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

SEE APPENDIX

We use the Log-Periodic Power Law Singularity (LPPLS) model to hunt for the distinct fingerprint of Bubbles:

1. Price rises faster than exponentially, therefore the logarithm of the price rises faster than linearly;

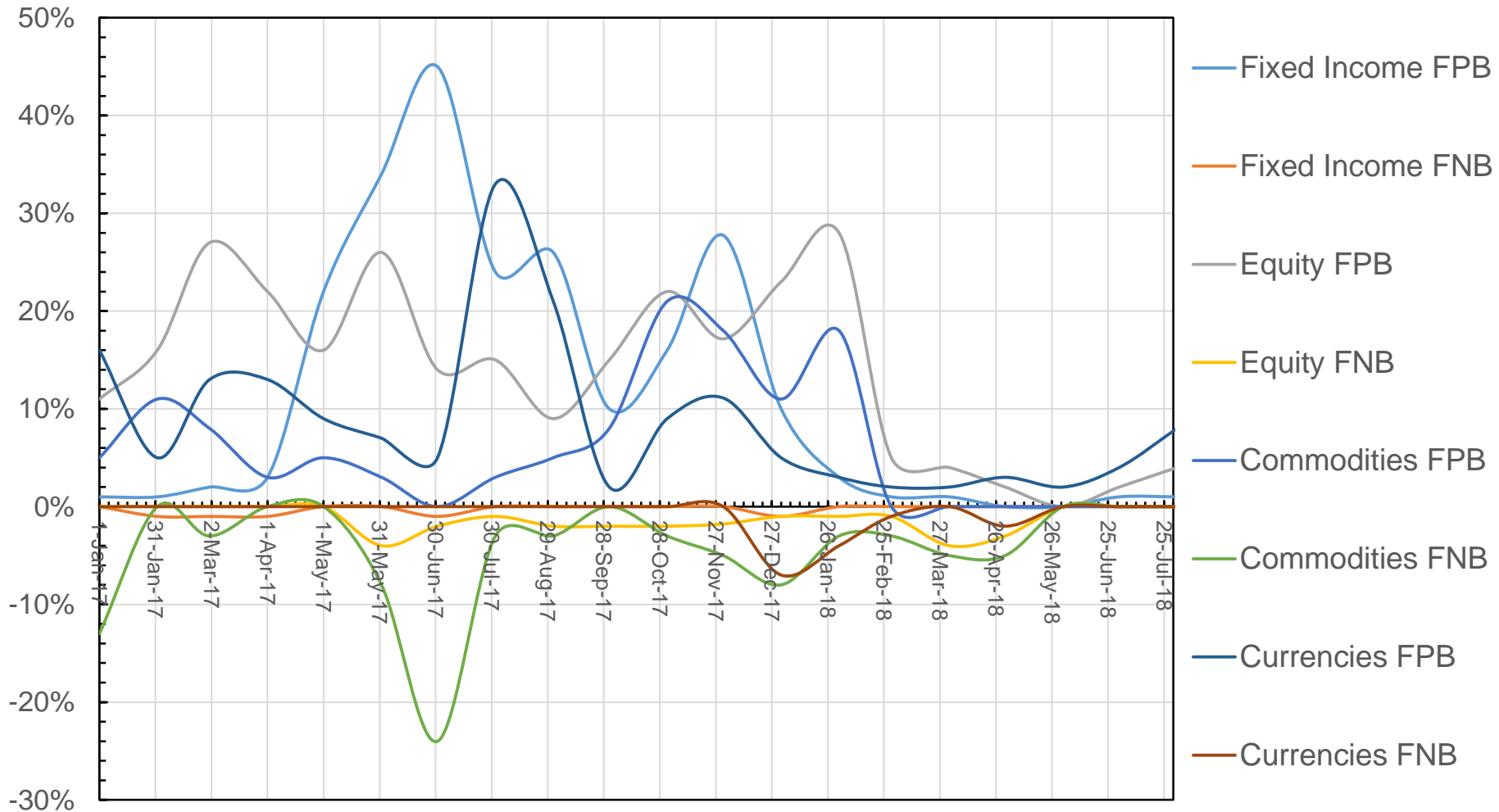2. There are accelerating oscillations, with a distinct characteristic.
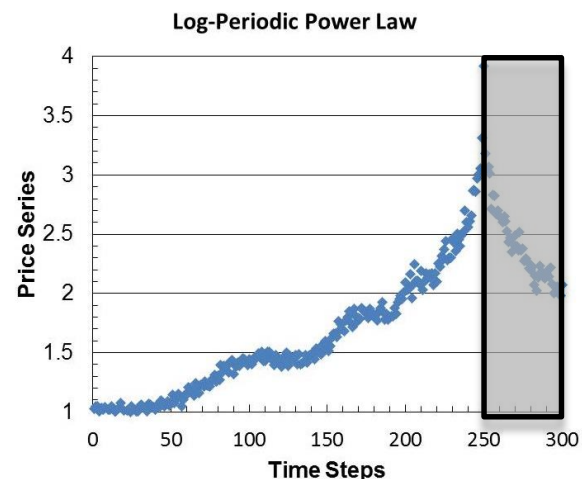
Positive bubble: imitation in **buying**
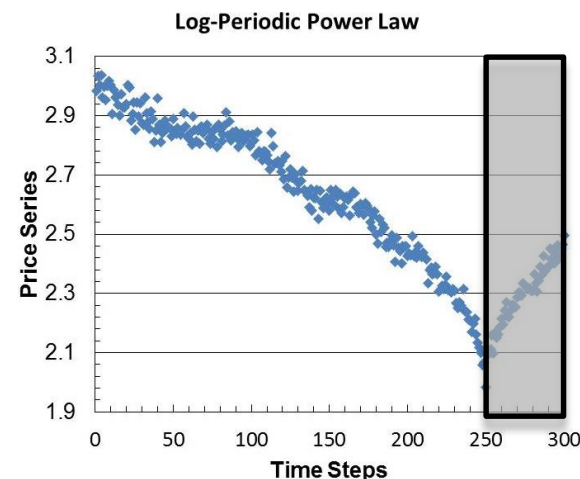
Negative bubble: imitation in **selling**

General Results – The Big Picture

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

Legend:
- Fixed Income FPB
- Fixed Income FNB
- Equity FPB
- Equity FNB
- Commodities FPB
- Commodities FNB
- Currencies FPB
- Currencies FNB

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

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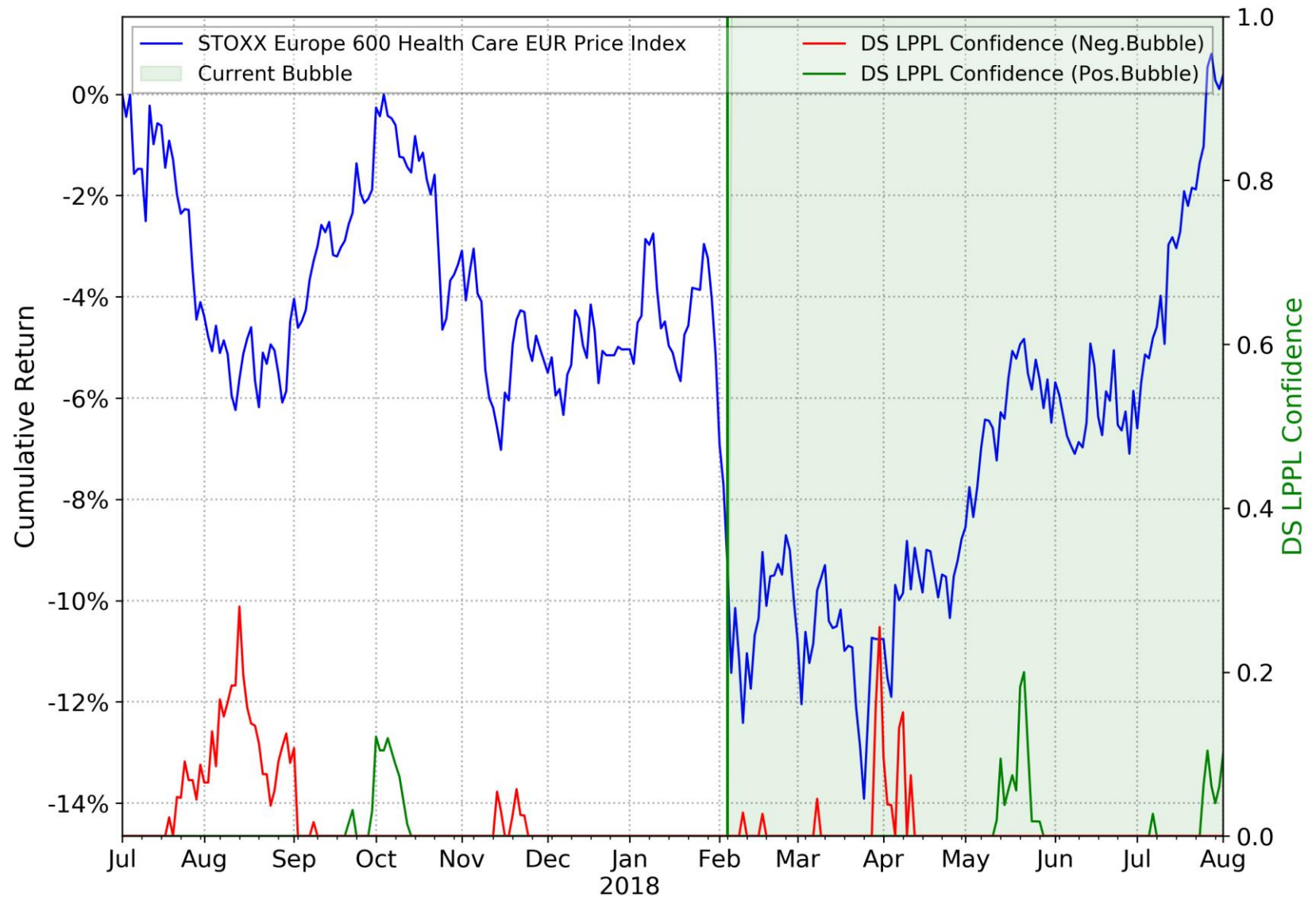| Category	Analyzed Assets	Fraction of Pos. Bubbles [%]	Fraction of Neg. Bubbles [%]
Fixed Income	150	1	0
Government Bonds	55	2	0
Finance and Insurance	21	0	0
Corporate Bonds	74	0	0
Equity	286	4	0
Country Indices	61	0	0
Europe	36	3	0
United States	189	5	0
Commodities	28	0	0
Forex	51	8	0

During July, we saw slight increases in positive bubble activity in the Equity (4%/2%) and Forex (8%/4%) sectors compared to the results reported last month. The fraction of positive bubbles remains near-zero for the other sectors, including the cryptocurrency sector. No negative bubble signals are detected amongst all asset classes This continues the trend of the previous months. Hence, overall, we still observe balanced markets with weak bubble activity.

Since there is nothing to show, the corresponding slides for the commodities and cryptocurrency sections are omitted in this report.

Bubble Data		Bubble Size bs [%]	Duration [$days$]	DS LPPL Confidence ci [%]	Geometric Average $\sqrt{bs \cdot ci}$ [%]	Cluster Analysis	$\sigma_{t_c}[days]$	Scenario Probability [%]
Name						Critical Time Prediction μ_{t_c}		
Positive Bubbles								
1	STOXX Europe 600 Health Care EUR Price Index	10	178	20	14	2018-08-06	1	13

The list of bubble assets in the Equities Index Europe section comprises a single positive bubble this month. The detected bubble size is 10%, the DS LPPL Confidence Indicator is at a fairly low level of 20%.

