

The FCO Cockpit Global Bubble Status Report

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The Financial Crisis Observatory (FCO) monthly report discusses the historical evolution of bubbles in and between different asset classes and geographies.

It 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.

In the first part of this report, we present the state of the world, based on the analysis of the systemic assets. In the second part, we zoom in on the bubble behavior of single stocks and discuss some specific cases.

To new readers, we recommend proceeding to the appendix for more detailed information about the methodology and procedures applied in this report.

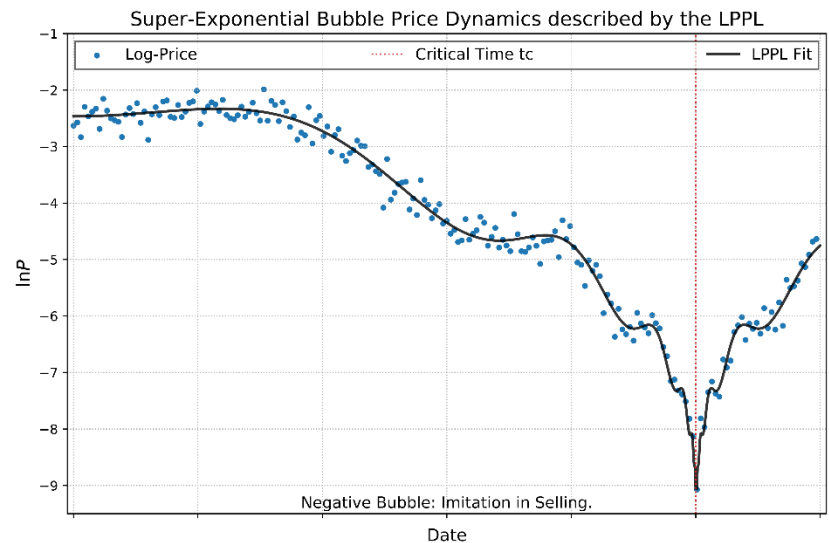
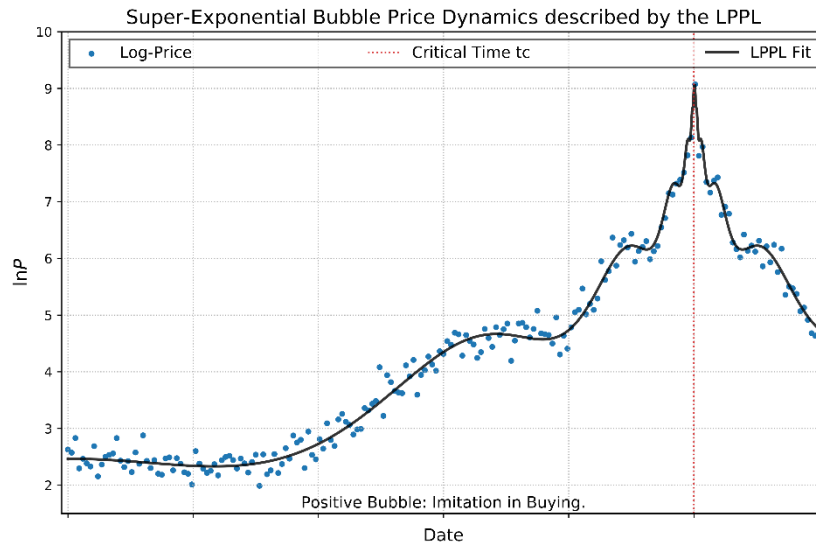
For an intuitive explanation of the methodology and the specifics of the indicators that are used in this report, we refer to: D. Sornette and P. Cauwels, Financial bubbles: mechanisms and diagnostics. Review of Behavioral Economics 2 (3), 279- 305 (2015)

<http://arxiv.org/abs/1404.2140> and <http://ssrn.com/abstract=2423790>

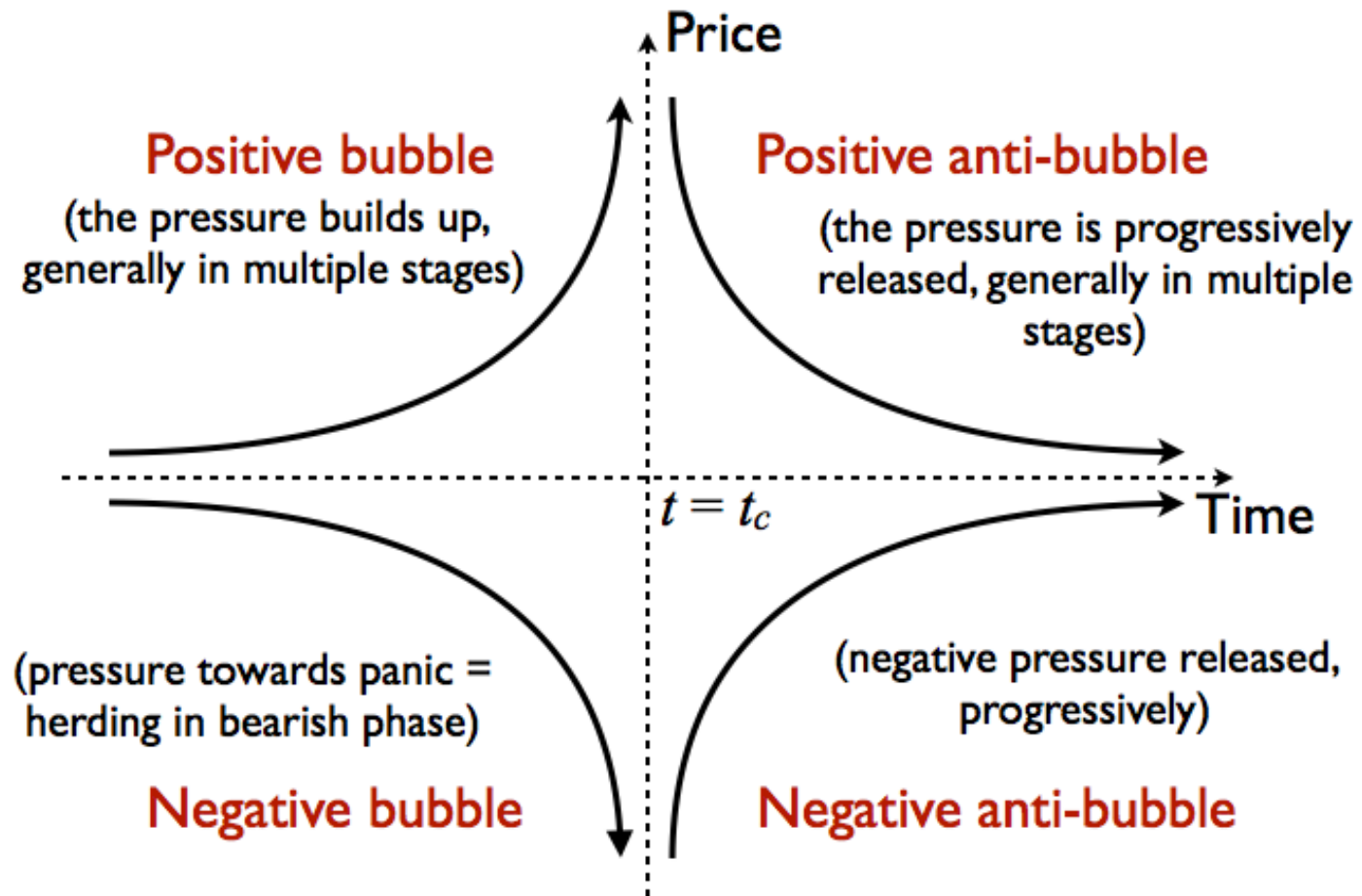
We use the Log-Periodic Power Law Singularity (LPPLS) model to hunt for the distinct fingerprint of **Financial Bubbles**. Basic assumptions of the model are:

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.

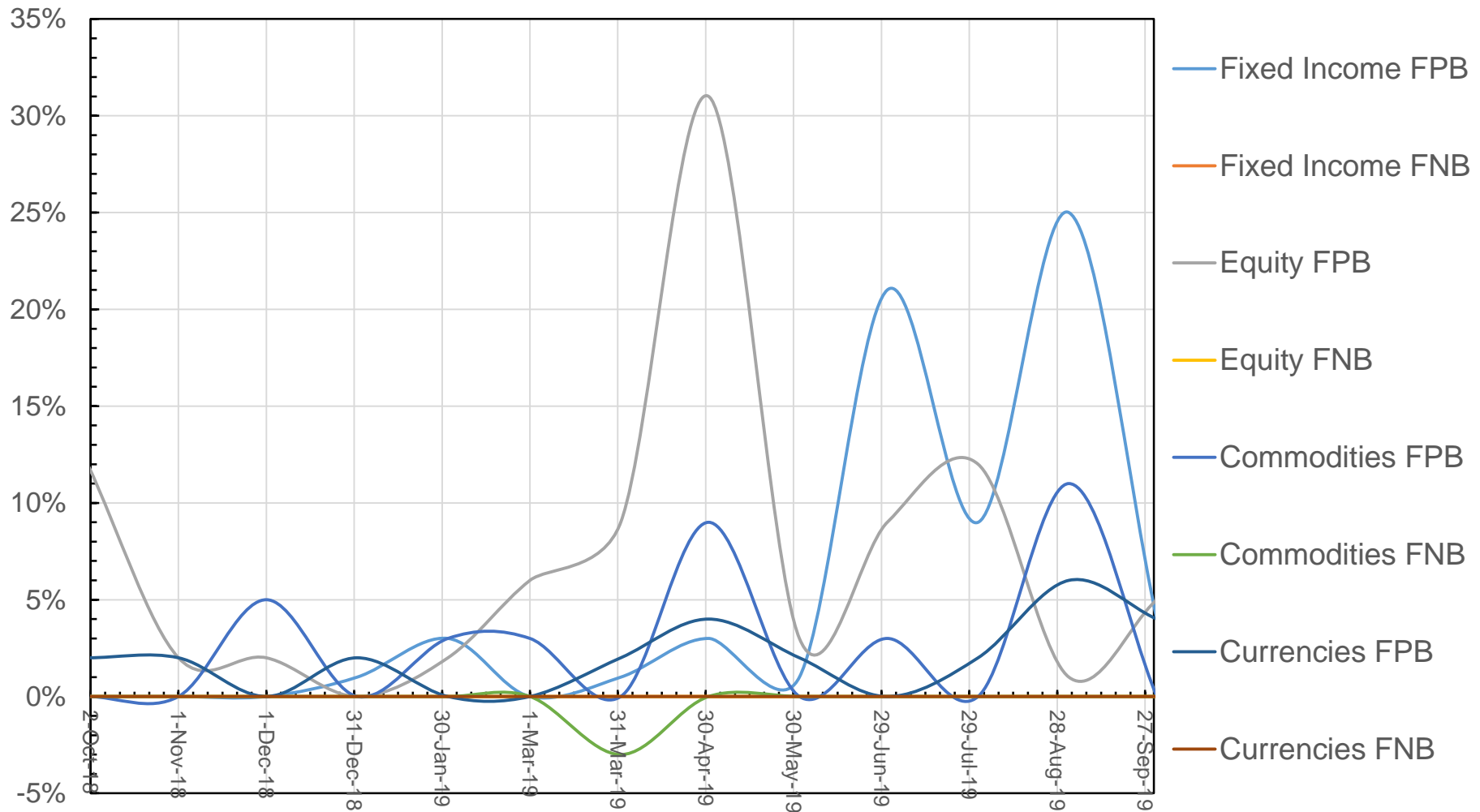


Bubble Regimes



General Results – The Big Picture

Historical evolution of the fraction of assets within an asset class that show significant bubble signals



FPB – Fraction of Positive Bubbles, FNB – Fraction of Negative Bubbles

General Results – This Month's Overview

Category	Analyzed Assets	Fraction of Pos. Bubbles [%]	Fraction of Neg. Bubbles [%]
Fixed Income	155	4	0
Government Bonds	55	7	0
Finance and Insurance	21	0	0
Corporate Bonds	79	3	0
Equity	306	5	0
Country Indices	67	1	0
Europe	36	3	0
United States	203	7	0
Commodities	23	0	0
Forex	48	4	0

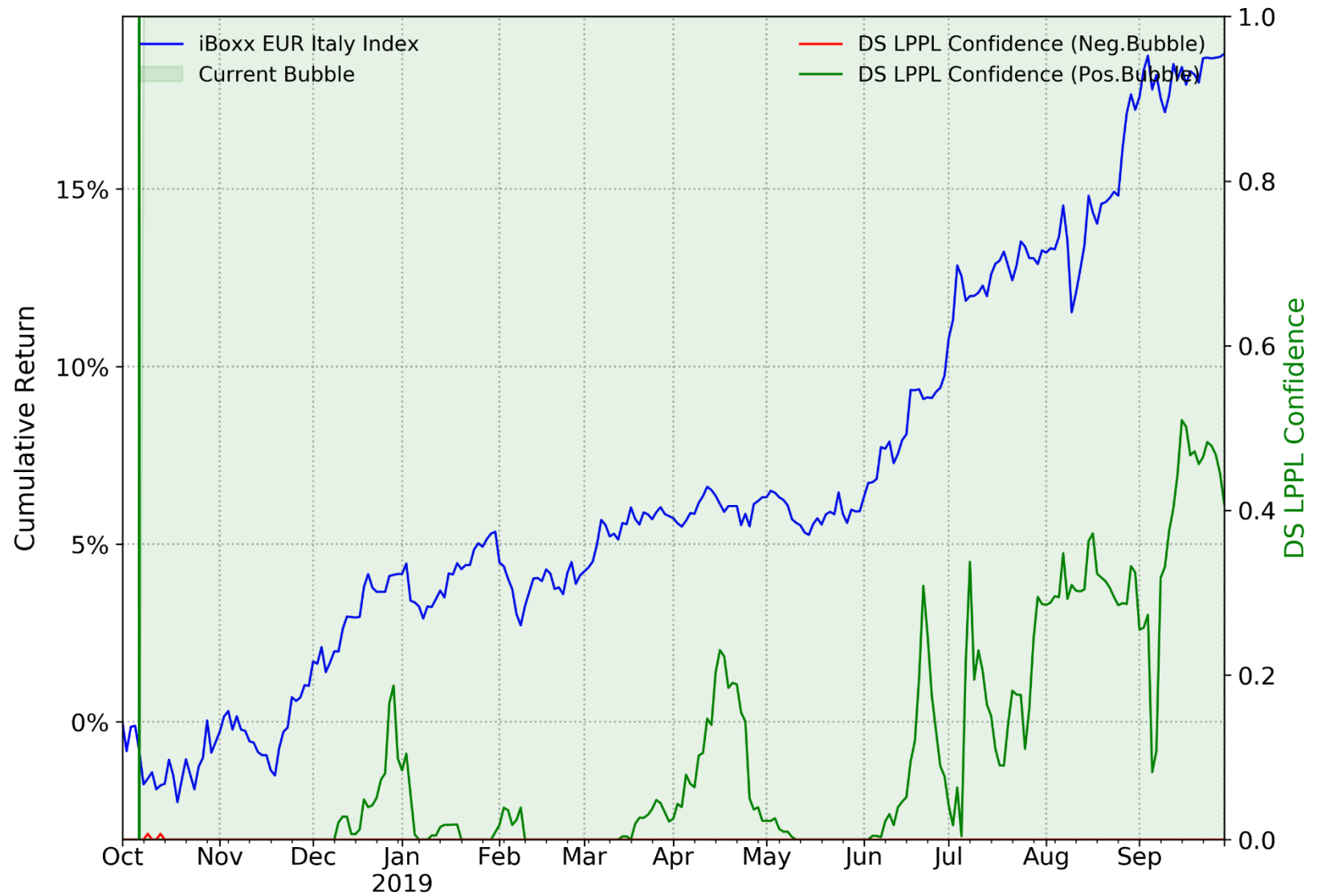
At the beginning of October, the number of bubble signals in the fixed income and commodities sectors decreases from the previous month's peak in bubble activity. In the equity and forex sectors, the activity remains at a low level.

