

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.





General Results – The Big Picture





General Results – This Month's Overview



	Category	Analyzed Assets	Fraction of Pos. Bubbles [%]	Fraction of Neg. Bubbles [%]
Fixed Income		155	0	0
	Government Bonds	55	0	0
	Finance and Insurance	21	0	0
	Corporate Bonds	79	0	0
Equity		315	10	0
	Country Indices	71	3	0
	Europe	36	0	0
	United States	208	14	0
Commodities		32	0	0
Forex		55	7	0

Overall, we see a slightly increased bubble activity amongst the equity sector at the beginning of September.

Specifically the US sector shows a number of signals on S&P sector indices.

The foreign exchange sector continues its trend from the previous month with a minimal amount of positive bubble activity.

All other sectors, fixed income, commodities and crypocurrencies do not show any signs of developing bubbles at all.

Equities – Country Indices



	Bubble Data			Cluster Analysis					
	Name	Bubble Size <i>bs</i> [%]	Duration [<i>days</i>]	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	S&P BSE Sensex Index	14	203		38	23	2018-09-11	11	83
2	CNX Nifty Index	16	167		25	20	2018-09-13	10	75

Since bubble signals in the fixed income sector remain at a level of zero activity at the beginning of September '18, we start out with the Equities section.

The country indices sector shows slightly increased positive bubble activity, with a 3% fraction of positive bubbles, compared to last month's 0%. No negative bubbles are found.

The two listed positive bubble signals are detected on the S&P BSE Sensex and CNX Nifty indices which both encompass Indian stocks. Their time series move in close lockstep which is why LPPL signals were obtained for both of them. The intensity of the signals is rather weak, with a maximum confidence indicator value of 38%.

The detected bubble sizes average to about 15% whilst the durations slightly differ. The largest signal cluster predicts a likely crash scenario for the 2nd week of September at a high probability of 83%.

The corresponding plots are given in the following slides.









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}	$\sigma_{t_c}[days]$	Scenario Probability [%]
Positive Bubbles										
1	S&P500 Hr & Empl Oyment Serv	35	182		62		46	2018-10-22	10	73
2	S&P500 Health Care Facilities	33	127		58		44	2018-09-29	1	34
3	S&P500 Divr Spt Svs	27	197		62		41	2018-09-01	1	82
4	S&P500 Footwear	26	181		55		38	2018-09-06	3	34
5	S&P500 Food Retail	33	168		28		30	2018-09-01	1	31
6	S&P500 Es Health Care	16	161		56		30	2018-09-06	4	75
7	S&P500 Railroads	17	125		49		29	2018-09-04	2	76
8	S&P500 Road & Rail	17	125		51		29	2018-09-04	3	85
9	S&P500 Tech Hard, Storage & Periph	21	119		34		27	2018-09-03	4	68
10	S&P500 Elt Eq/Ins	27	162		28		27	2018-08-31		95

In our close-up analysis of United States equity indices, as in August, once again, we find a multitude of S&P sector indices to be in a bubble regime. Overall, positive bubble activity has increased from 5% to 14% over the past month for US equities. The negative bubble activity stays zero.

Detected positive bubble sizes range between 16% to 35%. The largest confidence indicator value is 62%. For many of the listed assets, the cluster analysis finds short term likely bubble burst scenarios, a hint that currently there is increased upward momentum in these markets, leading to super-exponential price movements. The number of similar results backs the conclusion that overall US markets seem to be accelerating towards an unsustainable high, lately.

















Currencies – Real Effective Exchange Rates & PCA



Bubble Data **Cluster Analysis** DS LPPL Scenario Geometric Average **Critical Time** Duration Bubble Confidence $\sigma_{t_c}[days]$ Probability Name Size *bs* [%] [days] $\sqrt{bs \cdot ci}$ [%] Prediction μ_{tc} ci [%] [%] Positive Bubbles 1 HKD PC1 82 125 100 91 2018-09-19 1 64 **REER** Index 2 13 1 134 54 26 2018-09-01 41 Nigeria **REER** Index 3 19 223 31 24 9 2018-09-09 64 Egypt **REER** Index 16 286 17 2 4 16 2018-09-03 40 Uruquav

The currency sector experiences approximately steady bubble activity, compared to last month, with positive bubble assets making a fraction of 8% (7%) over all analyzed assets.