Again, we see a short-term prediction for the most likely bubble burst scenario. In this case, however, the scenario probability is rather low. The fact that the biggest detected cluster only has a size of 13% also tells us that there is a large number of other small clusters. In other words, using the kmeans procedure, we find that there is a lot of variety and inhomogeneity in the result data. This suggests that the bubble still needs time to mature so that one of the possible different scenarios found here becomes more clearly selected.
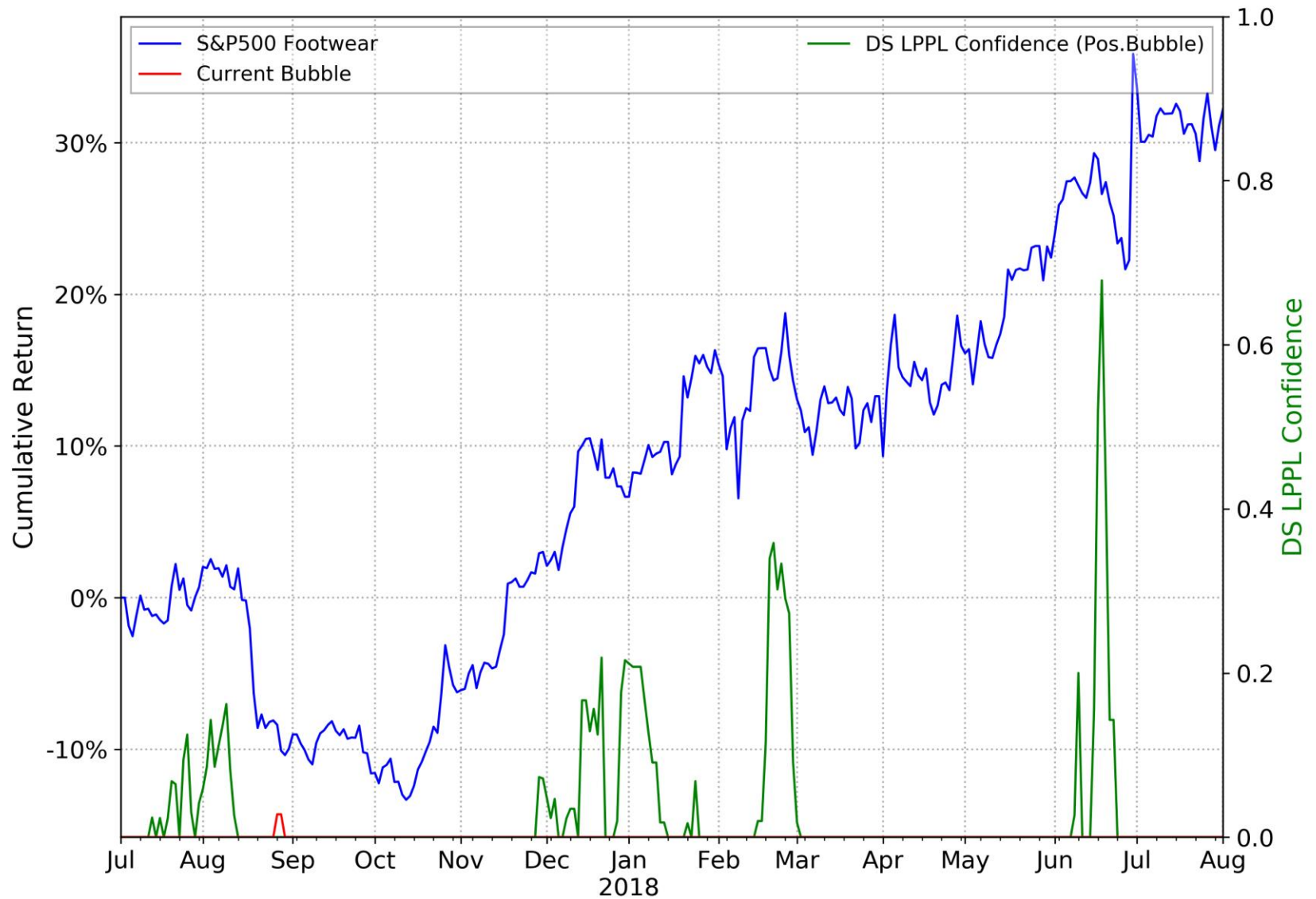
Equities – United States

Bubble Data					Cluster Analysis		
Name	Bubble Size bs [%]	Duration [days]	DS LPPL Confidence ci [%]	Geometric Average $\sqrt{bs \cdot ci}$ [%]	Critical Time Prediction μ_{t_c}	σ_{t_c} [days]	Scenario Probability [%]
Positive Bubbles							
1	S&P500 Textiles & Apparel	30	365	35	32	2018-08-07	11	54
2	S&P500 Footwear	14	116	31	21	2018-08-05	3	67
3	S&P 500/Citigroup Pure Growth	19	365	18	19	2018-08-13	7	78
4	S&P500 Leisure Products	17	136	18	18	2018-08-15	8	71
5	S&P500 Movies & Entertainment	16	130	18	17	2018-08-05	4	48
6	S&P500 Automotive Retail Si	14	178	15	14	2018-08-12	11	69
7	S&P500 Retailing	14	166	13	14	2018-09-01	23	64
8	S&P500 Road & Rail	16	167	11	14	2018-08-03	4	33
9	S&P500 Pharm Bio-T & Life Sciences	10	130	18	13	2018-08-04	1	83
10	S&P500 Railroads	17	167	10	13	2018-08-03	3	36

Here, we list ten United States Equity Indices that exhibit positive bubble activity at the beginning of August. The majority of bubbles are at the lower end in terms of detected bubble size, with 9/10 bubbles being less than 20% in size. The single asset with a larger bubble size (30%), the S&P500 Textiles & Apparel Index, is also the top ranked one (recall that we rank according to the geometric average of bubble size and LPPL confidence indicator). The cluster analysis section reveals that all biggest clusters predict a potential change of regime to be close to the present time. Obtained scenario probabilities vary between 33% and 83%. The graphical results for the top 3 identified bubbles are depicted on the following slides.

Bubble Data						Regime Change Analysis	
Name	Bubble Size bs [%]	Duration [$days$]	Bubble Start t_1	Critical Time t_c	σ_{t_c}[$days$]	Crash/Rally End Date	C/R Size [%]
Positive Bubbles							
1 S&P500 Food Distributors	24.8	173	2018-02-03	2018-07-26	1	2018-07-30	-6.3

In order to validate a prediction from the previous report, on the next slide, we show the S&P500 Food Distributors Index, which was listed in our report one month ago at the top of the US Equities positive bubble list, at a DS LPPL Confidence Indicator level of 74%. At that time, our cluster analysis predicted the critical bubble crash time for the 31st of July, with a standard deviation of +-3days and a scenario probability of 47%. For further details, please see the previous report.

Meanwhile, as the table above and the plot on the next slide reveal, the asset has undergone a correction of about 6% on July 30th (in our definition, a correction is at least 5% in size). Therefore, the drawdown has been correctly identified by our analysis in advance.

As a note: in the table above, where we state the true bubble data 'post mortem', the crash size (6.3%) has been estimated as the maximum drawdown between the critical time (peak of the bubble / start of crash) and the present. We can see that, as the critical time has occurred only recently and the price has only slightly recovered from the trough value after the critical time, there still is potential for an even larger, consecutive drop in the coming time.

Past Regime Change Detection: S&P500 Food Distributors
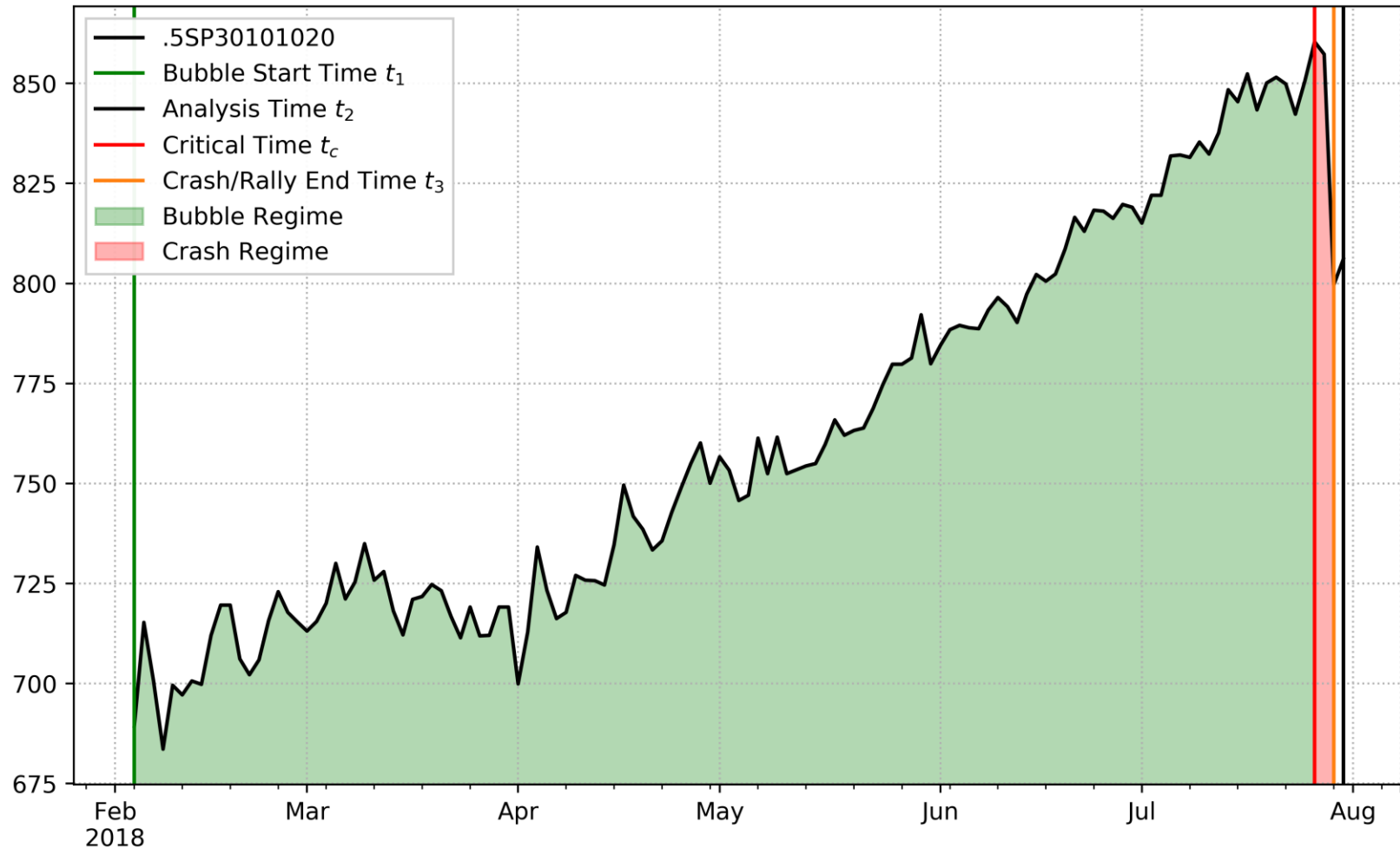
Bubble Size = 24.81%, Bubble Duration = 173days, Crash Size = -6.31%

Currencies – Real Effective Exchange Rates & PCA

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							
REER Index Egypt	12	187	98	35	2018-08-05	2	58
REER Index Nigeria	12	179	80	30	2018-08-04		35
REER Index Uruguay	13	258	19	16	2018-07-31		89

The analysis of REER[1] Index and fiat currency Principal Component time series shows that the Egyptian REER Index is still in a bubble state, with slightly grown bubble size (12%/10%) compared to last month and even larger magnitude of the confidence indicator (98%/84%). The almost maximally peaking value of the confidence indicator for this index signifies that the bubble-characteristic LPPL price pattern is found on almost all observed timescales. The reported bubble duration is about half a year.

Besides the Egyptian index, we find two other indices at similar positive bubble sizes, but much lower indicator values.

No signals were detected on any of the principal components (PC) calculated for basic fiat currencies from large selections of currency pairs. The resulting PC time series that we applied our analysis to are shown on the following slide.

[1] Real Effective Exchange Rate (REER) is a measure of the trade-weighted average exchange rate of a currency against a basket of currencies after adjusting for inflation differentials with regard to the countries concerned and expressed as an index number relative to a base year. The larger the REER, the stronger the currency.