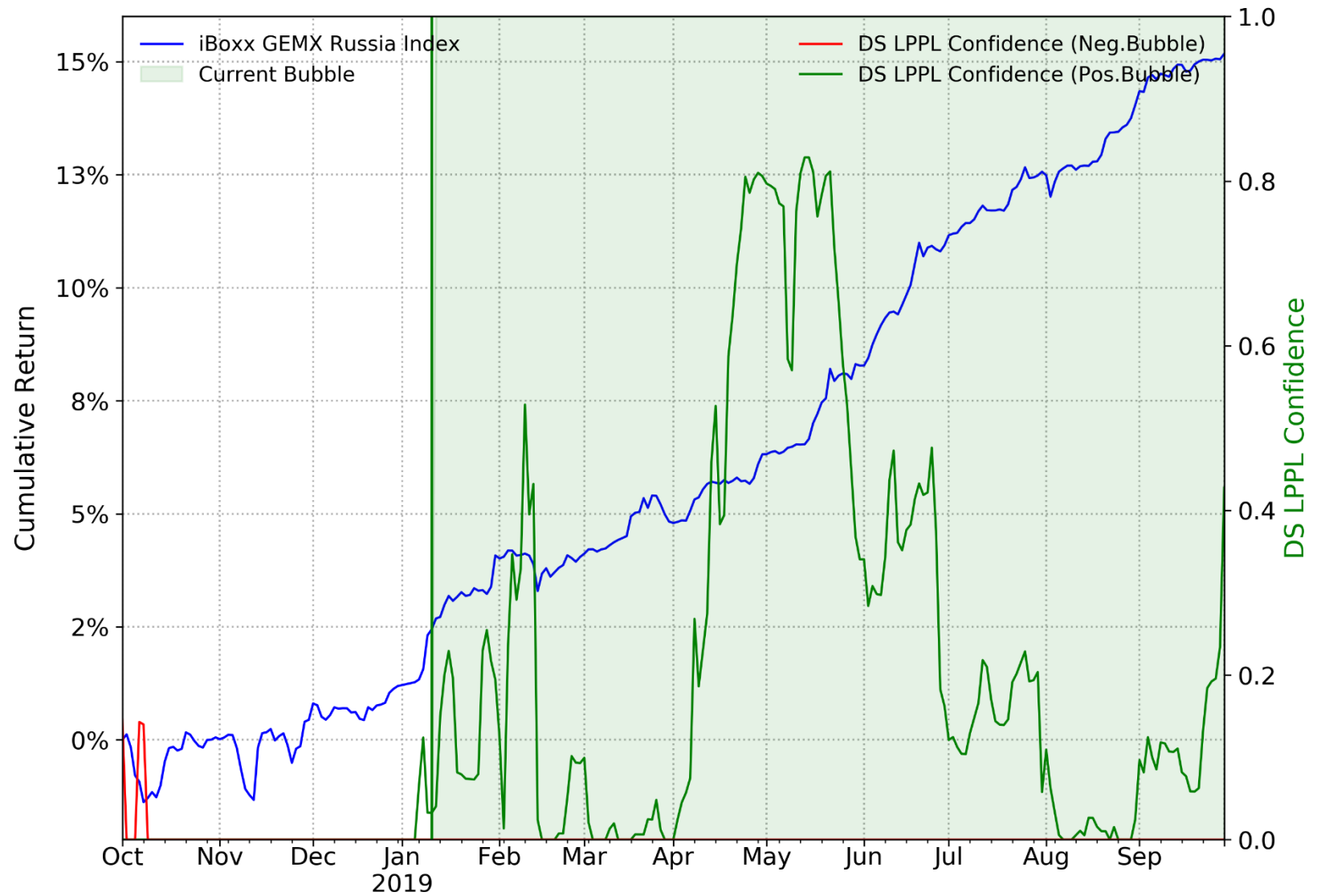
Fixed Income – Government Bonds

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 Mexico 10+ Index	25	285	34	29	2020-01-18	25	75
2	iBoxx EUR Italy Index	15	235	41	25	2019-10-03	2	28
3	iBoxx GEMX Russia Index	12	263	44	23	2019-09-30		29

The iBoxx Mexico Corporate Bond Index reappears at the top of our list of bubble signals. The estimated bubble size increases by 3% to 25% month-to-month. The confidence indicator increases from 29% to now 34%. Thus, the bubble is still in the growth phase and will likely continue to grow. This is also confirmed by the fact that the most likely predicted bubble scenario predicts the change of regime to occur in early 2020. Note that the associated probability of the scenario is quite high at 75%. The high standard deviation of the predicted critical time is explained by the fact that the forecast reaches quite far into the future. We will continue monitoring this index in future reports and investigate whether the scenario prediction remains stable. We show indicator plots for all listed indices on the following slides.



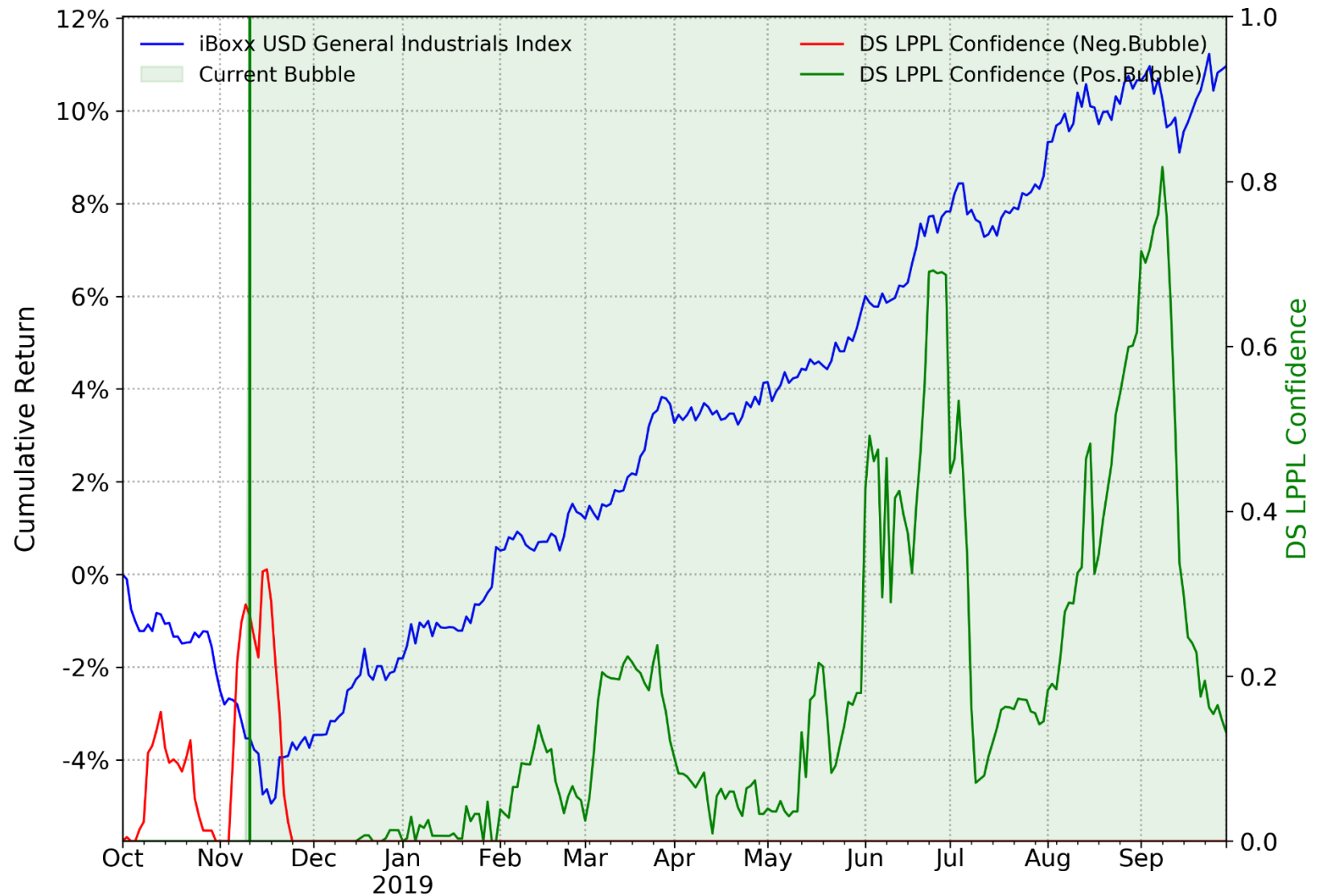


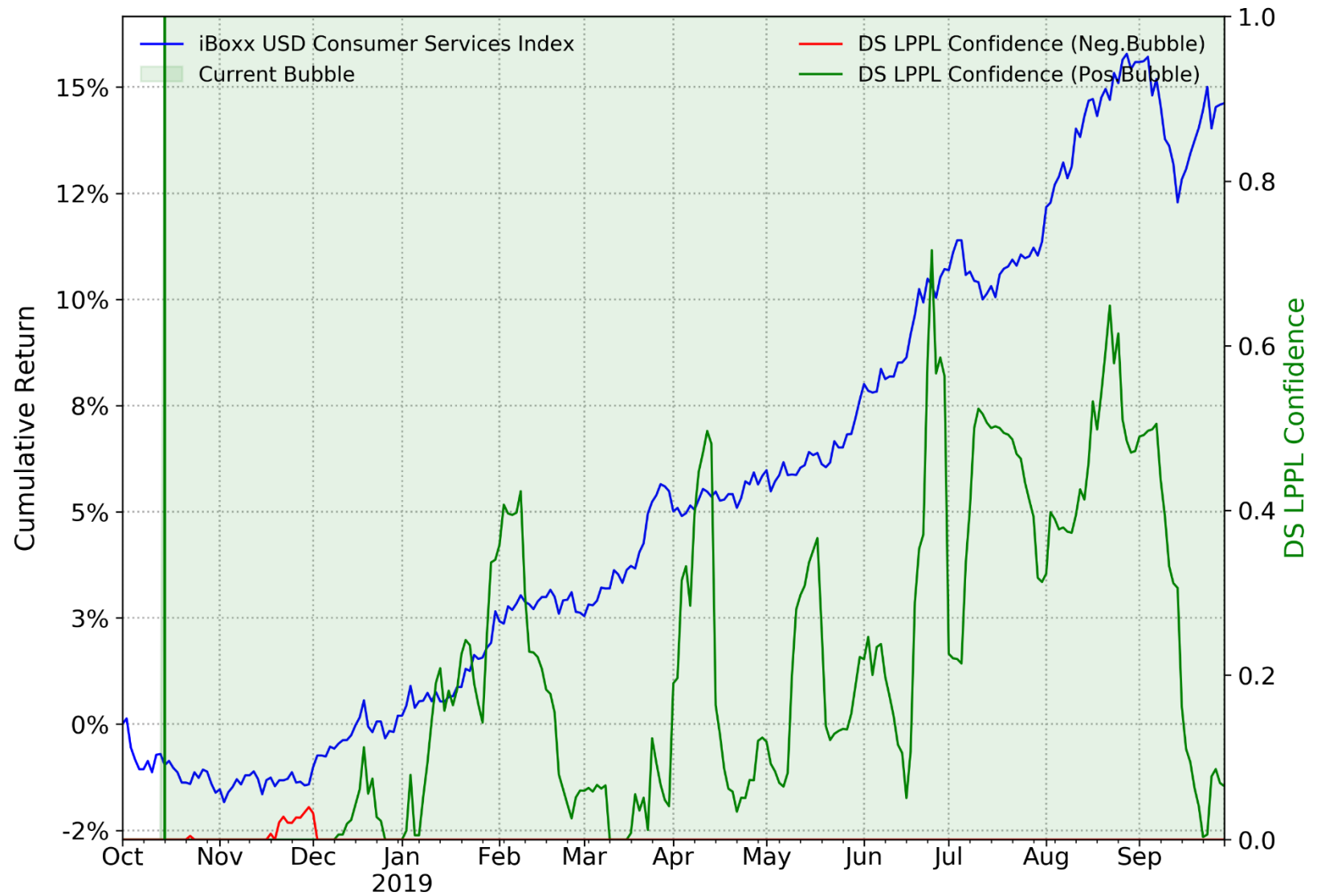


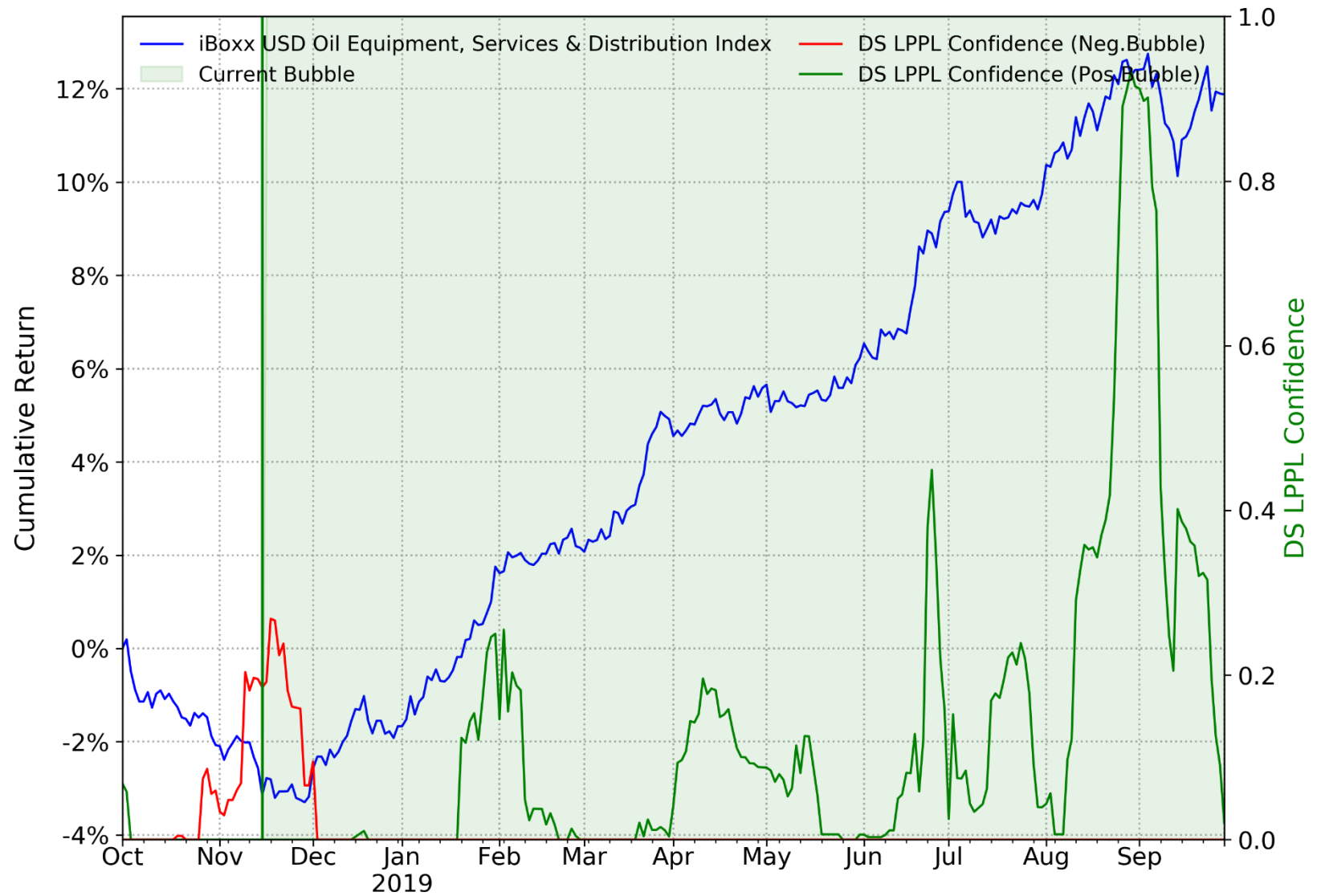
Fixed Income – Corporate Bonds

Bubble Data					Cluster Analysis			
	Name	Bubble Size <i>bs</i> [%]	Duration [<i>days</i>]	DS LPPL Confidence <i>ci</i> [%]	Geometric Average $\sqrt{bs \cdot ci}$ [%]	Critical Time Prediction μ_{t_c}	σ_{t_c} [<i>days</i>]	Scenario Probability [%]
Positive Bubbles								
1	iBoxx USD General Industrials Index	15	324	13	14	2019-09-30	1	47
2	iBoxx USD Consumer Services Index	15	365	10	12	2019-09-30		32

Amongst Corporate Bond Indices, we detect significant bubble activity on the General Industrials (already previously listed) and Consumer Services Indices. The sizes of both bubbles are estimated at 15%, and with low values of the confidence indicator. This means that the amount of super-exponential dynamics measured over different timescales is still low. Looking at the indicator plots for both indices on the following slides, we observe a much larger peak of the confidence indicator during the previous month. The indicator signal has sharply decreased as a result of a minor correction. The same has happened to the previously listed Oil Equipment, Services and Distribution Index which is also shown. Although indicator levels are temporarily declining, we should carefully observe the further evolution of the indices, because the previous growth of the indices was much larger than the small recent correction. This might mean that the price still deviates from its fundamental value.



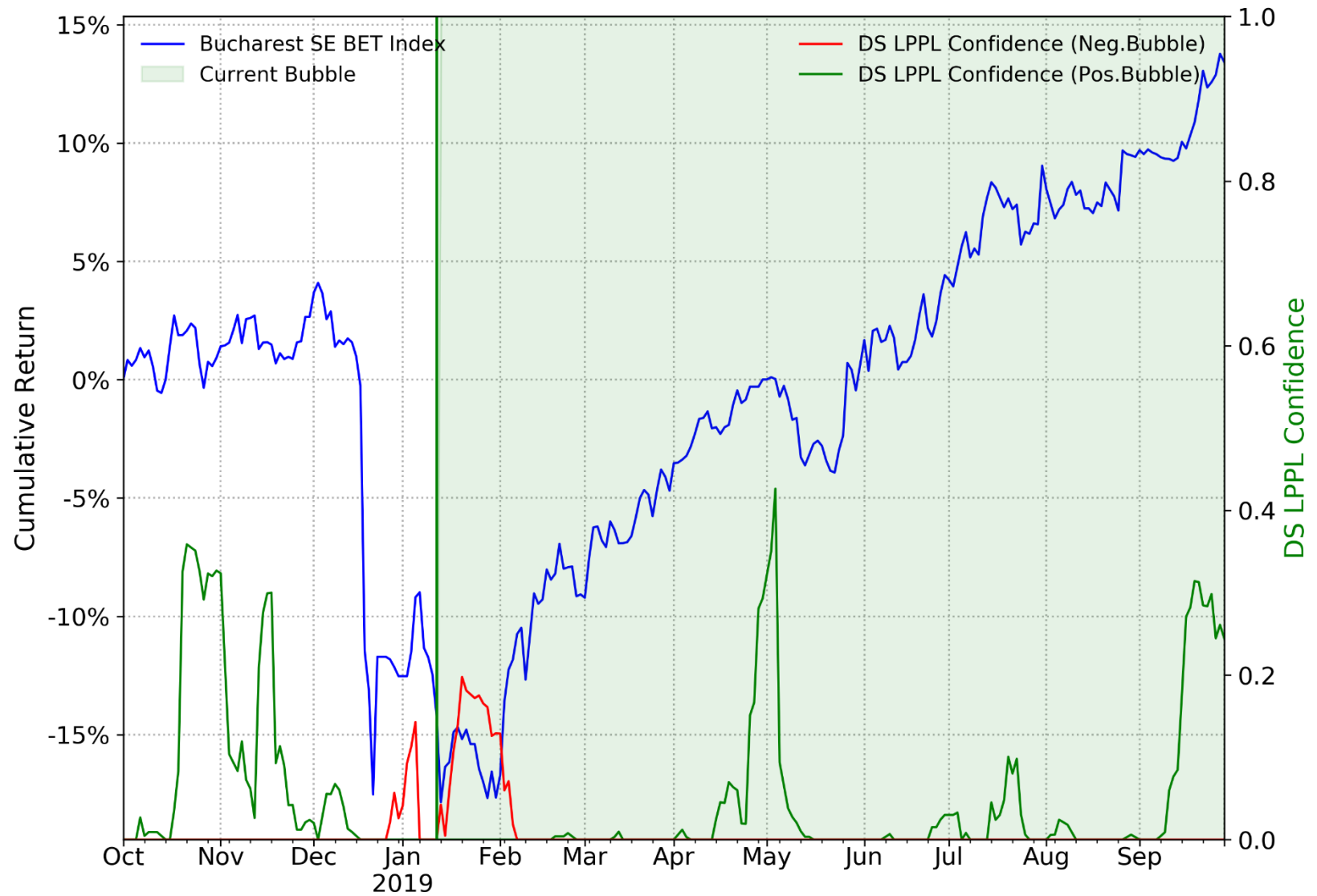




Equities – Country Indices

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	Bucharest SE BET Index	32	262	24	28	2019-10-13	12

