with strong fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
K&S AG	Germany	Materials	-26.2%	-18.6%	May-19	-18.2%	64.5%	16.2%
Publicis Groupe SA	France	Media & Entertainment	-26.3%	-26.3%	Nov-18	-11.2%	92.2%	81.1%
Electricite de France SA	France	Utilities	-40.8%	-35.3%	Jan-19	-10.3%	90.1%	0.9%
Tate & Lyle PLC	United Kingdom	Food, Beverage & Tobacco	-4.2%	-12.3%	Apr-19	-21.5%	83.2%	76.3%
Carnival PLC	United Kingdom	Consumer Services	-29.3%	-22.9%	Jan-19	-22.9%	71.0%	16.6%
Qiagen NV	Netherlands	Pharmaceuticals, Biotechnology & Life Sciences	-17.1%	-21.6%	May-19	-14.7%	63.9%	29.3%
DXC Technology Co	United States of America	Software & Services	-55.4%	-54.9%	Jan-19	-25.6%	93.0%	7.8%
Diamondback Energy Inc	United States of America	Energy	-24.7%	-19.0%	May-19	-34.4%	74.3%	92.8%
Ford Motor Co	United States of America	Automobiles & Components	-8.4%	-17.5%	Apr-19	-7.9%	81.1%	89.8%
Marathon Oil Corp	United States of America	Energy	-35.4%	-30.2%	May-19	-16.3%	68.0%	13.5%
Mosaic Co	United States of America	Materials	-45.7%	-33.9%	Dec-18	-15.6%	76.3%	3.4%
Viacom Inc	United States of America	Media & Entertainment	-32.8%	-27.9%	43556	-93.3%	88.7%	72.7%

Single Stocks

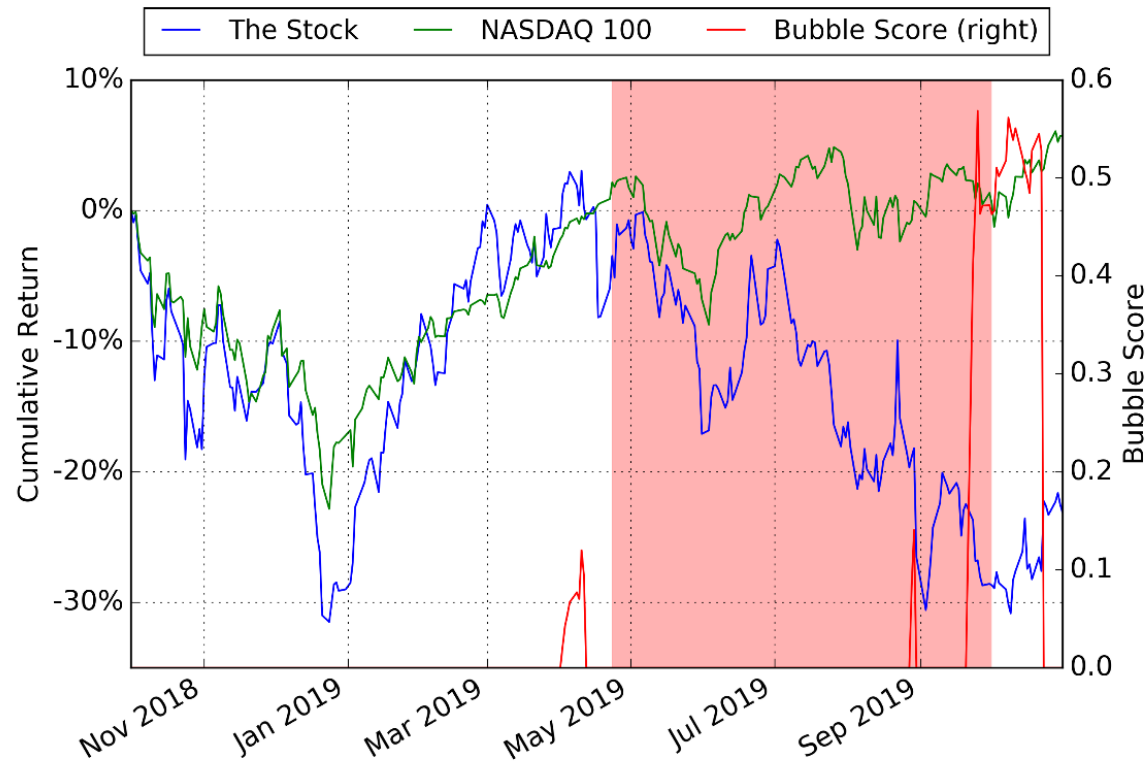
Quadrant 4 Stocks Current Month Example – Viacom Inc.