Currencies – PCA

First Principal Components of 8 Major Fiat Currencies

Single Stocks
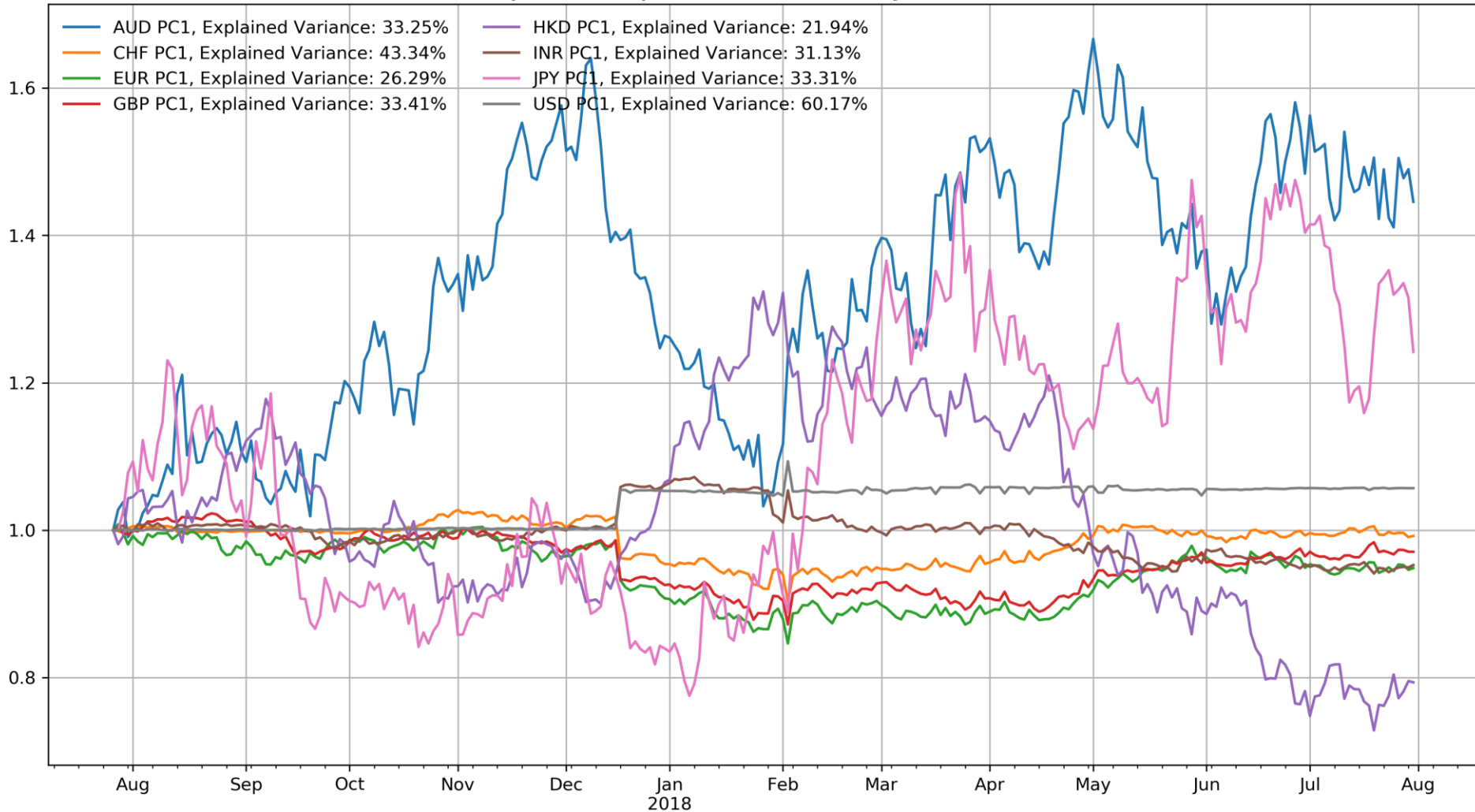
For 813 stocks, we calculate the bubble warning indicators as well as two financial strength indicators, which indicate the fundamental value of the stock and the growth capability respectively.
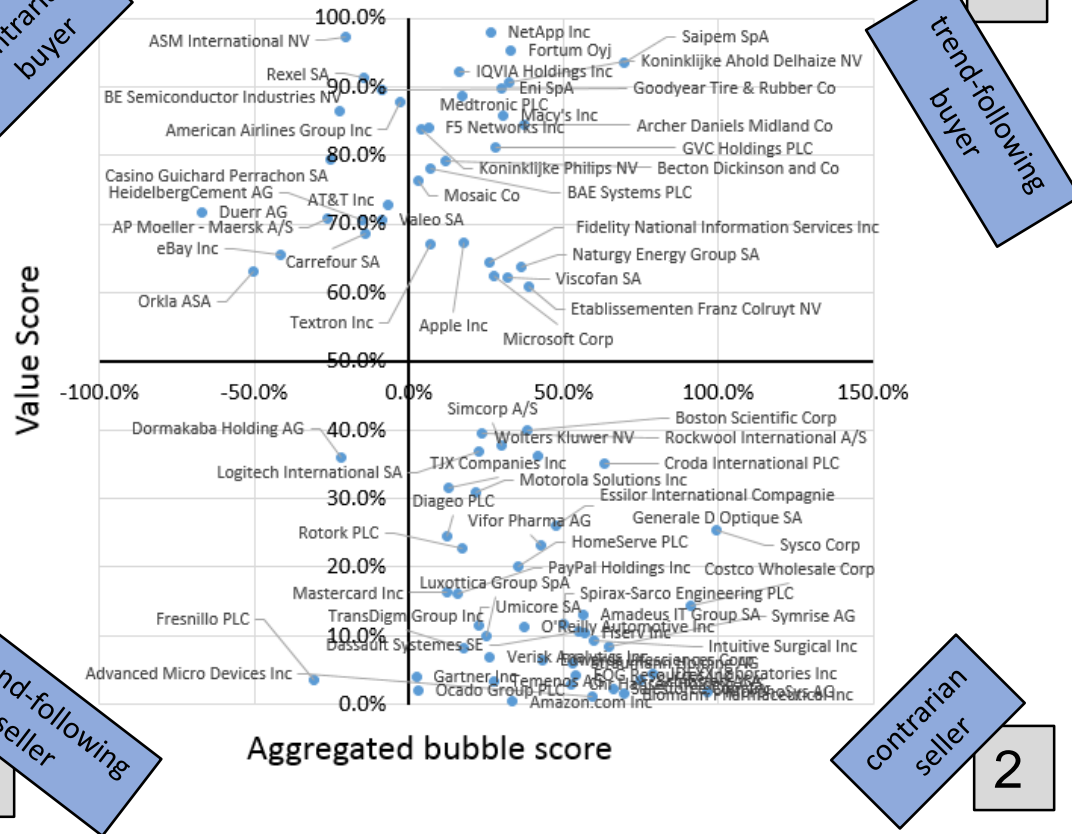
The stocks are the constituents of the Stoxx Europe 600, the S&P 500 and the Nasdaq 100 indices. From these, all doubles and stocks with incomplete data are removed. Because our financial strength indicators are specifically designed for corporates, all financial institutions are taken out of the set 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

The four quadrants: value versus bubble score

4 — Contrarian buyer

1 — trend-following buyer

3 — trend-following seller

2 — contrarian seller

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. Apple Inc);

2. Quadrant 2: Stocks with a strong positive bubble score and a weak value score (e.g. Symrise AG);

3. Quadrant 3: Stocks with a strong negative bubble score and a weak value score (e.g. Fresnillo PLC);

4. Quadrant 4: Stocks with strong negative bubble score and a strong financial strength (e.g. Orkla ASA)

*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%.
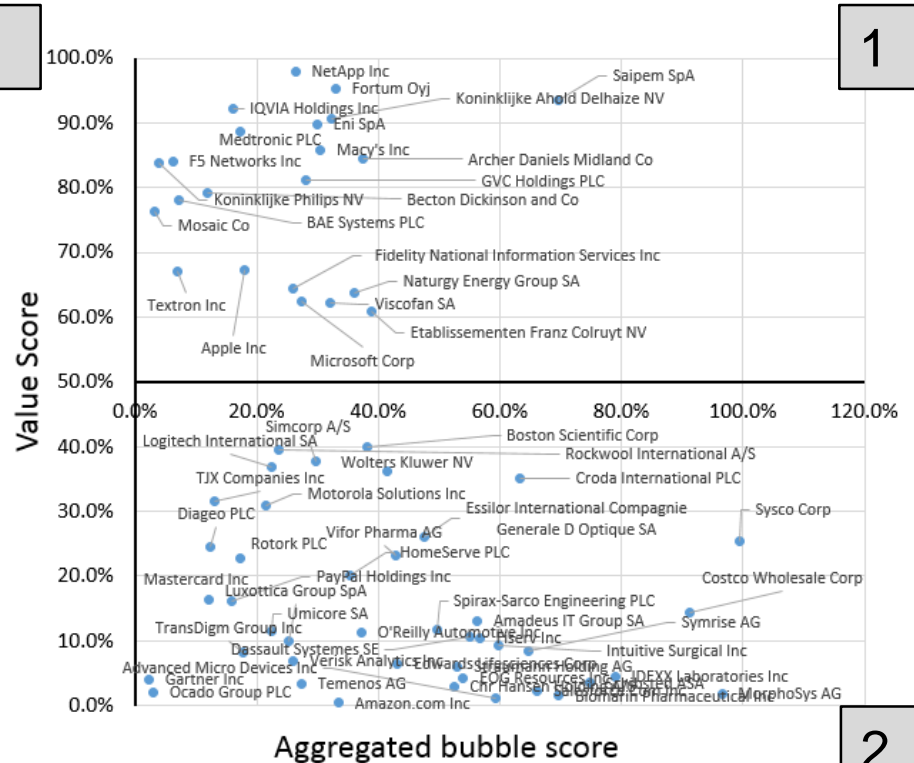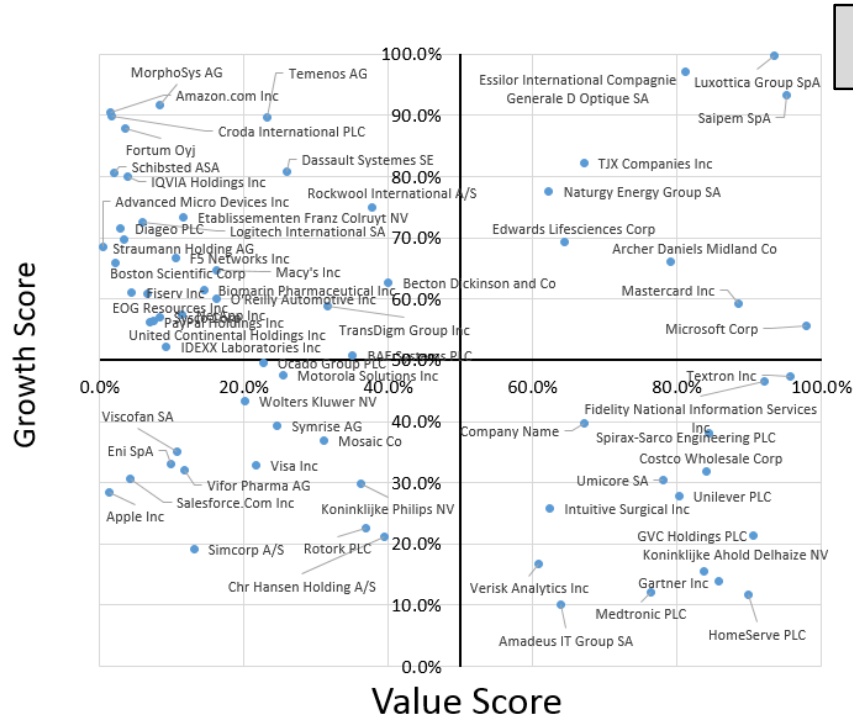
Single Stocks

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

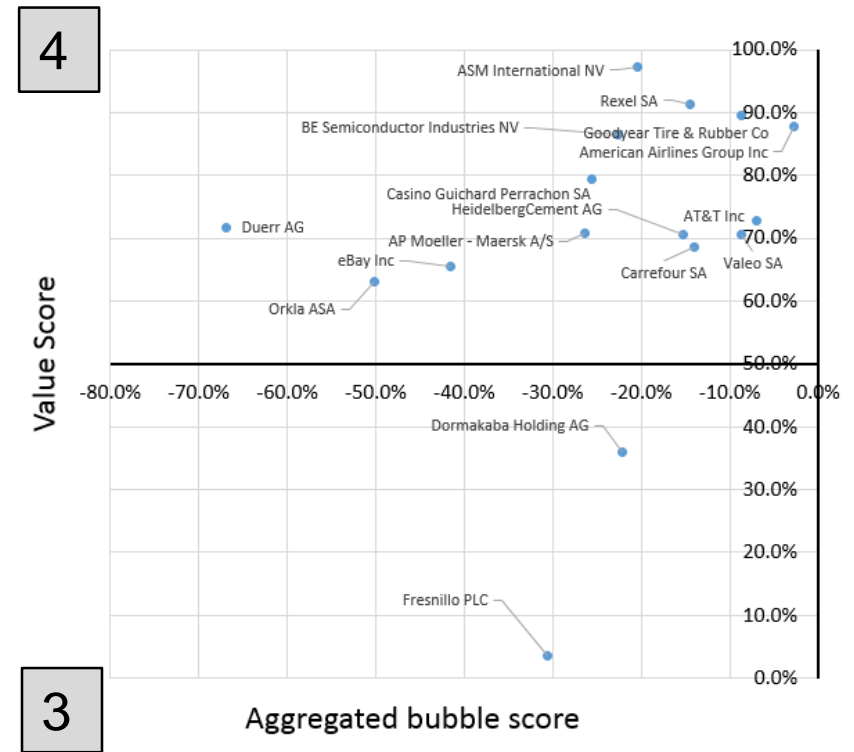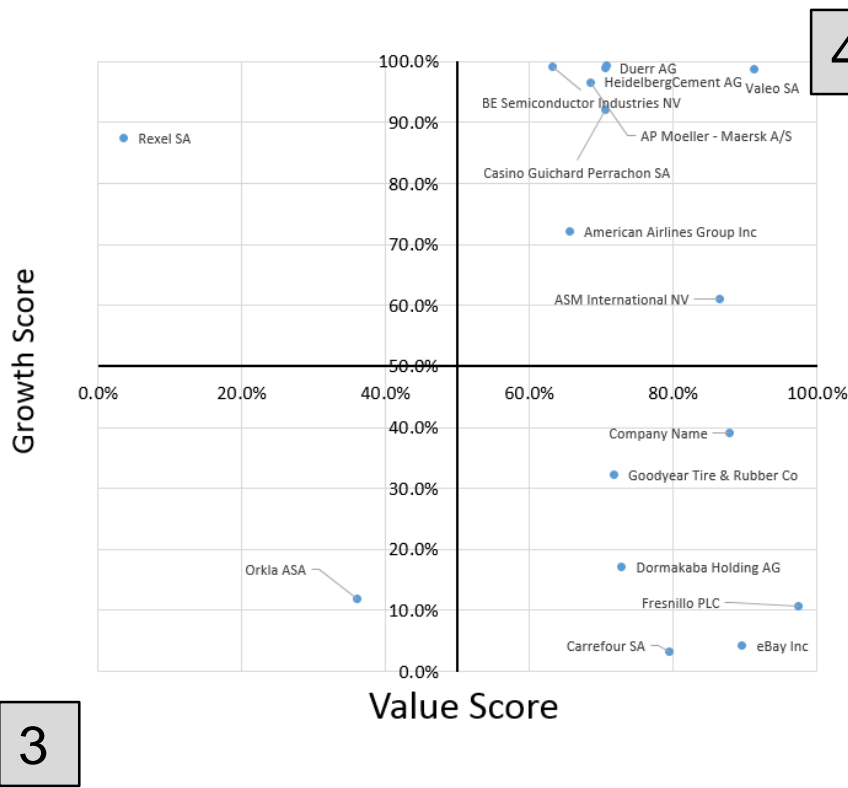Strong positive bubble signals with strong (respectively weak) fundamentals

