The FCO Cockpit
Global Bubble Status Report

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About

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.

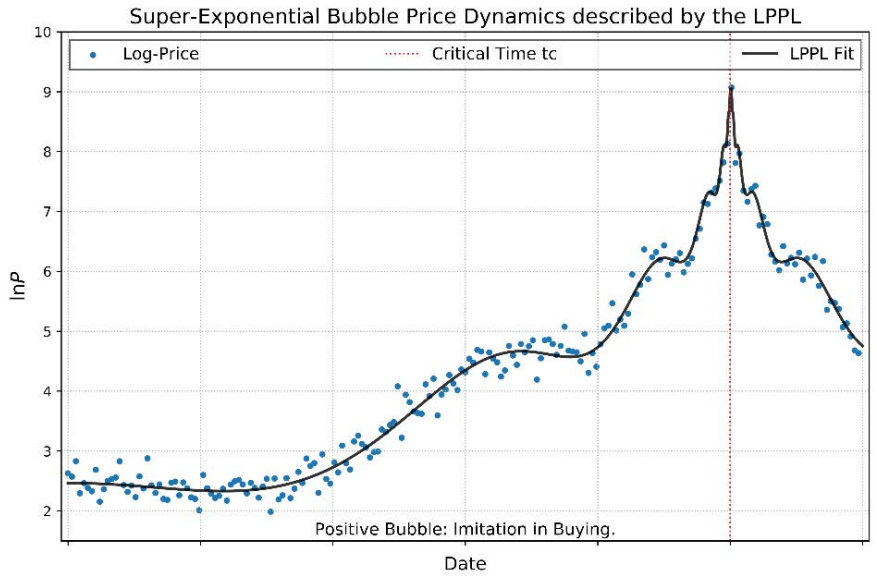
For an intuitive explanation of the methodology and the specifics of the indicators that are used in this report, we refer to: D. Sornette and P. Cauwels, Financial bubbles: mechanisms and diagnostics. Review of Behavioral Economics 2 (3), 279- 305 (2015)
http://arxiv.org/abs/1404.2140 and http://ssrn.com/abstract=2423790

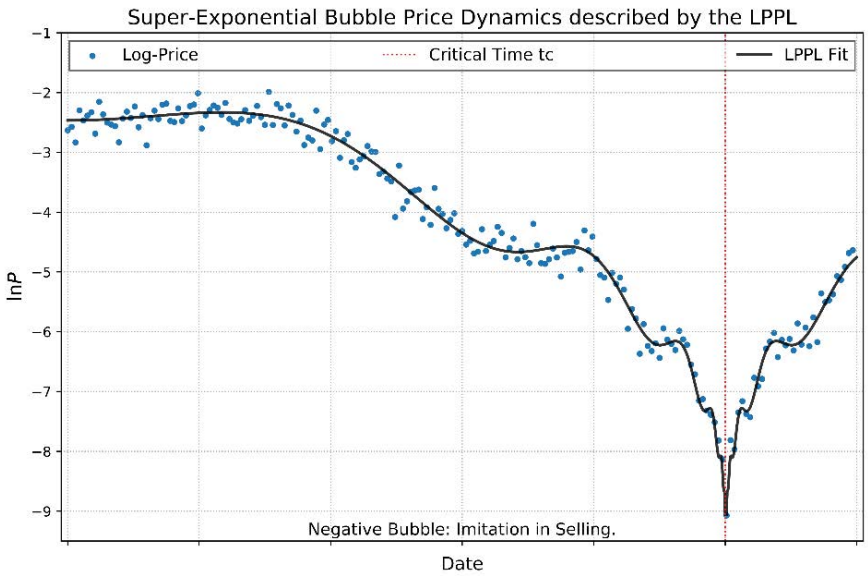
Methodology

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:

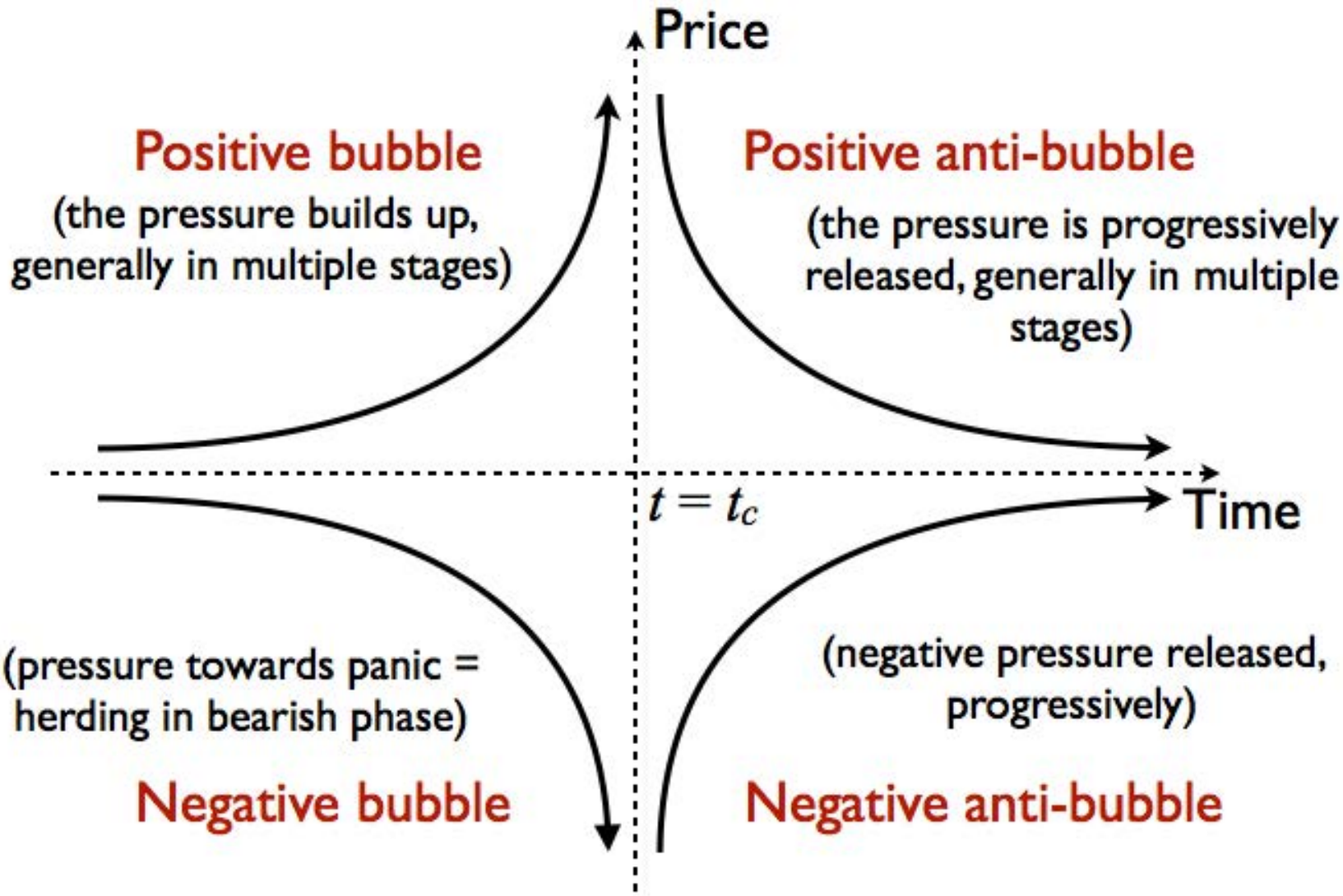
1. During the growth phase of a positive (negative) bubble, the price rises (falls) faster than exponentially. Therefore the logarithm of the price rises faster than linearly.
2. There are accelerating log-periodic oscillations around the super-exponential price evolution that symbolize increases in 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.



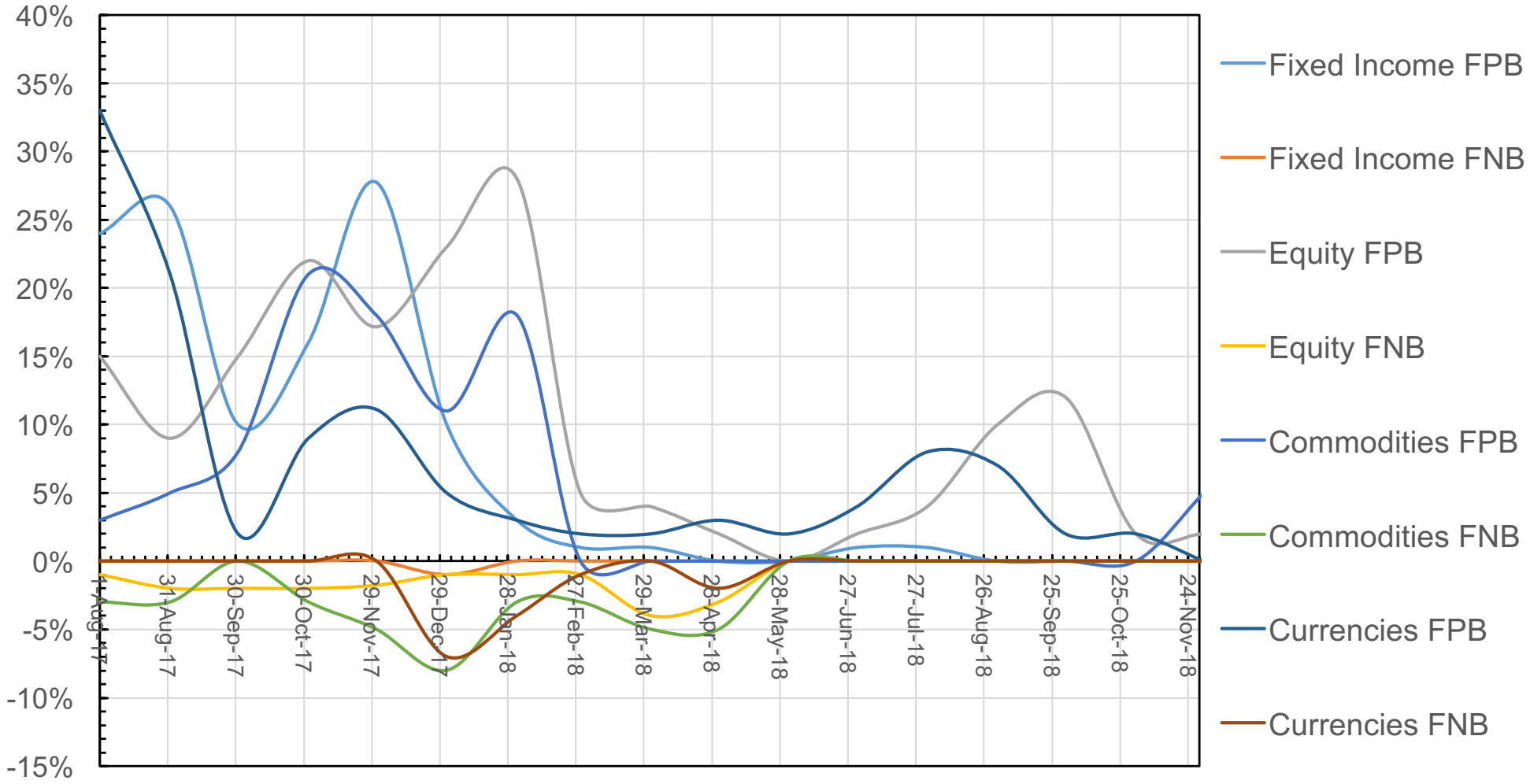


Bubble Regimes



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	0	0
Government Bonds	55	0	0
Finance and Insurance	21	0	0
Corporate Bonds	79	0	0
Equity	257	2	0
Country Indices	67	1	0
Europe	26	0	0
United States	164	2	0
Commodities	37	5	0
Forex	53	0	0

At the beginning of December, apart from the commodities sector, the low bubble activity amongst all asset classes continues.

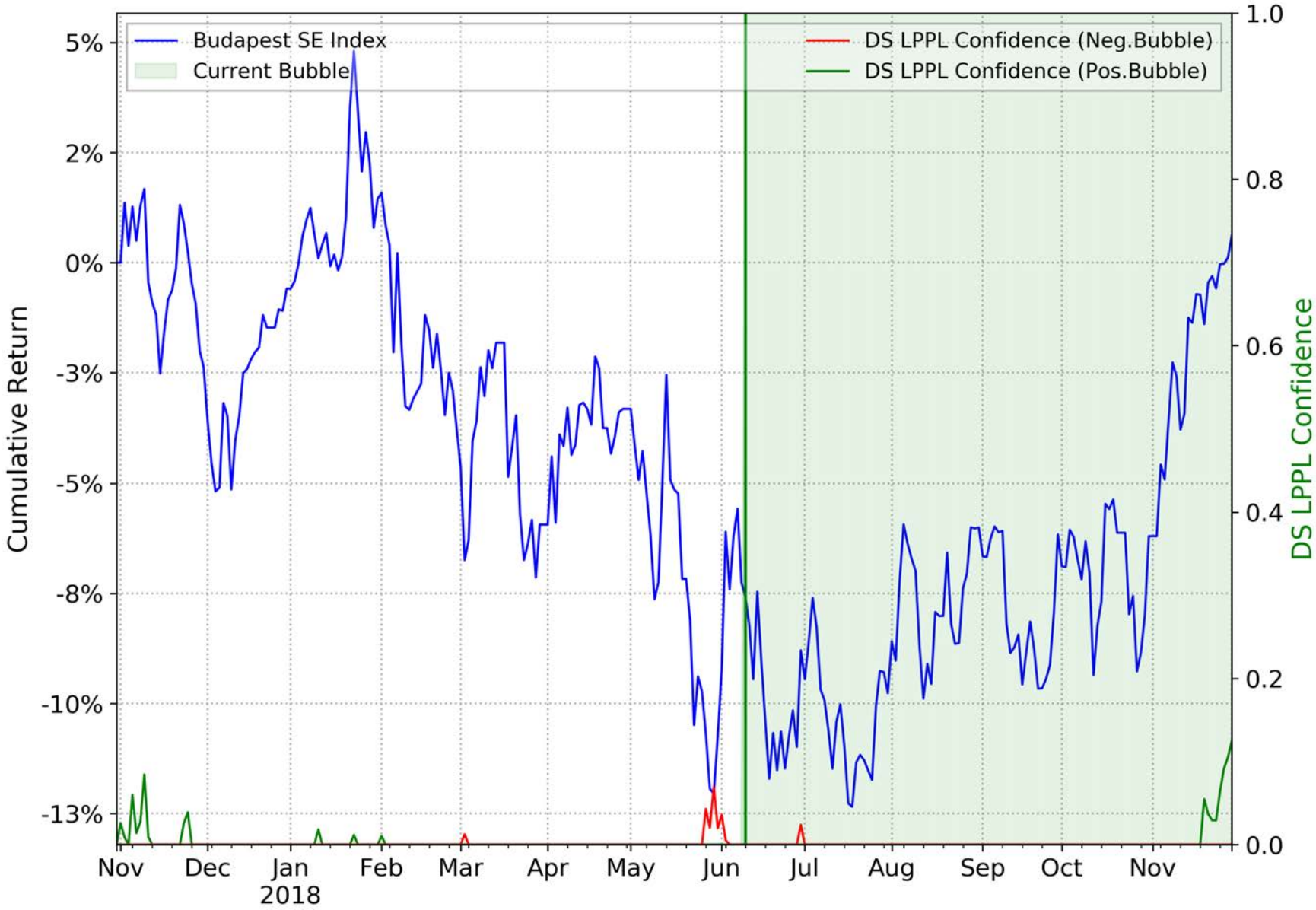
Following last month's trend, the equities sector shows a total fraction of positive bubble signals amounting to 2%. Amongst commodities, a 5% increase in the fraction of positive bubble signals is observed. No signals are detected for the Fixed Income and Forex Asset Classes.