- The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period delineates the time interval within which the strong negative bubble is identified. The Bubble Score of this seven month bubble has reached 93.3% with a bubble size -27.9%. We expect a rebound in the future, which is due to our diagnostic of a negative bubble signal with strong fundamentals, calling for a contrarian buyer position.

Single Stocks

Quadrant 4 Stocks Last Month Example – Alexion Pharmaceuticals Inc.



- The figure above plots the one year cumulative return of the stock (blue), NASDAQ 100 (green) and LPPLS Bubble Score (red line on the right y-axis). The red shaded period delineates the time interval within which the strong negative bubble was identified and reported last month. The stock has appreciated since we made our diagnostic, ending the month in positive territory, but with high volatility. This change of regime is in agreement with our DS LPPLS indicator. The strong fundamentals lead us to expect potential future increase in the price.

More Information

- ▶ Visit the **Financial Crisis Observatory** for more information

<http://www.er.ethz.ch/financial-crisis-observatory.html>

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- ▶ Contact **Systematic Investment Management AG** for practical implementation in investment portfolios

<https://www.simag.com/>

- ▶ **Contacts SIMAG**

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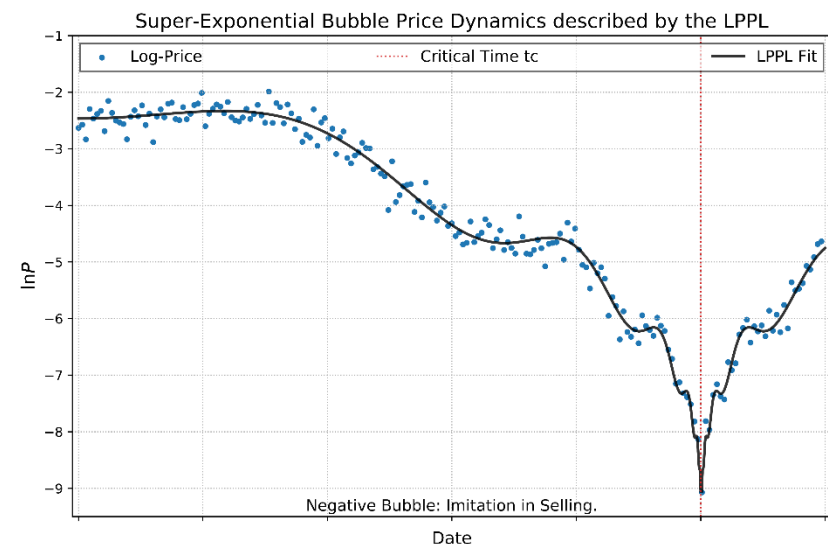
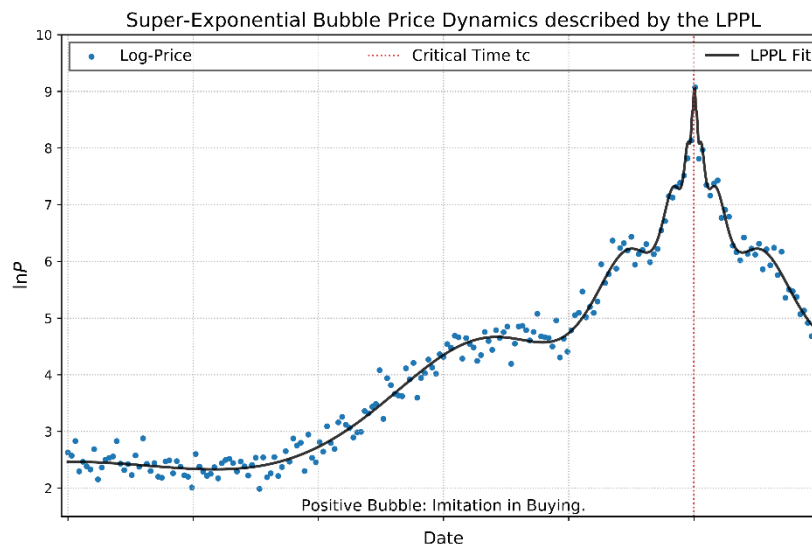
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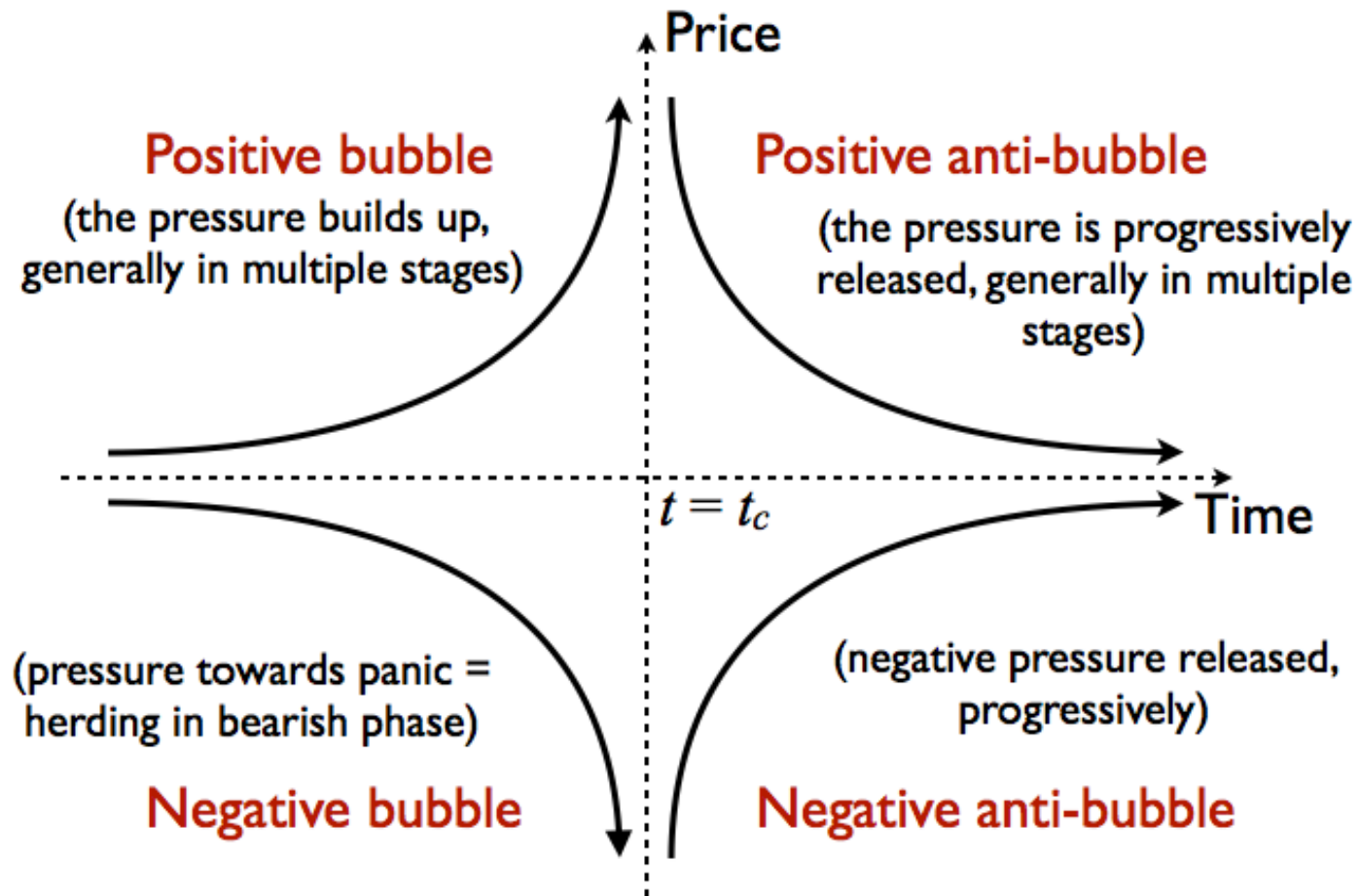
Appendix