Single Stocks

Quadrant 3 and 4 stocks

Strong negative bubble signals with weak (respectively strong) fundamentals

Single Stocks

Entrepreneurial Risks
ETH zürich

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
Apple Inc	United States of America	Technology Hardware & Equipment	20.6%	16.5%	Oct-17	17.9%	67.2%	39.6%
F5 Networks Inc	United States of America	Technology Hardware & Equipment	44.4%	44.4%	Aug-17	6.2%	84.0%	31.9%
Microsoft Corp	United States of America	Software & Services	45.3%	25.7%	Oct-17	27.4%	62.4%	25.8%
NetApp Inc	United States of America	Technology Hardware & Equipment	86.3%	95.4%	Aug-17	26.3%	97.9%	55.7%
Etablissementen Franz Colruyt NV	Belgium	Food & Staples Retailing	7.1%	15.9%	Jan-18	38.9%	60.8%	16.7%
BAE Systems PLC	United Kingdom	Capital Goods	12.4%	21.9%	Nov-17	7.1%	78.1%	30.5%
Naturgy Energy Group SA	Spain	Utilities	15.2%	27.0%	Nov-17	36.1%	63.8%	10.1%
Viscofan SA	Spain	Food, Beverage & Tobacco	20.1%	10.4%	Mar-18	32.0%	62.2%	77.5%
GVC Holdings PLC	Isle of Man	Consumer Services	53.9%	29.2%	Feb-18	28.0%	81.1%	97.2%
Koninklijke Ahold Delhaize NV	Netherlands	Food & Staples Retailing	29.2%	22.0%	Jan-18	32.3%	90.5%	21.3%
Koninklijke Philips NV	Netherlands	Health Care Equipment & Services	19.9%	12.9%	Nov-17	4.0%	83.8%	15.6%
Eni SpA	Italy	Energy	22.5%	22.5%	Aug-17	29.9%	89.8%	11.7%
Saipem SpA	Italy	Energy	39.6%	30.7%	Feb-18	69.7%	93.5%	99.8%
Fortum Oyj	Finland	Utilities	52.1%	27.3%	Dec-17	33.0%	95.2%	93.4%
Archer Daniels Midland Co	United States of America	Food, Beverage & Tobacco	14.8%	10.8%	Jan-18	37.4%	84.4%	38.0%
Becton Dickinson and Co	United States of America	Health Care Equipment & Services	23.4%	11.4%	Feb-18	12.0%	79.1%	66.2%
Fidelity National Information Services Inc	United States of America	Software & Services	17.8%	15.9%	Aug-17	25.9%	64.3%	69.2%
IQVIA Holdings Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	36.0%	20.3%	Feb-18	16.2%	92.1%	46.5%
Macy's Inc	United States of America	Retailing	95.3%	95.3%	Aug-17	30.5%	85.7%	13.9%
Medtronic PLC	Ireland; Republic of	Health Care Equipment & Services	6.4%	14.4%	Nov-17	17.4%	88.6%	59.3%
Mosaic Co	United States of America	Materials	46.0%	46.0%	Aug-17	3.1%	76.3%	12.2%
Textron Inc	United States of America	Capital Goods	37.5%	27.2%	Sep-17	6.8%	67.0%	82.3%
United Continental Holdings Inc	United States of America	Transportation	21.6%	21.2%	Jan-18	27.2%	95.7%	47.4%
Victrex PLC	United Kingdom	Materials	58.6%	23.5%	Dec-17	24.8%	80.2%	27.8%
Telefonaktiebolaget LM Ericsson	Sweden	Technology Hardware & Equipment	42.6%	38.0%	Nov-17	10.1%	84.5%	3.0%
Swedish Match AB	Sweden	Food, Beverage & Tobacco	71.4%	48.6%	Dec-17	48.3%	96.8%	65.7%

Quadrant 1 stocks: strong positive bubble signals with strong fundamentals
Example: Saipem SpA.
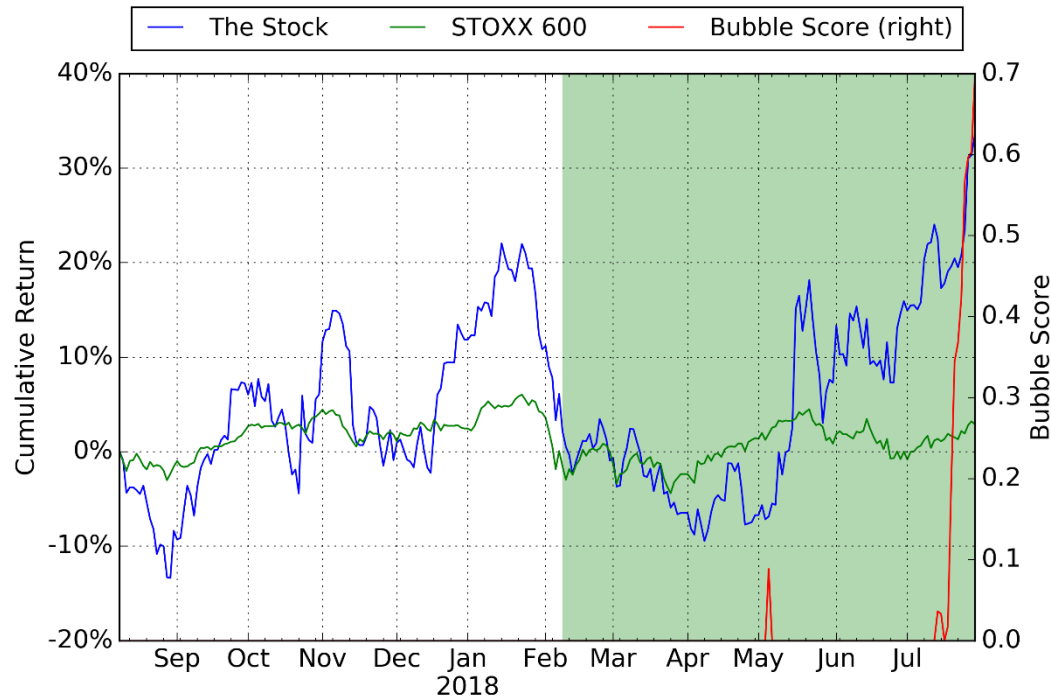
The above graph shows the one year cumulative return of the stock in blue (left hand scale), STOXX 600 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period is the strong positive bubble we identified. The Bubble Score of this six month bubble has reached 69.7% with a bubble size 30.7%.

Last month example: strong positive bubble signals with strong fundamentals, Howden Joinery Group PLC.

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 had a strong correction recently, which is in agreement with the DS LPPLS indicator, but not with the strong fundamentals.
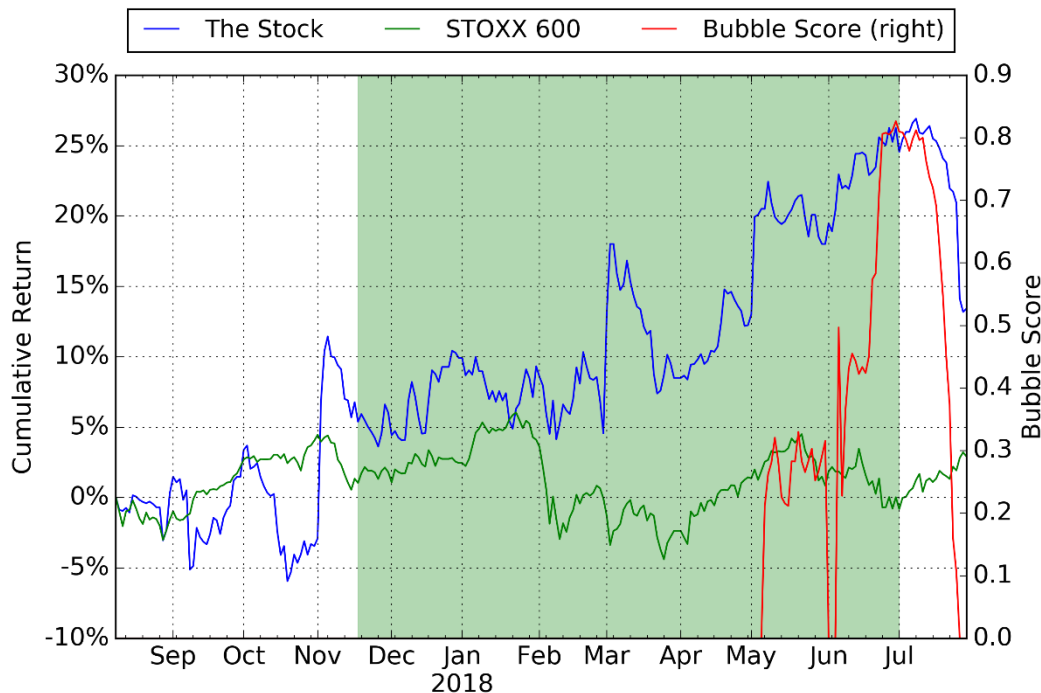
Single Stocks - Quadrant 2 stocks

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
Advanced Micro Devices Inc	United States of America	Semiconductors & Semiconductor Equipment	58.8%	93.6%	Dec-17	59.4%	1.2%	28.4%
Amazon.com Inc	United States of America	Retailing	83.8%	42.7%	Jan-18	33.4%	0.4%	68.5%
Biomarin Pharmaceutical Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	20.6%	21.0%	Feb-18	69.7%	1.5%	90.5%
Costco Wholesale Corp	United States of America	Food & Staples Retailing	39.9%	19.9%	Feb-18	91.2%	14.4%	61.4%
Fiserv Inc	United States of America	Software & Services	21.2%	18.6%	Sep-17	56.7%	10.5%	66.7%
IDEXX Laboratories Inc	United States of America	Health Care Equipment & Services	55.4%	31.8%	Feb-18	79.0%	4.4%	61.0%
Intuitive Surgical Inc	United States of America	Health Care Equipment & Services	60.1%	25.9%	Feb-18	59.8%	9.2%	52.2%
O'Reilly Automotive Inc	United States of America	Retailing	53.1%	47.9%	Oct-17	37.2%	11.3%	57.4%
PayPal Holdings Inc	United States of America	Software & Services	42.0%	7.6%	Feb-18	15.9%	16.1%	60.0%
Verisk Analytics Inc	United States of America	Commercial & Professional Services	35.7%	7.8%	Feb-18	26.0%	6.9%	56.2%
Umicore SA	Belgium	Materials	66.1%	41.6%	Oct-17	22.3%	11.6%	73.3%
Croda International PLC	United Kingdom	Materials	36.7%	17.7%	Feb-18	63.2%	35.1%	50.8%
MorphoSys AG	Germany	Pharmaceuticals, Biotechnology & Life Sciences	103.3%	55.5%	Feb-18	96.5%	1.7%	89.9%
Symrise AG	Germany	Materials	30.5%	20.1%	Feb-18	64.7%	8.4%	91.8%
Diageo PLC	United Kingdom	Food, Beverage & Tobacco	13.0%	15.2%	Sep-17	12.4%	24.6%	39.2%
Chr Hansen Holding A/S	Denmark	Materials	34.3%	34.3%	Aug-17	52.4%	2.8%	71.6%
Rockwool International A/S	Denmark	Capital Goods	82.3%	51.2%	Feb-18	23.7%	39.5%	21.2%
Simcorp A/S	Denmark	Software & Services	40.0%	33.3%	Mar-18	29.8%	37.8%	74.9%
Amadeus IT Group SA	Spain	Software & Services	48.1%	21.4%	Mar-18	56.3%	13.0%	19.2%
Dassault Systemes SE	France	Software & Services	56.2%	17.6%	Mar-18	55.0%	10.7%	35.1%
Essilor International Compagnie Generale D Optique SA	France	Health Care Equipment & Services	19.9%	18.3%	Feb-18	47.7%	26.0%	80.8%