At the top of the list, we see a positive bubble signal determined on the time series resulting from the principal component analysis (PCA) of the Hong Kong Dollar, which has recently undergone an appreciation. The results of the PCA for the HKD and other major fiat currencies are shown on the next slide.

We point out that again, at the third position, the REER Index Egypt which has been presented in several previous reports is listed. The prevailing bubble has increased in size to 19% from 12% in August.

In the cryptocurrency sector which remains calm, no bubbles were detected this month.

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





For 816 stocks, we calculate the bubble warning indicators as well as two financial strength indicators, which indicate the fundamental value of the stock and the growth capability respectively.

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



To analyze the financial strength of individual stocks, we have two indicators. Both scores give a value between zero and one, one being the best of the set and zero the worst, so the higher the score, the higher the financial strength.

- A <u>value score</u> 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 <u>growth score</u> 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*:

- <u>Quadrant 1:</u> Stocks with a strong positive bubble score and a strong value score (e.g. Apple Inc);
- Quadrant 2: Stocks with a strong positive bubble score and a weak value score (e.g. Wirecard AG);
- Quadrant 3: Stocks with a strong negative bubble score and a weak value score (e.g. L Brands Inc);
- <u>Quadrant 4:</u> Stocks with strong negative bubble score and a strong financial strength (e.g. Valeo SA)

*A strong positive bubble signal is identified if bubble score is larger than 10%, and a strong negative bubble signal is identified if bubble score is smaller than -10%. A strong value score is identified if value score is larger than 60%, and a weak value score is identified if value score is smaller than 40%.



Each quadrant has its own specs:

1. <u>Quadrant 1</u>: 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. <u>Quadrant 2</u>: 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. <u>Quadrant 3</u>: 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. <u>Quadrant 4:</u> 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