Methodology

- ▶ We use the Log-Periodic Power Law Singularity (LPPLS) model to hunt for the distinct fingerprint of **Financial Bubbles**. Basic assumptions of the model are:
 1. During the growth phase of a positive (negative) bubble, the price rises (falls) **faster than exponentially**. Therefore the logarithm of the price rises faster than linearly.
 2. There are accelerating **log-periodic oscillations** around the super-exponential price evolution that symbolize increases in volatility towards the end of the bubble.
 3. At the end of the bubble, the so-called critical time t_c , a finite time singularity occurs after which the bubble bursts.
- ▶ Together, these effects encompass irrational imitation and herding phenomena amongst market participants that lead to blow-up and instability of asset prices.



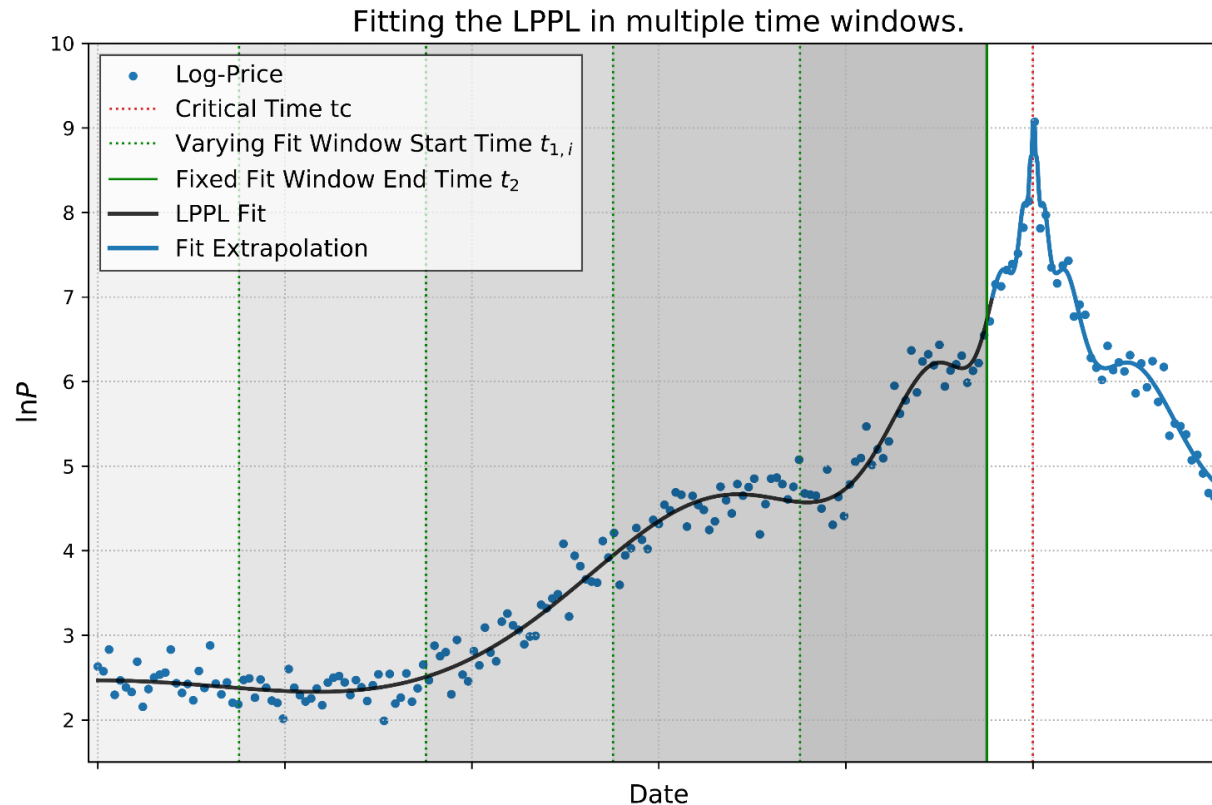
Bubble Regimes



The LPPLS Model

- ▶ Mathematically, the simplest version of the log-periodic power law singularity model that describes the expected trajectory of the logarithmic price in a bubble is given as:
- ▶ $LPPLS := E[\ln [P(t)] = A + B(t_c - t)^m + (t_c - t)^m [C_1 \cos(\omega \ln(t_c - t)) + C_2 \sin(\omega \ln(t_c - t))]]$
- ▶ The seven parameters describing the model dynamics are:
 - A The finite peak (valley) log-price at the time t_c when the positive (negative) bubble ends.
 - m The power law exponent.
 - B The power law intensity.
 - $C_{(1|2)}$ Magnitude coefficients of the log-periodic accelerating oscillations.
 - ω The log-periodic angular frequency of the log-periodic oscillations.
 - t_c The critical time at which the bubble ends.
- ▶ The set of seven model parameters is obtained by fitting the LPPLS formula to the price time series via a combination of Ordinary Least Squares and nonlinear optimization. The resulting values of the fit parameters reveal whether an asset is in a bubble state. Furthermore, the central parameter of interest, the critical time t_c , may warn of an imminent crash.

LPPLS Analysis of Price Time Series