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_{t_c}	σ_{t_c} [$days$]	Scenario Probability [%]
Positive Bubbles								
1	Budapest SE Index	12	166	15	13	2018-12-04	5	90

In the equities country indices sector, the Hungarian Budapest Index shows positive bubble dynamics. The bubble size of 12% over a period of 166 days is detected at an indicator value of 15%, a relatively low figure. The high scenario probability (90%) of the predicted most likely bubble burst time however indicates that there is a significant short-term super-exponential dynamics and the asset is therefore in an accelerating period right now. This can also be seen in the corresponding plot on the next page.

We furthermore depict the PFTS Ukraine stock exchange index which has undergone a minor correction during the past month, as forecasted correctly in the previous report. The corresponding bubble and crash data are given below the plot.


Budapest SE Index
Current Bubble
DS LPPL Confidence (Neg.Bubble)
DS LPPL Confidence (Pos.Bubble)
Cumulative Return
DS LPPL Confidence
5%
2%
0%
-3%
-5%
-8%
-10%
-13%
1.0
0.8
0.6
0.4
0.2
0.0
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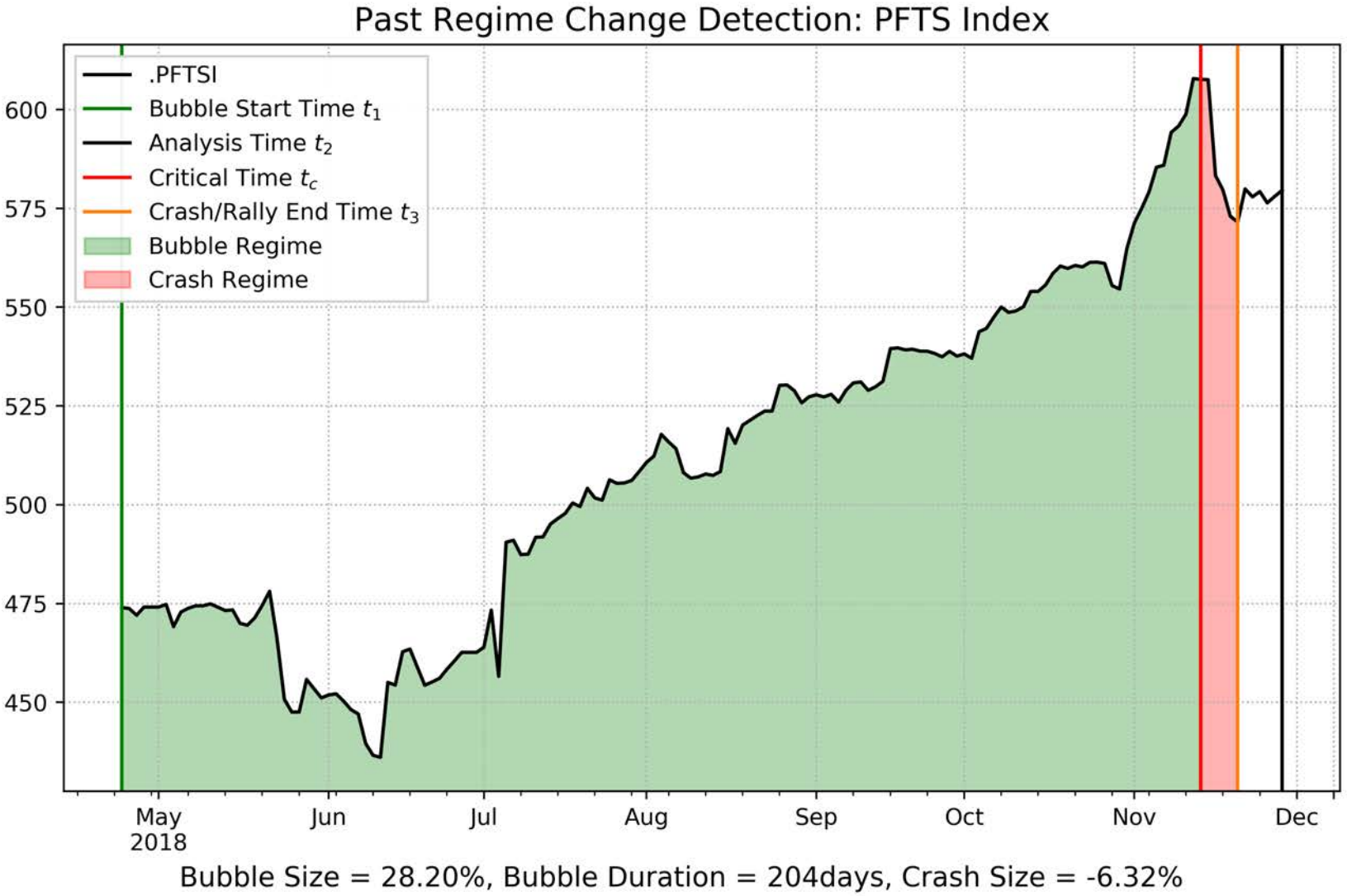
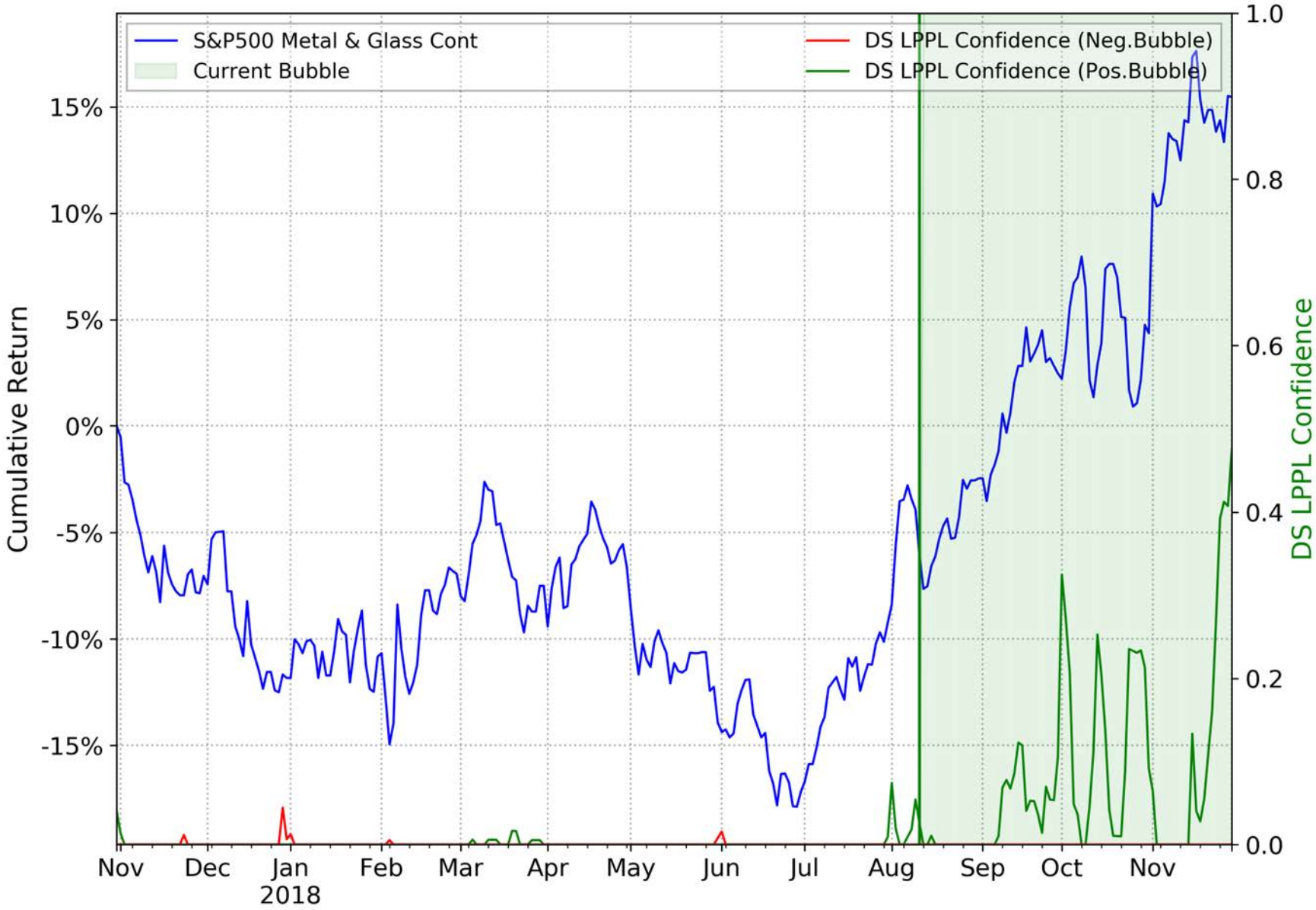

Past Regime Change Detection: PFTS Index
.PFTSI
Bubble Start Time t_1
Analysis Time t_2
Critical Time t_c
Crash/Rally End Time t_3
Bubble Regime
Crash Regime
600
575
550
525
500
475
450
May
2018
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Bubble Size = 28.20%, Bubble Duration = 204days, Crash Size = -6.32%

Equities – United States 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_{t_c}	σ_{t_c} [$days$]	Scenario Probability [%]
Positive Bubbles								
1	S&P500 Metal & Glass Cont	23	111	92	46	2018-12-28	1	49
2	S&P500 Restaurants	22	155	73	40	2018-12-20	1	20
3	S&P500 Ind Pwr&Ren Elec Pr	37	271	12	21	2019-01-07	1	28

Focusing on US Country indices, we identify several S&P 500 sub-indices to be in a positive bubble state during this month, the first two with a rather high confidence level of more than 70% and the third one at a lower indicator amplitude. Detected bubble sizes are above 20%, resulting in fairly large geometric average for all three indices. The predicted bubble burst dates for the first two indices are located in the last third of December. Plots of the indices are shown on the following slides.