The FCO Cockpit - Global Bubble Status Report 1st Sept 2018



Strong negative bubble signals with weak (respectively strong) fundamentals



Single Stocks





Quadrant 1 stocks: strong positive bubble signals with strong fundamentals

			Yearly		Bubble	Bubble	Value	Growth
Company Name	Country of Headquarters	GICS Industry Group Name	Return	Bubble Size	Start	Score	Score	Score
Apple Inc	United States of America	Technology Hardware & Equipment	43.8%	31.6%	Feb-18	28.4%	60.4%	44.0%
FLIR Systems Inc	United States of America	Technology Hardware & Equipment	59.9%	30.8%	Feb-18	34.0%	66.5%	78.7%
Garmin Ltd	Switzerland	Consumer Durables & Apparel	30.3%	12.8%	Feb-18	60.1%	63.0%	23.4%
Microsoft Corp	United States of America	Software & Services	50.2%	23.7%	Feb-18	29.9%	61.8%	27.0%
Qualcomm Inc	United States of America	Semiconductors & Semiconductor Equipment	33.5%	20.9%	Mar-18	73.1%	94.6%	22.1%
AstraZeneca PLC	United Kingdom	Pharmaceuticals, Biotechnology & Life Sciences	20.6%	21.3%	Nov-17	19.0%	67.6%	9.9%
Cineworld Group PLC	United Kingdom	Media	12.3%	38.3%	Jan-18	21.9%	64.8%	15.2%
MTU Aero Engines AG	Germany	Capital Goods	50.8%	40.0%	Apr-18	62.3%	60.2%	20.6%
Qiagen NV	Netherlands	Pharmaceuticals, Biotechnology & Life Sciences	22.7%	23.8%	Nov-17	17.2%	78.1%	27.1%
Thales SA	France	Capital Goods	29.8%	27.3%	Mar-18	98.3%	68.0%	76.0%
Electricite de France SA	France	Utilities	40.8%	30.2%	Nov-17	48.6%	94.0%	3.3%
Eutelsat Communications SA	France	Media	-15.0%	21.8%	Mar-18	63.7%	68.3%	15.3%
Saipem SpA	Italy	Energy	35.6%	32.4%	Feb-18	59.2%	92.8%	99.6%
Fortum Oyj	Finland	Utilities	36.6%	24.0%	Nov-17	6.1%	94.9%	93.5%
WM Morrison Supermarkets PLC	United Kingdom	Food & Staples Retailing	13.3%	17.1%	Apr-18	81.0%	90.7%	85.2%
Archer Daniels Midland Co	United States of America	Food, Beverage & Tobacco	16.0%	16.5%	Mar-18	33.7%	84.3%	38.8%
Allergan plc	Ireland; Republic of	Pharmaceuticals, Biotechnology & Life Sciences	-14.3%	24.3%	Feb-18	47.3%	97.1%	86.9%
Becton Dickinson and Co	United States of America	Health Care Equipment & Services	32.5%	18.0%	Feb-18	23.4%	80.3%	66.7%
Fidelity National Information Services Inc	United States of America	Software & Services	17.4%	17.4%	Sep-17	7.9%	65.2%	69.9%
Jacobs Engineering Group Inc	United States of America	Capital Goods	30.3%	22.9%	Mar-18	27.2%	88.0%	25.9%
Kroger Co	United States of America	Food & Staples Retailing	48.2%	34.4%	Mar-18	61.7%	62.3%	63.2%
Medtronic PLC	Ireland; Republic of	Health Care Equipment & Services	17.9%	23.4%	Mar-18	76.0%	90.6%	59.3%
Mosaic Co	United States of America	Materials	53.0%	26.7%	Mar-18	8.6%	80.1%	12.7%
Merck & Co Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	3.7%	21.6%	Feb-18	59.7%	68.9%	56.6%
Robert Half International Inc	United States of America	Commercial & Professional Services	69.3%	35.8%	Feb-18	6.8%	84.6%	37.1%
Ralph Lauren Corp	United States of America	Consumer Durables & Apparel	46.2%	46.2%	Sep-17	1.5%	75.5%	39.1%
Thermo Fisher Scientific Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	24.7%	15.3%	Mar-18	37.8%	77.3%	55.5%
Textron Inc	United States of America	Capital Goods	33.4%	31.6%	Sep-17	8.9%	67.2%	82.6%
Telefonaktiebolaget LM Ericsson	Sweden	Technology Hardware & Equipment	68.0%	52.1%	Nov-17	9.4%	91.5%	3.2%
Swedish Match AB	Sweden	Food, Beverage & Tobacco	71.2%	74.2%	Sep-17	66.1%	96.6%	65.4%



Quadrant 1 stocks: strong positive bubble signals with strong fundamentals Example: Thales 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 green shaded period is the strong positive bubble we identified. The Bubble Score of this six month bubble has reached 98.3% with a bubble size 27.3%.

Single Stocks - Quadrant 1 stocks



Last month example: strong positive bubble signals with strong fundamentals, Saipem SpA.

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 continued to strengthen with some volatility, which is in agreement with the DS LPPLS indicator and the strong fundamentals.