- ▶ In order to avoid overfitting and to continuously collect information about price dynamics, we scan asset log-price trajectories for super-exponential price dynamics by sequentially fitting the LPPLS model in different time windows to the underlying price series. The procedure is illustrated in the plot.
- ▶ For a fixed fit window end time, t_2 , we select different window start times $t_{1,i}$ and fit the LPPL model in each of the resulting windows. This gives one set of calibrated LPPL parameters per fit window. In our monthly report, t_2 , the time of analysis is always the start of the month, i.e. the report date (1st July 2018 for the present report).

The DS LPPL Confidence Indicator

- ▶ As illustrated on the previous slide, for a fixed analysis time, t_2 , we iteratively perform LPPLS fits over many different window start times $t_{1,i}$. Based on the resulting sets of fit parameters (one per fit window), we determine the bubble start time t_1^* , i.e. the time in the past at which the price (if it did) entered a super-exponential bubble phase from a previous phase of normal price growth. For more information on the determination of the bubble start time, we refer the reader to [1].
- ▶ Next, we discard all fit results that correspond to windows with start time earlier than the bubble start time t_1^* . Then, we filter parameters in each of the remaining fit calibrations according to filter criteria established in [2]. The imposed filter boundaries are chosen such that only fits with model parameter values that likely correspond to real bubble dynamics are accepted. Such fits are then marked as qualified.
- ▶ In order to fully capture the information that is contained in the remainder of the calibrations and condense it to a meaningful figure, we have developed the DS LPPLS Confidence Indicator. The indicator is calculated as the number of qualified fits divided by the total number of fits. It quantifies the presence of super-exponential price dynamics obtained over various differently sized time windows. A high value of the indicator signals that LPPLS signatures were detected on many timescales. A low value shows that almost no bubble dynamics were found.
- ▶ We distinguish between a positive bubble and a negative bubble confidence indicator.