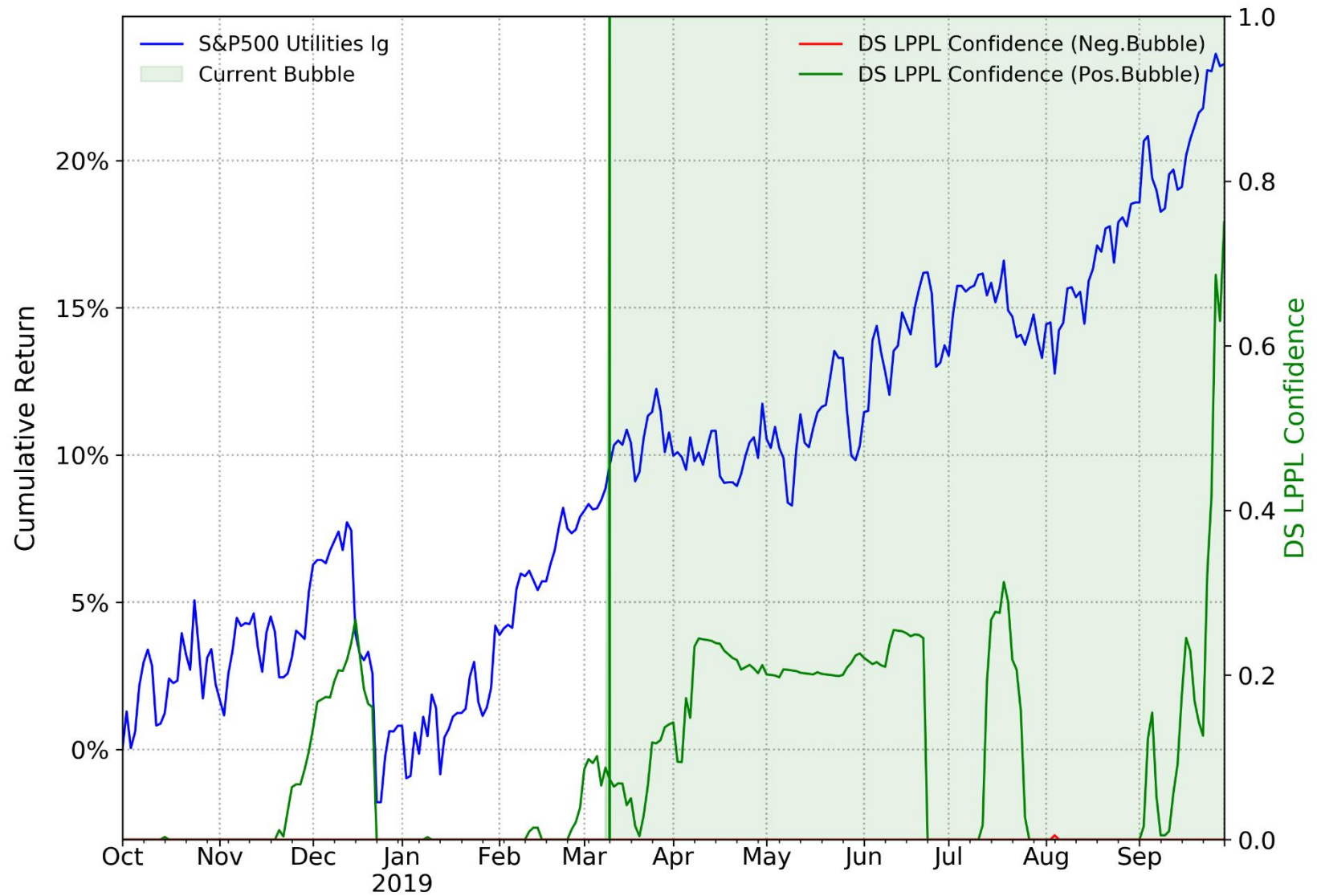
In the equity country index analysis, we detect a single bubble on the Romanian Index. The measured bubble size amounts to 32% at a value of the confidence indicator of 24%. As we see on the following slide, the index had previously undergone a strong correction of about 15% in the beginning of 2019. The turning point of this correction has been accurately pinpointed by our negative bubble indicator. In the subsequent period throughout 2019, the index has recovered by more than 30% to a new high.

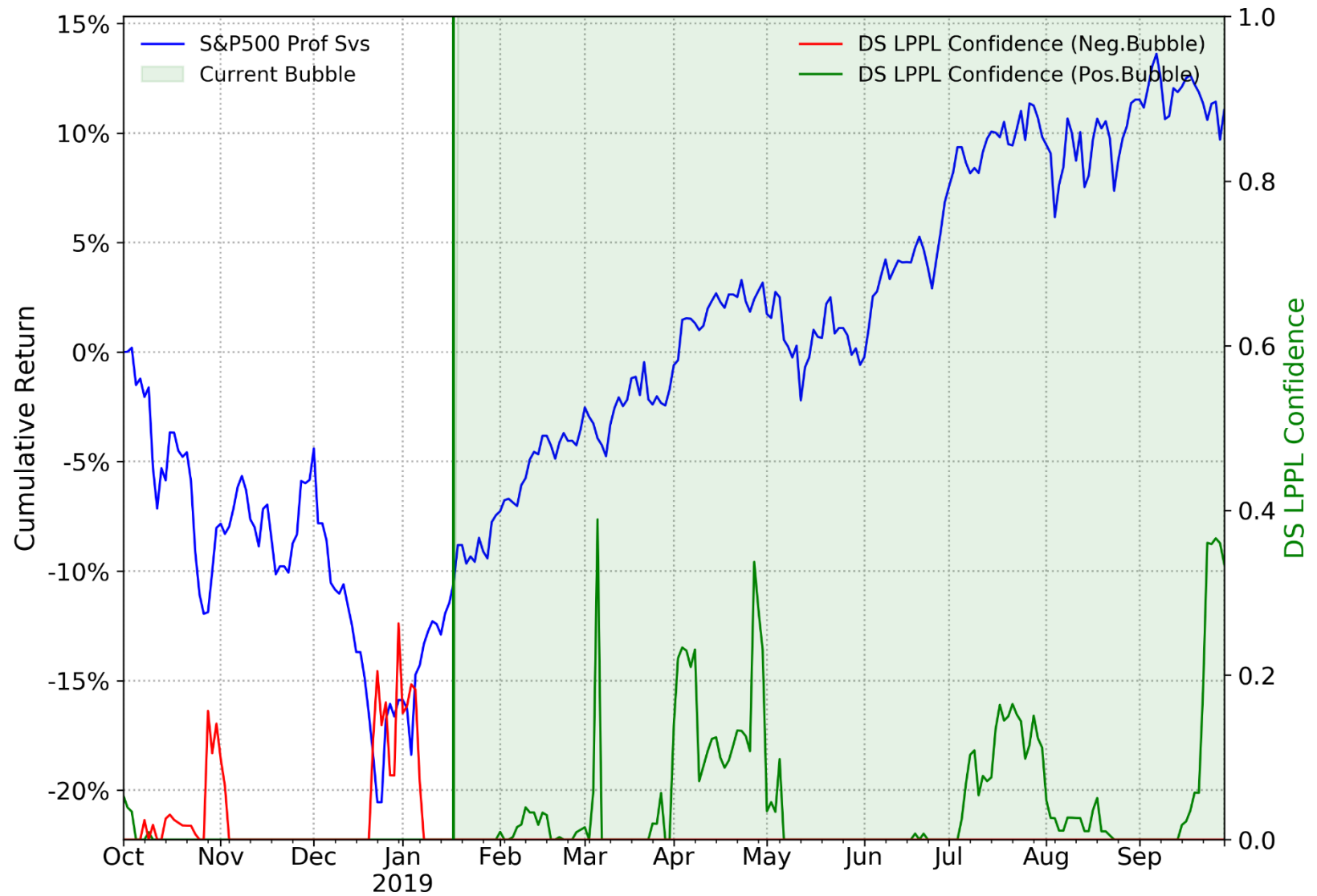


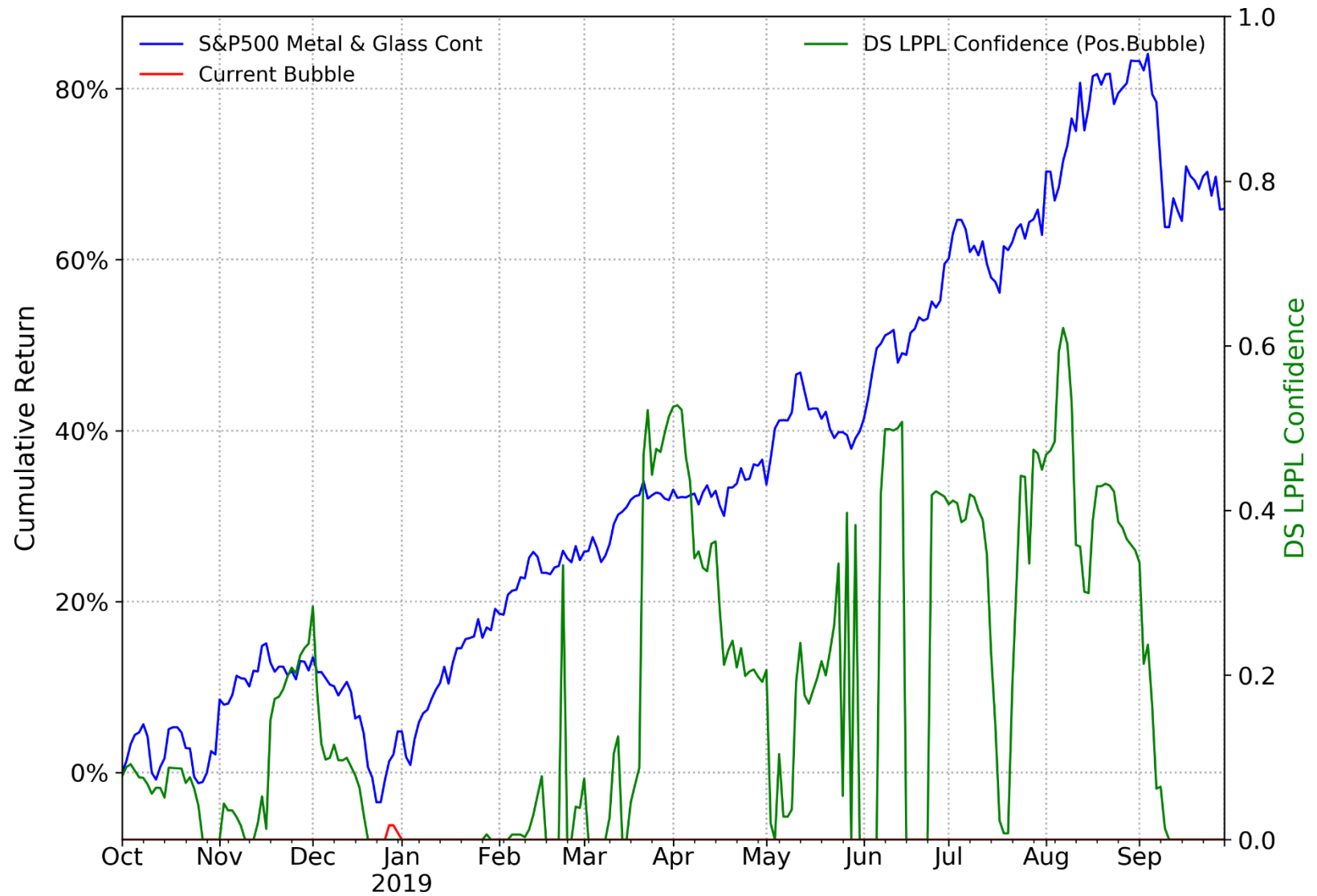
Equities – United States

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	S&P500 Utilities lg	12	205	75	31	2019-10-08	1	86
2	S&P500 Es Utilities	12	205	75	31	2019-10-08	1	86
3	S&P500 Prof Svs	24	256	33	28	2019-12-06	12	57
4	S&P500 Resh/Cnsl Svs	25	255	29	27	2019-12-26	18	58
5	S&P500 Fd/Staples Rtl	23	277	25	24	2019-10-23	14	68

At the top of the US Equity sector list of bubble signals, we detect positive bubble activity on the Utilities sub-indices of the S&P 500 family. Detected bubble sizes reach from 12% to 25%. Comparing this to the previous month's results of 19%-67%, this is somewhat lower. On the contrary, the confidence indicator for the listed bubbles shows higher values of 25%-75%, compared to 11%-35% for the indices listed in the previous report. In addition to the top 3 listed assets, we show the previously listed Metal & Glass Index which has indeed experienced a crash of more than 10-15% in the September, as forecasted in the previous report.