S&P500 Metal & Glass Cont
Current Bubble
DS LPPL Confidence (Neg.Bubble)
DS LPPL Confidence (Pos.Bubble)
Cumulative Return
DS LPPL Confidence
15%
10%
5%
0%
-5%
-10%
-15%
1.0
0.8
0.6
0.4
0.2
0.0
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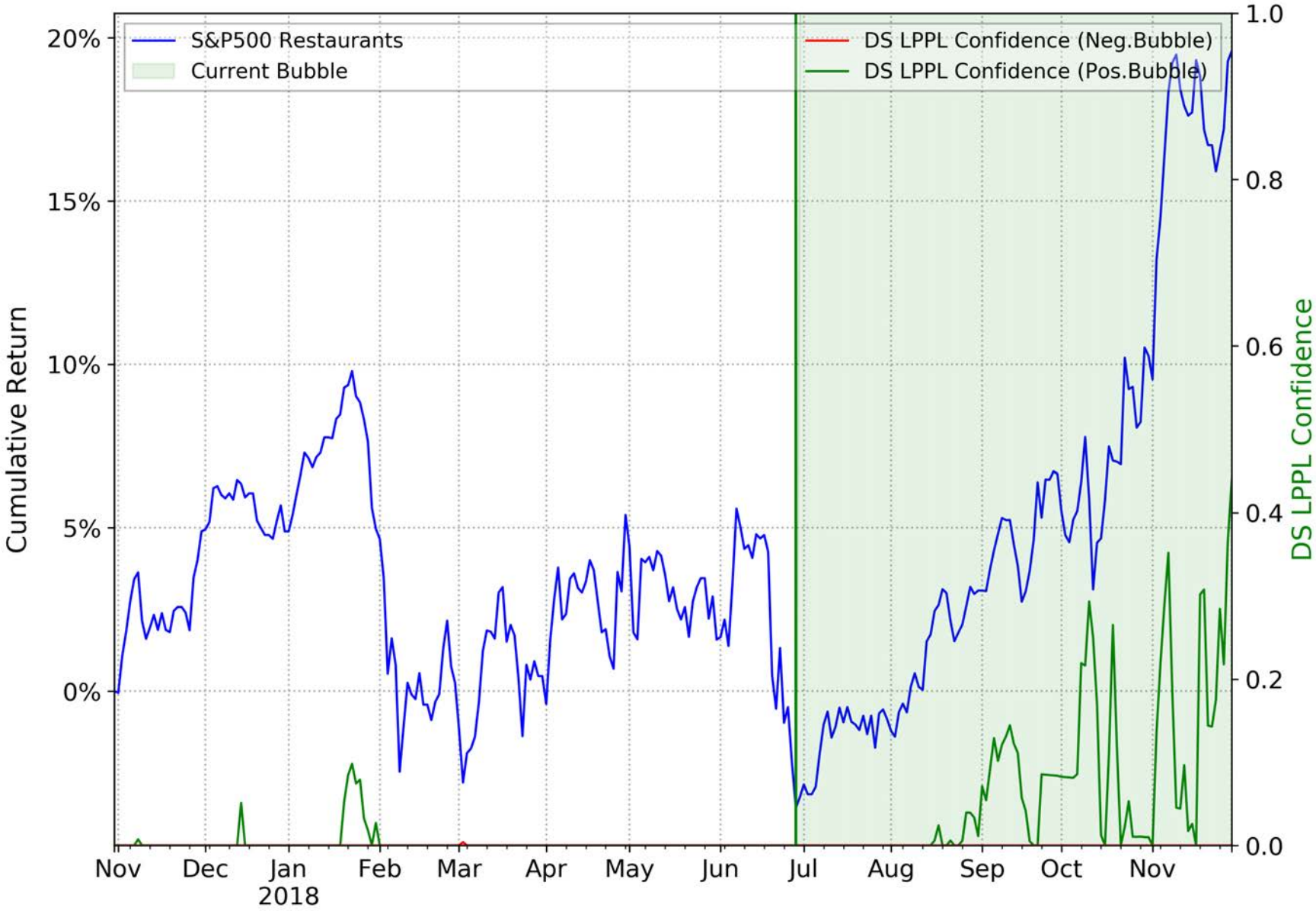
S&P500 Restaurants
Current Bubble
DS LPPL Confidence (Neg.Bubble)
DS LPPL Confidence (Pos.Bubble)
Cumulative Return
DS LPPL Confidence
20%
15%
10%
5%
0%
1.0
0.8
0.6
0.4
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0.0
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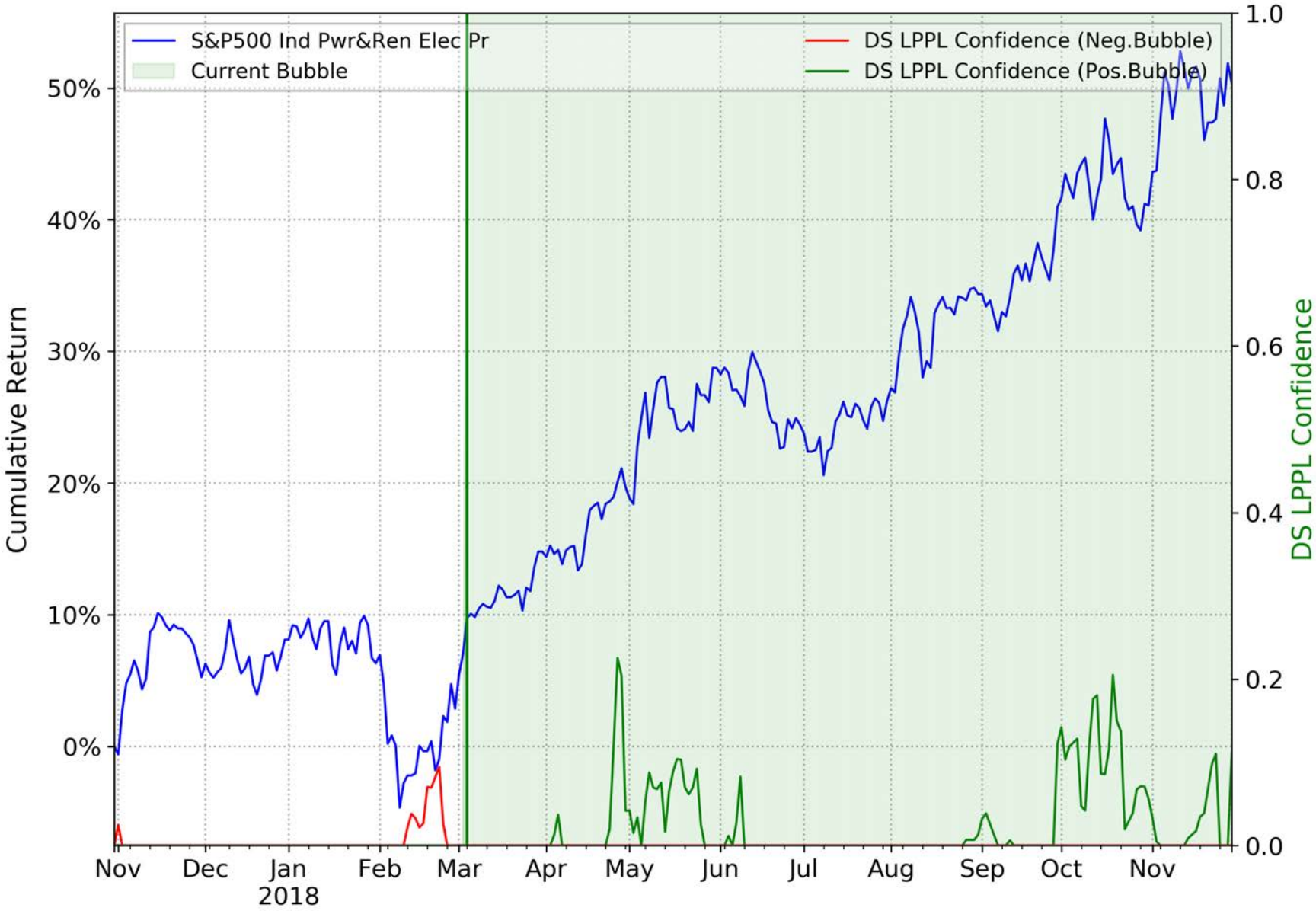
S&P500 Ind Pwr&Ren Elec Pr
Current Bubble
DS LPPL Confidence (Neg.Bubble)
DS LPPL Confidence (Pos.Bubble)
Cumulative Return
DS LPPL Confidence
50%
40%
30%
20%
10%
0%
1.0
0.8
0.6
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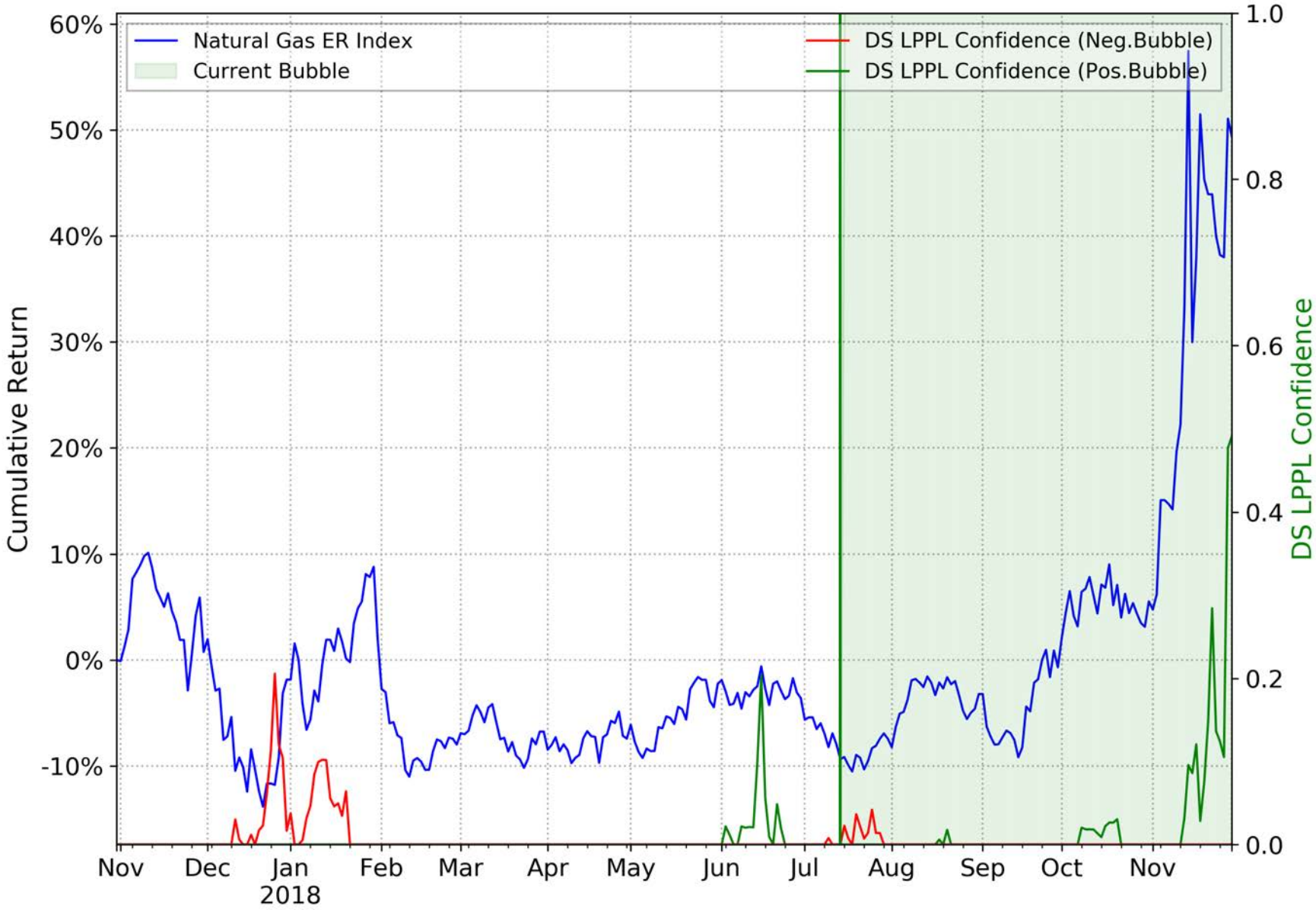
Commodities

	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	Natural Gas ER Index	59	297	23	37	2018-12-04	5	95
2	Palladium ER Index	19	271	27	23	2018-12-01	3	78

The commodities class lists two positive bubbles, one appearing in natural gas at 59% bubble size and another one in the Palladium Index. High-probability short-term bubble burst scenarios are predicted for both assets. For the natural gas index, this prediction is clearly a critical one, regarding the immense size of the detected bubble that has evolved over this index during the past year and the recent strong price appreciation.


Natural Gas ER Index
Current Bubble
DS LPPL Confidence (Neg.Bubble)
DS LPPL Confidence (Pos.Bubble)
Cumulative Return
DS LPPL Confidence
60%
50%
40%
30%
20%
10%
0%
-10%
1.0
0.8
0.6
0.4
0.2
0.0
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Commodities – Natural Gas

As seen on the previous slide, the natural gas index has appreciated by 40%+ during November alone. The explosion of the commodity's price really is a textbook example how suddenly and rapidly prices can evolve during a bubble regime. The start of the winter season, increasing demands [1,2], supply worries, cold weather forecasts [3] and other (partly even contradictory) news, i.e. a random series of news and events concerning natural gas, suddenly triggered the market to turn upwards, thereby initiating a bubble. Beforehand, the market was in a rather pessimistic state regarding the gas price [3]. As a consequence, not only the increased purchase of the good by traders, but also the coverage of short positions by other traders are responsible for driving the price up. The resulting devastating short-squeeze even put several traders out of business [4].

Nearly all of the recent events influencing the natural gas price and being reported online are connected to very uncertain predictions and events that are not yet realized. It is the ground of such rumours on which bubbles grow. Therefore, we observe the natural gas price with strong suspicion, assuming a current highly instable state of the price which is by far not certain to remain at its current level. For interested readers, the initiation of bubbles based on random news events is for instance elaborated in [5].

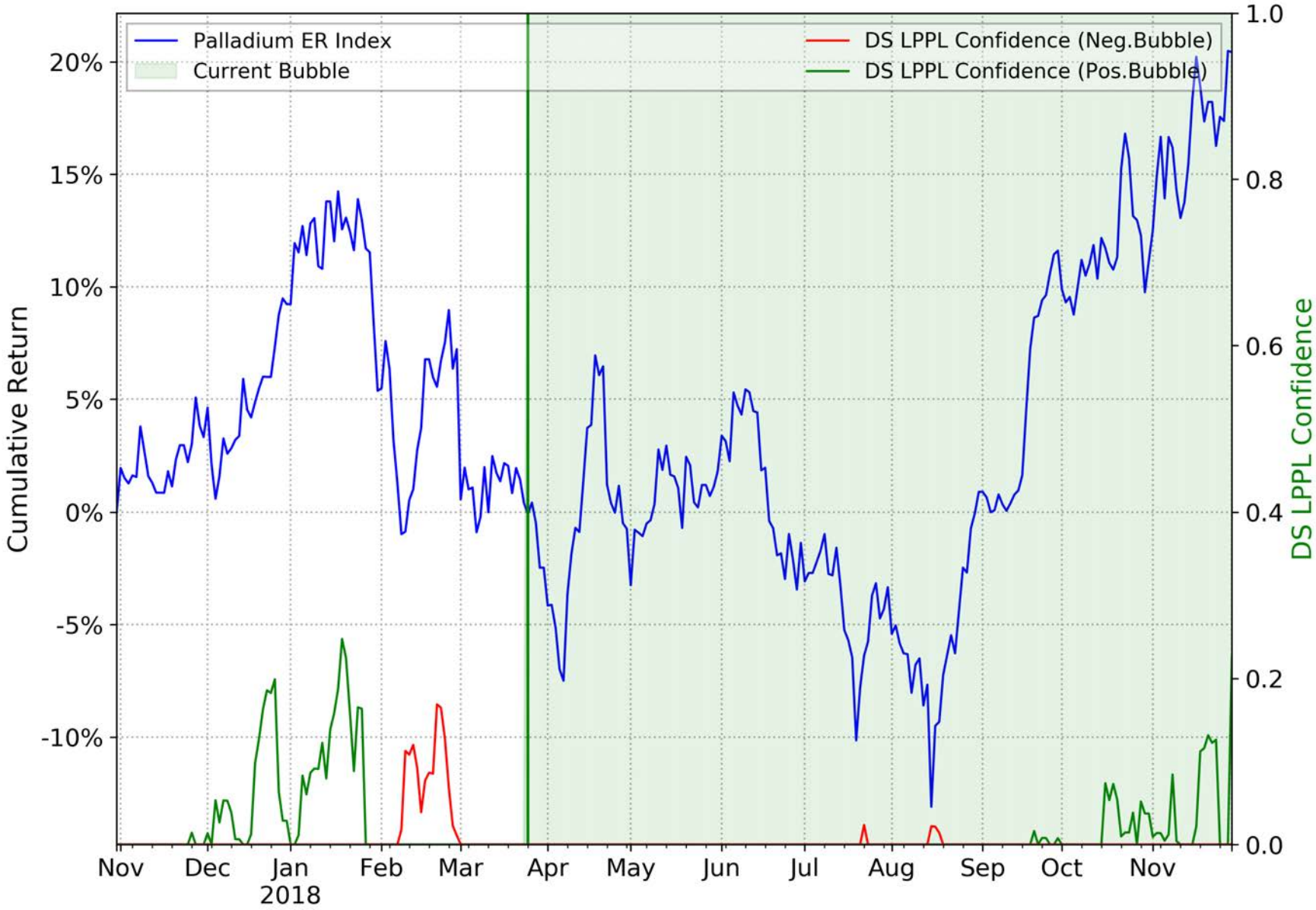
[1] https://oilprice.com/Energy/Natural-Gas/Natural-Gas-Skyrockets-As-China-Pledges-Huge-Supply-Boost.html