[1] Demos, Guilherme and Sornette, Didier, Comparing nested data sets and objectively determining financial bubbles' inceptions, Physica A: Statistical Mechanics and its Applications 524, 661-675 (2019) (<https://ssrn.com/abstract=3007070>)

[2] A. Johansen and D. Sornette, Shocks, Crashes and Bubbles in Financial Markets, Brussels Economic Review (Cahiers économiques de Bruxelles) 53 (2), 201-253 (summer 2010) and papers at http://www.er.ethz.ch/media/publications/social-systems-finance/bubbles_and_crashes_theory_empirical_analyses.html

K-means Clustering for Critical Time Prediction

- ▶ Following the methodology established in Gerlach, Demos and Sornette [1], we employ k-means clustering to our LPPLS calibration results to find possible future scenarios for the ending of a bubble. We are particularly interested in providing a prediction for the critical time t_c which, according to the mathematical definition of the log-periodic power law model, is the time at which we can expect the change of regime in the price of an asset to occur.
- ▶ As we fit the LPPLS model on many different time window sizes, we often encounter variation in the LPPLS fit parameter sets that are obtained from each fit. The higher the similarity of the resulting parameter sets, the more we trust in their prediction for the critical time parameter. This idea of enhanced believability of results when they repetitively occur on multiple time scales is also the foundation of the DS LPPLS Confidence Indicator.
- ▶ We detect similar LPPLS fits by applying k-means clustering to the set of LPPLS calibrations over all selected time windows. Here, we report the mean critical times $\mu_{(t_c)}$ and standard deviations $\sigma_{(t_c)}$ of the largest such cluster. Furthermore, as complement to the Confidence Indicator, we report the associated scenario probability of the biggest cluster, defined as the number of members in the largest cluster divided by the total number of fits. The scenario probability is therefore a measure similar to the LPPLS Confidence, however with the difference that no constraints are imposed on the parameters to find qualified fits for the LPPLS confidence index.

[1] J.-C. Gerlach, G. Demos and D. Sornette, Dissection of Bitcoin's Multiscale Bubble History from January 2012 to February 2018, Royal Society Open Science 6, 180643 (2019) (<https://ssrn.com/abstract=3164246>)