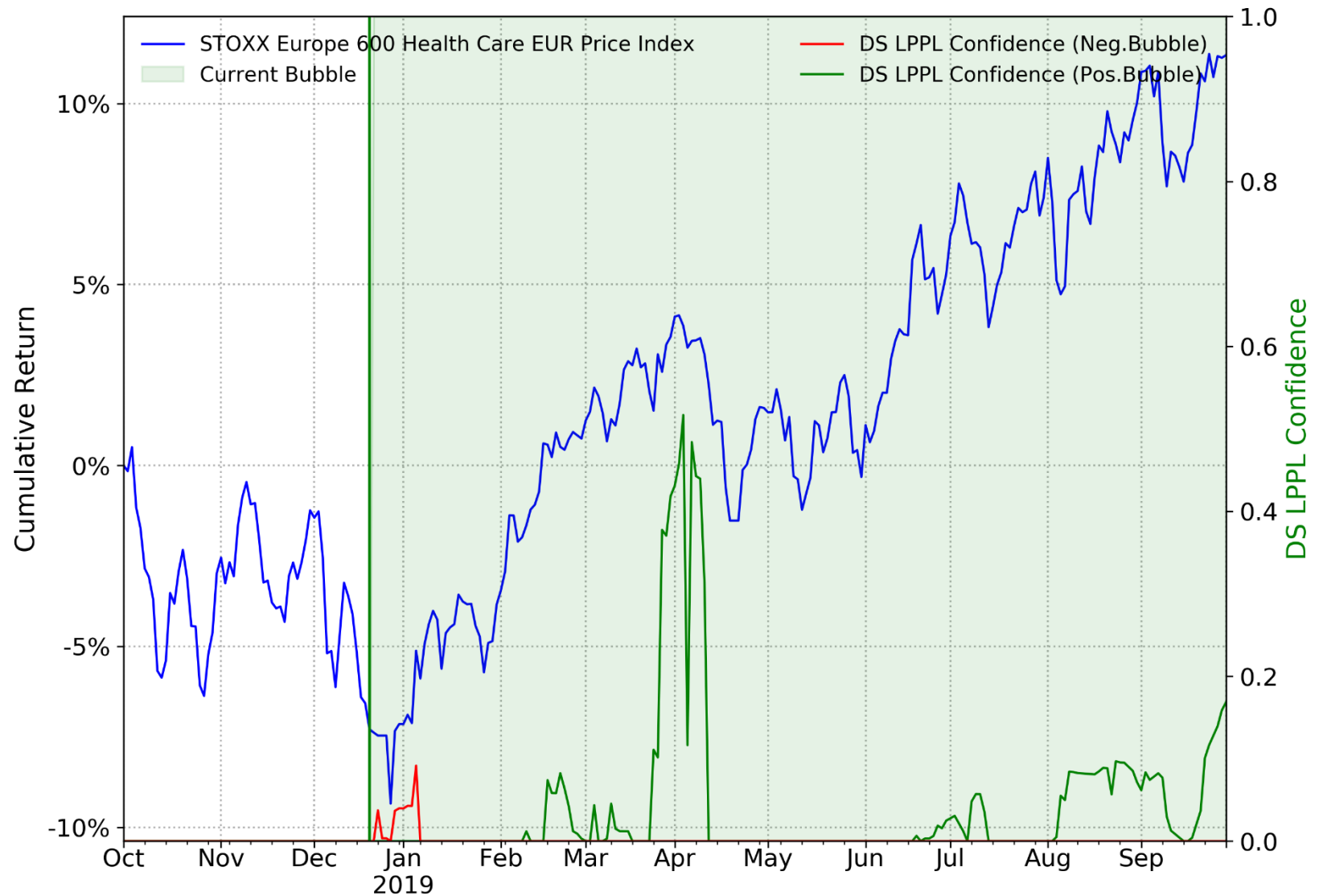


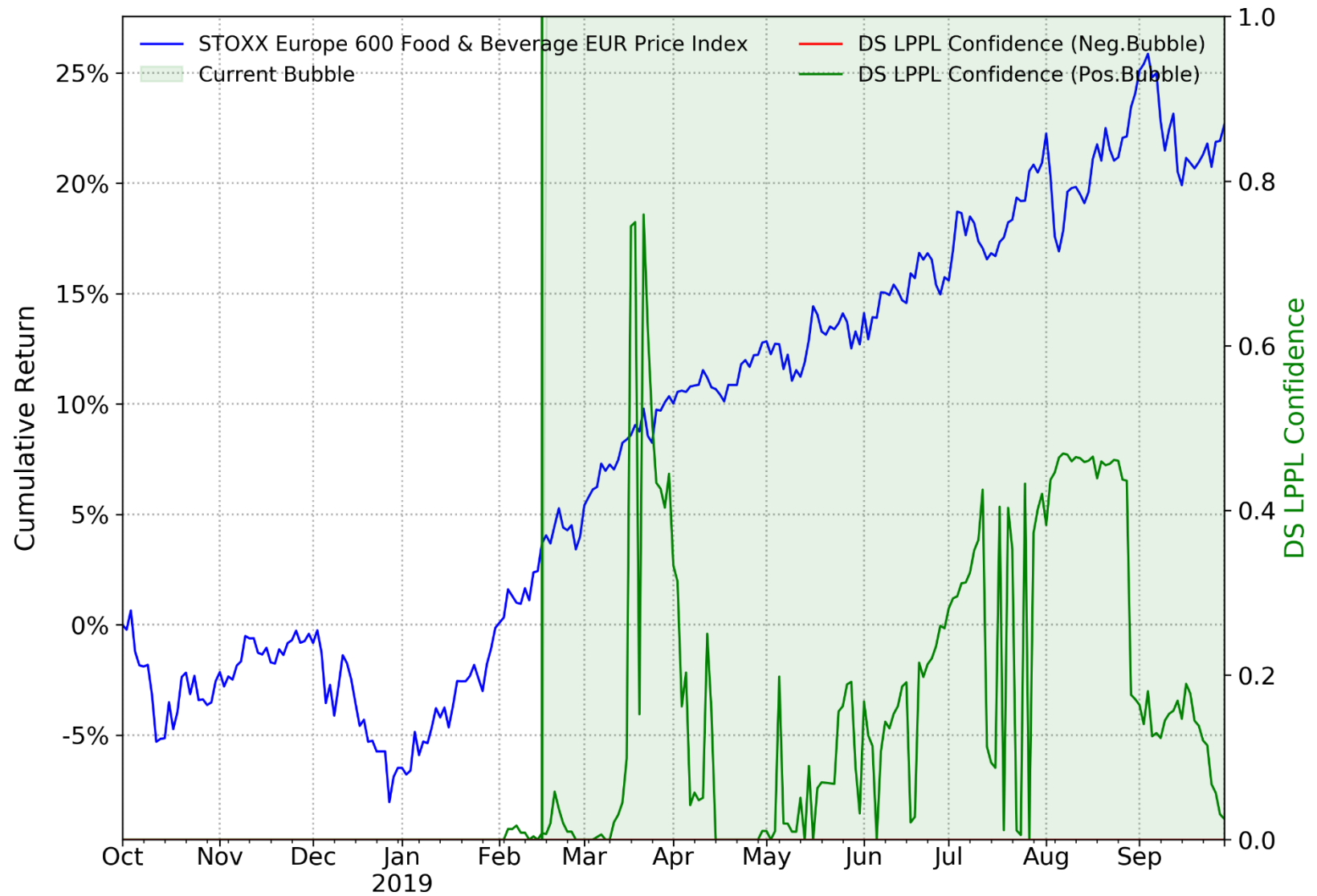




Bubble Data					Cluster Analysis			
Name	Bubble Size bs [%]	Duration [days]	DS LPPL Confidence ci [%]	Geometric Average $\sqrt{bs \cdot ci}$ [%]	Critical Time Prediction μ_{tc}	σ_{tc} [days]	Scenario Probability [%]	
Positive Bubbles								
1	STOXX Europe 600 Health Care EUR Price Index	11	158	16	13	2019-10-04	3	43

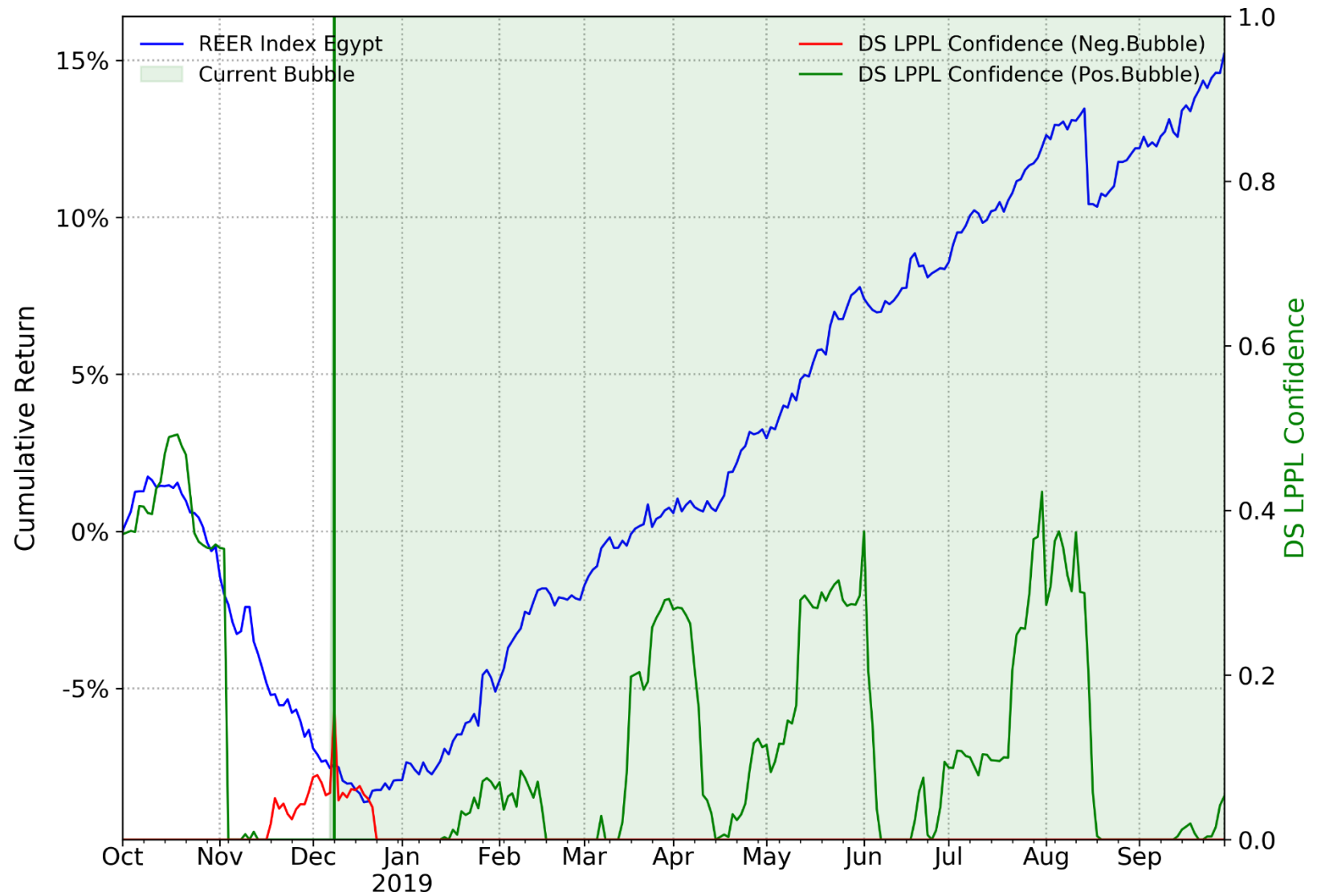
There is a single bubble detected for the European Health Care Equity index. Both bubble size and confidence indicator are still at low levels. Moreover, we present the further evolution of signals for the previously reported Food & Beverages sector. Note that the signals have decreased, because of a minor, recent drawdown.

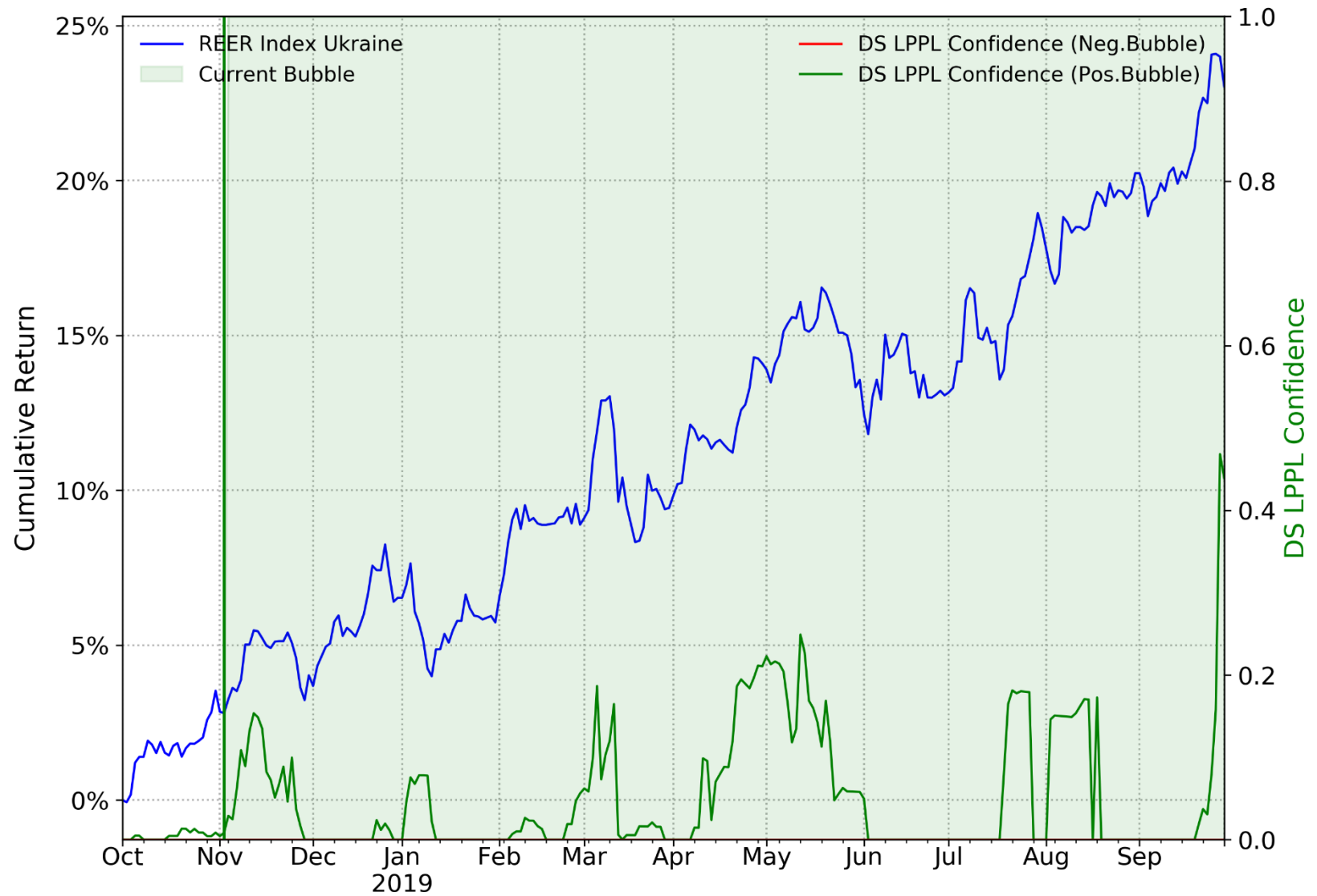




Bubble Data					Cluster Analysis			
	Name	Bubble Size bs [%]	Duration [days]	DS LPPL Confidence ci [%]	Geometric Average $\sqrt{bs \cdot ci}$ [%]	Critical Time Prediction μ_{t_c}	σ_{t_c}	Scenario Probability [%]
							[days]	
Positive Bubbles								
1	REER Index Egypt	24	303	23	23	2019-10-08	14	60
2	REER Index Ukraine	12	201	12	12	2019-10-05	4	64

Turning to the analysis of the currency sector, we detect positive bubble signals for two Real Effective Exchange Rate Indices. Both indices have continuously risen throughout the past year, indicating appreciation of the country's respective currencies. We already detected super-exponential signals multiple times on the REER Index Egypt. Compared to the previous report, the bubble size remains stable at 25% (24% previously), but the confidence indicator decreases (25% compared to 52% previously). For the Ukraine Index, we just recently observe a sharp peak in the indicator value, due to a recent increase of the index.