Quadrant 2 stocks: strong positive bubble signals with weak fundamentals

			Yearly	Bubble	Bubble	Bubble	Value	Growth
Company Name	Country of Headquarters	GICS Industry Group Name	Return	Size	Start	Score	Score	Score
Advanced Micro Devices Inc	United States of America	Semiconductors & Semiconductor Equipment	105.3%	141.1%	Mar-18	86.3%	1.2%	35.2%
Amazon.com Inc	United States of America	Retailing	102.9%	47.7%	Jan-18	43.0%	0.5%	69.5%
ANSYS Inc	United States of America	Software & Services	44.0%	25.1%	Nov-17	0.6%	15.0%	62.6%
Costco Wholesale Corp	United States of America	Food & Staples Retailing	43.6%	24.4%	Mar-18	100.0%	15.2%	62.0%
Cintas Corp	United States of America	Commercial & Professional Services	58.5%	29.8%	Feb-18	26.2%	14.6%	78.4%
Fiserv Inc	United States of America	Software & Services	29.6%	12.2%	Mar-18	51.7%	13.8%	67.2%
IDEXX Laboratories Inc	United States of America	Health Care Equipment & Services	60.0%	60.0%	Sep-17	20.5%	3.4%	61.4%
Illumina Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	68.1%	47.2%	Mar-18	43.1%	2.5%	56.5%
Intuitive Surgical Inc	United States of America	Health Care Equipment & Services	61.5%	46.6%	Feb-18	24.8%	8.0%	53.7%
O'Reilly Automotive Inc	United States of America	Retailing	61.9%	38.2%	Mar-18	26.1%	10.4%	58.3%
Paychex Inc	United States of America	Software & Services	27.4%	27.4%	Sep-17	8.5%	29.3%	75.4%
Ross Stores Inc	United States of America	Retailing	58.1%	24.6%	Feb-18	65.9%	37.5%	53.3%
Take-Two Interactive Software Inc	United States of America	Software & Services	34.4%	34.4%	Sep-17	22.7%	39.0%	6.5%
Verisk Analytics Inc	United States of America	Commercial & Professional Services	47.6%	16.6%	Mar-18	94.7%	7.8%	56.9%
Auto Trader Group PLC	United Kingdom	Software & Services	22.2%	35.1%	Nov-17	25.6%	25.2%	29.9%
Bunzl plc	United Kingdom	Capital Goods	6.4%	11.2%	Nov-17	4.8%	17.5%	25.6%
Burberry Group PLC	United Kingdom	Consumer Durables & Apparel	27.8%	27.8%	Sep-17	43.1%	32.1%	45.7%
Compass Group PLC	United Kingdom	Consumer Services	3.5%	7.8%	Nov-17	26.6%	7.4%	72.3%
Croda International PLC	United Kingdom	Materials	37.4%	17.1%	Feb-18	54.3%	34.8%	50.1%
Wirecard AG	Germany	Software & Services	162.8%	86.4%	Apr-18	100.0%	26.0%	46.3%
DSV A/S	Denmark	Transportation	30.4%	27.1%	Oct-17	9.1%	13.0%	39.5%
Simcorp A/S	Denmark	Software & Services	54.2%	54.2%	Sep-17	41.0%	30.4%	75.1%
Amadeus IT Group SA	Spain	Software & Services	47.0%	28.9%	Apr-18	83.8%	14.0%	20.3%
Dassault Systemes SE	France	Software & Services	62.6%	28.6%	Mar-18	81.0%	11.2%	37.3%
lpsen SA	France	Pharmaceuticals, Biotechnology & Life Sciences	35.7%	27.6%	Feb-18	50.5%	21.6%	21.9%
Relx NV	Netherlands	Commercial & Professional Services	5.5%	13.1%	Feb-18	9.8%	5.4%	70.0%
Wolters Kluwer NV	Netherlands	Commercial & Professional Services	41.1%	41.1%	Sep-17	47.1%	39.3%	30.8%