[2] https://oilprice.com/Energy/Natural-Gas/India-Looks-To-Double-Its-Natural-Gas-Usage.html

[3] https://oilprice.com/Energy/Natural-Gas/Cold-Snap-Could-Send-Natural-Gas-To-5.html

[4] https://oilprice.com/Energy/Natural-Gas/Natural-Gas-Price-Explosion-Bankrupts-Traders.html

[5] (Harras & Sornette, 2011) https://www.sciencedirect.com/science/article/pii/S0167268111000898


Palladium ER Index
Current Bubble
DS LPPL Confidence (Neg.Bubble)
DS LPPL Confidence (Pos.Bubble)
Cumulative Return
DS LPPL Confidence
20%
15%
10%
5%
0%
-5%
-10%
1.0
0.8
0.6
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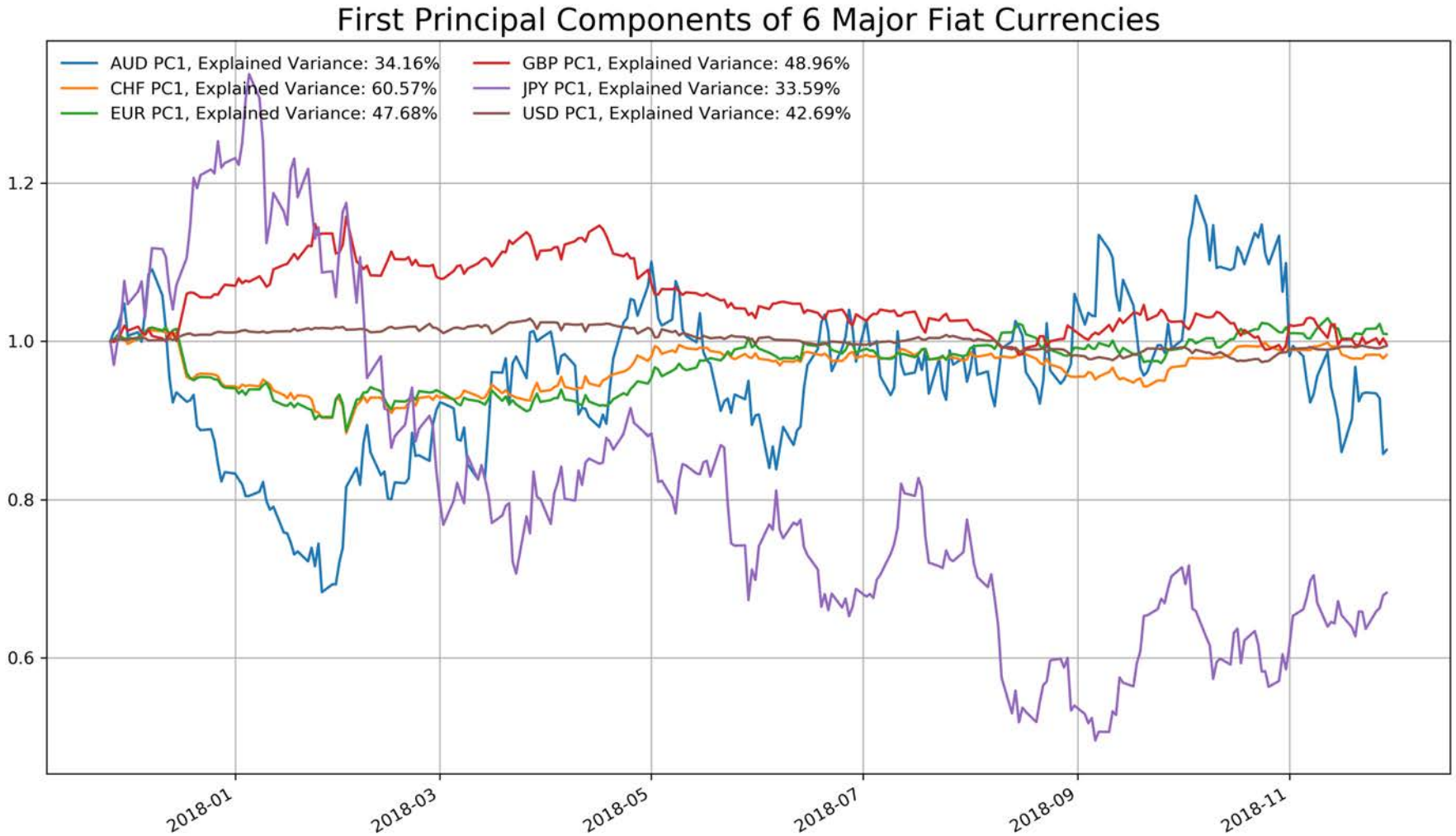
Currencies – PCA



There are no relevant results to show for the forex and cryptocurrency sectors. The PCA analysis of the major currencies is shown above.

Single Stocks

For 823 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.

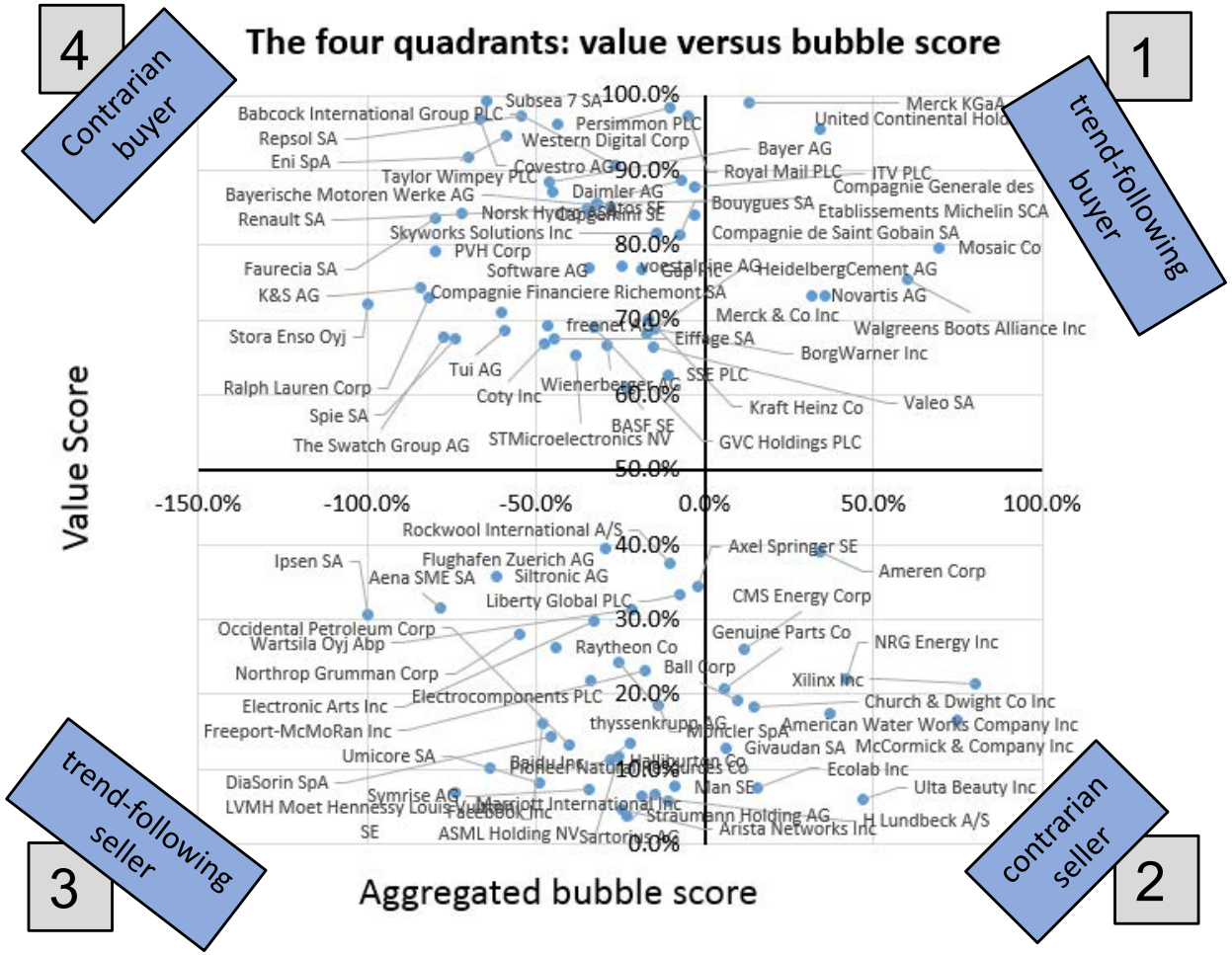
The stocks are the constituents of the Stoxx Europe 600, the S&P 500 and the Nasdaq 100 indices. From these, all doubles and stocks with incomplete data are removed. Because our financial strength indicators are specifically designed for corporates, all financial institutions are taken out of the set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

List of Indicators

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



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. Norvatis AG);
2. Quadrant 2: Stocks with a strong positive bubble score and a weak value score (e.g. CMS Energy Group);
3. Quadrant 3: Stocks with a strong negative bubble score and a weak value score (e.g. Ipsen SA);
4. Quadrant 4: Stocks with strong negative bubble score and a strong financial strength (e.g. Tui AG)

**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

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

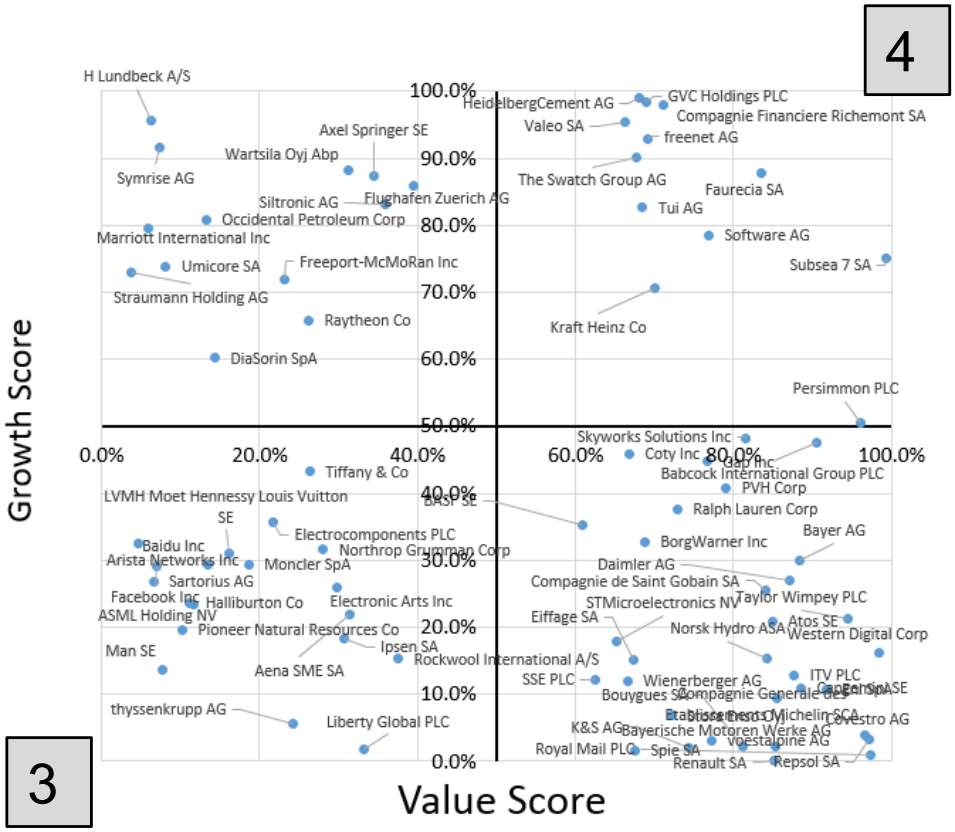
Quadrant 1 and 2 stocks

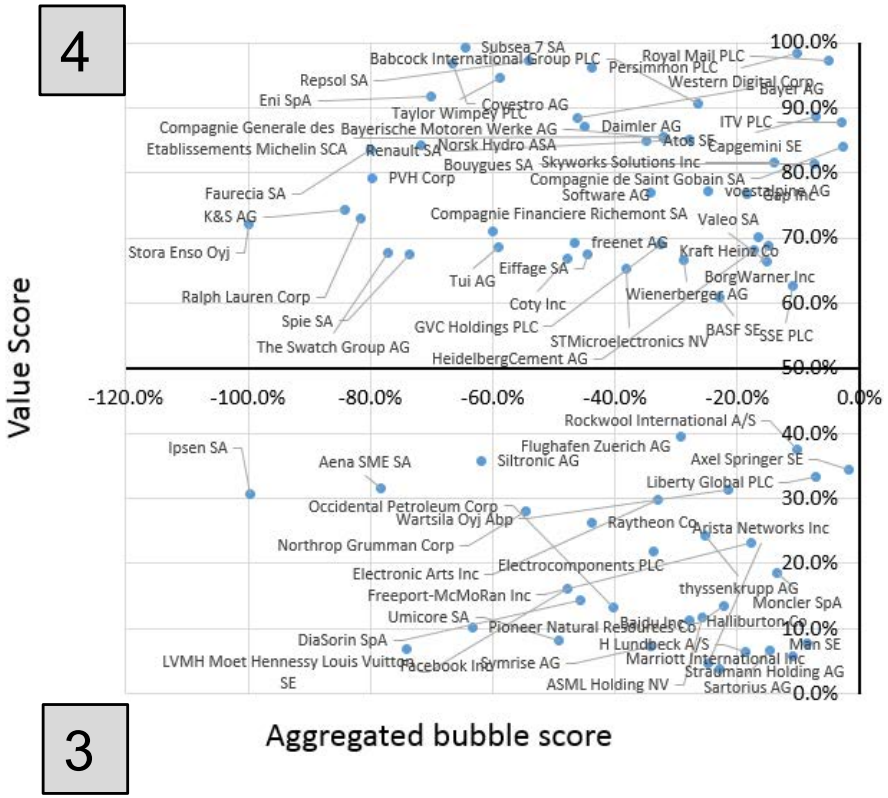
Strong positive bubble signals with strong (respectively weak) fundamentals