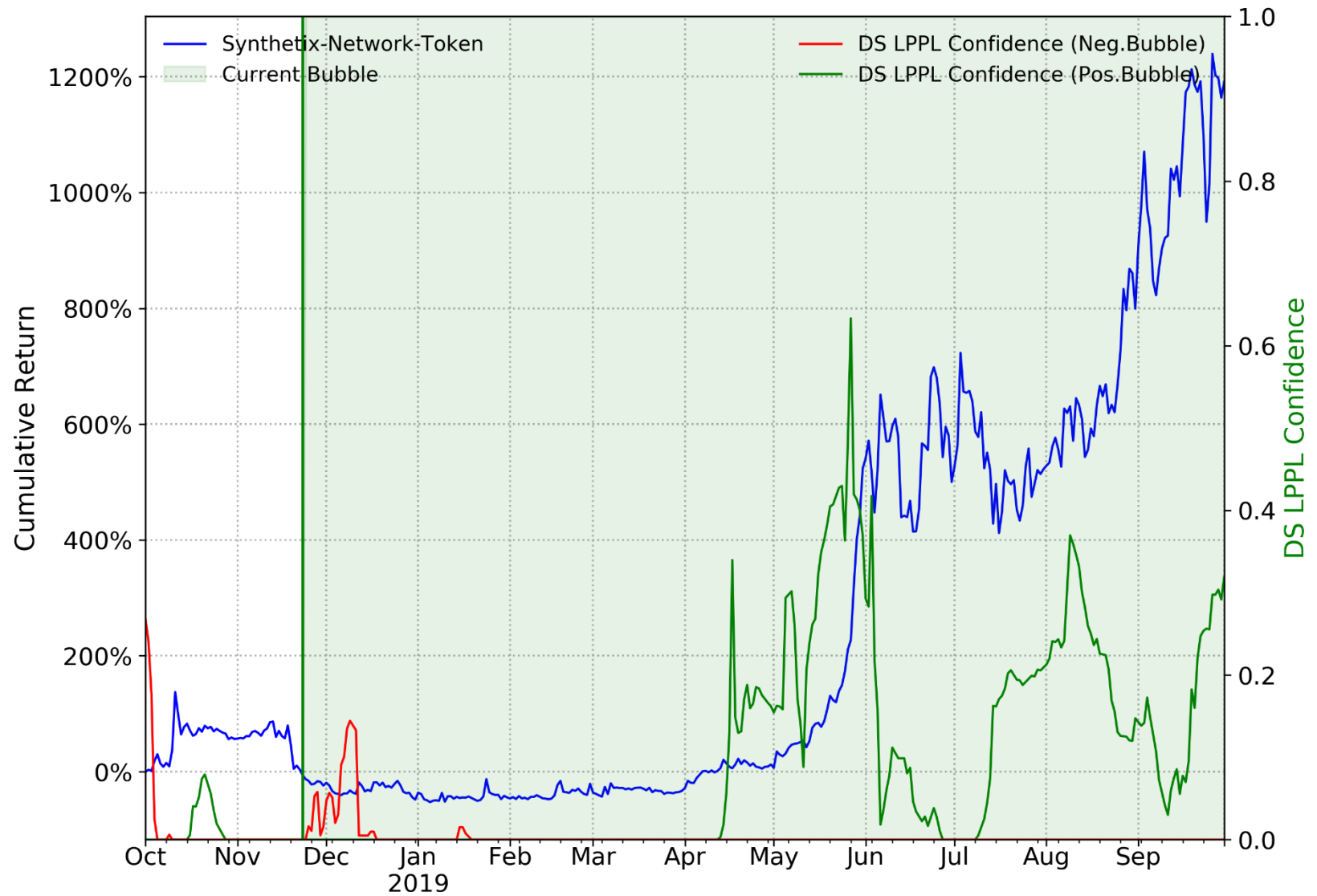


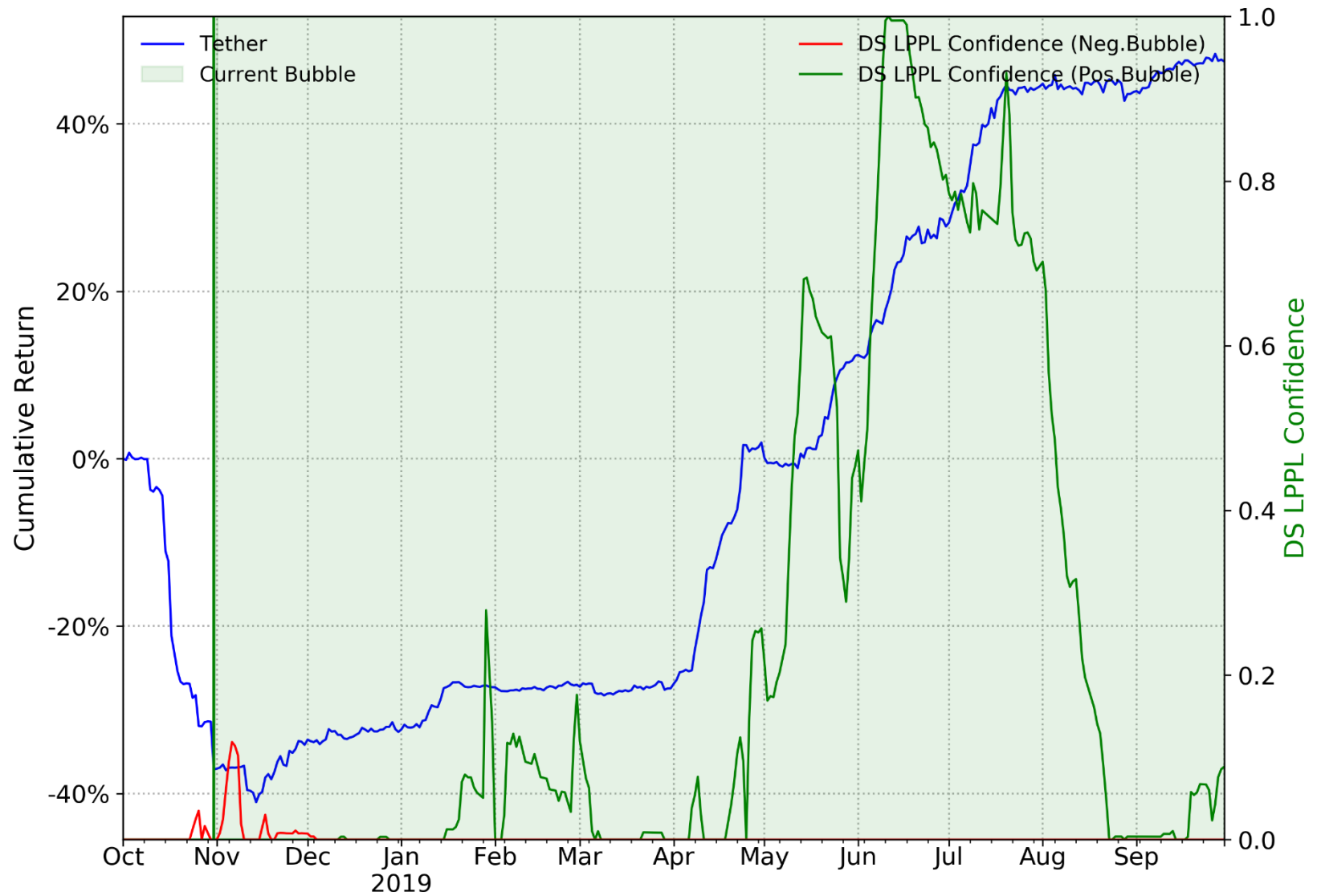


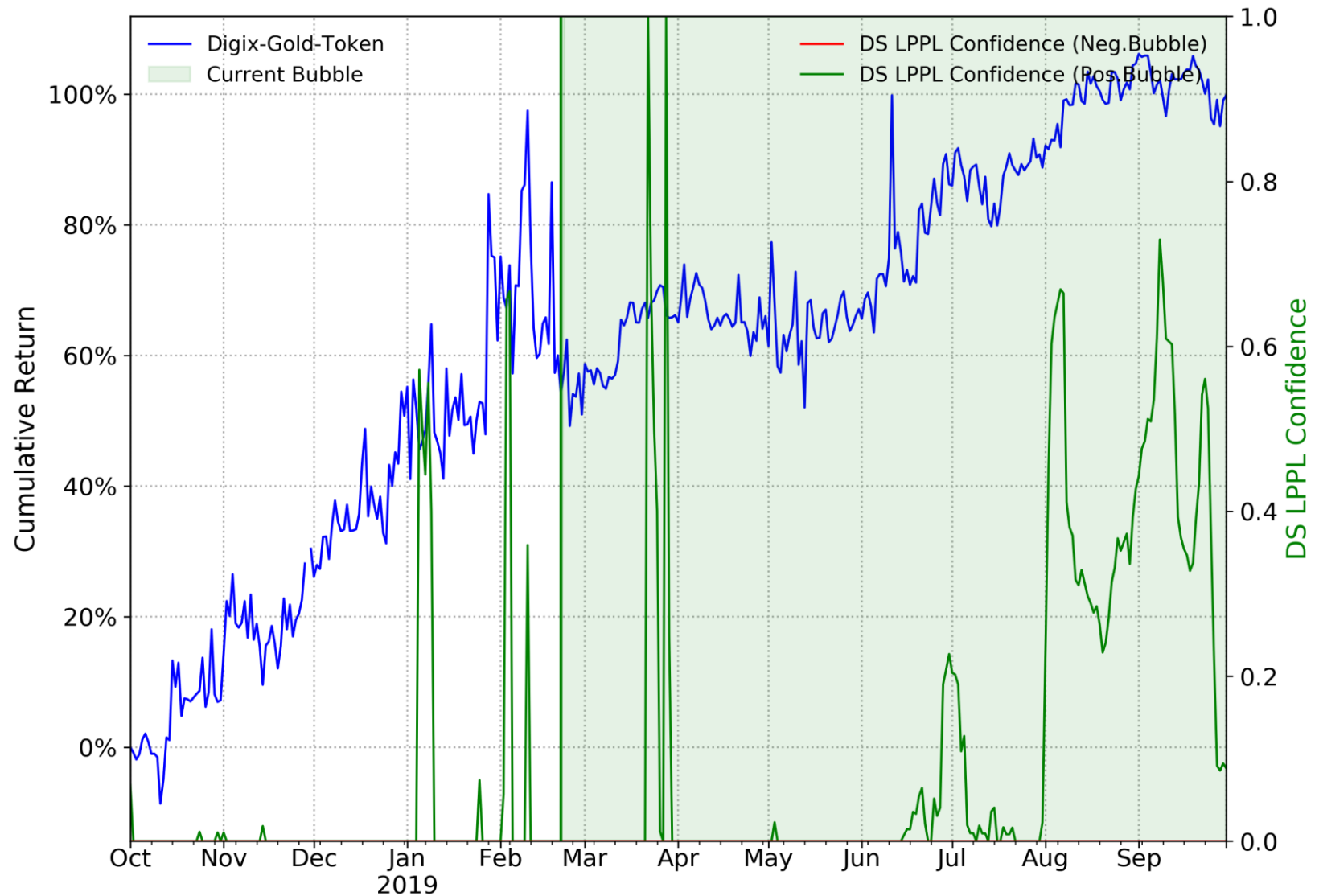
Bubble Data					Cluster Analysis				
Name		Bubble Size bs [%]	Duration [days]	DS LPPL Confidence ci [%]	Geometric Average $\sqrt{bs \cdot ci}$ [%]	Critical Time Prediction μ_{t_c}	σ_{t_c} [days]	Scenario Probability [%]	
Positive Bubbles									
1	Synthetic-Network-Token	158	124	20	56	2020-01-07	15	53	
2	Tether	47	152	22	32	2019-10-01	3	52	

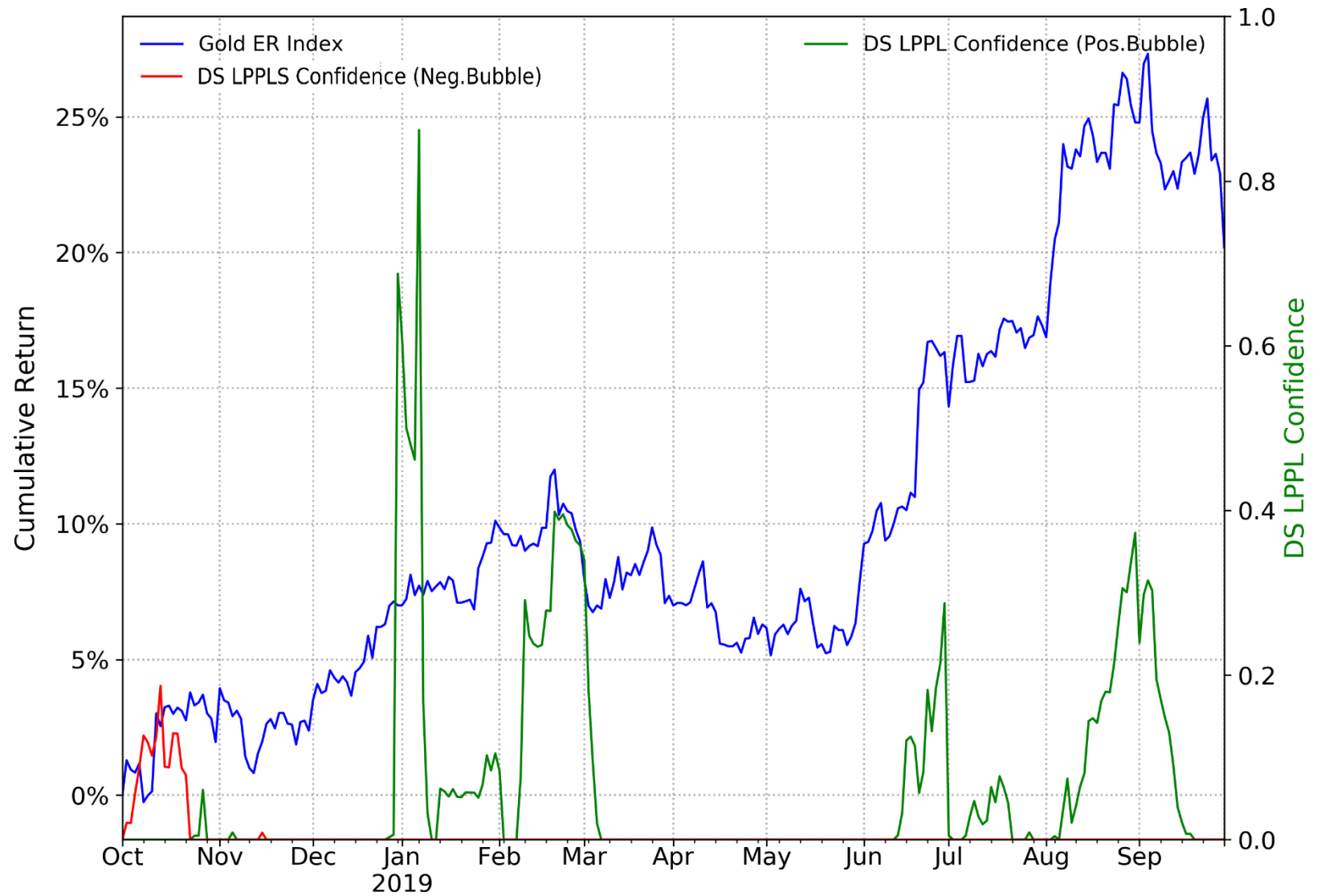
As in previous reports, we detect again a positive bubble signal on the market capitalization time series of Tether which has recently plateaued. Furthermore, we detect a large bubble on the Synthetic-Network-Token. The detected bubble size is 158%! As often observed for cryptocurrencies, the bubble size is not only large, but also extreme in relation to the duration over which the bubble has formed. In this case, the bubble has grown to this enormous size in only about 4 months. In our experience, due to this strong momentum and unsustainable growth, LPPLS predictions have proven to work quite well on cryptocurrencies in the past.

The previously listed Digix-Gold-Token has disappeared from our bubble list, again. In the previous report, we had detected positive bubble activity on both the token as well as the underlying base commodity, namely Gold. Thus, we show again the time series for both assets. As visible, the price of Gold has recently decreased.









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.

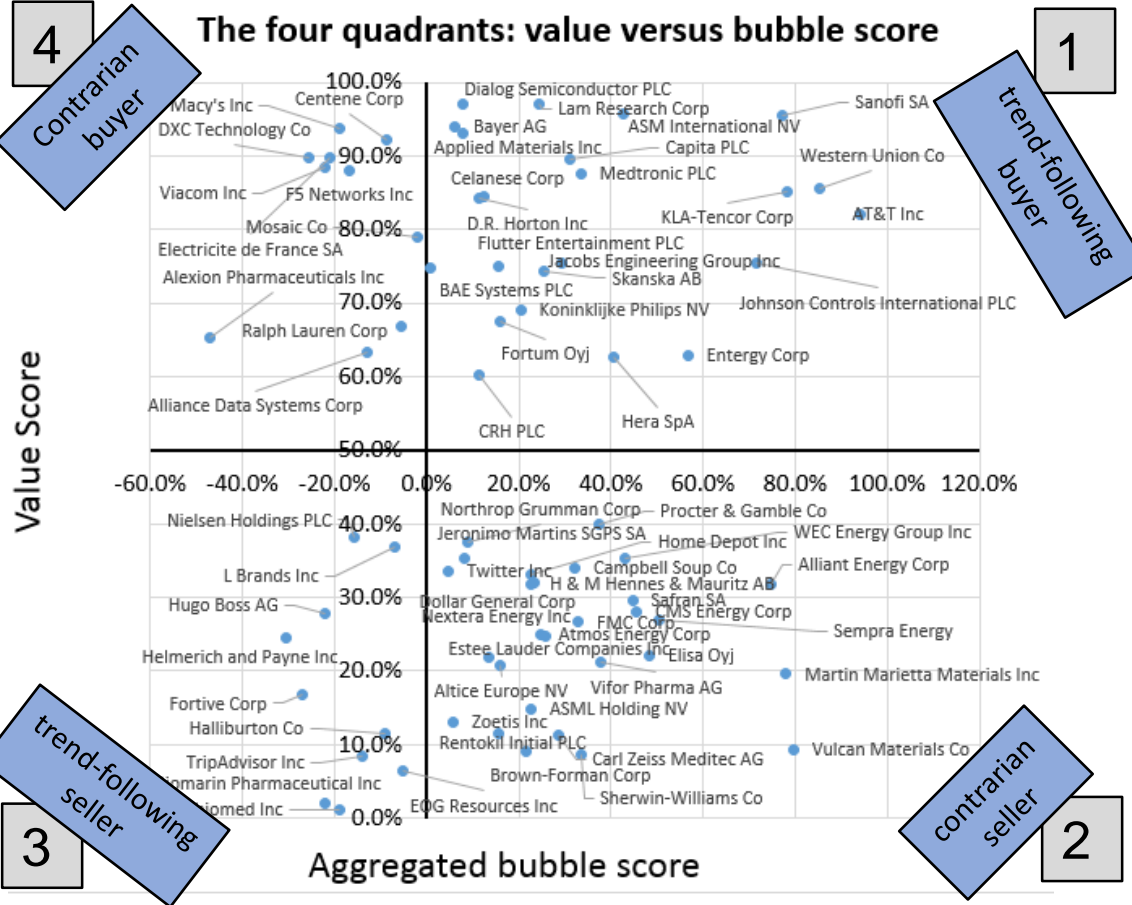
The stocks are the constituents of the Stoxx Europe 600, the S&P 500 and the Nasdaq 100 indices. From these, all doubles and stocks with incomplete data are removed. Because our financial strength indicators are specifically designed for corporates, all financial institutions are taken out of the set as well.

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).

Single Stocks

The four quadrants: value versus bubble score



By plotting the value score against the aggregated bubble score, we can divide the stocks into four quadrants*:

1. [Quadrant 1](#): Stocks with a strong positive bubble score and a strong value score (e.g. Hera SpA);
2. [Quadrant 2](#): Stocks with a strong positive bubble score and a weak value score (e.g. Twitter Inc);
3. [Quadrant 3](#): Stocks with a strong negative bubble score and a weak value score (e.g. Hugo Boss AG);
4. [Quadrant 4](#): Stocks with strong negative bubble score and a strong financial strength (e.g. Viacom Inc)

*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%.

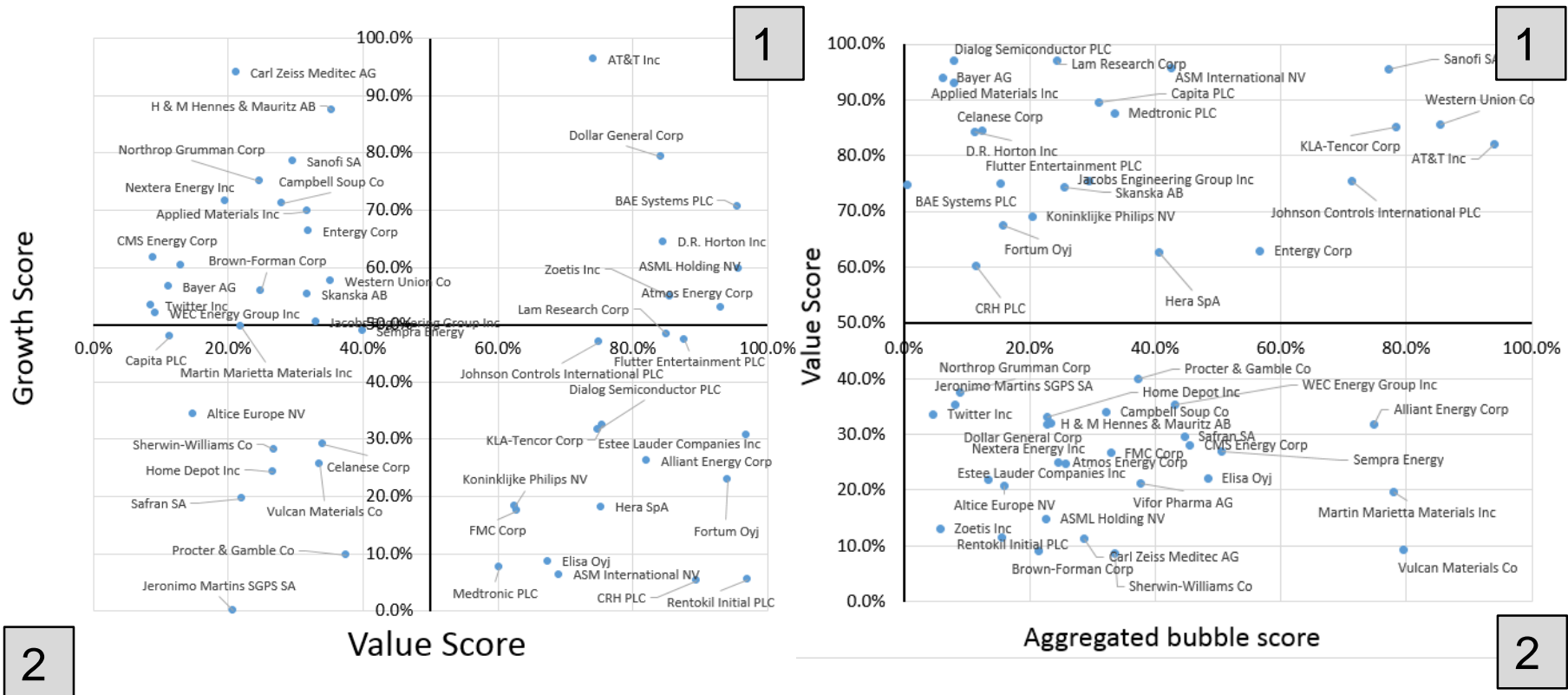
Each quadrant has its own specs:

1. 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.
2. 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.
3. 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.
4. 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.