Quadrant 2 stocks: strong positive bubble signals with weak fundamentals

			Yearly	Bubble	Bubble	Bubble	Value	Growth
Company Name	Country of Headquarters	GICS Industry Group Name	Return	Size	Start	Score	Score	Score
Halma PLC	United Kingdom	Technology Hardware & Equipment	29.8%	33.0%	Sep-17	12.9%	15.1%	36.2%
Kerry Group PLC	Ireland; Republic of	Food, Beverage & Tobacco	25.3%	19.2%	Mar-18	100.0%	27.2%	70.1%
Relx PLC	United Kingdom	Commercial & Professional Services	3.3%	14.5%	Feb-18	35.3%	5.1%	49.1%
Rotork PLC	United Kingdom	Capital Goods	37.6%	34.7%	Sep-17	18.3%	30.1%	48.3%
Givaudan SA	Switzerland	Materials	15.9%	10.2%	Feb-18	22.9%	14.5%	11.8%
Temenos AG	Switzerland	Software & Services	77.8%	37.3%	Dec-17	46.3%	3.9%	70.3%
Spirax-Sarco Engineering PLC	United Kingdom	Capital Goods	24.2%	23.6%	Mar-18	30.2%	10.9%	32.0%
Advance Auto Parts Inc	United States of America	Retailing	64.0%	53.2%	Jan-18	11.4%	28.9%	61.9%
Amphenol Corp	United States of America	Technology Hardware & Equipment	15.0%	10.8%	Mar-18	3.7%	20.2%	37.6%
CF Industries Holdings Inc	United States of America	Materials	60.5%	33.2%	Mar-18	100.0%	8.3%	82.0%
Salesforce.Com Inc	United States of America	Software & Services	60.2%	41.8%	Feb-18	18.9%	2.3%	66.4%
Dollar General Corp	United States of America	Retailing	39.5%	21.6%	Mar-18	19.1%	35.0%	43.0%
Darden Restaurants Inc	United States of America	Consumer Services	39.5%	49.3%	Sep-17	6.9%	32.5%	59.4%
Equifax Inc	United States of America	Commercial & Professional Services	38.6%	21.2%	Oct-17	30.9%	11.9%	54.3%
W W Grainger Inc	United States of America	Capital Goods	109.2%	28.9%	Mar-18	30.9%	36.8%	26.2%
Nordstrom Inc	United States of America	Retailing	34.5%	23.1%	Mar-18	8.3%	23.9%	65.7%
Motorola Solutions Inc	United States of America	Technology Hardware & Equipment	51.8%	43.5%	Oct-17	19.8%	28.3%	38.1%
NiSource Inc	United States of America	Utilities	0.6%	15.1%	Apr-18	9.3%	35.2%	44.9%
Nike Inc	United States of America	Consumer Durables & Apparel	53.0%	21.7%	Apr-18	95.5%	9.4%	40.0%
Roper Technologies Inc	United States of America	Capital Goods	26.2%	8.7%	Apr-18	9.0%	18.8%	63.1%
Sysco Corp	United States of America	Food & Staples Retailing	42.0%	42.0%	Sep-17	21.5%	32.7%	29.8%
Union Pacific Corp	United States of America	Transportation	35.9%	13.1%	Feb-18	16.9%	40.0%	71.2%
Visa Inc	United States of America	Software & Services	38.5%	32.7%	Dec-17	55.3%	7.2%	57.0%
Zoetis Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	38.9%	13.6%	Feb-18	40.9%	10.8%	55.1%
Unilever PLC	United Kingdom	Household & Personal Products	0.5%	11.0%	Mar-18	21.9%	22.1%	32.5%
Alfa Laval AB	Sweden	Capital Goods	28.7%	29.3%	Sep-17	33.7%	34.9%	6.7%
Swedish Orphan Biovitrum AB (publ)	Sweden	Pharmaceuticals, Biotechnology & Life Sciences	137.3%	105.1%	Mar-18	79.7%	8.7%	78.3%

Single Stocks - Quadrant 2 stocks



Quadrant 2 stocks: strong positive bubble signals with weak fundamentals Example: Wirecard 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 green shaded period is the strong positive bubble we identified. The Bubble Score of this five month bubble has reached 100% with a bubble size 86.4%. The strong positive bubble signals and weak fundamentals indicate a high probability of correction in the future. However, it should be noted that Wirecard has just replaced Commerzbank in the German DAX 30 index, boosting its visibility and credentials, suggesting that the bubble will continue for a while.



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

The figure below plots the one year cumulative return of the stock (blue), NASDAQ 100 (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 100% this month. Together with the weak fundamentals, one should be careful about the strong downside risk of this stock.