Single Stocks

Quadrant 3 and 4 stocks

Strong negative bubble signals with weak (respectively strong) fundamentals





Single Stocks

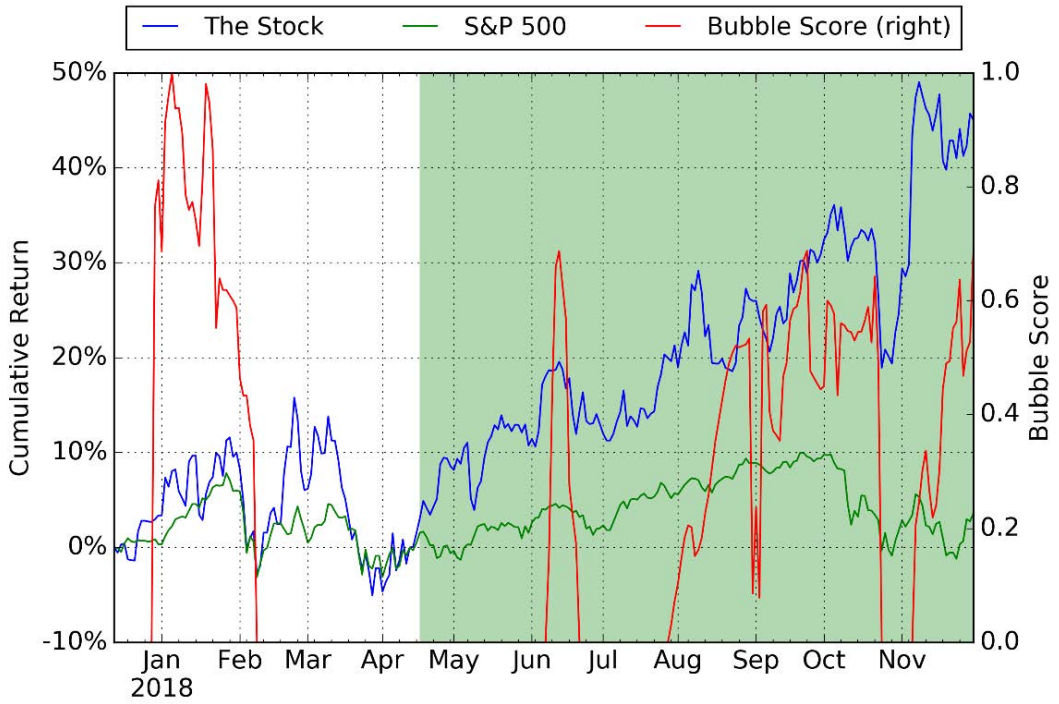
Quadrant 1 stocks: strong positive bubble signals with strong fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
United Continental Holdings Inc	United States of America	Transportation	53.2%	36.2%	Jun-18	34.2%	95.4%	51.9%
Walgreens Boots Alliance Inc	United States of America	Food & Staples Retailing	20.3%	35.7%	Jul-18	60.0%	75.3%	39.4%
Merck KGaA	Germany	Pharmaceuticals, Biotechnology & Life Sciences	8.1%	22.7%	Mar-18	13.0%	98.9%	81.8%
Novartis AG	Switzerland	Pharmaceuticals, Biotechnology & Life Sciences	8.5%	19.1%	Mar-18	31.8%	73.1%	76.2%
Mosaic Co	United States of America	Materials	44.6%	40.7%	Apr-18	69.5%	79.6%	17.0%
Merck & Co Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	41.7%	35.3%	Apr-18	35.6%	73.3%	58.6%

Single Stocks - Quadrant 1 stocks

Quadrant 1 stocks: strong positive bubble signals with strong fundamentals

Example: Mosaic Co.

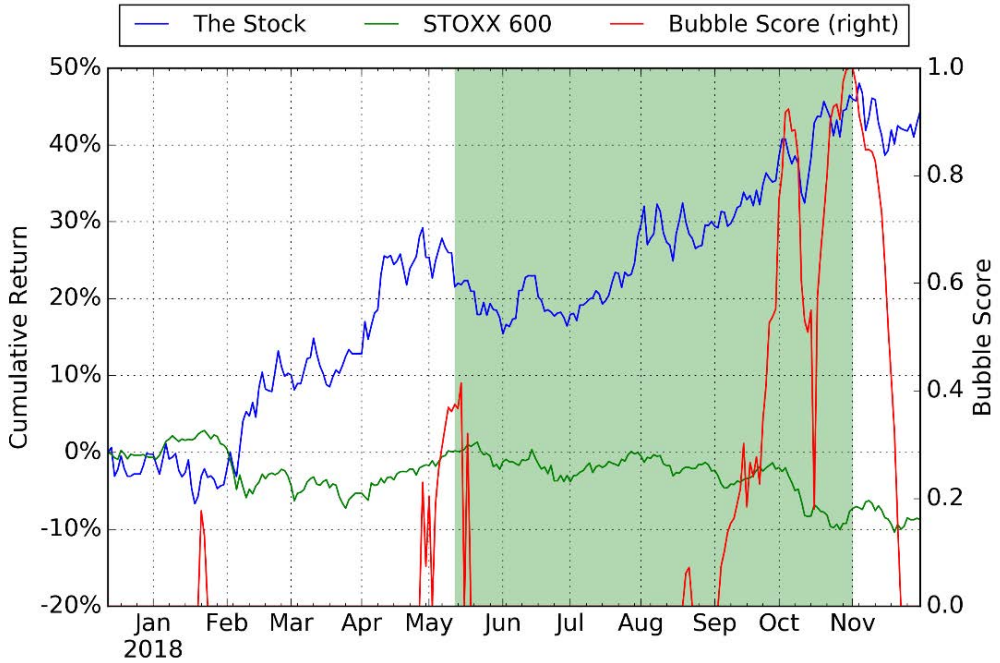


The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period is the strong positive bubble we identified. The Bubble Score of this seven month bubble has reached 69.5% with a bubble size 40.7%.

Single Stocks - Quadrant 1 stocks

Last month example: strong positive bubble signals with strong fundamentals, Marine Harvest ASA.

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 has stopped its ascent in the past month and seens to enter into a plateau, which is in agreement with the DS LPPLS indicator of a change of regime. Our assessment of the strong fundamentals suggests that the plateau will hold and may be just a step followed by more growth.



Single Stocks - Quadrant 2 stocks

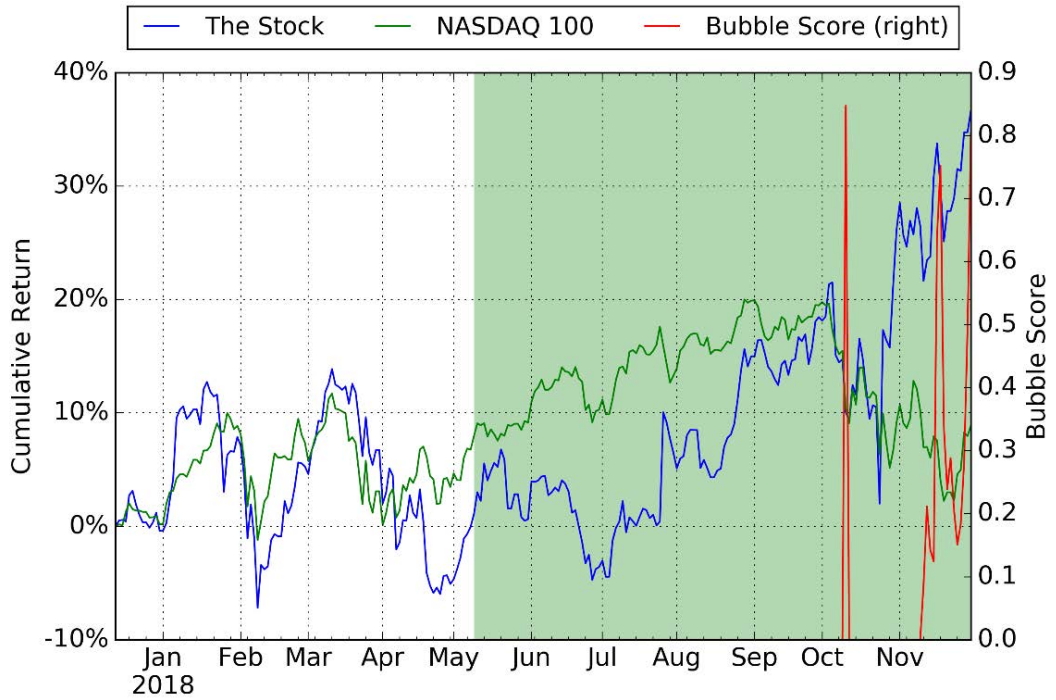
Quadrant 2 stocks: strong positive bubble signals with weak fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Ulta Beauty Inc	United States of America	Retailing	37.1%	30.6%	Apr-18	47.1%	6.1%	64.9%
Xilinx Inc	United States of America	Semiconductors & Semiconductor Equipment	35.9%	35.1%	May-18	80.3%	21.4%	37.9%
Givaudan SA	Switzerland	Materials	10.2%	14.7%	Mar-18	6.2%	12.9%	12.8%
Ameren Corp	United States of America	Utilities	12.8%	13.4%	Jun-18	34.3%	39.0%	64.0%
American Water Works Company Inc	United States of America	Utilities	5.6%	9.4%	Jul-18	37.3%	17.5%	62.3%
Ball Corp	United States of America	Materials	28.3%	27.6%	May-18	9.7%	19.2%	31.2%
Church & Dwight Co Inc	United States of America	Household & Personal Products	36.6%	33.2%	Mar-18	14.4%	18.3%	52.7%
CMS Energy Corp	United States of America	Utilities	6.2%	15.8%	Jan-18	11.8%	26.1%	71.0%
Ecolab Inc	United States of America	Materials	19.4%	25.6%	Feb-18	15.7%	7.4%	73.5%
Genuine Parts Co	United States of America	Retailing	13.4%	12.8%	Jun-18	5.7%	20.7%	57.0%
McCormick & Company Inc	United States of America	Food, Beverage & Tobacco	49.6%	30.6%	Jun-18	74.9%	16.6%	66.0%
NRG Energy Inc	United States of America	Utilities	38.8%	15.4%	May-18	42.1%	22.0%	97.3%
WEC Energy Group Inc	United States of America	Utilities	7.1%	13.8%	43101	24.5%	34.3%	53.2%
Zoetis Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	30.8%	19.6%	43132	10.1%	8.7%	56.1%
H & M Hennes & Mauritz AB	Sweden	Retailing	-16.3%	29.8%	43160	2.6%	36.7%	26.5%

Single Stocks - Quadrant 2 stocks

Quadrant 2 stocks: strong positive bubble signals with weak fundamentals

Example: Xilinx Inc.

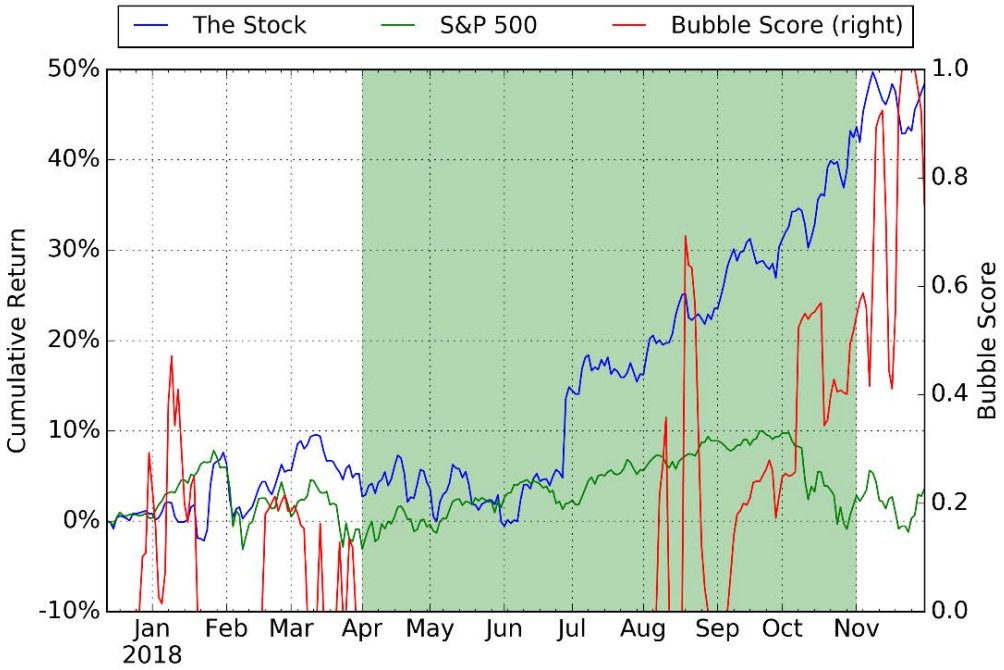


The above graph shows the one year cumulative return of the stock in blue (left hand scale), NASDAQ 100 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period is the strong positive bubble we identified. The Bubble Score of this seven month bubble has reached 80.3% with a bubble size 35.1%. 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, McCormick & Company Inc.

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 in last month. Note that the stock price had stopped its appreciation in the past month, which in agreement with the weak fundamentals and our DS LPPLS indicator. One should remain cautious as this stock is still identified with a strong bubble signal and weak fundamental this month.