Single Stocks

Quadrants 1 and 2 (stocks)

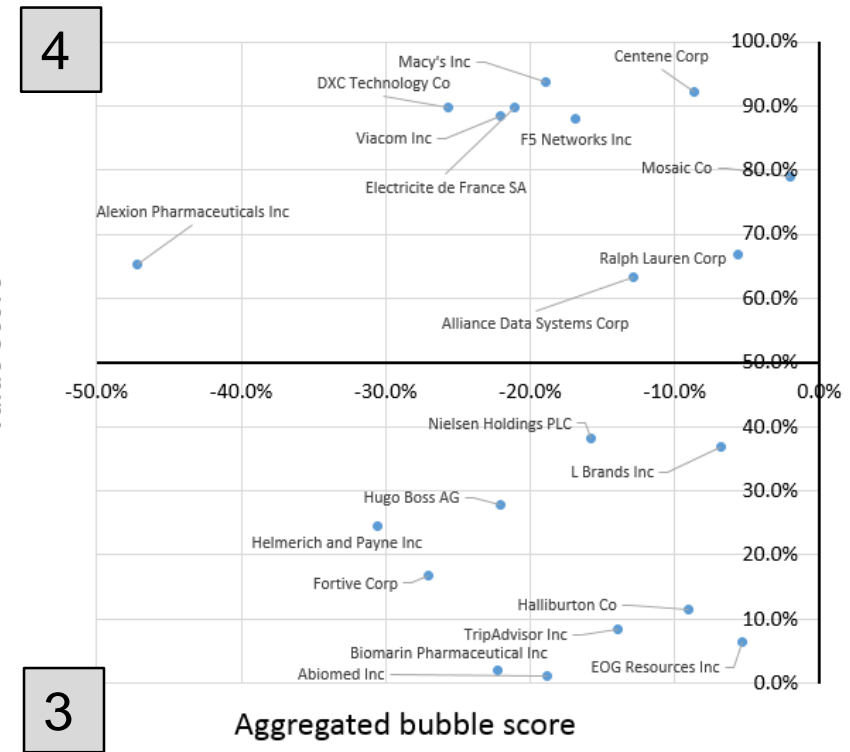
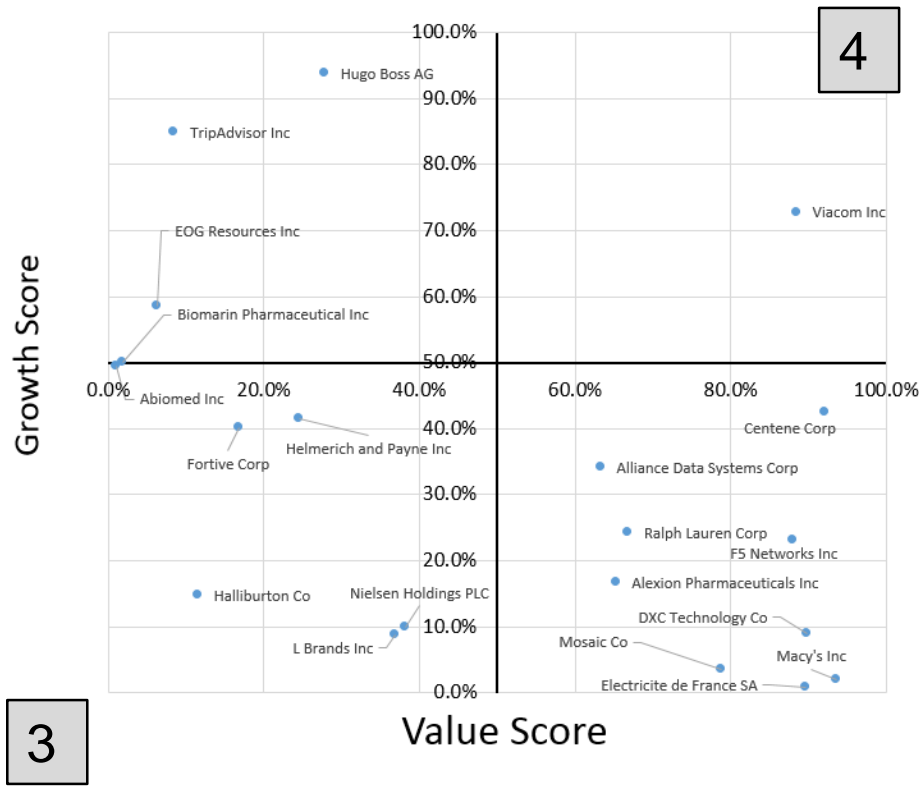
Strong positive bubble signals with strong (respectively weak) fundamentals



Single Stocks

Quadrants 3 and 4 (stocks)

Strong negative bubble signals with weak (respectively strong) fundamentals



Single Stocks

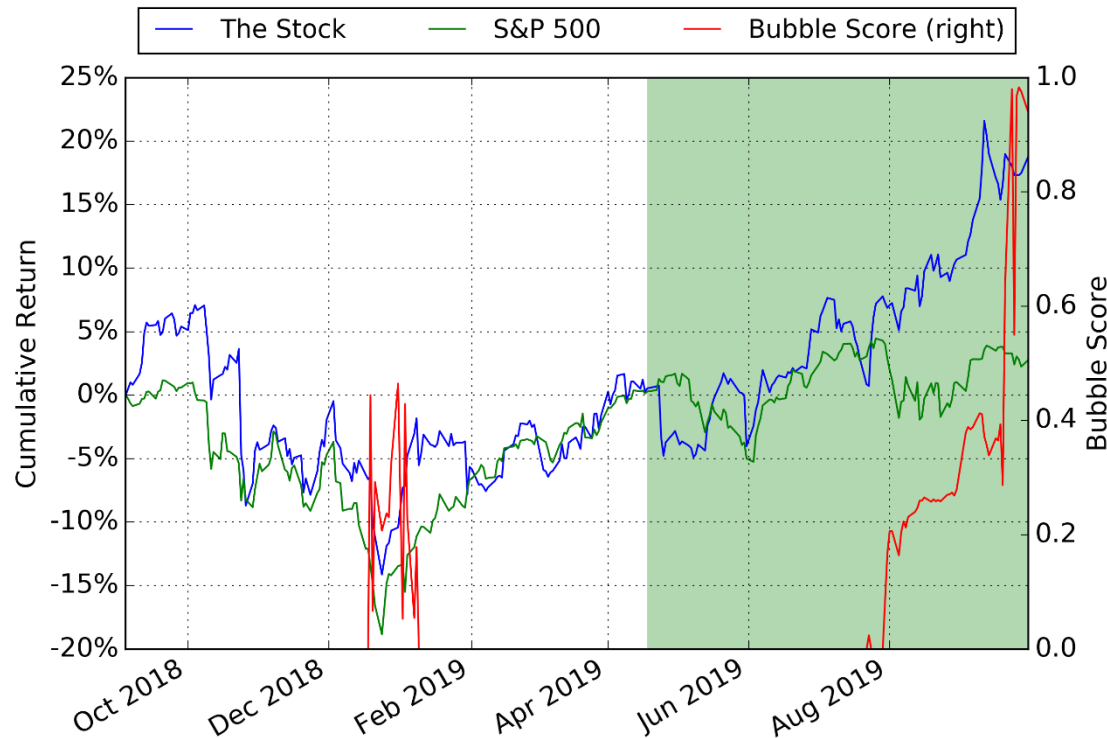
Quadrant 1 stocks: strong positive bubble signals with strong fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Bayer AG	Germany	Pharmaceuticals, Biotechnology & Life Sciences	-13.7%	13.4%	May-19	6.1%	94.0%	22.8%
Fortum Oyj	Finland	Utilities	3.3%	8.7%	Feb-19	15.9%	67.4%	8.6%
Sanofi SA	France	Pharmaceuticals, Biotechnology & Life Sciences	12.5%	15.9%	May-19	77.3%	95.5%	70.6%
BAE Systems PLC	United Kingdom	Capital Goods	-5.4%	22.6%	Feb-19	0.6%	74.8%	31.6%
Dialog Semiconductor PLC	United Kingdom	Semiconductors & Semiconductor Equipment	148.2%	106.8%	Oct-18	7.9%	97.1%	5.5%
Capita PLC	United Kingdom	Commercial & Professional Services	13.8%	25.4%	May-19	31.0%	89.6%	5.3%
CRH PLC	Ireland; Republic of	Materials	13.5%	10.6%	Apr-19	11.5%	60.1%	7.5%
Medtronic PLC	Ireland; Republic of	Health Care Equipment & Services	12.9%	20.2%	Mar-19	33.5%	87.6%	47.4%
Flutter Entertainment PLC	Ireland; Republic of	Consumer Services	23.2%	21.6%	Jan-19	15.5%	75.0%	46.9%
Johnson Controls International PLC	Ireland; Republic of	Capital Goods	25.4%	11.7%	May-19	71.4%	75.3%	18.1%
Hera SpA	Italy	Utilities	47.1%	17.8%	Mar-19	40.7%	62.6%	18.2%
Koninklijke Philips NV	Netherlands	Health Care Equipment & Services	16.8%	34.0%	Oct-18	20.4%	69.1%	6.3%
ASM International NV	Netherlands	Semiconductors & Semiconductor Equipment	107.8%	129.9%	Nov-18	42.5%	95.7%	59.7%
Skanska AB	Sweden	Capital Goods	13.9%	20.6%	Apr-19	25.5%	74.2%	96.4%
AT&T Inc	United States of America	Telecommunication Services	13.0%	22.9%	Apr-19	94.0%	82.1%	26.1%
Applied Materials Inc	United States of America	Semiconductors & Semiconductor Equipment	39.7%	31.1%	Mar-19	7.9%	93.1%	52.9%
Celanese Corp	United States of America	Materials	19.9%	32.5%	Jan-19	12.5%	84.6%	64.4%
D.R. Horton Inc	United States of America	Consumer Durables & Apparel	33.8%	18.6%	Apr-19	11.3%	84.2%	79.2%
Entergy Corp	United States of America	Utilities	40.7%	39.0%	Dec-18	56.7%	62.8%	17.4%
Jacobs Engineering Group Inc	United States of America	Capital Goods	19.4%	33.1%	Feb-19	29.4%	75.5%	32.3%
KLA-Tencor Corp	United States of America	Semiconductors & Semiconductor Equipment	60.8%	46.5%	May-19	78.3%	85.1%	48.2%
Lam Research Corp	United States of America	Semiconductors & Semiconductor Equipment	60.0%	60.0%	Oct-18	24.5%	97.0%	30.6%
Western Union Co	United States of America	Software & Services	27.5%	22.4%	43556	85.4%	85.5%	54.9%

Single Stocks - Quadrant 1 stocks

Quadrant 1 stocks: strong positive bubble signals with strong fundamentals

Example: AT&T Inc.

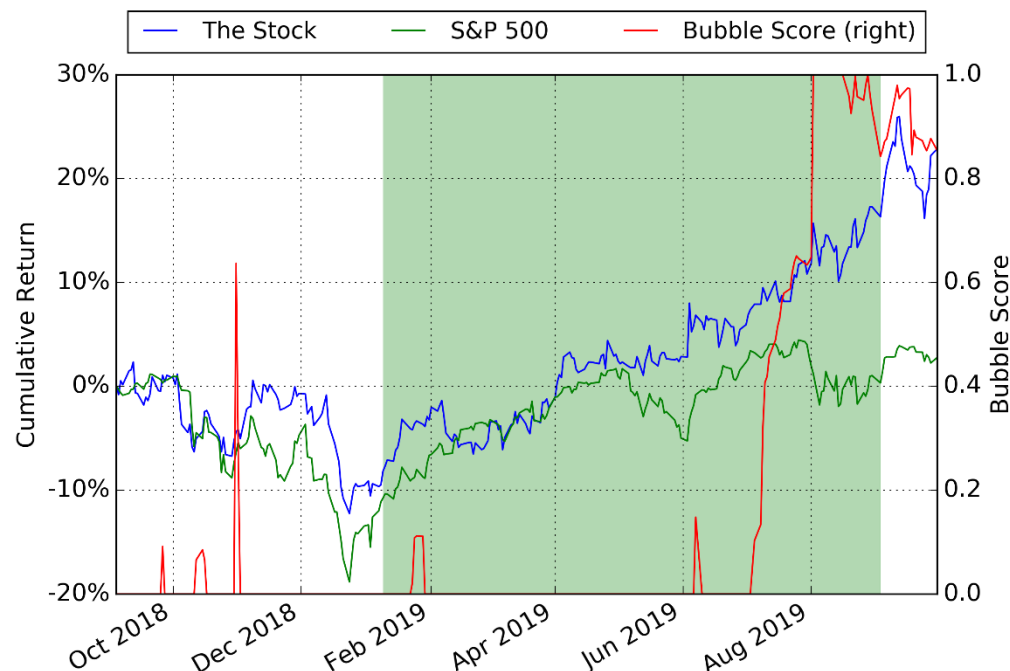


The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period is the strong positive bubble we identified. The Bubble Score of this six month bubble has reached 94% with a bubble size 22.9%.

Single Stocks - Quadrant 1 stocks

Last month example: strong positive bubble signals with strong fundamentals, Western Union Co.

The figure below 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 is the strong positive bubble we identified and reported last month. The stock had first a strong draw-up followed by an equally strong correction in the first half of the past month, and finished the month with a gain of more than 5%. The large value of our DS LPPLS indicator indicates a transition to a new regime, likely to be a consolidation of the gains.



Single Stocks - Quadrant 2 stocks

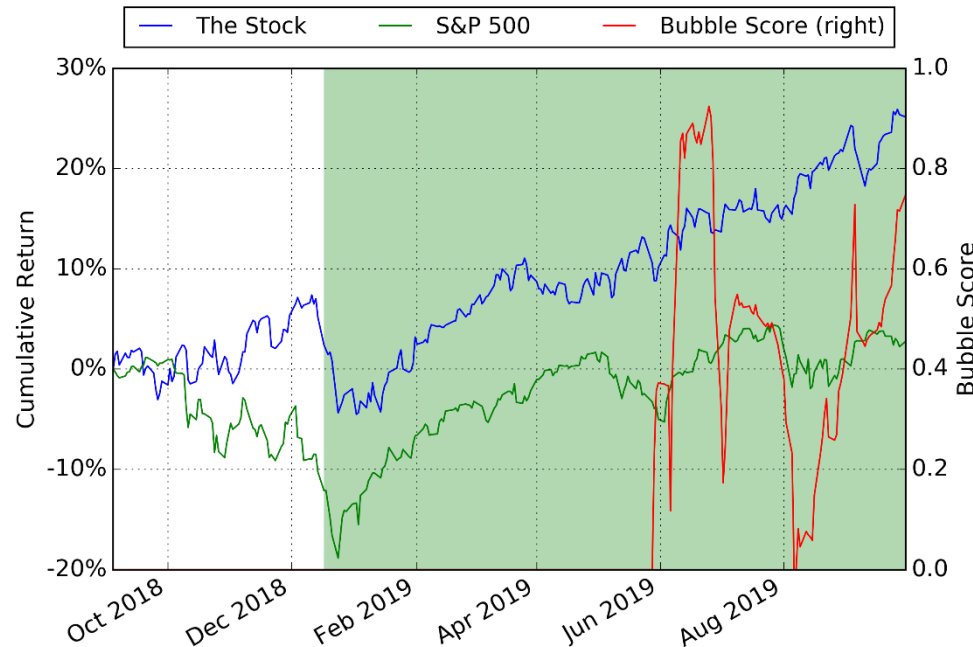
Quadrant 2 stocks: strong positive bubble signals with weak fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Vifor Pharma AG	Switzerland	Pharmaceuticals, Biotechnology & Life Sciences	8.0%	27.4%	Jan-19	37.7%	21.3%	93.9%
Carl Zeiss Meditec AG	Germany	Health Care Equipment & Services	56.1%	62.3%	Nov-18	28.6%	11.2%	56.6%
Elisa Oyj	Finland	Telecommunication Services	33.6%	22.6%	Apr-19	48.4%	22.1%	19.6%
Safran SA	France	Capital Goods	29.0%	30.2%	Jan-19	44.7%	29.6%	78.5%
Rentokil Initial PLC	United Kingdom	Commercial & Professional Services	46.5%	33.8%	Feb-19	15.6%	11.4%	47.9%
ASML Holding NV	Netherlands	Semiconductors & Semiconductor Equipment	42.8%	40.6%	Feb-19	22.7%	14.8%	34.4%
Altice Europe NV	Netherlands	Media & Entertainment	106.4%	160.8%	Jan-19	15.9%	20.8%	0.0%
Jeronimo Martins SGPS SA	Portugal	Food & Staples Retailing	35.1%	23.3%	Jan-19	8.2%	35.4%	87.4%
H & M Hennes & Mauritz AB	Sweden	Retailing	12.5%	20.2%	May-19	22.7%	31.8%	55.2%
Alliant Energy Corp	United States of America	Utilities	22.3%	30.9%	Dec-18	74.7%	31.7%	69.9%
Atmos Energy Corp	United States of America	Utilities	17.6%	22.0%	Oct-18	24.6%	24.9%	55.9%
Brown-Forman Corp	United States of America	Food, Beverage & Tobacco	25.1%	20.1%	Mar-19	21.4%	9.0%	61.6%
CMS Energy Corp	United States of America	Utilities	26.3%	27.3%	Jan-19	45.6%	28.1%	71.1%
Campbell Soup Co	United States of America	Food, Beverage & Tobacco	25.1%	29.6%	Feb-19	32.2%	34.0%	29.0%
Dollar General Corp	United States of America	Retailing	51.2%	50.0%	Dec-18	23.5%	32.0%	66.2%
FMC Corp	United States of America	Materials	16.3%	37.8%	Dec-18	32.9%	26.6%	24.3%
Home Depot Inc	United States of America	Retailing	18.5%	27.1%	Mar-19	22.7%	33.0%	50.4%
Estee Lauder Companies Inc	United States of America	Household & Personal Products	41.8%	17.1%	Apr-19	13.3%	21.9%	49.6%
Martin Marietta Materials Inc	United States of America	Materials	51.5%	61.4%	Dec-18	78.0%	19.6%	71.6%
Nextera Energy Inc	United States of America	Utilities	34.1%	22.3%	Apr-19	25.8%	24.7%	75.1%
Northrop Grumman Corp	United States of America	Capital Goods	19.3%	35.6%	Mar-19	8.9%	37.5%	9.7%
Procter & Gamble Co	United States of America	Household & Personal Products	51.3%	25.8%	Feb-19	37.2%	40.0%	48.8%
Sempra Energy	United States of America	Utilities	26.8%	19.0%	43525	50.6%	26.9%	28.2%
Sherwin-Williams Co	United States of America	Materials	29.5%	30.7%	43525	33.6%	8.6%	53.3%
Twitter Inc	United States of America	Media & Entertainment	40.8%	29.6%	43466	4.7%	33.5%	25.6%
Vulcan Materials Co	United States of America	Materials	38.6%	17.1%	43586	79.6%	9.2%	51.9%
WEC Energy Group Inc	United States of America	Utilities	37.7%	36.0%	43466	43.2%	35.2%	57.6%
Zoetis Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	34.6%	50.3%	43435	5.8%	13.1%	60.4%

Single Stocks - Quadrant 2 stocks

Quadrant 2 stocks: strong positive bubble signals with weak fundamentals

Example: Alliant Energy Corp.