Quadrant 3 stocks: strong negative bubble signals with weak fundamentals

						Bubble	Value	Growth
Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Score	Score	Score
Iliad SA	France	Telecommunication Services	-50.5%	-34.3%	Apr-18	-17.9%	8.2%	96.9%
Telenor ASA	Norway	Telecommunication Services	-3.1%	-9.3%	Feb-18	-34.5%	27.3%	74.8%
Randgold Resources Ltd	Jersey	Materials	-34.0%	-27.5%	Nov-17	-19.3%	9.9%	85.7%
DKSH Holding AG	Switzerland	Commercial & Professional Services	-13.4%	-15.1%	Oct-17	-27.9%	34.1%	18.4%
L Brands Inc	United States of America	Retailing	-34.6%	-48.2%	Jan-18	-33.6%	16.5%	11.3%
Northrop Grumman Corp	United States of America	Capital Goods	12.3%	-14.6%	Feb-18	-10.7%	39.8%	32.6%

Single Stocks - Quadrant 3 stocks



Quadrant 3 stocks: strong negative bubble signals with weak fundamentals Example: Telenor ASA.



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 seven month bubble has reached 34.5% with a bubble size -9.3%.

Single Stocks - Quadrant 3 stocks



Last month example: strong negative bubble signals with weak fundamentals, Fresnillo PLC.

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 continued its drawdown in the past month, which is in agreement with the weak fundamentals and our DS LPPLS indicator.





Quadrant 4 stocks: strong negative bubble signals with strong fundamentals

			Yearly	Bubble	Bubble	Bubble	Value	Growth
Company Name	Country of Headquarters	GICS Industry Group Name	Return	Size	Start	Score	Score	Score
Applied Materials Inc	United States of America	Semiconductors & Semiconductor Equipment	-8.6%	-21.8%	Feb-18	-15.5%	75.0%	49.0%
Lam Research Corp	United States of America	Semiconductors & Semiconductor Equipment	0.3%	-13.7%	Oct-17	-3.1%	98.3%	22.7%
NetEase Inc	China	Software & Services	-26.4%	-35.5%	Mar-18	-42.8%	97.9%	86.3%
Vodafone Group PLC	United Kingdom	Telecommunication Services	-24.4%	-29.1%	Nov-17	-13.9%	99.5%	2.9%
Western Digital Corp	United States of America	Technology Hardware & Equipment	-26.3%	-35.0%	Mar-18	-34.3%	98.7%	20.0%
Bayer AG	Germany	Pharmaceuticals, Biotechnology & Life Sciences	-27.0%	-15.8%	Apr-18	-40.2%	86.0%	33.8%
Continental AG	Germany	Automobiles & Components	-22.6%	-29.5%	Mar-18	-90.2%	69.2%	9.7%
Daimler AG	Germany	Automobiles & Components	-15.4%	-21.7%	Oct-17	-29.6%	87.9%	28.8%
1&1 Drillisch AG	Germany	Telecommunication Services	-25.6%	-32.4%	Feb-18	-57.6%	79.4%	97.7%
HeidelbergCement AG	Germany	Materials	-16.7%	-24.1%	Nov-17	-4.0%	70.5%	99.0%
Rheinmetall AG	Germany	Capital Goods	2.8%	-16.3%	Jan-18	-25.3%	81.9%	18.8%
Pandora A/S	Denmark	Consumer Durables & Apparel	-39.8%	-40.0%	Feb-18	-16.2%	90.9%	92.6%
Faurecia SA	France	Automobiles & Components	-3.9%	-23.2%	Apr-18	-56.0%	90.1%	85.0%
Casino Guichard Perrachon SA	France	Food & Staples Retailing	-44.9%	-46.4%	Dec-17	-36.8%	80.0%	2.3%
Bouygues SA	France	Capital Goods	-1.8%	-11.6%	Nov-17	-5.6%	86.2%	2.2%
Valeo SA	France	Automobiles & Components	-36.3%	-27.8%	Apr-18	-89.6%	70.2%	92.3%
Compagnie Plastic Omnium SA	France	Automobiles & Components	-1.7%	-17.0%	Apr-18	-21.4%	73.4%	72.7%
ASM International NV	Netherlands	Semiconductors & Semiconductor Equipment	-10.1%	-23.1%	Nov-17	-32.3%	98.2%	9.6%
BE Semiconductor Industries NV	Netherlands	Semiconductors & Semiconductor Equipment	-35.5%	-53.1%	Feb-18	-3.9%	85.4%	60.5%
Telecom Italia SpA	Italy	Telecommunication Services	-29.2%	-26.5%	Dec-17	-5.5%	89.3%	95.3%
Eastman Chemical Co	United States of America	Materials	14.1%	-11.2%	Mar-18	-31.3%	69.4%	12.1%