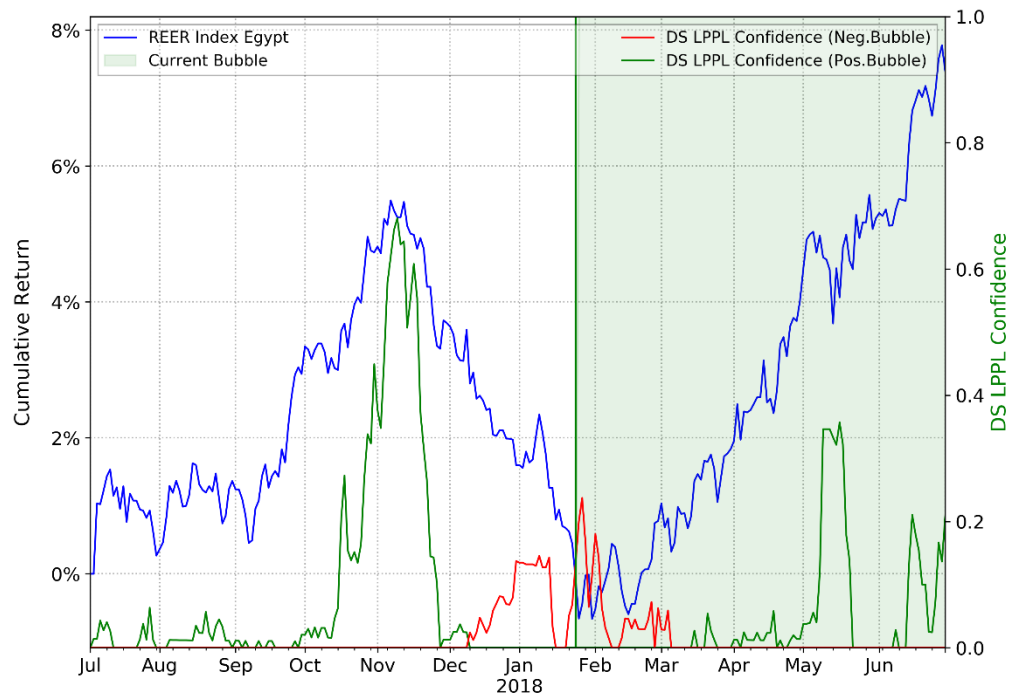
Result Presentation

- ▶ We present the monthly results of our bubble analysis in the form of a table such as the example given below.
- ▶ In each table, we separately list assets that are in a positive, respectively, negative bubble state. Furthermore, the table is divided into two sections, bubble data and cluster analysis.
- ▶ The first section provides asset and estimated bubble characteristics (size and duration), as well as the value of the confidence indicator. We rank assets according to their geometric average of the absolute of bubble size and confidence indicator. In this way, we incorporate the bubble size into the ranking.
- ▶ In the table section cluster analysis, the prediction data of the two most probable bubble burst scenarios are presented (see previous slide).

Bubble Data					Cluster Analysis			
	Name	Bubble Size bs [%]	Duration [days]	DS LPPL Confidence ci [%]	Geometric Average $\sqrt{bs \cdot ci}$ [%]	Critical Time Prediction μ_{tc}	σ_{tc} [days]	Scenario Probability [%]
Positive Bubbles								
1	iBoxx GEMX Kenya Index	11	276	24	16	2018-07-19	19	62
Negative Bubbles								
1								

Result Presentation

- For each asset class, we also supply the confidence indicator time series for the bubble assets listed in the tables. The plot shows the cumulative return (left y-scale, in %) of the analyzed price trajectory (blue) since the beginning of the plot time range. We also plot the time series of the positive (green) and negative (red) DS LPPLS Confidence indicators (right y-scale). The indicator time series are calculated by repetitively applying the procedure described on the slide 'The DS LPPLS Confidence Indicator' over moving window end times t_2 . Furthermore, if, at the last analyzed time, a non-zero indicator value results, i.e. the asset is presently in a bubble state, we outline the time interval for the positive (green shaded) or negative (red shaded) bubble from its beginning to present.



Real Effective Exchange Rate Indices

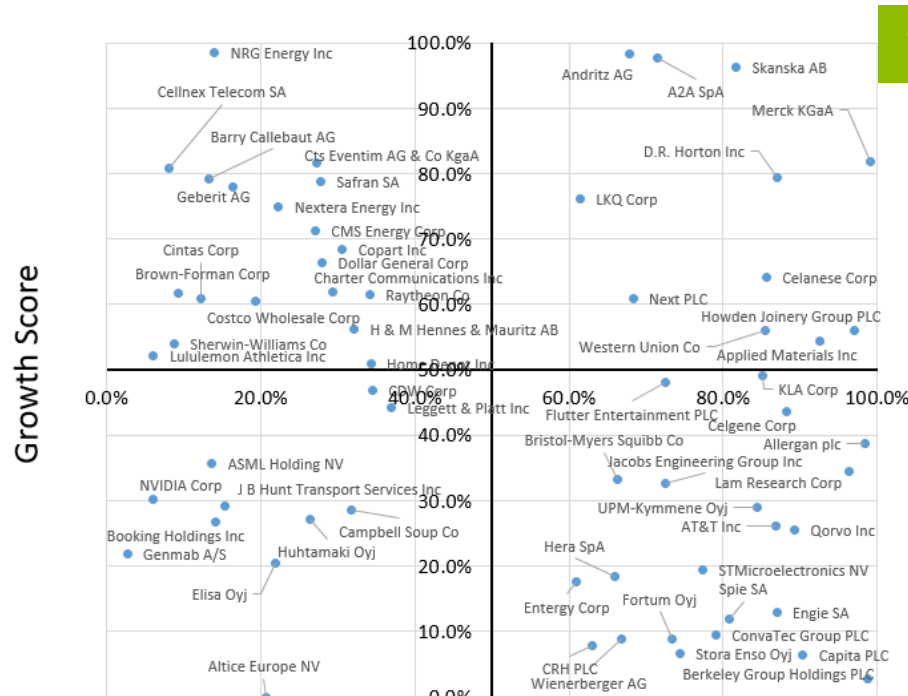
- ▶ 98 Real Effective Exchange Rate (REER) Indices for different currencies are investigated for bubble characteristics.
- ▶ The (here CPI-weighted) REER Indices are a measure for the trading competitiveness of the corresponding country.
- ▶ In contrast to single currency cross rates, the REER is a rather absolute measure of the domestic currency value because it is calculated versus a selection of other currencies.
- ▶ This has the advantage that, unlike with the methodologies that were used in previous reports, positive and negative bubbles in the value of the currency can clearly be distinguished, as visible in the table above.