Single Stocks - Quadrant 3 stocks

Entrepreneurial Risks
ETH zürich

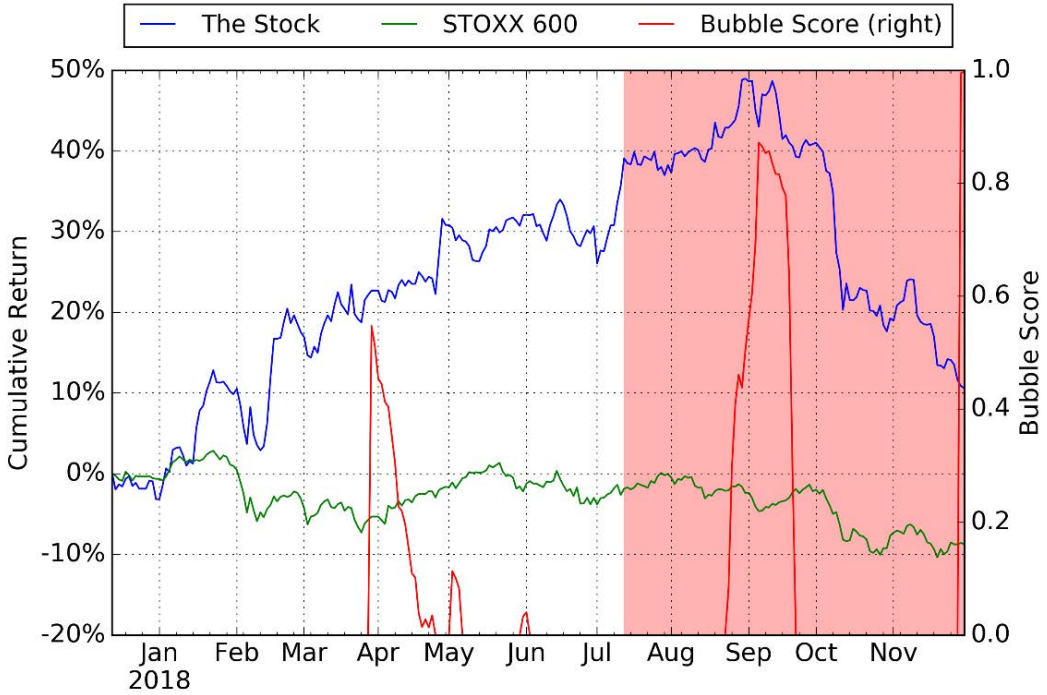
Quadrant 3 stocks: strong negative bubble signals with weak fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
ASML Holding NV	Netherlands	Semiconductors & Semiconductor Equipment	-0.3%	-18.1%	Jun-18	-25.7%	11.7%	23.5%
Baidu Inc	China	Media & Entertainment	-18.8%	-25.6%	May-18	-22.2%	13.5%	29.3%
Electronic Arts Inc	United States of America	Media & Entertainment	-21.0%	-35.8%	May-18	-33.0%	29.8%	26.0%
Facebook Inc	United States of America	Media & Entertainment	-21.2%	-26.7%	May-18	-74.1%	6.9%	29.2%
Liberty Global PLC	United Kingdom	Media & Entertainment	-23.2%	-16.6%	May-18	-7.2%	33.3%	1.8%
Marriott International Inc	United States of America	Consumer Services	-9.9%	-16.2%	Mar-18	-10.9%	5.8%	79.6%
Umicore SA	Belgium	Materials	-2.8%	-23.0%	Jun-18	-49.2%	8.1%	73.9%
Man SE	Germany	Capital Goods	-4.9%	-6.0%	Jul-18	-8.6%	7.7%	13.7%
Axel Springer SE	Germany	Media & Entertainment	-16.2%	-17.5%	Jan-18	-1.8%	34.5%	87.4%
Sartorius AG	Germany	Health Care Equipment & Services	37.4%	-17.6%	Jul-18	-14.7%	6.6%	26.9%
Symrise AG	Germany	Materials	0.5%	-9.3%	Jul-18	-34.3%	7.3%	91.5%
thyssenkrupp AG	Germany	Materials	-30.5%	-28.9%	Feb-18	-25.3%	24.3%	5.6%
Siltronic AG	Germany	Semiconductors & Semiconductor Equipment	-31.6%	-46.9%	May-18	-61.9%	35.8%	83.1%
H Lundbeck A/S	Denmark	Pharmaceuticals, Biotechnology & Life Sciences	-10.7%	-35.3%	May-18	-18.7%	6.3%	95.6%
Rockwool International A/S	Denmark	Capital Goods	3.3%	-32.4%	Jul-18	-10.2%	37.5%	15.3%
Aena SME SA	Spain	Transportation	-17.2%	-10.7%	Jul-18	-78.3%	31.5%	21.9%
Electrocomponents PLC	United Kingdom	Technology Hardware & Equipment	-15.5%	-29.2%	Jun-18	-33.6%	21.7%	35.7%
Ipsen SA	France	Pharmaceuticals, Biotechnology & Life Sciences	12.1%	-20.5%	Jul-18	-99.8%	30.7%	18.2%
LVMH Moet Hennessy Louis Vuitton SE	France	Consumer Durables & Apparel	3.4%	-17.7%	May-18	-47.9%	16.2%	31.1%
DiaSorin SpA	Italy	Health Care Equipment & Services	-1.7%	-22.8%	Jun-18	-45.7%	14.3%	60.1%
Moncler SpA	Italy	Consumer Durables & Apparel	18.5%	-29.6%	Jun-18	-13.6%	18.6%	29.4%
Wartsila Oyj Abp	Finland	Capital Goods	-19.0%	-20.1%	Apr-18	-21.6%	31.2%	88.2%
Flughafen Zuerich AG	Switzerland	Transportation	-27.6%	-26.5%	Feb-18	-29.3%	39.5%	85.9%
Straumann Holding AG	Switzerland	Health Care Equipment & Services	-12.3%	-18.5%	Jun-18	-22.8%	3.8%	72.9%
Arista Networks Inc	United States of America	Technology Hardware & Equipment	5.2%	-13.2%	Jun-18	-24.7%	4.7%	32.4%
Freeport-McMoRan Inc	United States of America	Materials	-26.3%	-29.3%	Jun-18	-17.7%	23.1%	71.8%
Halliburton Co	United States of America	Energy	-29.2%	-33.7%	Feb-18	-27.8%	11.2%	23.6%
Northrop Grumman Corp	United States of America	Capital Goods	-15.3%	-23.7%	Jan-18	-54.7%	28.1%	31.6%
Occidental Petroleum Corp	United States of America	Energy	-0.4%	-14.7%	May-18	-40.2%	13.2%	80.8%
Pioneer Natural Resources Co	United States of America	Energy	-5.6%	-22.7%	Apr-18	-63.4%	10.2%	19.7%
Raytheon Co	United States of America	Capital Goods	-7.1%	-19.5%	Feb-18	-43.9%	26.2%	65.7%
Tiffany & Co	United States of America	Retailing	-8.4%	-30.4%	May-18	-86.5%	26.4%	43.3%
Atlas Copco AB	Sweden	Capital Goods	-13.6%	-16.6%	43070	-32.1%	22.8%	88.8%
Weir Group PLC	United Kingdom	Capital Goods	-26.7%	-29.5%	43191	-76.9%	29.6%	88.1%

Single Stocks - Quadrant 3 stocks

Quadrant 3 stocks: strong negative bubble signals with weak fundamentals

Example: Ipsen SA.

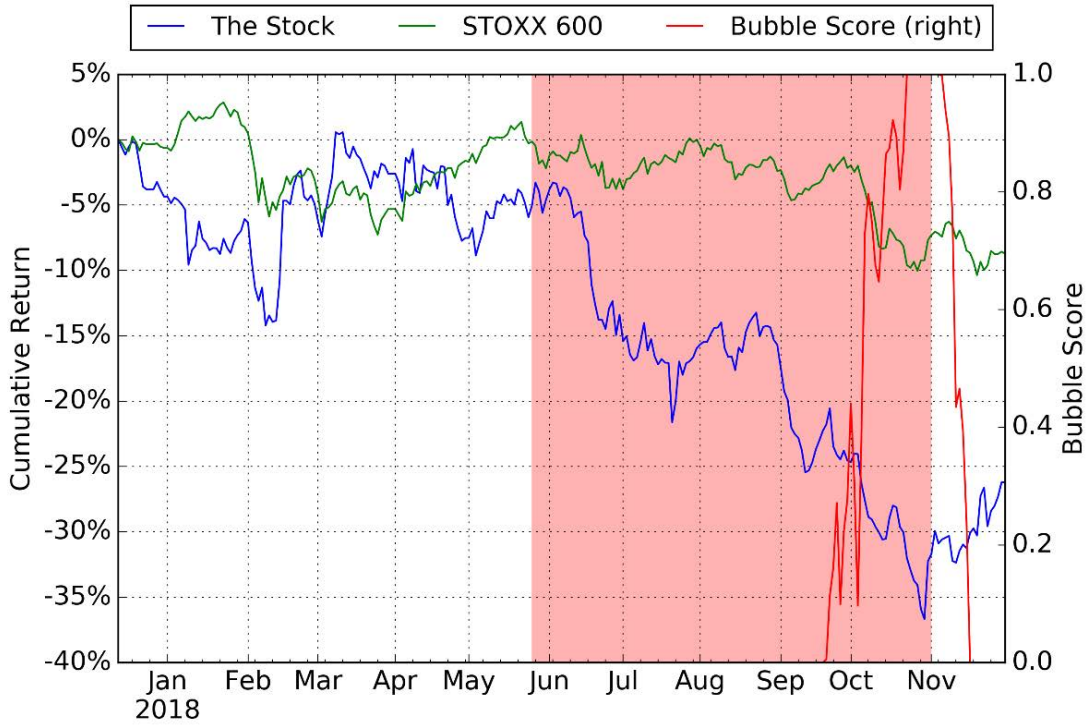


The above graph shows the one year cumulative return of the stock in blue (left hand scale), STOXX 600 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period is the negative bubble we identified. The Bubble Score of this five month bubble has reached 99.8% with a bubble size -20.5%.

Single Stocks - Quadrant 3 stocks

Last month example: strong negative bubble signals with weak fundamentals, Huhtamaki Oyj.

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 started a strong rebound in November, which is in agreement with the DS LPPLS indicator. Given the weak fundamentals, we can expect an increased volatility in the coming months.



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
Kraft Heinz Co	United States of America	Food, Beverage & Tobacco	-35.3%	-15.7%	Jun-18	-16.5%	70.1%	70.6%
Skyworks Solutions Inc	United States of America	Semiconductors & Semiconductor Equipment	-22.7%	-25.0%	May-18	-14.0%	81.5%	48.1%
Western Digital Corp	United States of America	Technology Hardware & Equipment	-45.1%	-47.8%	May-18	-10.2%	98.4%	16.2%
Babcock International Group PLC	United Kingdom	Commercial & Professional Services	-15.9%	-22.0%	Apr-18	-26.4%	90.6%	47.6%
Covestro AG	Germany	Materials	-40.5%	-33.7%	Jul-18	-66.7%	96.7%	4.0%
BASF SE	Germany	Materials	-31.3%	-28.8%	Feb-18	-22.9%	60.9%	35.2%
Bayer AG	Germany	Pharmaceuticals, Biotechnology & Life Sciences	-37.6%	-32.9%	Jun-18	-46.1%	88.5%	30.0%
Bayerische Motoren Werke AG	Germany	Automobiles & Components	-16.2%	-22.1%	Jan-18	-32.1%	85.4%	2.3%
Daimler AG	Germany	Automobiles & Components	-29.9%	-11.9%	Jul-18	-44.9%	87.1%	27.1%
freenet AG	Germany	Telecommunication Services	-41.6%	-32.7%	Apr-18	-46.5%	69.3%	93.0%
HeidelbergCement AG	Germany	Materials	-34.2%	-32.7%	Jan-18	-17.2%	68.2%	99.0%
K&S AG	Germany	Materials	-22.8%	-34.4%	Mar-18	-84.2%	74.4%	2.1%
Software AG	Germany	Software & Services	-23.3%	-15.3%	May-18	-34.1%	76.9%	78.5%
Repsol SA	Spain	Energy	4.8%	-11.6%	Jul-18	-54.2%	97.2%	3.3%
Atos SE	France	Software & Services	-42.4%	-32.0%	Apr-18	-34.8%	84.9%	20.9%
Faurecia SA	France	Automobiles & Components	-46.9%	-53.7%	May-18	-80.0%	83.6%	87.8%
Capgemini SE	France	Software & Services	4.1%	-9.5%	Apr-18	-7.1%	88.6%	10.9%
Bouygues SA	France	Capital Goods	-22.9%	-24.2%	Jan-18	-7.5%	81.3%	2.2%
Eiffage SA	France	Capital Goods	-8.3%	-15.6%	May-18	-44.5%	67.4%	15.2%
Valeo SA	France	Automobiles & Components	-58.2%	-54.7%	Mar-18	-15.1%	66.3%	95.4%
Compagnie Generale des Etablissements Michelin SCA	France	Automobiles & Components	-23.5%	-26.8%	Feb-18	-32.0%	85.5%	9.4%
Renault SA	France	Automobiles & Components	-27.0%	-34.3%	Mar-18	-27.8%	85.2%	0.1%
Compagnie de Saint Gobain SA	France	Capital Goods	-30.1%	-26.0%	Feb-18	-2.8%	84.1%	25.5%
Spie SA	France	Commercial & Professional Services	-42.8%	-29.7%	Jun-18	-73.7%	67.6%	1.6%