Quadrant 4 stocks: strong negative bubble signals with strong fundamentals Example: Continental 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 month bubble has reached 90.2% with a bubble size -29.5%. 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, Duerr 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



CICS Industry Crown Name		Return	Bubble Size		Bubble Score		Value Score		Growtl	h Score
GICS Industry Group Name	Sep 1st	Aug 1st	Sep 1st	Aug 1st	Sep 1st	Aug 1st	Sep 1st	Aug 1st	Sep 1st	Aug 1st
Pharmaceuticals, Biotechnology & Life Sciences	3.6%	6.7%	0.0%	0.0%	0.0%	0.0%	64.2%	63.4%	57.2%	57.4%
Consumer Services	5.9%	8.4%	0.0%	0.0%	0.0%	0.0%	28.1%	29.0%	47.2%	46.5%
Retailing	48.3%	42.0%	0.0%	43.2%	0.0%	15.4%	17.1%	17.2%	57.9%	57.7%
Transportation	10.7%	12.8%	0.0%	0.0%	0.0%	0.0%	60.2%	60.6%	56.3%	56.3%
Consumer Durables & Apparel	14.9%	12.8%	0.0%	0.0%	0.0%	0.0%	35.2%	35.9%	54.8%	54.9%
Semiconductors & Semiconductor Equipment	22.0%	25.9%	0.0%	0.0%	0.0%	0.0%	62.6%	63.7%	29.9%	29.7%
Technology Hardware & Equipment	32.0%	18.6%	0.0%	0.0%	0.0%	0.0%	67.7%	72.7%	43.2%	39.1%
Automobiles & Components	-4.6%	5.2%	-17.6%	0.0%	-49.2%	0.0%	76.8%	78.1%	50.3%	50.3%
Telecommunication Services	-4.5%	-6.1%	0.0%	0.0%	0.0%	0.0%	57.5%	56.4%	38.3%	38.1%
Energy	12.4%	21.6%	0.0%	0.0%	0.0%	0.0%	51.4%	50.7%	52.4%	52.8%
Software & Services	28.7%	27.6%	0.0%	20.7%	0.0%	50.8%	37.0%	36.5%	48.0%	47.9%
Materials	1.7%	9.8%	0.0%	0.0%	0.0%	0.0%	52.7%	51.3%	44.0%	47.3%
Health Care Equipment & Services	22.0%	20.4%	13.2%	20.4%	36.5%	44.3%	65.1%	64.8%	58.5%	58.4%
Capital Goods	3.8%	6.6%	0.0%	0.0%	0.0%	0.0%	47.5%	47.3%	53.1%	52.7%
Media	3.6%	-3.5%	0.0%	0.0%	0.0%	0.0%	41.9%	40.1%	51.4%	52.7%
Commercial & Professional Services	14.2%	13.3%	10.1%	7.0%	81.0%	56.6%	28.4%	27.8%	51.6%	51.3%
Food & Staples Retailing	11.8%	9.2%	7.2%	0.0%	96.0%	0.0%	59.0%	58.1%	59.3%	60.2%
Household & Personal Products	-1.2%	-0.3%	0.0%	0.0%	0.0%	0.0%	34.1%	32.9%	51.4%	53.1%
Food, Beverage & Tobacco	-6.7%	-4.0%	0.0%	0.0%	0.0%	0.0%	43.0%	43.9%	58.5%	58.9%
Utilities	-3.8%	-1.5%	0.0%	0.0%	0.0%	0.0%	52.5%	52.2%	45.7%	43.4%
Insurance	1.8%	1.7%	0.0%	0.0%	0.0%	0.0%	-	-	-	
Real Estate	0.6%	2.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	
Diversified Financials	9.5%	9.8%	0.0%	0.0%	0.0%	0.0%		-	-	
Banks	0.8%	5.0%	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 4 industry groups with a positive bubble score: *Automobiles & components, Health Care Equipment & Services, Commercial & Professional Services,* and *Food & Staples Retailing* as shown in the figures in the next slide. *Health Care Equipment & Services,* and *Commercial & Professional Services* are the two industry groups that we reported last month, and both of the indexes continued to appreciate.