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
Wolters Kluwer NV	Netherlands	Commercial & Professional Services	40.9%	40.9%	Aug-17	41.5%	36.2%	29.9%
HomeServe PLC	United Kingdom	Commercial & Professional Services	44.0%	27.6%	Nov-17	35.3%	20.0%	43.3%
Luxottica Group SpA	Italy	Consumer Durables & Apparel	20.8%	21.2%	Oct-17	25.2%	9.8%	33.0%
Schibsted ASA	Norway	Media	37.7%	32.8%	Feb-18	74.7%	3.4%	87.9%
Ocado Group PLC	United Kingdom	Retailing	280.5%	280.5%	Aug-17	3.0%	2.0%	80.6%
Rotork PLC	United Kingdom	Capital Goods	52.4%	41.2%	Sep-17	17.3%	22.6%	49.6%
Logitech International SA	Switzerland	Technology Hardware & Equipment	36.7%	27.1%	Feb-18	22.3%	36.8%	22.6%
Straumann Holding AG	Switzerland	Health Care Equipment & Services	46.4%	24.8%	Mar-18	53.1%	5.9%	72.6%
Temenos AG	Switzerland	Software & Services	77.0%	62.8%	Sep-17	27.4%	3.3%	69.7%
Vifor Pharma AG	Switzerland	Pharmaceuticals, Biotechnology & Life Sciences	93.4%	78.3%	Sep-17	42.8%	23.2%	89.7%
Spirax-Sarco Engineering PLC	United Kingdom	Capital Goods	21.3%	23.3%	Dec-17	49.7%	11.7%	32.1%
Boston Scientific Corp	United States of America	Health Care Equipment & Services	24.7%	24.7%	Feb-18	38.1%	40.0%	62.6%
Salesforce.Com Inc	United States of America	Software & Services	56.3%	46.7%	Aug-17	66.2%	2.2%	65.9%
EOG Resources Inc	United States of America	Energy	46.7%	28.1%	Feb-18	54.0%	4.2%	30.6%
Edwards Lifesciences Corp	United States of America	Health Care Equipment & Services	24.2%	24.4%	Dec-17	43.2%	6.5%	60.9%
Gartner Inc	United States of America	Software & Services	15.3%	13.7%	Nov-17	2.3%	3.9%	80.1%
Mastercard Inc	United States of America	Software & Services	53.9%	33.4%	Nov-17	12.2%	16.2%	64.7%
Motorola Solutions Inc	United States of America	Technology Hardware & Equipment	37.7%	37.7%	Aug-17	21.6%	31.0%	36.9%
Sysco Corp	United States of America	Food & Staples Retailing	29.3%	14.1%	Feb-18	99.4%	25.3%	47.6%
TransDigm Group Inc	United States of America	Capital Goods	33.4%	27.3%	Jan-18	17.9%	8.2%	56.9%
TJX Companies Inc	United States of America	Retailing	36.2%	36.2%	Aug-17	13.0%	31.6%	58.9%
Visa Inc	United States of America	Software & Services	36.4%	23.3%	Dec-17	4.4%	7.4%	56.3%
Unilever PLC	United Kingdom	Household & Personal Products	-1.0%	13.2%	Feb-18	14.7%	21.6%	32.8%

Quadrant 2 stocks: strong positive bubble signals with weak fundamentals
Example: Costco Wholesale Corp.
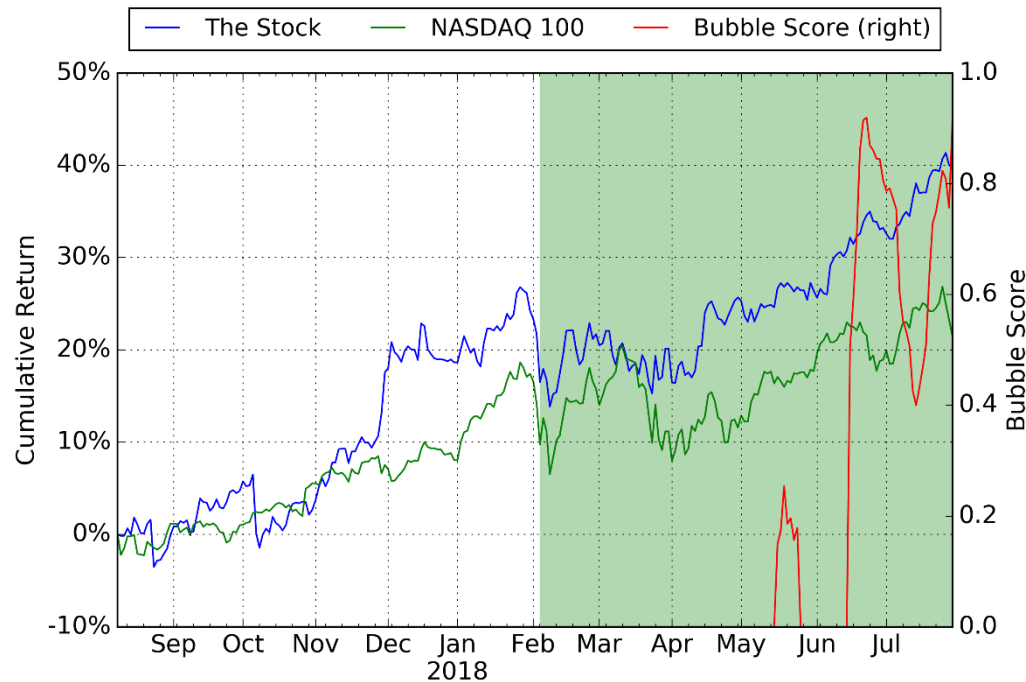
The above graph shows the one year cumulative return of the stock in blue (left hand scale), NASDAQ 100 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period is the strong positive bubble we identified. The Bubble Score of this fix month bubble has reached 91.2% with a bubble size 19.9%. The strong positive bubble signals and weak fundamentals indicate a high probability of correction in the future.

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Last month example: strong positive bubble signals with weak fundamentals, Sysco Corp.

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 continued to rise in the past month, and is still identified with a Bubble Score of 99.4% this month. Together with the weak fundamentals, one should be careful about the strong downside risk of this stock.
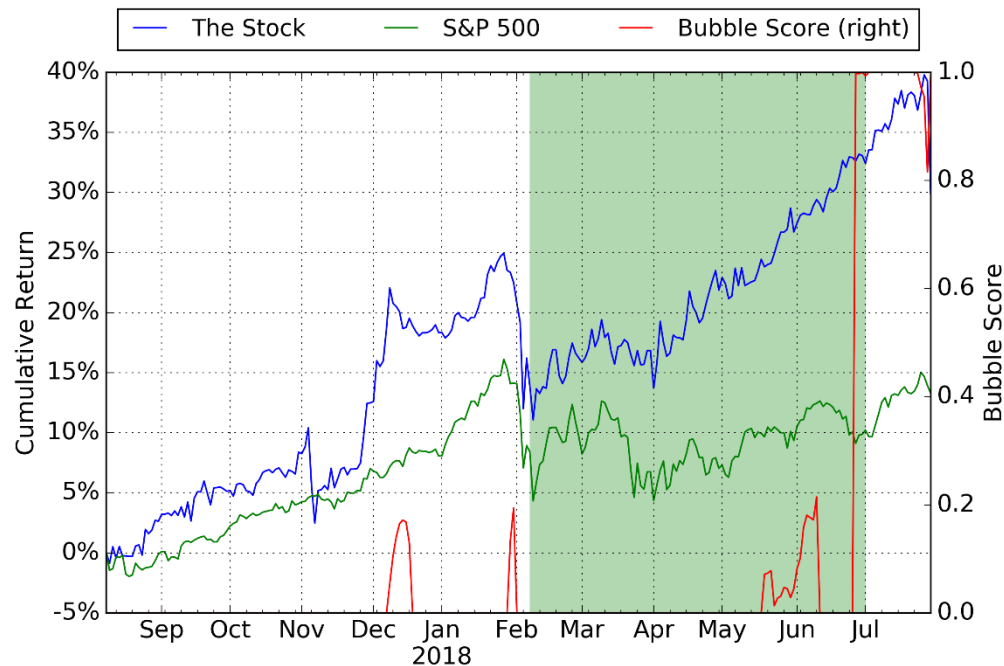
Single Stocks - Quadrant 3 stocks

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
Fresnillo PLC	Mexico	Materials	-35.7%	-18.3%	Feb-18	-30.6%	3.6%	87.5%
Dormakaba Holding AG	Switzerland	Capital Goods	-24.4%	-35.4%	Sep-17	-22.2%	36.0%	11.9%

Quadrant 3 stocks: strong negative bubble signals with weak fundamentals
Example: Fresnillo PLC.
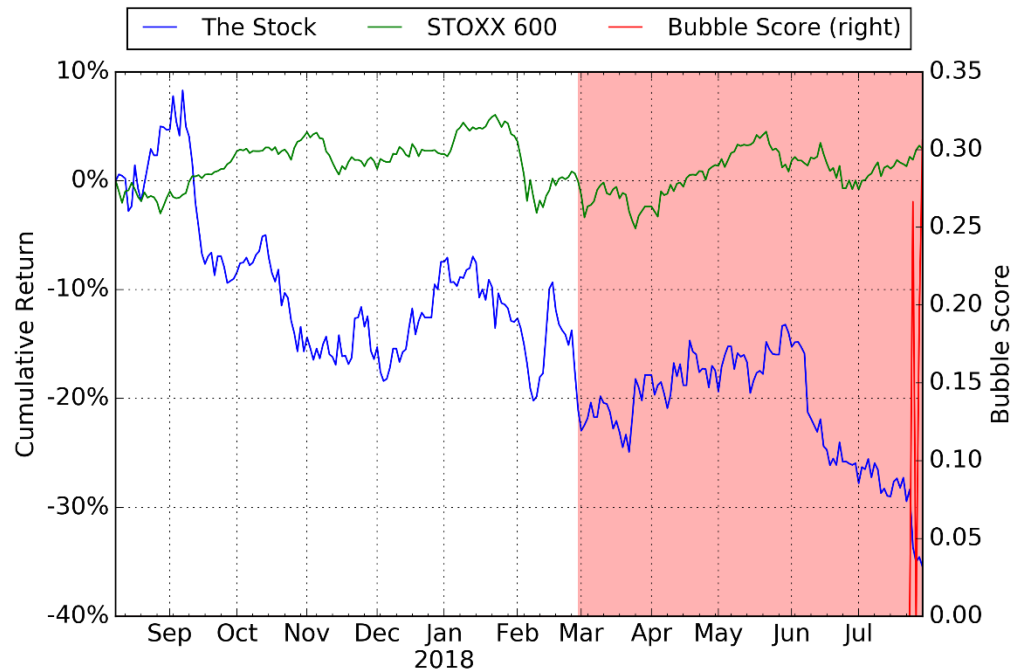
The above graph shows the one year cumulative return of the stock in blue (left hand scale), STOXX 600 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period is the strong negative bubble we identified. The Bubble Score of this five month bubble has reached 30.6% with a bubble size -18.3%.

Last month example: strong negative bubble signals with weak fundamentals, Proximus NV.