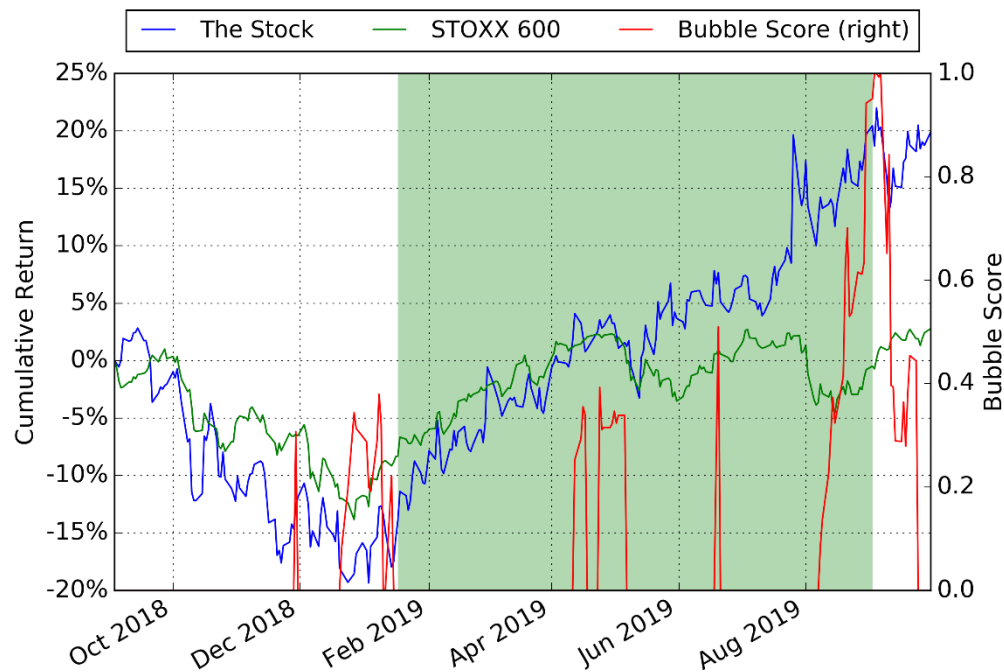


The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period is the positive bubble we identified. The Bubble Score of this ten month bubble has reached 74.7% with a bubble size 30.9%. 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: strong positive bubble signals with weak fundamentals, Teleperformance SE.

The figure below plots the one year cumulative return of the stock (blue), STOXX 600 (green) and LPPLS Bubble Score (red lines on the right y-axis). The green shaded period is the strong positive bubble we identified and reported last month. Note that the stock price has slowed its appreciation speed and entering into a volatile regime, which is in agreement with the weak fundamentals and our DS LPPLS indicator.



Single Stocks - Quadrant 3 stocks

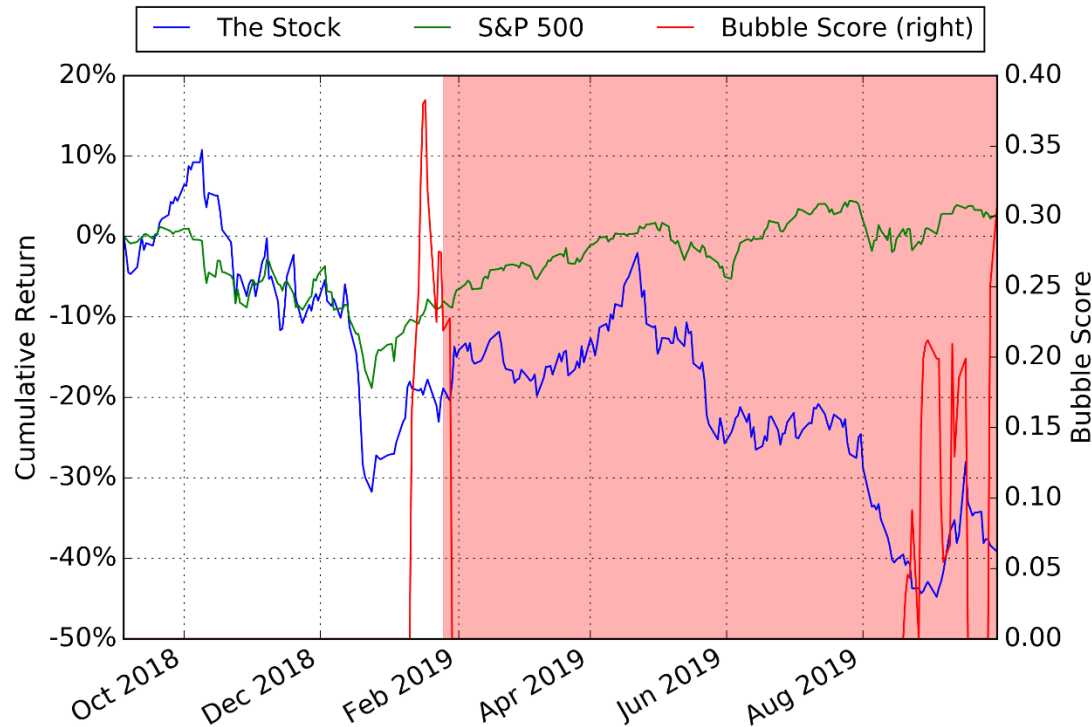
Quadrant 3 stocks: strong negative bubble signals with weak fundamentals

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	-25.1%	-20.9%	Jan-19	-22.1%	27.8%	93.8%
Nielsen Holdings PLC	United States of America	Commercial & Professional Services	-21.0%	-15.0%	Jan-19	-15.8%	38.2%	9.8%
Abiomed Inc	United States of America	Health Care Equipment & Services	-55.0%	-47.3%	Nov-18	-18.8%	1.1%	49.5%
Biomarin Pharmaceutical Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	-35.4%	-32.8%	Oct-18	-22.2%	1.9%	50.1%
EOG Resources Inc	United States of America	Energy	-43.9%	-19.3%	Mar-19	-5.3%	6.3%	58.6%
Fortive Corp	United States of America	Capital Goods	-16.6%	-14.8%	Feb-19	-27.0%	16.8%	40.2%
Halliburton Co	United States of America	Energy	-55.3%	-32.5%	Mar-19	-9.1%	11.5%	14.7%
Helmerich and Payne Inc	United States of America	Energy	-45.1%	-28.4%	Jan-19	-30.6%	24.5%	41.4%
L Brands Inc	United States of America	Retailing	-32.0%	-33.3%	Nov-18	-6.8%	36.9%	8.7%
TripAdvisor Inc	United States of America	Media & Entertainment	-19.1%	-27.3%	43497	-14.0%	8.5%	84.9%

Single Stocks - Quadrant 3 stocks

Quadrant 3 stocks: strong negative bubble signals with weak fundamentals

Example: Helmerich and Payne Inc.

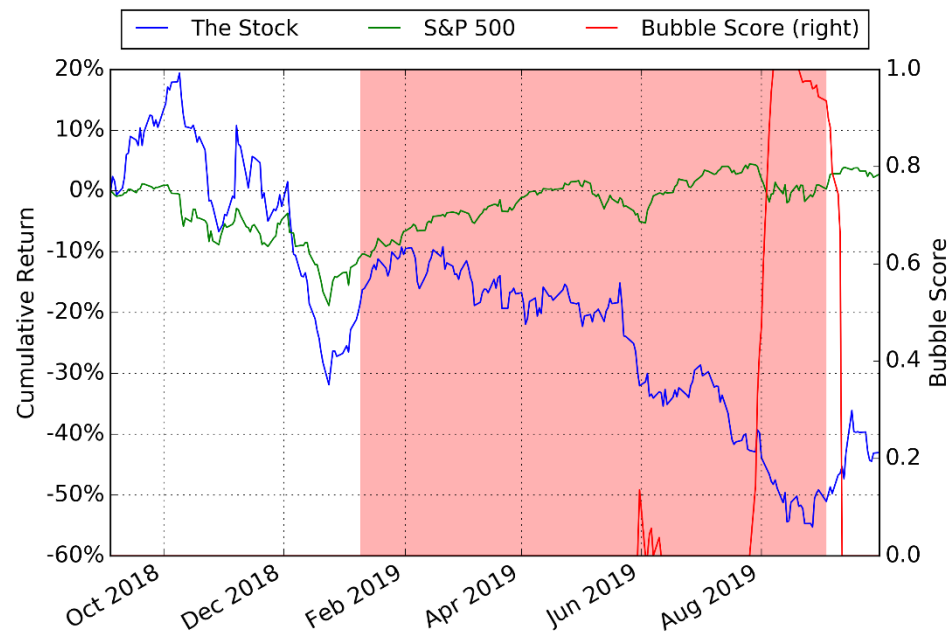


The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period is the negative bubble we identified. The Bubble Score of this eight month bubble has reached 30.6% with a bubble size -28.4%.

Single Stocks - Quadrant 3 stocks

Last month example: strong negative bubble signals with weak fundamentals, Cimarex Energy Co.

The figure below 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 is the strong negative bubble we identified and reported in last month. The stock price has a strong rebound in the past month, which is in agreement with the DS LPPLS indicator. The strong rebound may not develop further due to the pressure from the weak fundamentals.



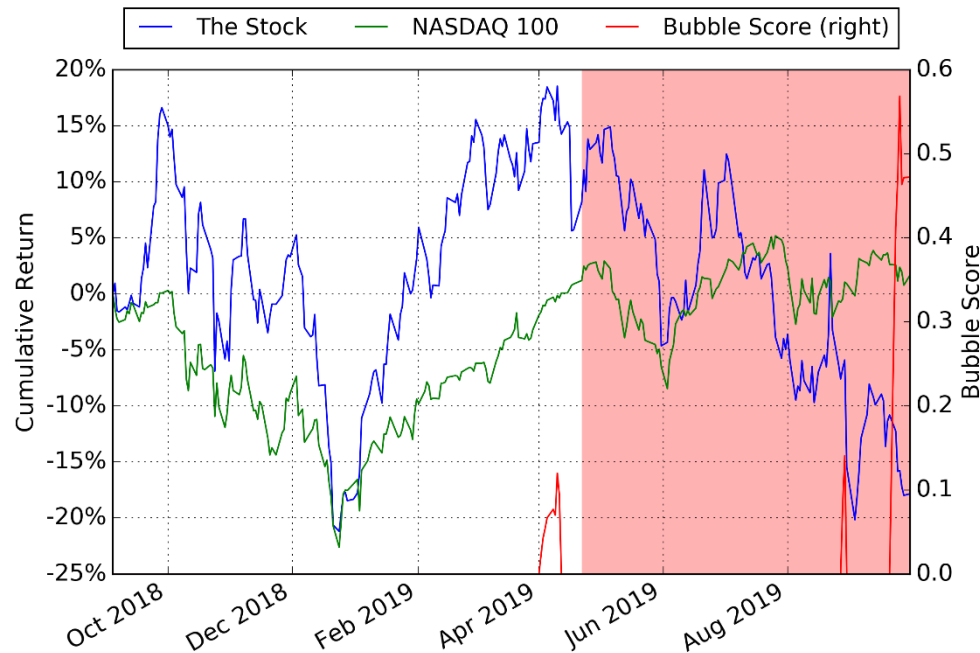
Single Stocks - Quadrant 4 stocks

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
Electricite de France SA	France	Utilities	-32.8%	-27.0%	Dec-18	-21.1%	89.7%	0.9%
Alexion Pharmaceuticals Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	-25.0%	-27.8%	Apr-19	-47.2%	65.2%	16.6%
Alliance Data Systems Corp	United States of America	Software & Services	-43.6%	-43.6%	Oct-18	-12.9%	63.3%	34.1%
Centene Corp	United States of America	Health Care Equipment & Services	-39.5%	-39.5%	Nov-18	-8.7%	92.1%	42.5%
DXC Technology Co	United States of America	Software & Services	-67.1%	-50.1%	Jan-19	-25.7%	89.8%	9.0%
F5 Networks Inc	United States of America	Technology Hardware & Equipment	-20.6%	-19.9%	Oct-18	-16.8%	88.0%	23.1%
Macy's Inc	United States of America	Retailing	-53.0%	-40.5%	Jan-19	-18.9%	93.7%	1.9%
Mosaic Co	United States of America	Materials	-38.1%	-33.7%	Dec-18	-2.0%	78.9%	3.5%
Ralph Lauren Corp	United States of America	Consumer Durables & Apparel	-25.3%	-23.1%	Feb-19	-5.6%	66.8%	24.2%
Viacom Inc	United States of America	Media & Entertainment	-26.8%	-19.3%	43556	-22.1%	88.5%	72.8%

Single Stocks - Quadrant 4 stocks

Quadrant 4 stocks: strong negative bubble signals with strong fundamentals
Example: Alexion Pharmaceuticals Inc.

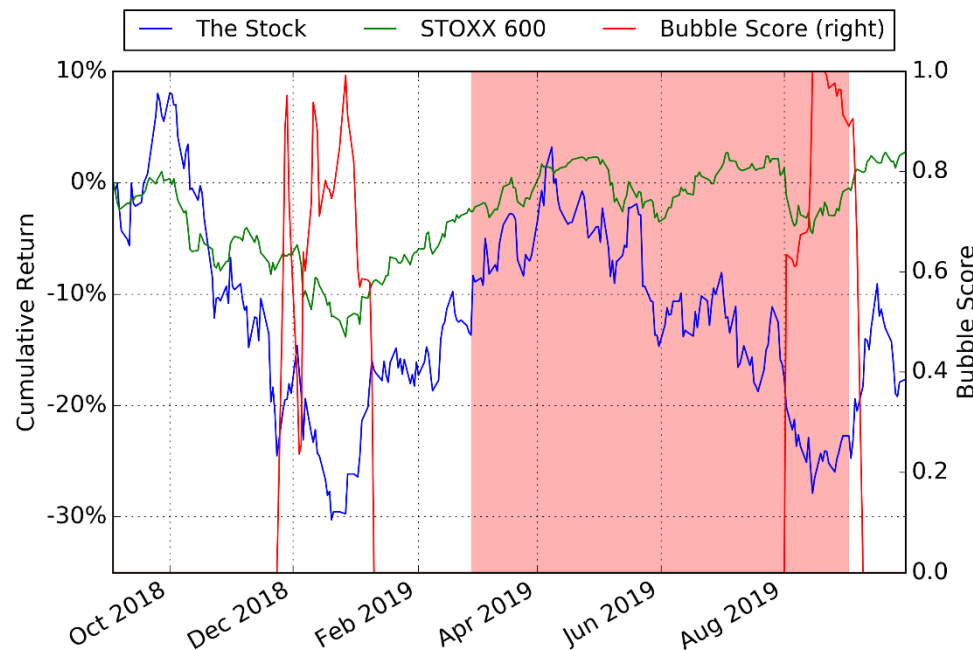


The above graph shows the one year cumulative return of the stock in blue (left hand scale), NASDAQ 100 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period is the strong negative bubble we identified. The Bubble Score of this six month bubble has reached 47.2% with a bubble size -27.8%. 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: strong negative bubble signals with strong fundamentals, Subsea 7 SA.

The figure below plots the one year cumulative return of the stock (blue), STOXX 600 (green) and LPPLS Bubble Score (red line on the right y-axis). The red shaded period is the strong negative bubble we identified and reported in last month. The stock has strongly appreciated since we made our diagnostic, ending the month in positive territory, but with high volatility. This is in agreement with our DS LPPLS indicator. The strong fundamentals lead us to expect potential future increase in the price.