Below shows the performance of the other two industry groups we reported last month. Both of them are following the existing upward trend.



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.



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 May, June, July and August 2018 continue to outperform among others, while Contrarian Short Portfolios are have a hard time due to the market rally, except in August. At the same time, Trend-Following Long Portfolios are doing well except those initiated in June, due to the recent correction of Intel (INTC.O), whose large market cap controls the performance of the portfolio. 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

The FCO Cockpit - Global Bubble Status Report 1st Sept 2018

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 logprice 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: <u>https://ssrn.com/abstract=3007070 or http://dx.doi.org/10.2139/ssrn.3007070</u>

[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 <u>http://www.er.ethz.ch/media/publications/social-systems-finance/bubbles_and_crashes_theory_empirical_analyses.html</u>

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: <u>https://ssrn.com/abstract=3164246</u> or <u>http://dx.doi.org/10.2139/ssrn.3164246</u>



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 <i>bs</i> [%]	Duration [<i>days</i>]	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.





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

The (here CPI-weighted) REER Indices are a measure for the trading competitiveness of the corresponding country.

In contrast to single currency cross rates, the REER is a rather absolute measure of the domestic currency value because it is calculated versus a selection of other currencies.

This has the advantage that, unlike with the methodologies that were used in previous reports, positive and negative bubbles in the value of the currency can clearly be distinguished, as visible in the table above.

Currencies – Principal Component Analysis



As an alternative method to generate a base currency time series from a variety of the currency's cross rates, we apply a principal component analysis (PCA). In total, we perform the PCA for 10 major fiat currencies. For each currency, more than 100 cross rates are grouped into a time series dataset, which, using PCA, is then condensed down into a single time series to which we apply our LPPLS analysis. The time series is assembled according to the weights of the first principal component (PC1) of the dataset. It is used as an aggregate representation of all currency cross rates..

More precisely, taking for instance the Swiss franc as a base currency, we consider N=100 currency crosses expressing how much the Swiss franc is valued in these N other currencies. We calculate N time series of returns for the each cross with the base currency (Swiss franc). We then perform a PCA on the dataset of these N return time series. The corresponding PC1 represents the common factor explaining the largest part of the variance of the returns of these N time series. It is interpreted as the embodiment of the real Swiss franc dynamics, filtering out the impact of the other currencies. The LPPLS algorithm is then applied to this equivalent time series.

The plot given in the first part of the report depicts the equivalent time series constructed from the PC1 for each of the ten currency pairs. In the legend, the explained variance of the PC1 is given for each currency. A high explained variance means that most of the crosses of the base currency with other currencies move in a correlated way, which can be interpreted as reflecting a common factor, namely the base currency's intrinsic value dynamics.



To analyze the financial strength of individual stocks in the second part of the report, we have two indicators. Both scores give a value between zero and one, one being the best of the set and zero the worst, so the higher the score, the higher the financial strength.

- A <u>value score</u> 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 <u>growth score</u> 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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