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 stopped its drawdown and went into a plateau in the past month, which is in agreement with our DS LPPLS indicator suggesting a coming change of regime. Given the weak fundamentals, we can expect an increased volatility in the coming months.
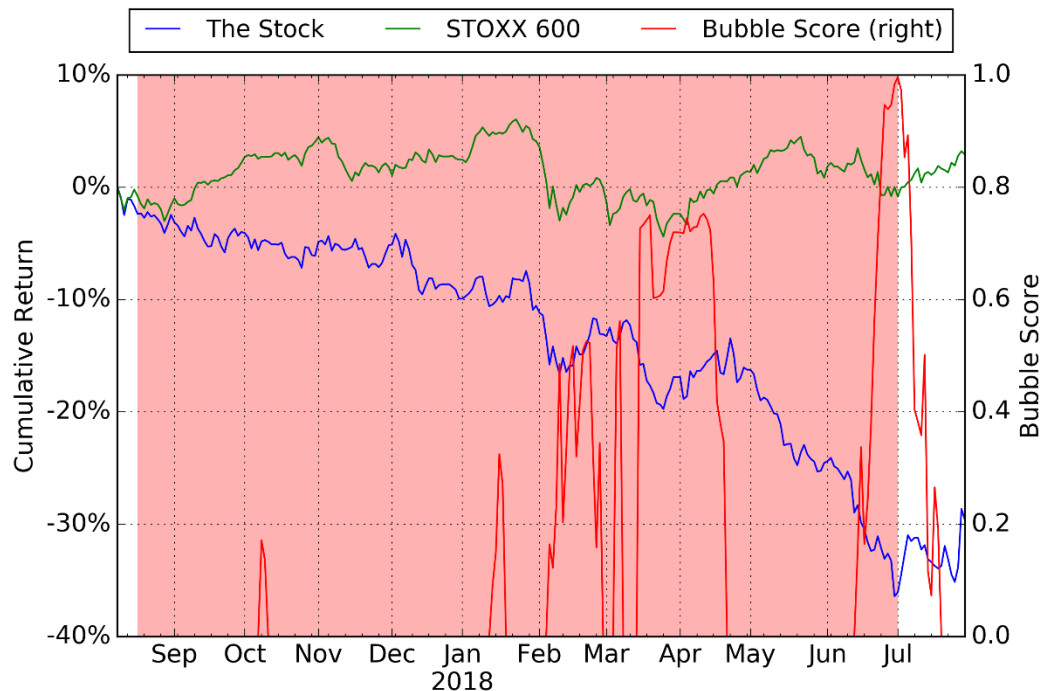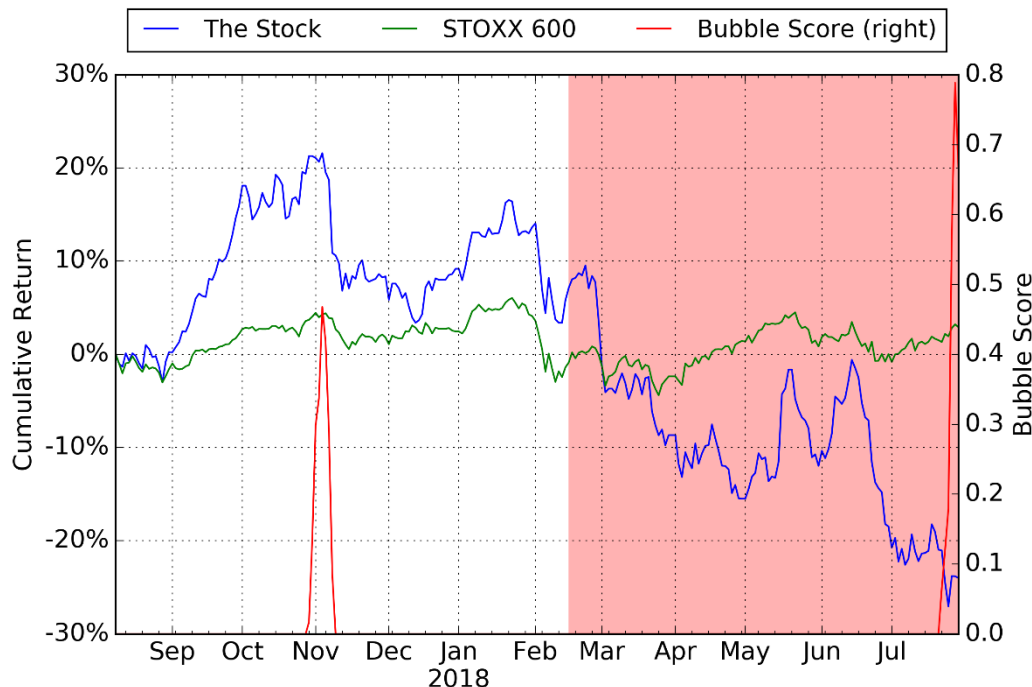
Single Stocks - Quadrant 4 stocks

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
American Airlines Group Inc	United States of America	Transportation	-19.4%	-26.5%	Jan-18	-2.7%	87.8%	39.1%
eBay Inc	United States of America	Software & Services	-3.9%	-20.5%	Feb-18	-41.5%	65.6%	72.1%
Goodyear Tire & Rubber Co	United States of America	Automobiles & Components	-20.3%	-19.6%	Feb-18	-8.7%	89.5%	4.3%
Duerr AG	Germany	Capital Goods	-23.0%	-29.0%	Feb-18	-66.9%	71.7%	32.2%
HeidelbergCement AG	Germany	Materials	-9.2%	-14.0%	Sep-17	-15.3%	70.5%	98.9%
AP Moeller - Maersk A/S	Denmark	Transportation	-32.2%	-32.2%	Aug-17	-26.4%	70.7%	99.3%
Carrefour SA	France	Food & Staples Retailing	-25.0%	-14.1%	Mar-18	-14.1%	68.5%	96.4%
Casino Guichard Perrachon SA	France	Food & Staples Retailing	-32.5%	-31.8%	Sep-17	-25.5%	79.3%	3.3%
Valeo SA	France	Automobiles & Components	-24.5%	-29.9%	Sep-17	-8.8%	70.6%	92.1%
Rexel SA	France	Capital Goods	-2.2%	-19.4%	Oct-17	-14.5%	91.3%	98.8%
ASM International NV	Netherlands	Semiconductors & Semiconductor Equipment	-0.1%	-17.8%	Jan-18	-20.5%	97.3%	10.7%
BE Semiconductor Industries NV	Netherlands	Semiconductors & Semiconductor Equipment	-29.6%	-52.2%	Feb-18	-22.6%	86.3%	61.1%
Orkla ASA	Norway	Food, Beverage & Tobacco	-15.1%	-16.1%	Jan-18	-50.1%	63.1%	99.1%
AT&T Inc	United States of America	Telecommunication Services	-16.0%	-16.0%	Aug-17	-7.0%	72.8%	17.1%

Quadrant 4 stocks: strong negative bubble signals with strong fundamentals
Example: Duerr AG.

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 five and a half month bubble has reached 66.9% with a bubble size -29%. 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.

Last month example: strong negative bubble signals with strong fundamentals, Daimler AG.

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 started a rebound in the past month, which is in agreement with our DS LPPLS indicator and strong fundamentals. We expect this stock to appreciate further in the future due to the strong fundamentals and following its neglect by investors in previous months.
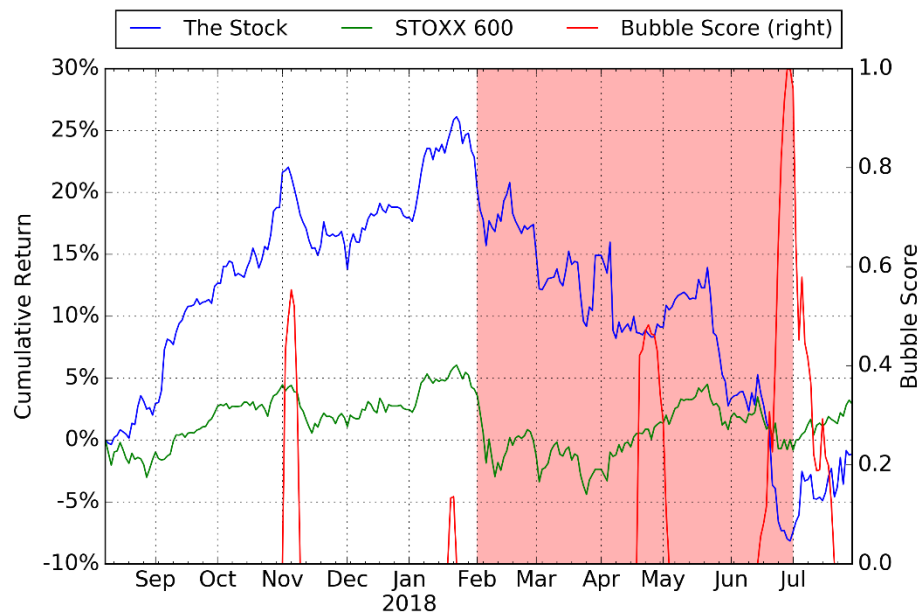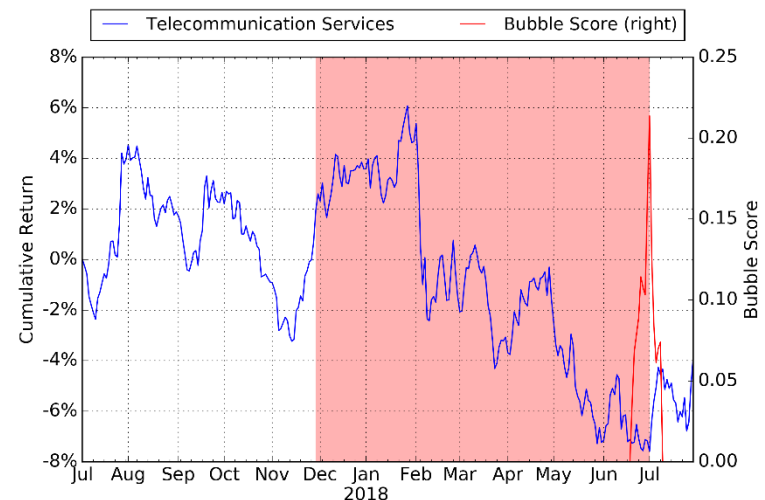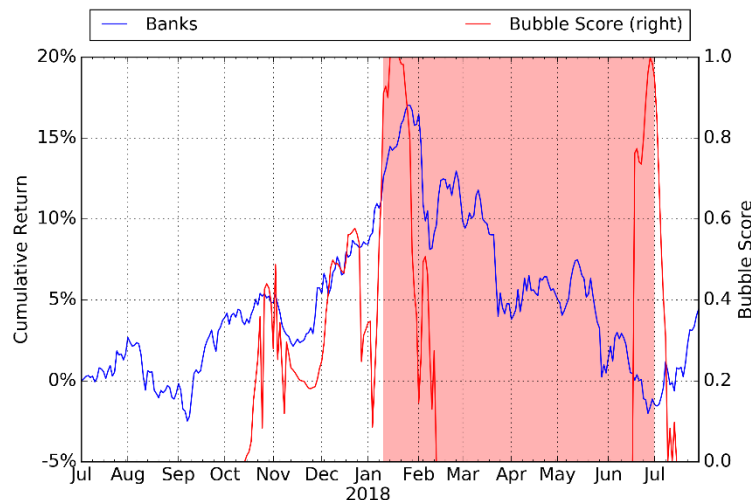
Sectors

| GICS Industry Group Name	Yearly Return		Bubble Size		Bubble Score		Value Score		Growth Score	
	Aug 1st	Jul 1st	Aug 1st	Jul 1st	Aug 1st	Jul 1st	Aug 1st	Jul 1st	Aug 1st	Jul 1st
Pharmaceuticals, Biotechnology & Life Sciences	6.7%	-1.7%	0.0%	0.0%	0.0%	0.0%	63.4%	63.6%	57.4%	56.7%
Consumer Services	8.4%	5.4%	0.0%	0.0%	0.0%	0.0%	29.0%	28.0%	46.5%	46.7%
Retailing	42.0%	40.5%	43.2%	0.0%	15.4%	0.0%	17.2%	17.6%	57.7%	57.6%
Transportation	12.8%	6.2%	0.0%	0.0%	0.0%	0.0%	60.6%	57.1%	56.3%	55.5%
Consumer Durables & Apparel	12.8%	15.0%	0.0%	0.0%	0.0%	0.0%	35.9%	36.6%	54.9%	54.9%
Semiconductors & Semiconductor Equipment	25.9%	23.8%	0.0%	0.0%	0.0%	0.0%	63.7%	64.1%	29.7%	29.8%
Technology Hardware & Equipment	18.6%	20.6%	0.0%	0.0%	0.0%	0.0%	72.7%	70.5%	39.1%	39.6%
Automobiles & Components	5.2%	3.9%	0.0%	0.0%	0.0%	0.0%	78.1%	76.6%	50.3%	50.3%
Telecommunication Services	-6.1%	-6.0%	0.0%	-9.0%	0.0%	-16.3%	56.4%	56.9%	38.1%	38.0%
Energy	21.6%	20.0%	0.0%	0.0%	0.0%	0.0%	50.7%	49.7%	52.8%	52.8%
Software & Services	27.6%	24.7%	20.7%	0.0%	50.8%	0.0%	36.5%	35.8%	47.9%	46.9%
Materials	9.8%	8.4%	0.0%	0.0%	0.0%	0.0%	51.3%	51.0%	47.3%	47.3%
Health Care Equipment & Services	20.4%	14.0%	20.4%	0.0%	44.3%	0.0%	64.8%	63.9%	58.4%	58.1%
Capital Goods	6.6%	2.3%	0.0%	0.0%	0.0%	0.0%	47.3%	45.3%	52.7%	53.3%
Media	-3.5%	-2.5%	0.0%	0.0%	0.0%	0.0%	40.1%	40.0%	52.7%	52.6%
Commercial & Professional Services	13.3%	9.9%	7.0%	0.0%	56.6%	0.0%	27.8%	28.5%	51.3%	51.4%
Food & Staples Retailing	9.2%	8.8%	0.0%	0.0%	0.0%	0.0%	58.1%	59.2%	60.2%	60.3%
Household & Personal Products	-0.3%	-0.2%	0.0%	0.0%	0.0%	0.0%	32.9%	35.3%	53.1%	50.1%
Food, Beverage & Tobacco	-4.0%	-7.4%	0.0%	0.0%	0.0%	0.0%	43.9%	42.7%	58.9%	58.3%
Utilities	-1.5%	0.6%	0.0%	0.0%	0.0%	0.0%	52.2%	52.3%	43.4%	43.3%
Insurance	1.7%	-1.9%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Real Estate	2.0%	3.5%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Diversified Financials	9.8%	6.1%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Banks	5.0%	-1.9%	0.0%	-11.0%	0.0%	-98.5%	-	-	-	-

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 4 industry groups with a positive bubble score: *Retailing*, *Software & Services, Health Care Equipment & Services*, and *Commercial & Professional Services*, as shown in the figure in the next slide. These four industry groups have very strong performances this year, due to the strong economics and revenues.