Currencies – Principal Component Analysis

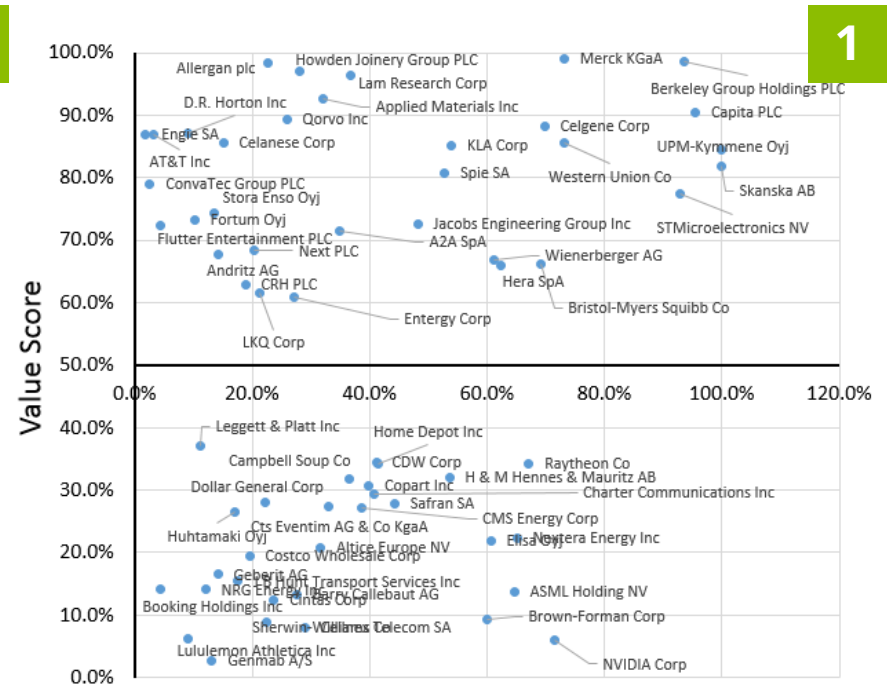
- ▶ As an alternative method to generate a base currency time series from a variety of the currency's cross rates, we apply a principal component analysis (PCA). In total, we perform the PCA for 10 major fiat currencies. For each currency, more than 100 cross rates are grouped into a time series dataset, which, using PCA, is then condensed down into a single time series to which we apply our LPPLS analysis. The time series is assembled according to the weights of the first principal component (PC1) of the dataset. It is used as an aggregate representation of all currency cross rates..
- ▶ More precisely, taking for instance the Swiss franc as a base currency, we consider $N=100$ currency crosses expressing how much the Swiss franc is valued in these N other currencies. We calculate N time series of returns for the each cross with the base currency (Swiss franc). We then perform a PCA on the dataset of these N return time series. The corresponding PC1 represents the common factor explaining the largest part of the variance of the returns of these N time series. It is interpreted as the embodiment of the real Swiss franc dynamics, filtering out the impact of the other currencies. The LPPLS algorithm is then applied to this equivalent time series.
- ▶ The plot given in the first part of the report depicts the equivalent time series constructed from the PC1 for each of the ten currency pairs. In the legend, the explained variance of the PC1 is given for each currency. A high explained variance means that most of the crosses of the base currency with other currencies move in a correlated way, which can be interpreted as reflecting a common factor, namely the base currency's intrinsic value dynamics.

Single Stocks

Quadrants 1 and 2 – strong positive bubble signals with strong (respectively weak) fundamentals



1



1

2

Value Score

Aggregated bubble score

2

Single Stocks

Quadrants 3 and 4 – strong negative bubble signals with weak (respectively strong) fundamentals