Single Stocks - Quadrant 4 stocks

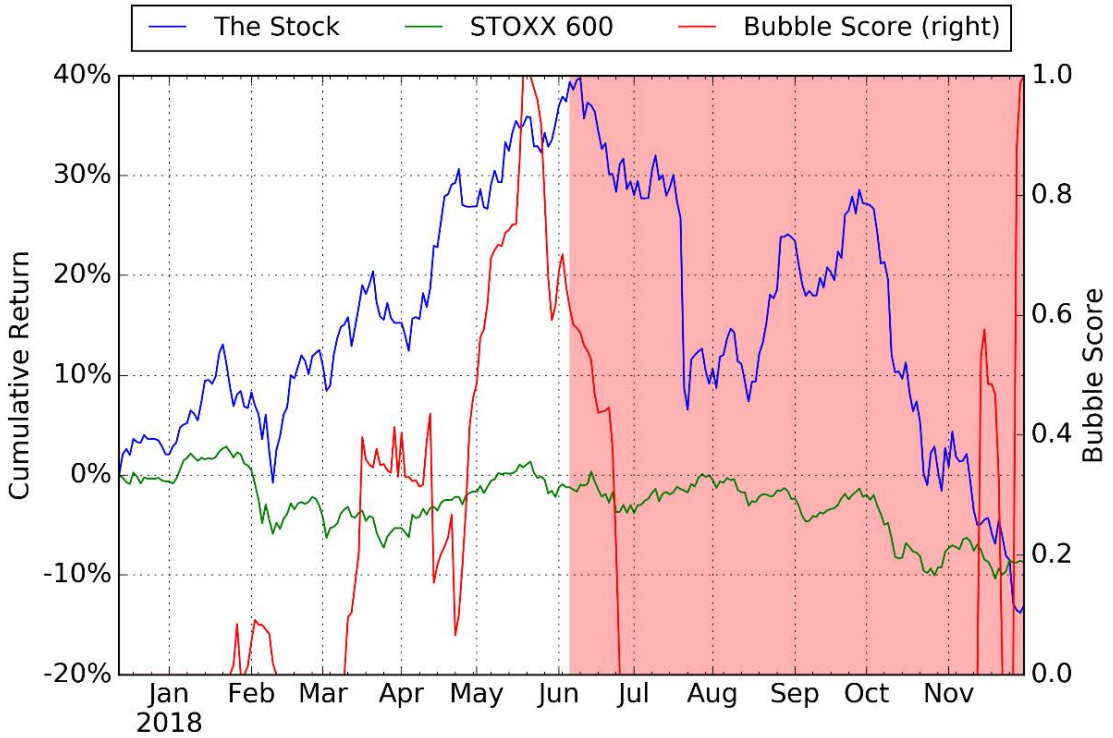
Quadrant 4 stocks: strong negative bubble signals with strong fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
GVC Holdings PLC	Isle of Man	Consumer Services	-20.2%	-30.3%	Jul-18	-32.6%	69.0%	98.4%
Eni SpA	Italy	Energy	2.1%	-11.8%	Jul-18	-70.2%	91.7%	10.7%
STMicroelectronics NV	Switzerland	Semiconductors & Semiconductor Equipment	-30.3%	-39.4%	Jun-18	-38.2%	65.2%	17.9%
ITV PLC	United Kingdom	Media & Entertainment	-12.7%	-13.4%	Jun-18	-3.0%	87.7%	12.9%
Stora Enso Oyj	Finland	Materials	-15.3%	-37.6%	Jun-18	-100.0%	72.2%	6.8%
Norsk Hydro ASA	Norway	Materials	-29.1%	-23.4%	Jun-18	-71.7%	84.3%	15.4%
Subsea 7 SA	United Kingdom	Energy	-20.7%	-25.4%	Jun-18	-64.5%	99.3%	75.1%
voestalpine AG	Austria	Materials	-40.1%	-30.7%	Jun-18	-24.7%	77.3%	3.2%
Wienerberger AG	Austria	Materials	2.6%	-15.7%	May-18	-28.8%	66.6%	12.0%
Persimmon PLC	United Kingdom	Consumer Durables & Apparel	-28.4%	-27.5%	Apr-18	-43.7%	96.1%	50.4%
Royal Mail PLC	United Kingdom	Transportation	-28.1%	-36.2%	Jun-18	-5.1%	97.3%	1.0%
Compagnie Financiere Richemont SA	Switzerland	Consumer Durables & Apparel	-26.4%	-31.7%	May-18	-60.0%	71.1%	97.9%
The Swatch Group AG	Switzerland	Consumer Durables & Apparel	-24.3%	-39.5%	Jun-18	-77.1%	67.7%	90.0%
SSE PLC	United Kingdom	Utilities	-16.3%	-20.3%	May-18	-10.9%	62.6%	12.2%
Tui AG	Germany	Consumer Services	-22.1%	-32.6%	Jun-18	-59.1%	68.5%	82.6%
Taylor Wimpey PLC	United Kingdom	Consumer Durables & Apparel	-33.5%	-27.1%	Jun-18	-58.8%	94.5%	21.3%
BorgWarner Inc	United States of America	Automobiles & Components	-23.2%	-24.4%	Feb-18	-14.9%	68.8%	32.8%
Coty Inc	United States of America	Household & Personal Products	-57.3%	-42.5%	May-18	-47.7%	66.8%	45.9%
Gap Inc	United States of America	Retailing	-17.8%	-18.7%	Dec-17	-18.5%	76.7%	44.7%
PVH Corp	United States of America	Consumer Durables & Apparel	-16.1%	-32.8%	Jun-18	-79.7%	79.1%	40.8%
Ralph Lauren Corp	United States of America	Consumer Durables & Apparel	15.0%	-16.4%	May-18	-81.6%	72.9%	37.7%
Boliden AB	Sweden	Materials	-22.7%	-26.7%	43132	-19.6%	84.6%	3.8%
Trelleborg AB	Sweden	Capital Goods	-20.2%	-23.7%	43132	-6.8%	71.4%	86.1%
William Hill PLC	United Kingdom	Consumer Services	-48.2%	-48.3%	43221	-91.6%	77.6%	1.9%

Single Stocks - Quadrant 4 stocks

Quadrant 4 stocks: strong negative bubble signals with strong fundamentals

Example: Stora Enso Oyj.

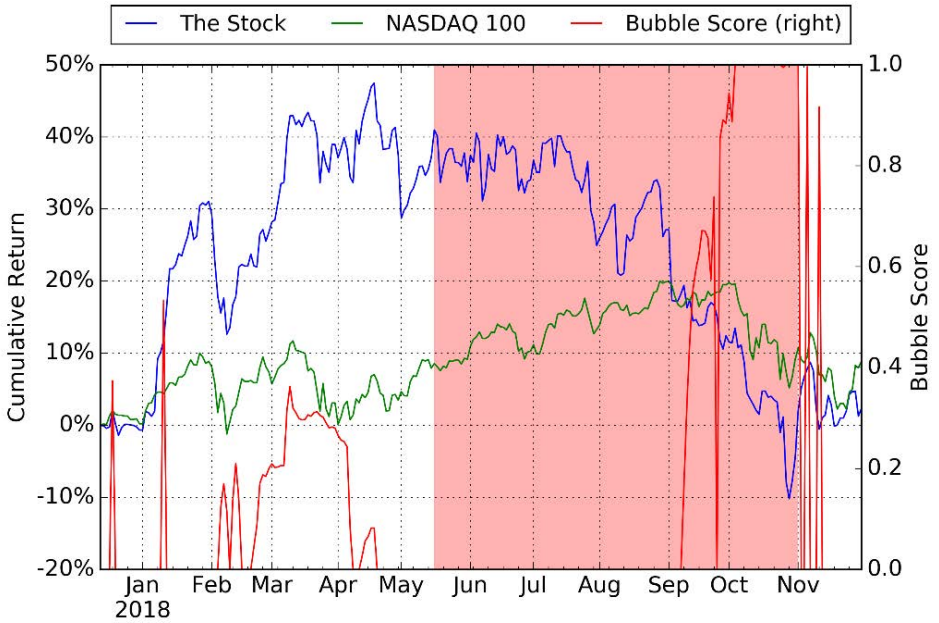


The above graph shows the one year cumulative return of the stock in blue (left hand scale), STOXX 600 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period is the strong negative bubble we identified. The Bubble Score of this six month bubble has reached 100% with a bubble size -37.6%. 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, Seagate Technology PLC.

The figure below 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 is the strong negative bubble we identified and reported in last month. The stock has stopped its drawdown and entered into a small plateau recently, which is in agreement with our DS LPPLS indicator. We expect this stock to appreciate further in the future due to the strong fundamentals and following its neglect by investors in previous months.



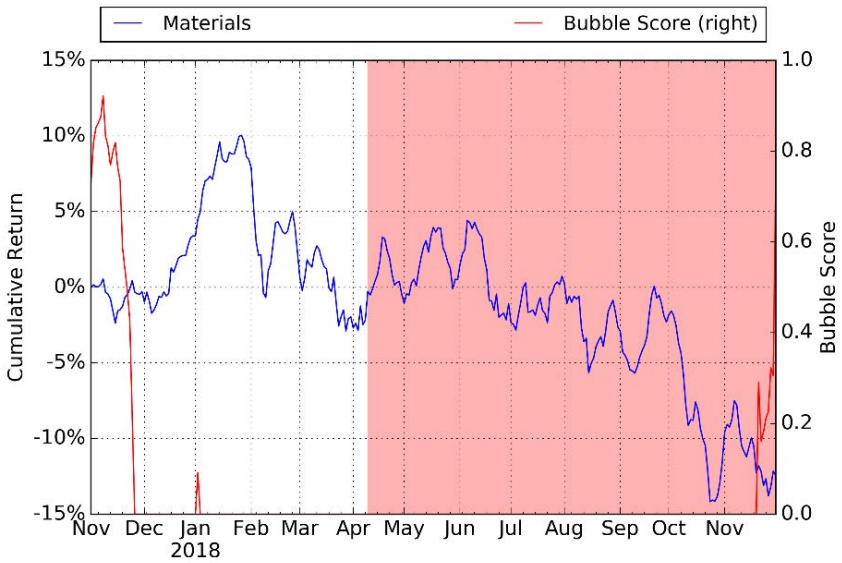
Sectors

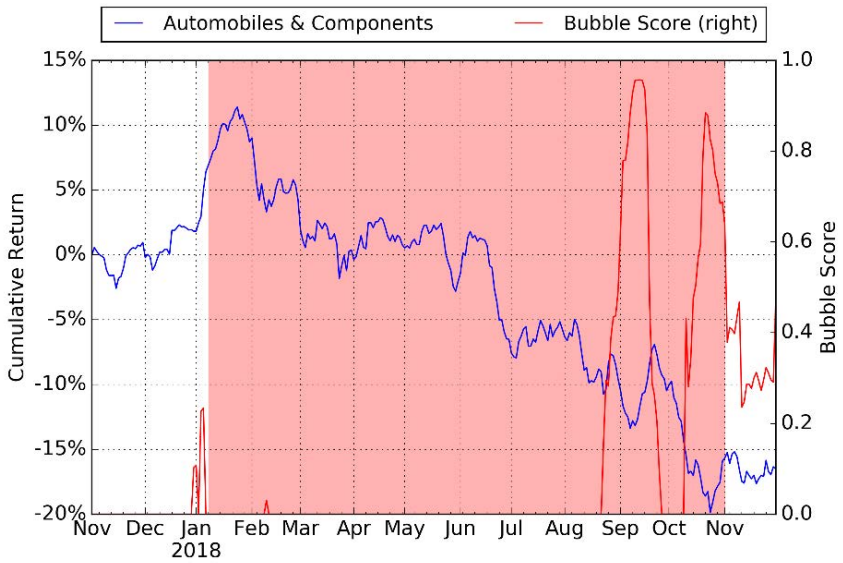
GICS Industry Group Name	Yearly Return		Bubble Size		Bubble Score		Value Score		Growth Score	
	Dec 1st	Nov 1st	Dec 1st	Nov 1st	Dec 1st	Nov 1st	Dec 1st	Nov 1st	Dec 1st	Nov 1st
Pharmaceuticals, Biotechnology & Life Sciences	7.4%	3.6%	0.0%	0.0%	0.0%	0.0%	63.6%	65.0%	57.4%	56.9%
Consumer Services	-1.5%	-5.0%	0.0%	0.0%	0.0%	0.0%	29.7%	29.9%	48.8%	47.5%
Retailing	19.1%	22.4%	0.0%	0.0%	0.0%	0.0%	19.4%	20.2%	57.8%	57.7%
Transportation	-0.6%	0.9%	0.0%	0.0%	0.0%	0.0%	57.0%	59.5%	56.3%	55.8%
Consumer Durables & Apparel	-7.0%	-3.2%	0.0%	0.0%	0.0%	0.0%	37.0%	35.2%	54.5%	54.5%
Semiconductors & Semiconductor Equipment	-5.6%	-12.4%	0.0%	0.0%	0.0%	0.0%	58.4%	57.2%	28.8%	28.0%
Technology Hardware & Equipment	2.9%	11.8%	0.0%	0.0%	0.0%	0.0%	72.1%	67.5%	41.4%	43.5%
Automobiles & Components	-16.9%	-16.2%	-18.5%	-22.9%	-47.5%	-68.5%	77.4%	77.9%	49.5%	49.4%
Telecommunication Services	-6.3%	-4.5%	0.0%	0.0%	0.0%	0.0%	63.8%	65.7%	39.4%	38.8%
Energy	-5.4%	-3.1%	0.0%	0.0%	0.0%	0.0%	51.4%	51.4%	51.6%	52.0%
Software & Services	9.2%	6.5%	0.0%	0.0%	0.0%	0.0%	39.2%	44.7%	45.5%	43.1%
Materials	-11.9%	-12.3%	-12.2%	0.0%	-72.5%	0.0%	53.4%	53.2%	41.8%	42.0%
Health Care Equipment & Services	16.5%	12.2%	0.0%	0.0%	0.0%	0.0%	66.1%	65.9%	59.1%	58.2%
Capital Goods	-9.2%	-9.6%	0.0%	0.0%	0.0%	0.0%	47.1%	46.6%	53.6%	52.7%
Media & Entertainment	3.3%	5.9%	0.0%	0.0%	0.0%	0.0%	28.0%	27.5%	51.5%	53.1%
Commercial & Professional Services	2.1%	-0.8%	0.0%	0.0%	0.0%	0.0%	33.9%	33.3%	49.4%	49.0%
Food & Staples Retailing	7.2%	12.6%	0.0%	0.0%	0.0%	0.0%	55.1%	61.7%	63.7%	63.0%
Household & Personal Products	0.1%	-3.8%	0.0%	0.0%	0.0%	0.0%	37.3%	35.2%	53.1%	52.2%
Food, Beverage & Tobacco	-10.0%	-7.2%	0.0%	0.0%	0.0%	0.0%	44.8%	44.0%	57.6%	59.1%
Utilities	-0.7%	-4.8%	0.0%	0.0%	0.0%	0.0%	51.8%	52.1%	46.4%	46.1%
Insurance	-6.2%	-8.4%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Real Estate	-3.5%	-6.6%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Diversified Financials	-7.3%	-4.7%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Banks	-11.7%	-10.2%	0.0%	0.0%	0.0%	0.0%	-	-	-	-

Sectors

Since Dec 2017, we are using 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 2 industry groups with a negative bubble score: *Automobiles & Components,* and *Materials*, as shown in the figure below. The index of *Automobiles & Components* stopped its drawdown for a month, although it is still identified with a strong negative bubble score.