Note that the *Bank* industry group has started a strong rebound since our identification of the strong bubble score last month. In the *Telecommunication Services* industry group, the price index turned into a volatile plateau, which is in agreement with our diagnostic of a moderate bubble last month.

Sectors

Portfolio Construction & Performance
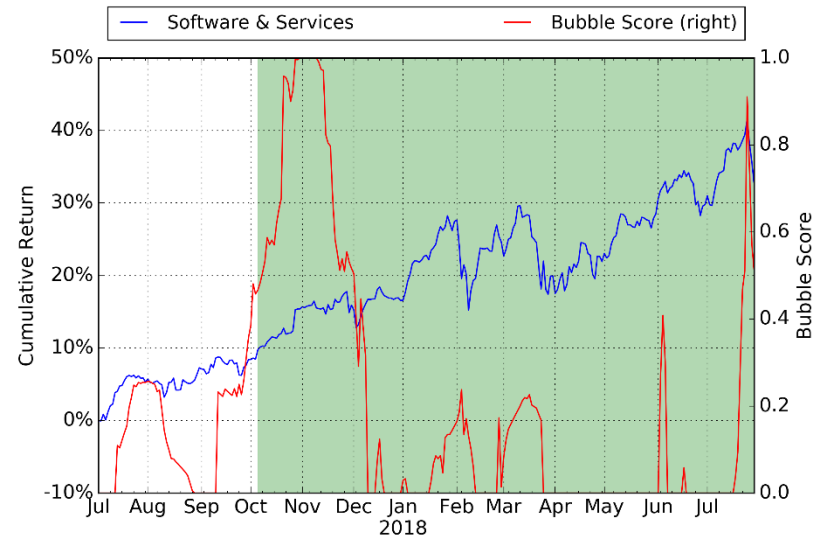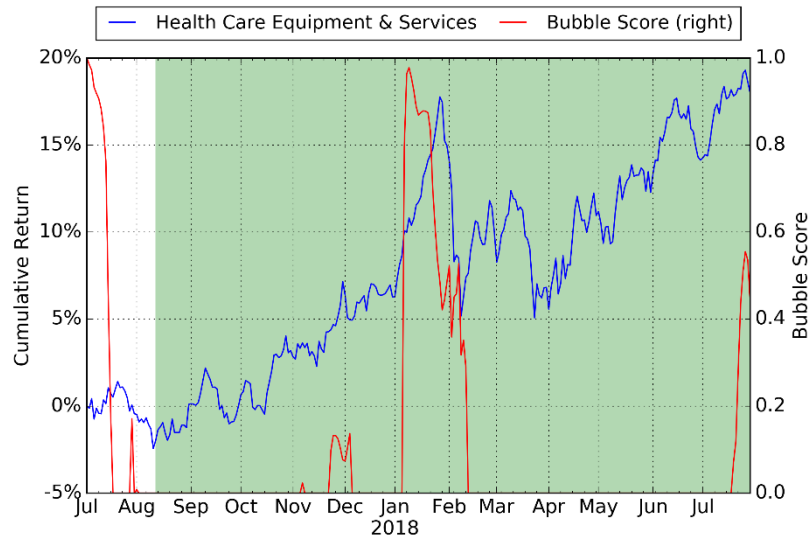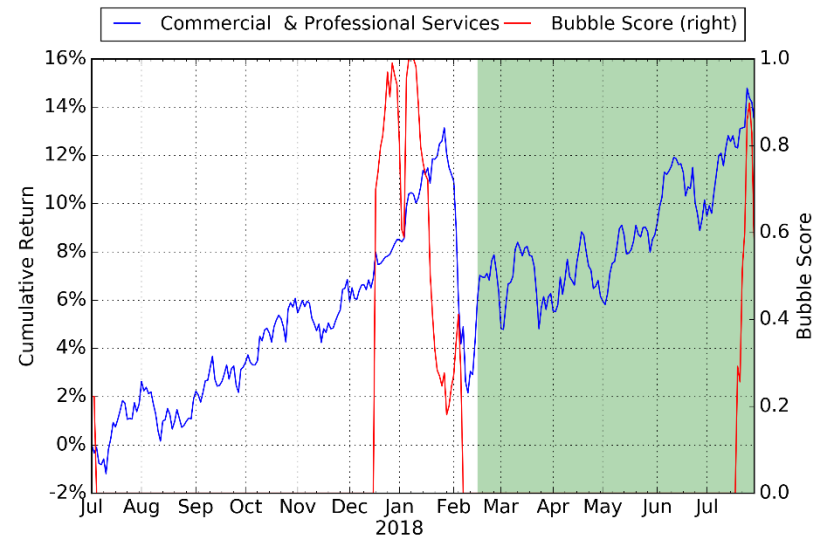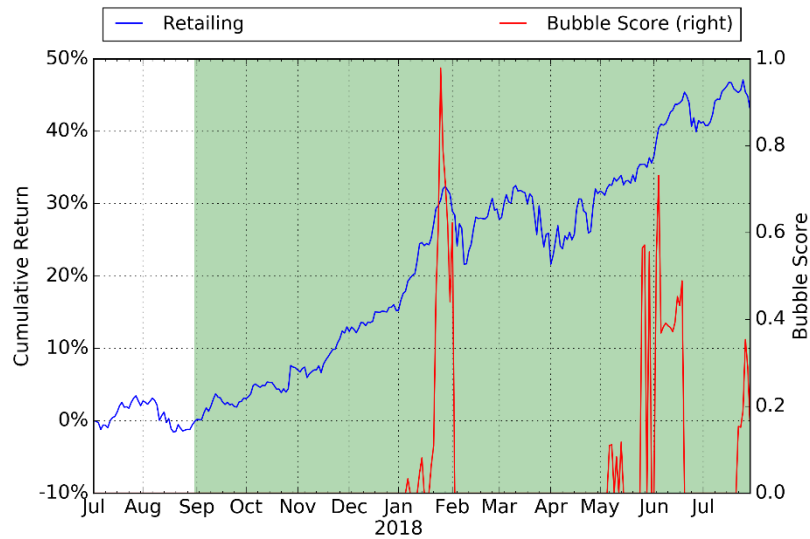
Here we illustrate the methodology of the portfolio construction process based on the results of our previous analyses.

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
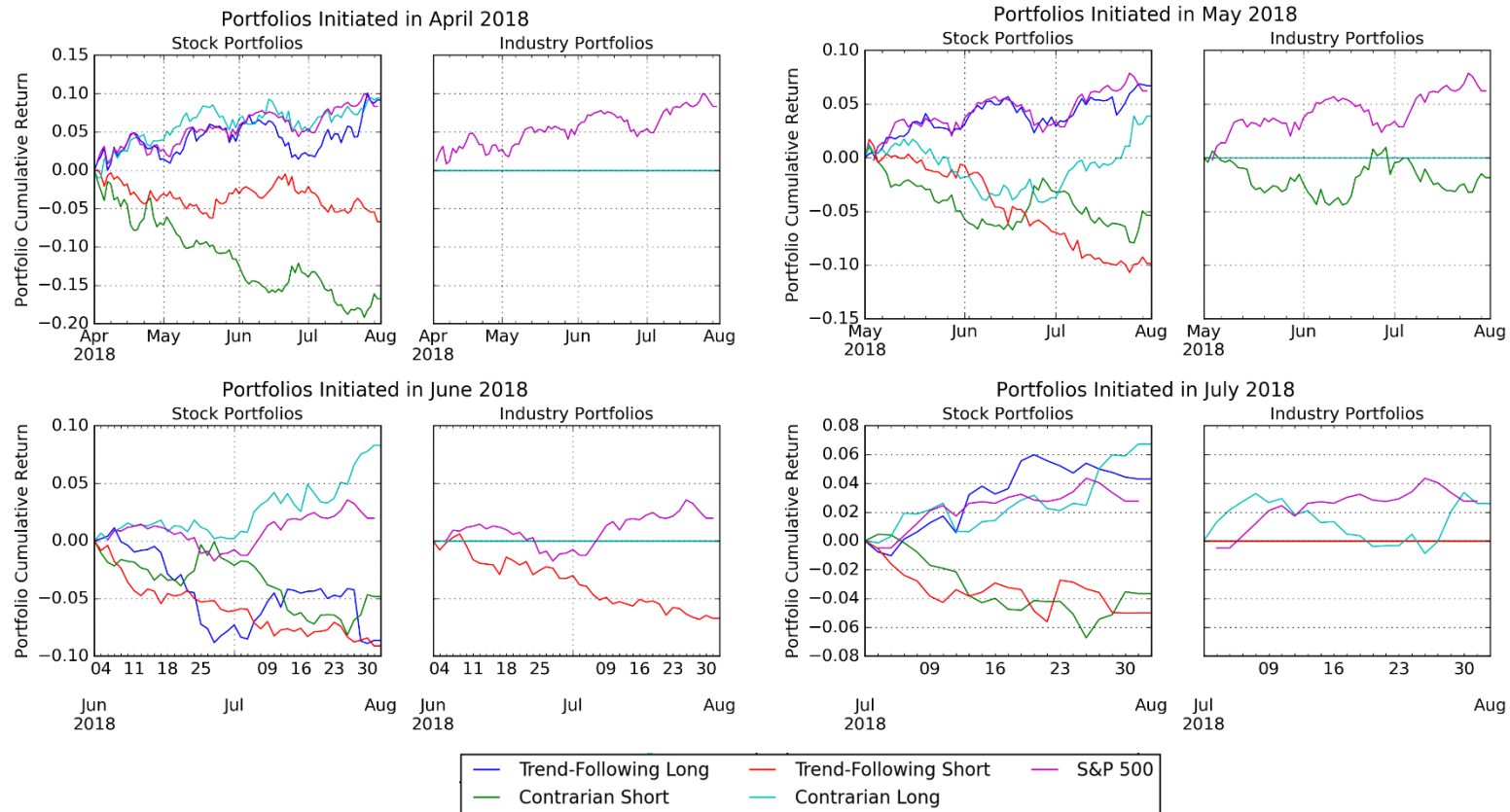
This month, we find that Contrarian Long Portfolios initiated in April, May, June and July 2018 continue to outperform among others, while Contrarian Short Portfolios have a hard time due to the recent market rally.

Contrarian Portfolios are more delicate to use due to their sensitivity to timing the expected reversal and exhibit very volatile performances. 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.
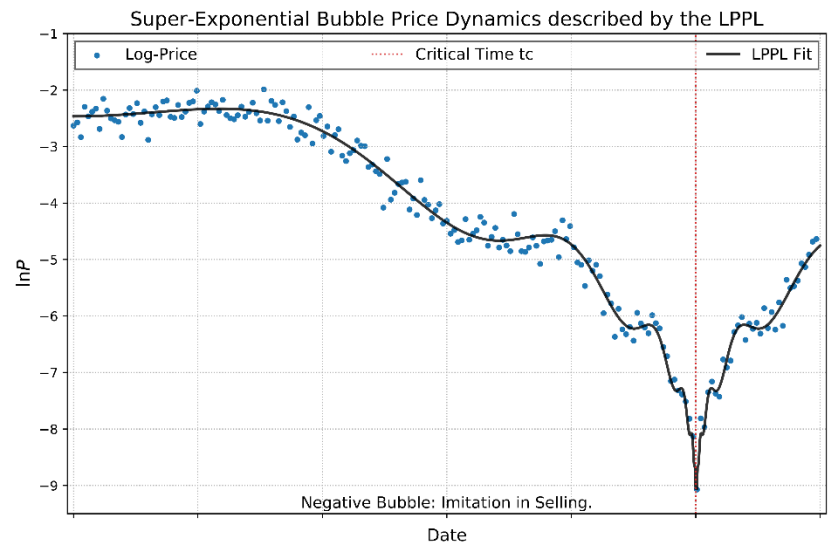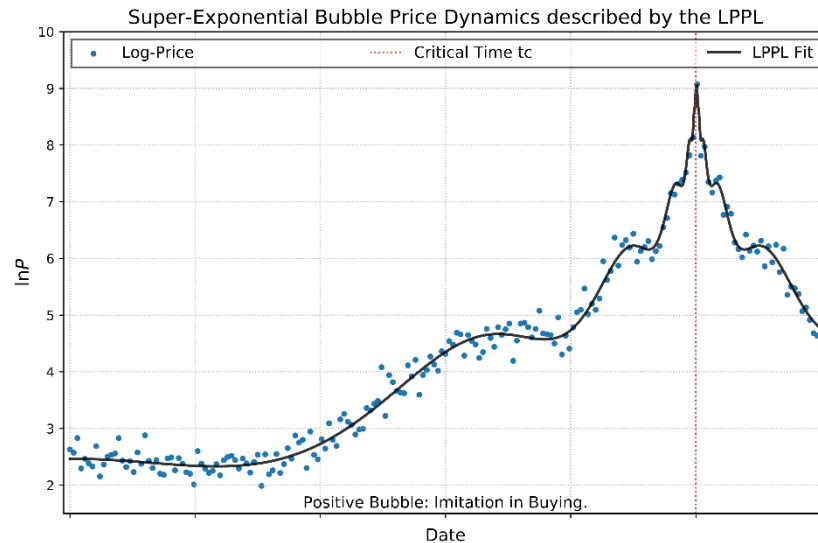
Appendix:

LPPLS fits and method

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.