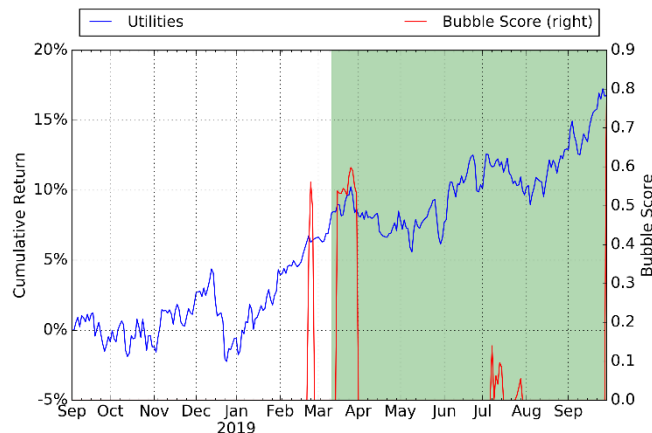
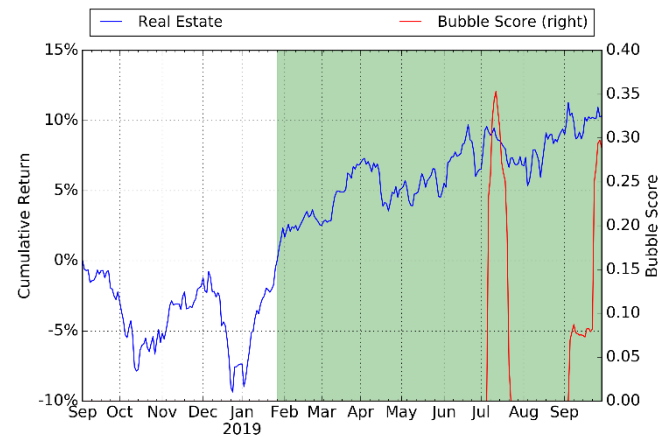
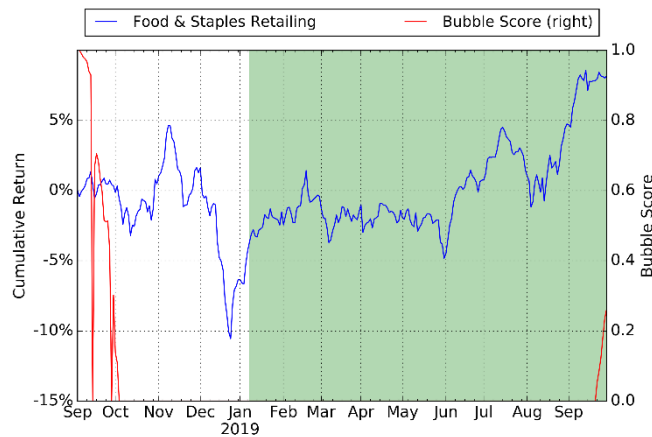


Sectors

GICS Industry Group Name	Yearly Return		Bubble Size		Bubble Score		Value Score		Growth Score	
	Oct 1st	Sep 1st	Oct 1st	Sep 1st	Oct 1st	Sep 1st	Oct 1st	Sep 1st	Oct 1st	Sep 1st
Pharmaceuticals, Biotechnology & Life Sciences	0.7%	-3.0%	0.0%	0.0%	0.0%	0.0%	69.3%	70.6%	51.8%	50.8%
Consumer Services	17.6%	14.6%	0.0%	0.0%	0.0%	0.0%	31.4%	31.8%	48.8%	49.1%
Retailing	4.1%	-3.4%	0.0%	0.0%	0.0%	0.0%	19.2%	19.7%	55.7%	55.9%
Transportation	3.0%	-3.2%	0.0%	0.0%	0.0%	0.0%	54.4%	54.8%	49.2%	49.5%
Consumer Durables & Apparel	11.7%	-2.2%	0.0%	0.0%	0.0%	0.0%	33.1%	32.9%	56.2%	56.5%
Semiconductors & Semiconductor Equipment	16.1%	4.4%	0.0%	0.0%	0.0%	0.0%	60.4%	62.2%	35.1%	33.8%
Technology Hardware & Equipment	2.9%	-6.4%	0.0%	0.0%	0.0%	0.0%	60.3%	57.9%	42.9%	42.3%
Automobiles & Components	-3.2%	-12.5%	0.0%	0.0%	0.0%	0.0%	74.0%	74.4%	57.2%	56.8%
Telecommunication Services	5.5%	-0.6%	0.0%	0.0%	0.0%	0.0%	64.9%	65.0%	42.1%	42.4%
Energy	-16.0%	-20.1%	0.0%	0.0%	0.0%	0.0%	54.5%	54.5%	49.2%	49.1%
Software & Services	16.6%	11.5%	0.0%	0.0%	0.0%	0.0%	34.4%	35.1%	46.2%	46.8%
Materials	1.4%	-5.2%	0.0%	0.0%	0.0%	0.0%	54.9%	54.9%	50.1%	50.2%
Health Care Equipment & Services	2.9%	1.2%	0.0%	0.0%	0.0%	0.0%	58.8%	60.5%	49.6%	49.9%
Capital Goods	3.0%	-5.7%	0.0%	0.0%	0.0%	0.0%	49.5%	50.1%	48.4%	48.7%
Media & Entertainment	15.9%	14.7%	0.0%	0.0%	0.0%	0.0%	30.4%	28.9%	43.4%	44.1%
Commercial & Professional Services	19.1%	9.3%	0.0%	0.0%	0.0%	0.0%	31.6%	30.1%	53.8%	52.3%
Food & Staples Retailing	10.9%	4.3%	12.3%	0.0%	26.2%	0.0%	50.8%	49.8%	53.8%	53.2%
Household & Personal Products	25.9%	17.6%	0.0%	0.0%	0.0%	0.0%	33.0%	33.1%	47.1%	47.5%
Food, Beverage & Tobacco	10.1%	5.7%	0.0%	0.0%	0.0%	0.0%	47.3%	46.8%	53.6%	53.4%
Utilities	19.0%	11.7%	7.7%	0.0%	83.3%	0.0%	50.7%	51.5%	44.0%	44.8%
Insurance	10.9%	3.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Real Estate	19.7%	10.1%	10.2%	0.0%	28.9%	0.0%	-	-	-	-
Diversified Financials	3.7%	-4.7%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Banks	-3.1%	-13.8%	0.0%	0.0%	0.0%	0.0%	-	-	-	-

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 3 industry groups with a positive bubble score: *Food & Staples Retailing*, *Real Estate*, and *Utilities*, as plotted below.



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.

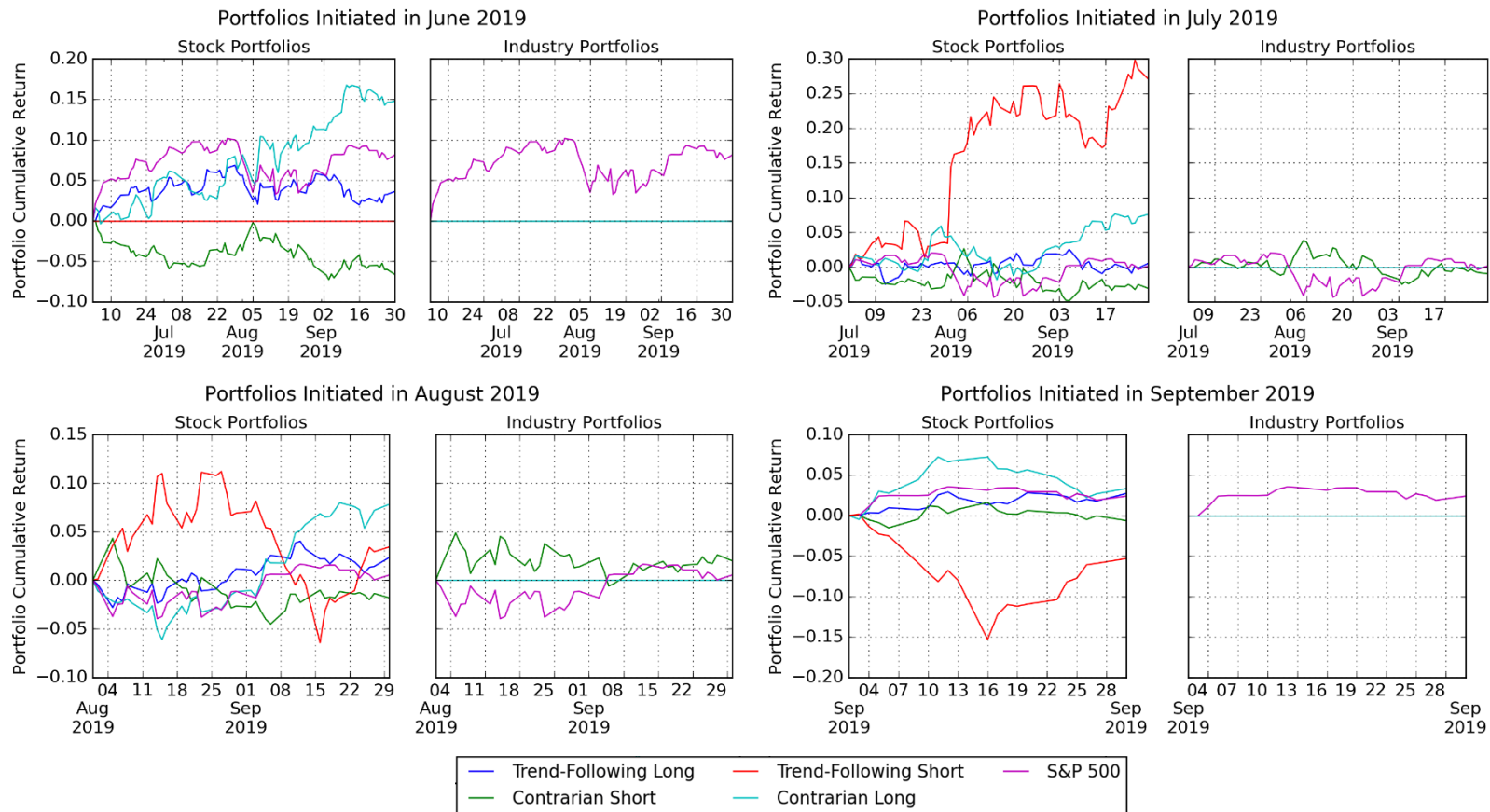
(3) Contrarian Long Stock Portfolio (CLSP) is made of the stocks that have a **negative** bubble signal as well as a **strong** value score.

(4) and Contrarian Short Stock Portfolio (CSSP) is made of the stocks that have a **positive** bubble signal as well as a **weak** value score.

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



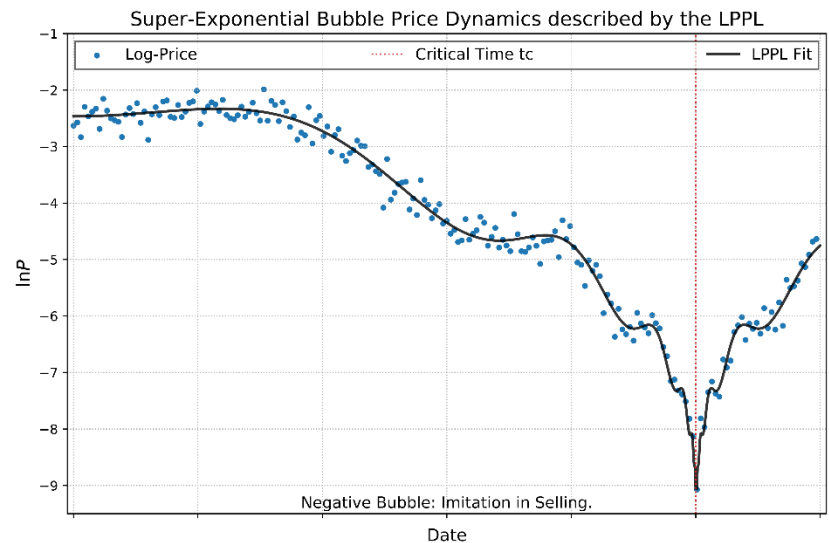
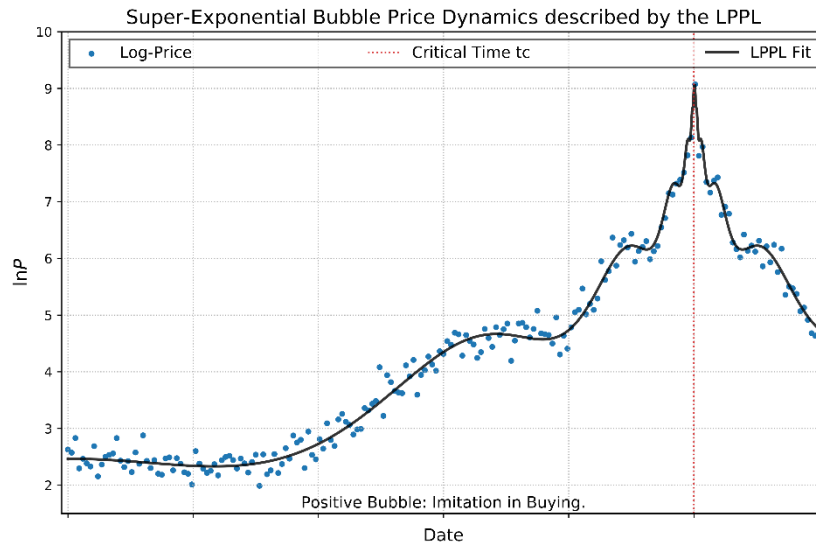
This month, we find that the Contrarian Long Stock Portfolios have outperformed most of the portfolios, while the Contrarian Short Portfolios have poor performances. Contrarian Portfolios are more delicate to use due to their sensitivity to timing the expected reversal and exhibit very volatile performances, 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.

Appendix

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.



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:

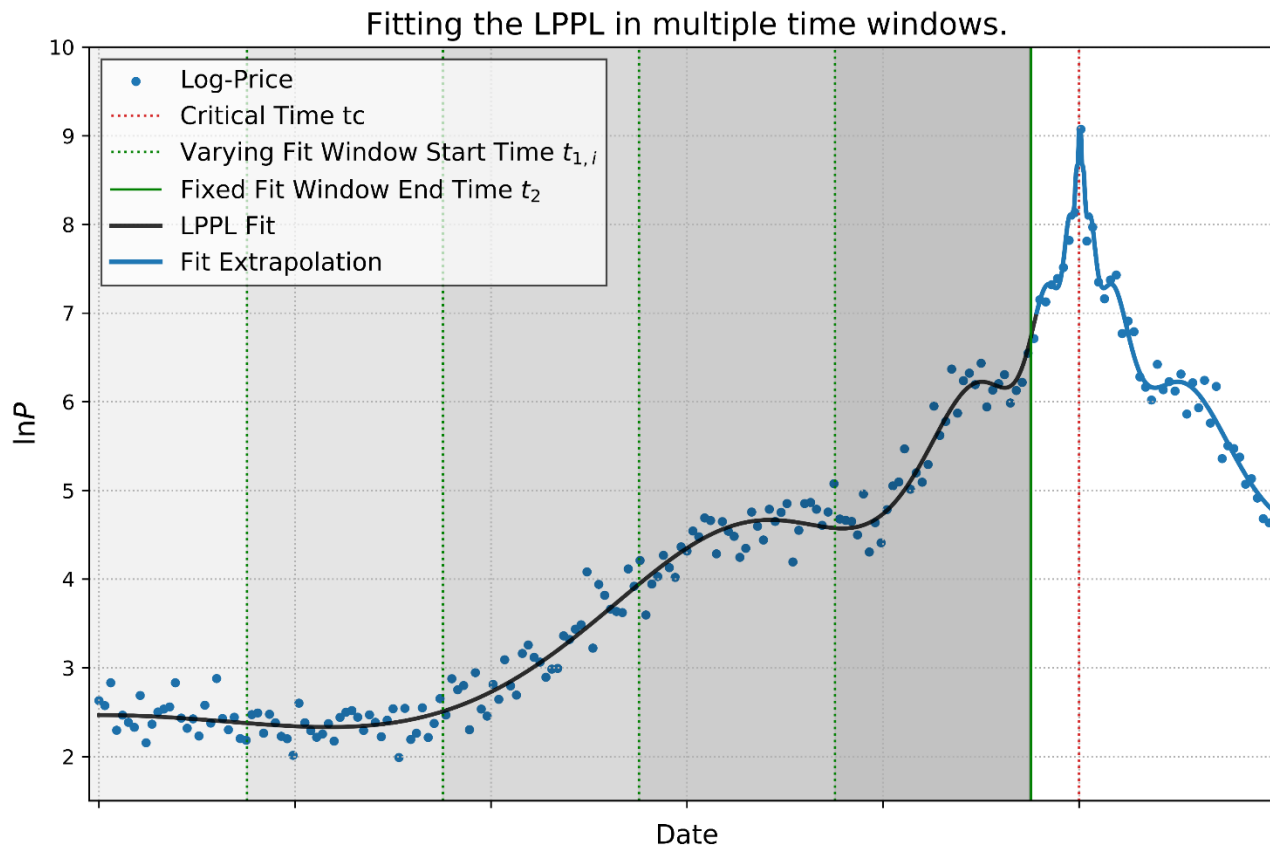
$$LPPLS := E[\ln P(t)] = A + B(t_c - t)^m + (t_c - t)^m [C_1 \cos(\omega \ln(t_c - t)) + C_2 \sin(\omega \ln(t_c - t))]$$

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

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 μ_{t_c} and standard deviations σ_{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.

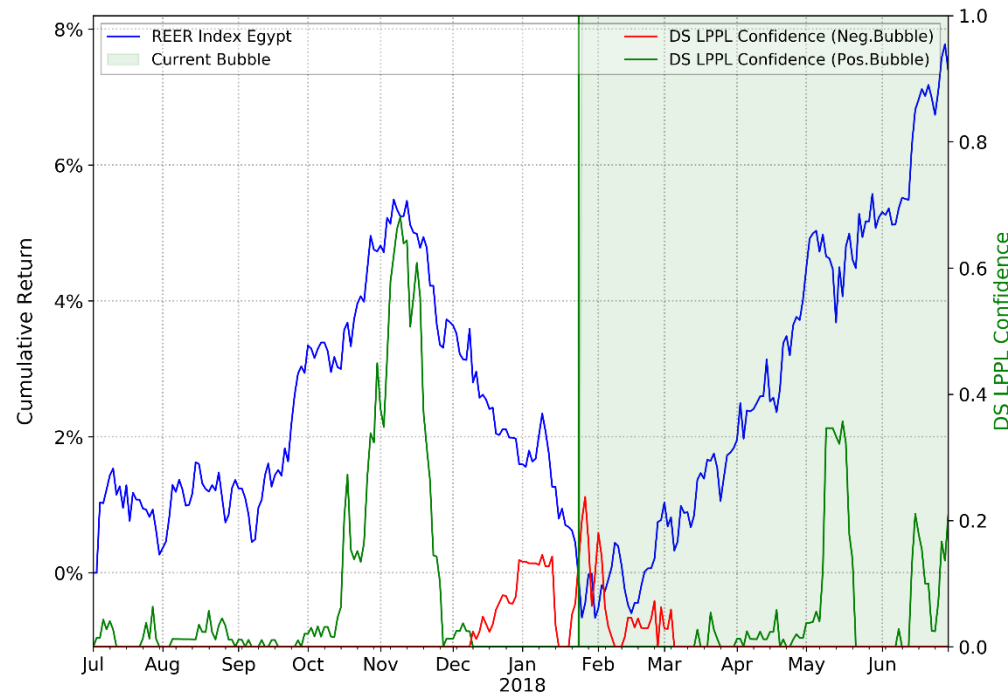
The first section provides asset and estimated bubble characteristics (size and duration), as well as the value of the confidence indicator. We rank assets according to their geometric average of the absolute of bubble size and confidence indicator. In this way, we incorporate the bubble size into the 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.



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.

To analyze the financial strength of individual stocks in the second part of the report, 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).

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