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

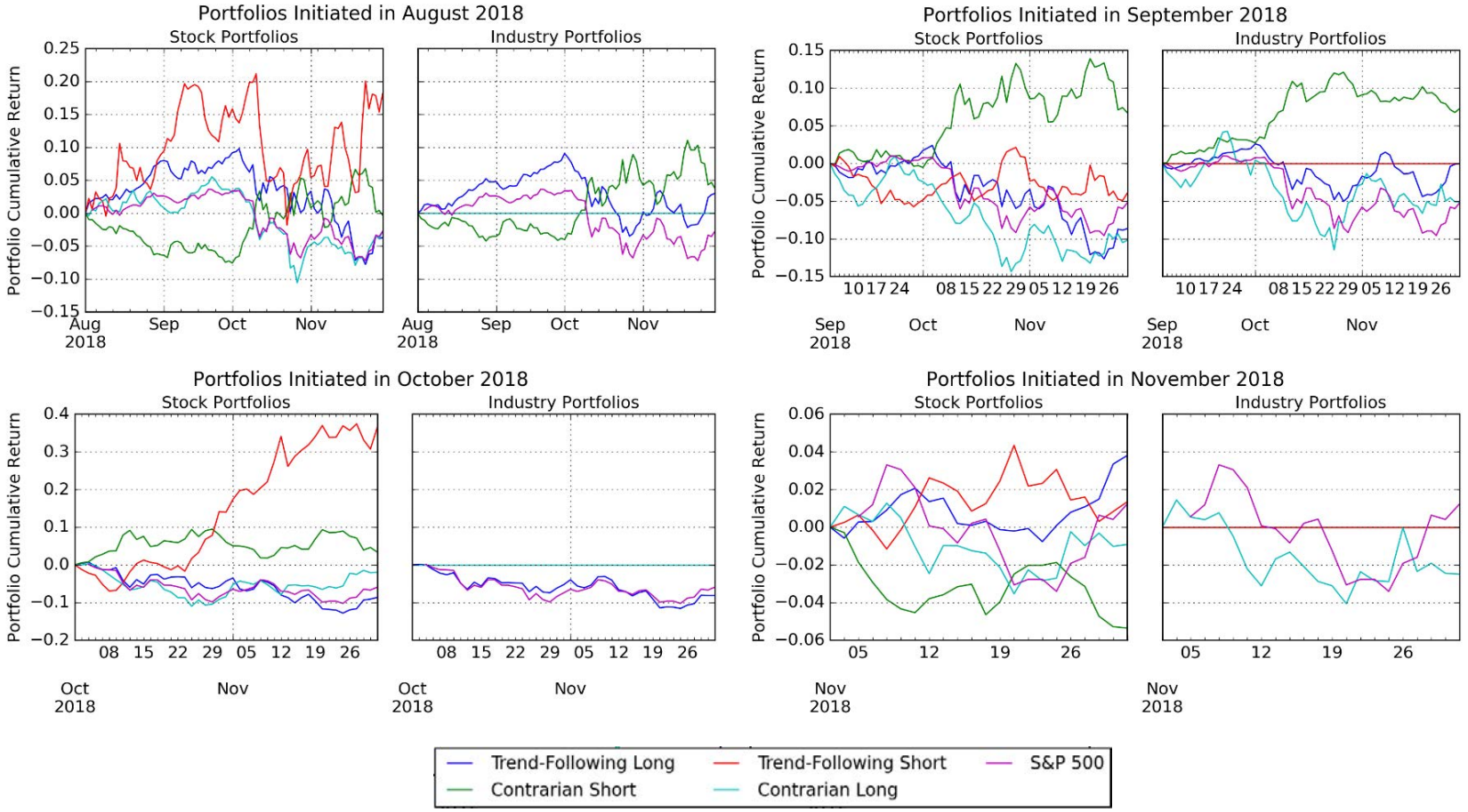
Portfolio Construction & Performance

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.

Since we started to use a new version of bubble signals and algorithm in November 2017, we only present the portfolios we initiated in November 2017 and later.

Portfolio Construction & Performance



This month, we find that Short Portfolios initiated in August, September and October 2018 outperformed the others, due to the recent market corrections. 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.

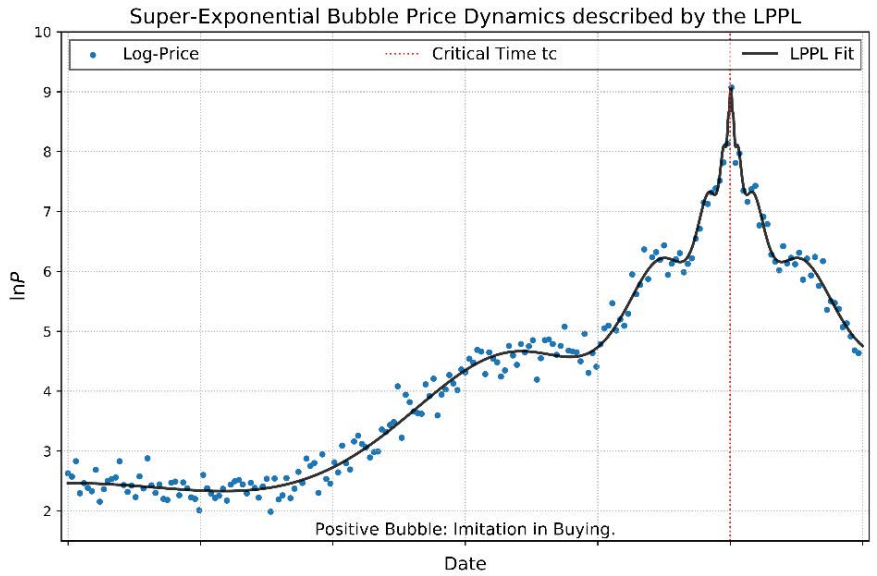
Appendix

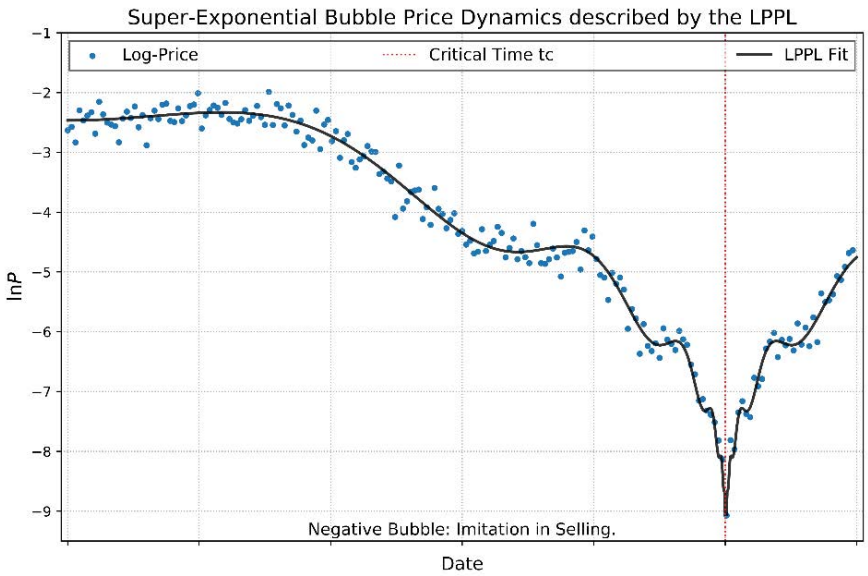
Methodology

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.





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:

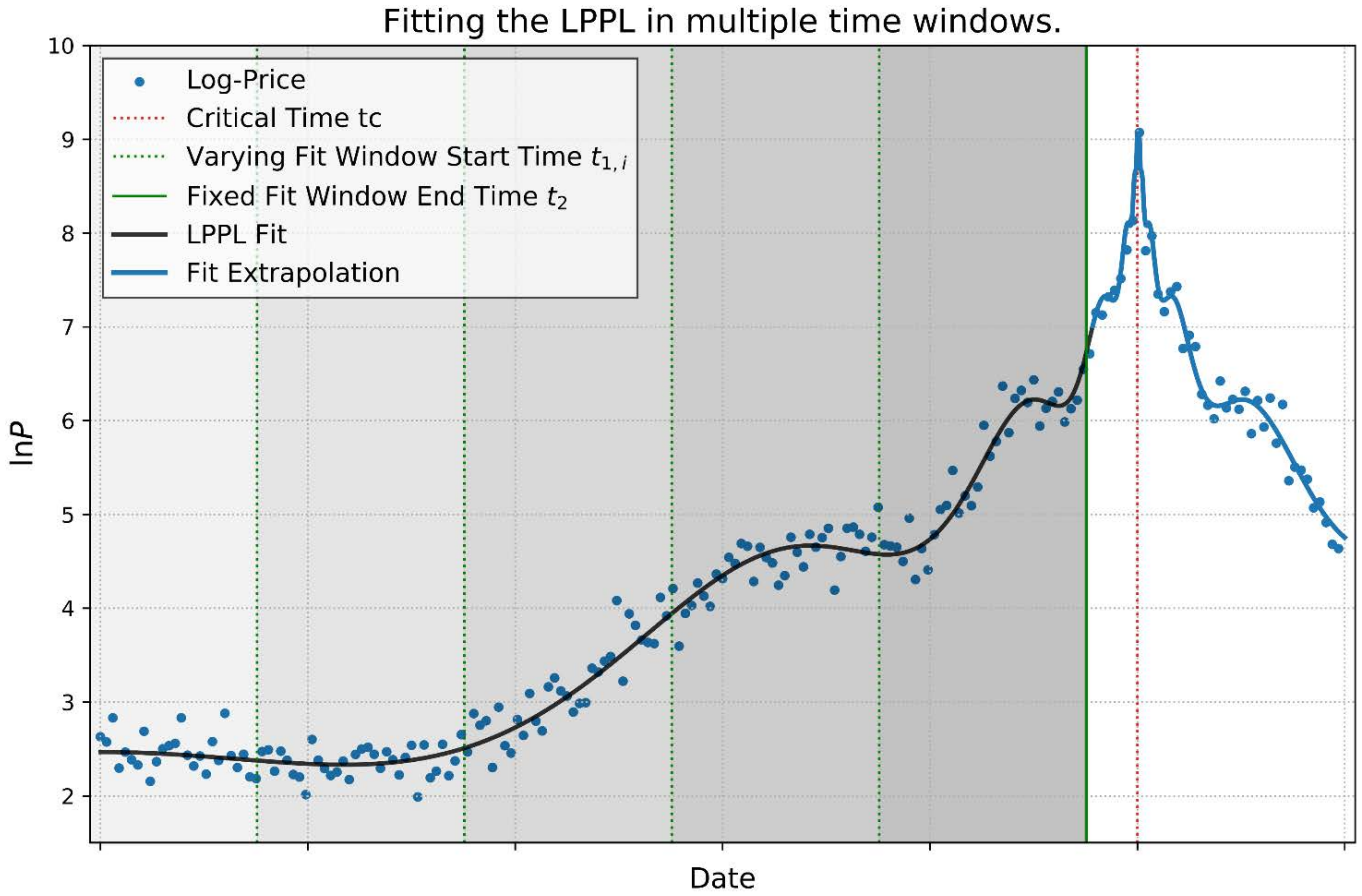
$$LPPLS \coloneqq E[\ln P(t)] = A + B(t_c - t)^m + (t_c - t)^m [C_1 \cos(\omega \ln(t_c - t)) + C_2 \sin(\omega \ln(t_c - t))]$$

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, Lagrange Regularisation Approach to Compare Nested Data Sets and Determine Objectively Financial Bubbles' Inceptions (July 22, 2017). Swiss Finance Institute Research Paper No. 18-20. Available at SSRN: https://ssrn.com/abstract=3007070 or http://dx.doi.org/10.2139/ssrn.3007070

[2] A. Johansen and D. Sornette, Shocks, Crashes and Bubbles in Financial Markets, Brussels Economic Review (Cahiers economiques 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 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] Gerlach, Demos and Sornette, Didier, Dissection of Bitcoin's Multiscale Bubble History (April 12, 2018). Swiss Finance Institute Research Paper No. 18-30. Available at SSRN: https://ssrn.com/abstract=3164246 or http://dx.doi.org/10.2139/ssrn.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.

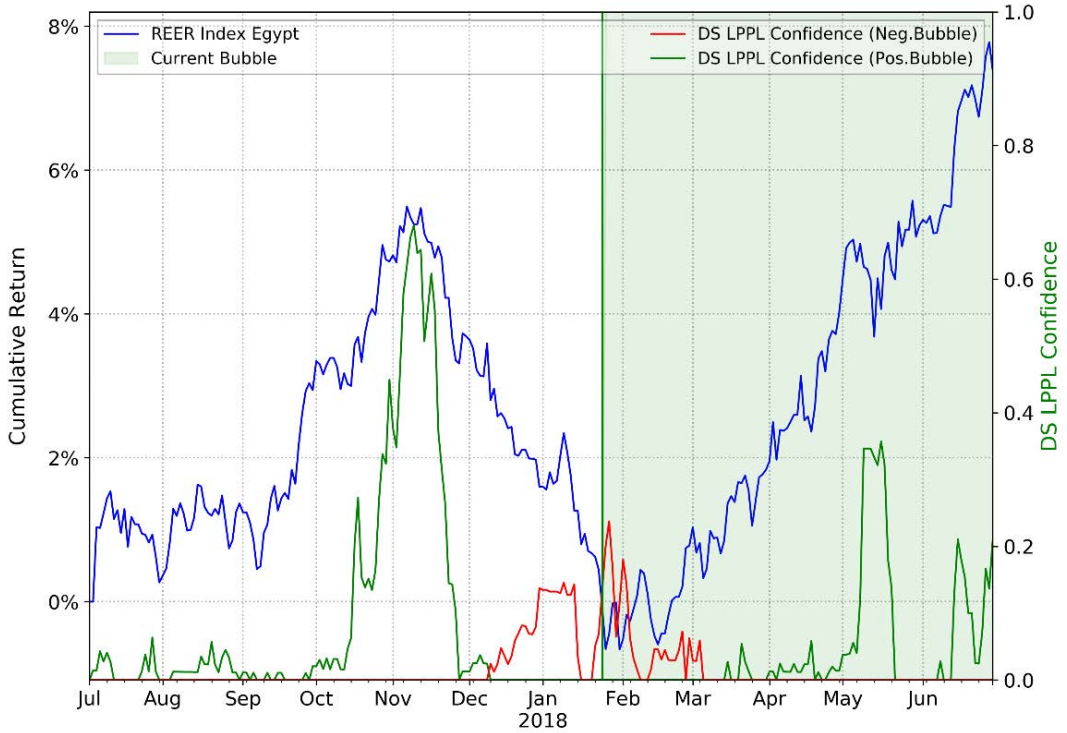
The first section provides asset and estimated bubble characteristics (size and duration), as well as the value of the confidence indicator. We rank assets according to their geometric average of the absolute of bubble size and confidence indicator. In this way, we incorporate the bubble size into the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

Value and Growth Score

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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