Super-Exponential Bubble Price Dynamics described by the LPPL
Positive Bubble: Imitation in Buying.

Super-Exponential Bubble Price Dynamics described by the LPPL
Negative Bubble: Imitation in Selling.

The LPPLS Model

Mathematically, the simplest version of the log-periodic power law singularity model that describes the expected trajectory of the logarithmic price in a bubble is given as:

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

The seven parameters describing the model dynamics are:

- A The finite peak (valley) log-price at the time t_c when the positive (negative) bubble ends.

- m The power law exponent.

- B The power law intensity.

- $C_{1|2}$ Magnitude coefficients of the log-periodic accelerating oscillations.

- ω The log-periodic angular frequency of the log-periodic oscillations.

- t_c The critical time at which the bubble ends.

The set of seven model parameters is obtained by fitting the LPPLS formula to the price time series via a combination of Ordinary Least Squares and nonlinear optimization. The resulting values of the fit parameters reveal whether an asset is in a bubble state. Furthermore, the central parameter of interest, the critical time t_c, may warn of an imminent crash.

LPPLS Analysis of Price Time Series

Fitting the LPPL in multiple time windows.
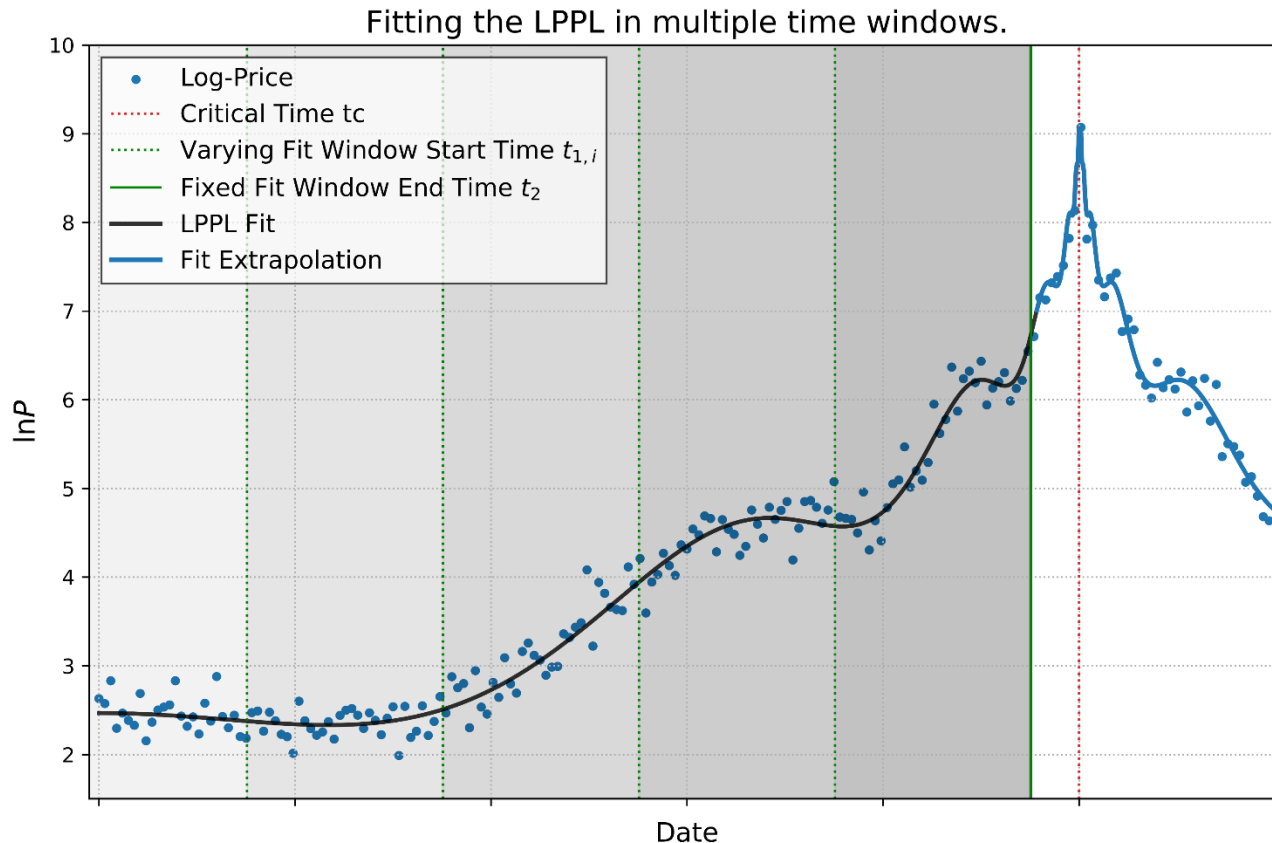
In order to avoid overfitting and to continuously collect information about price dynamics, we scan asset log-price trajectories for super-exponential price dynamics by sequentially fitting the LPPLS model in different time windows to the underlying price series. The procedure is illustrated in the plot.

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 August 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

kmeans Clustering for Critical Time Prediction

Following the methodology established in Gerlach, Demos and Sornette [1], we employ kmeans 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
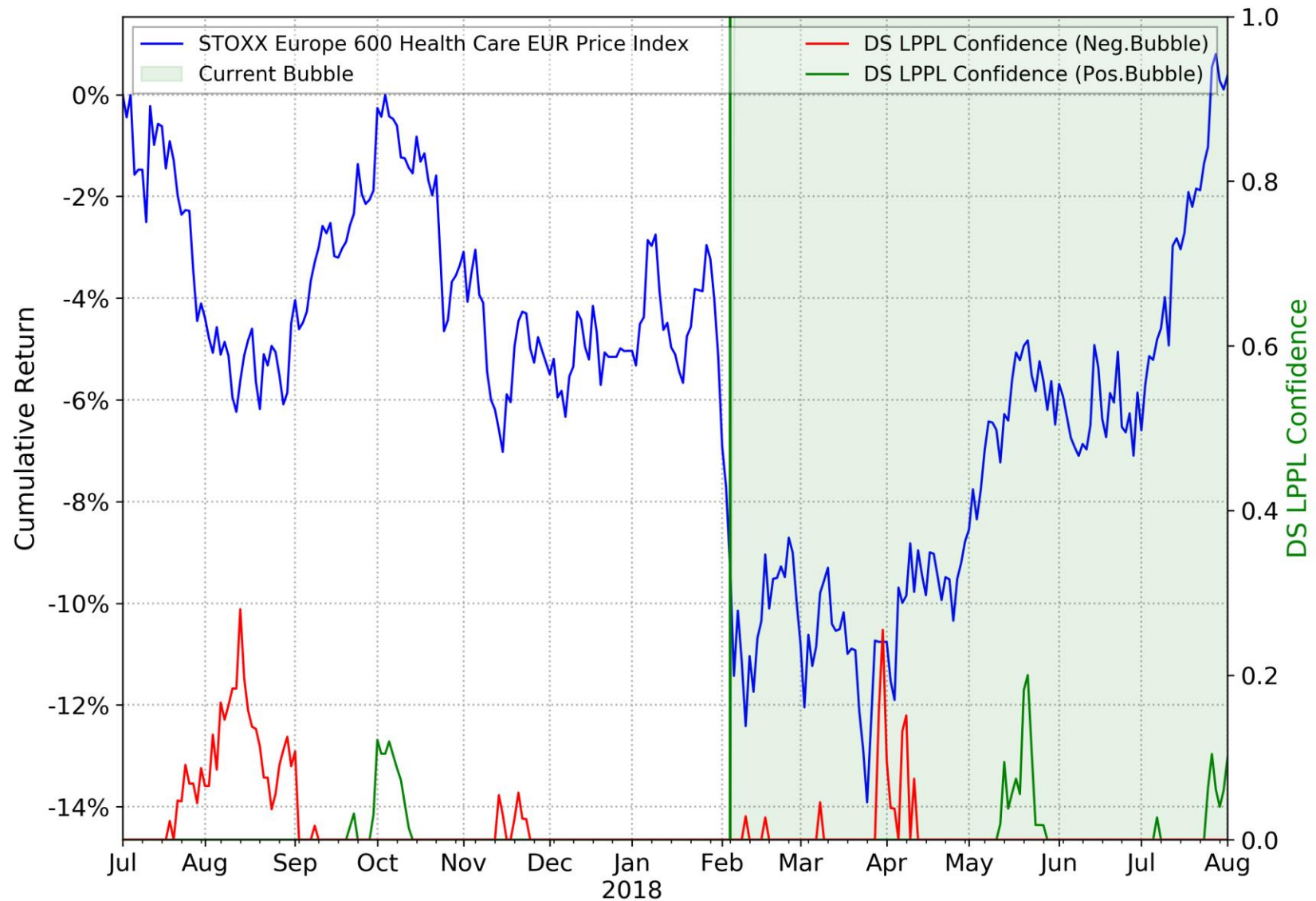
We present the monthly results of our bubble analysis in the form of a table such as the example given below.

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}	$\sigma_{t_c}[days]$	Scenario Probability [%]
Positive Bubbles								
1	STOXX Europe 600 Health Care EUR Price Index	10	178	20	14	2018-08-06	1	13

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
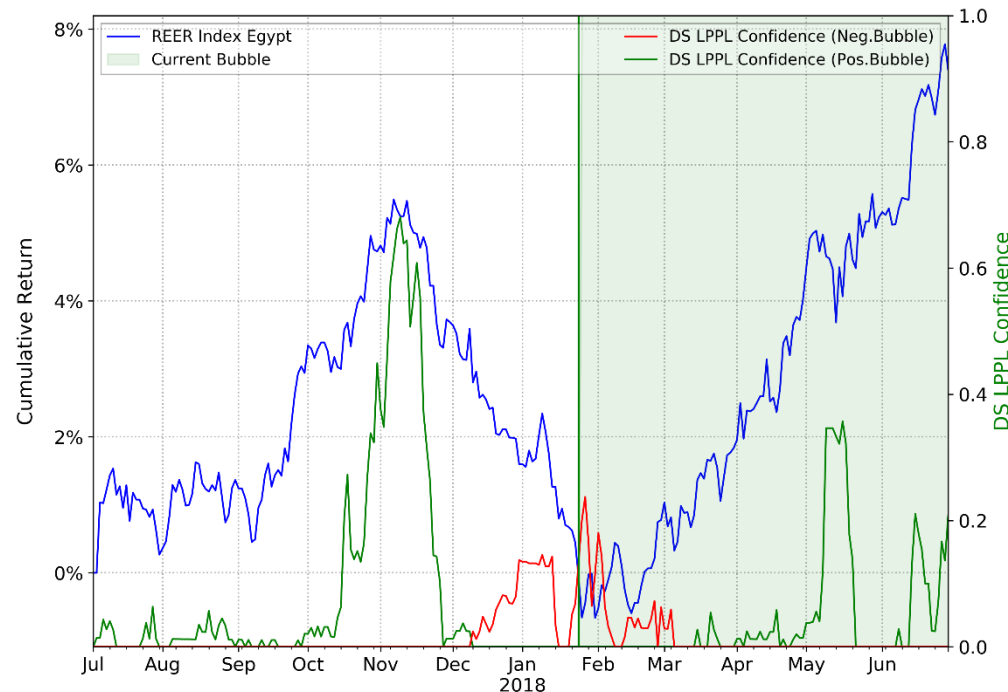
98 Real Effective Exchange Rate (REER) Indices for different currencies are investigated for bubble characteristics.

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).

Visit the Financial Crisis Observatory for more information

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