

The FCO Cockpit Global Bubble Status Report

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August 1st , 2019

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About



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

It is the result of an extensive analysis done on the historical time series of about 450 systemic assets and about 850 single stocks. The systemic assets are bond, equity and commodity indices, as well as a selection of currency pairs. The single stocks are mainly US and European equities. The data is from Thomson Reuters.

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

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

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

Methodology



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

- 1. During the growth phase of a positive (negative) bubble, the price rises (falls) faster than exponentially. Therefore the logarithm of the price rises faster than linearly.
- 2. There are accelerating log-periodic oscillations around the super-exponential price evolution that symbolize increases in volatility towards the end of the bubble.
- 3. At the end of the bubble, the so-called critical time t_c , a finite time singularity occurs after which the bubble bursts.

Together, these effects encompass irrational imitation and herding phenomena amongst market participants that lead to blow-up and instability of asset prices.



Bubble Regimes





General Results – The Big Picture





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

General Results – This Month's Overview



	Category	Analyzed Assets	Fraction of Pos. Bubbles [%]	Fraction of Neg. Bubbles [%]
Fixed Income		155	9	0
	Government Bonds	55	18	0
	Finance and Insurance	21	0	0
	Corporate Bonds	79	5	0
Equity		300	12	0
	Country Indices	65	2	0
	Europe	36	3	0
	United States	199	17	0
Commodities		30	0	0
Forex		54	2	0

Since last report, we observe an increase in the fraction of positive bubble signals in the equity class from previous 9% to 12% and a drop from 21% to 9% for fixed income indices. Bubble activity amongst the commodity and forex sectors continues to be low.

Fixed Income – Government Bond Indices

Bubble Data



Cluster Analysis

Name		Bubble Size bs [%]	Duration [<i>days</i>]	DS LPPL Confidence ci [%]		Geometric Average $\sqrt{bs \cdot ci}$ [%]	Critical Time Prediction μ_{t_c}		σ _{tc} [days]	Scenario Probability [%]	
	Positive Bubbles										
	1	iBoxx GEMX Sri Lanka Index	17	286		87		39	2019-07-26	1	48
	2	iBoxx Asia Philippines Index	25	286		30		28	2019-08-20	2	22
	3	iBoxx Asia Philippines Government Index	25	286		30		28	2019-08-20	2	22
	4	iBoxx GEMX Mexico 10+ Index	16	219		45		27	2019-09-27	5	49
	5	iBoxx Asia Indonesia Index	12	260		40		22	2019-09-28	14	61

As in July, we report continuing bubble growth and rising bubble activity, symbolized by the magnitude of the DS LPPL Confidence Indicator, for the Sri Lankan and Philippines government bond indices. For the Sri Lankan index, the reported indicator value of 87% and the estimated bubble size of 17% are quite high. The corresponding plots for both indices, depicting the recent surges of the indicator series, are provided on the following slides.





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Equities – Country Indices



	Bubble Data						Cluster Analysis				
	Name	Bubble Size bs [%]	Duration [<i>days</i>]	DS LPPL Confidence ci [%]		Geometric Average $\sqrt{bs \cdot ci}$ [%]	Critical Time Prediction μ_{t_c}	σ _{tc} [days]	Scenario Probability [%]		
Positive Bubbles											
1	New Zealand Se Top50 Free Index	10	111		50	23	2019-07-30	3	88		

A bubble of estimated size 10% is detected for the New Zealand Equity Index. We see that the indicator value, with 50%, is at a medium level. As the critical time prediction shows, the most probable scenario forecasts an immediate change of regime of the index. We will revisit this prediction in the next report. Again, we can observe the recent surge of the indicator in the time series plot provided on the next page.





Equities – United States

Pubble Date



	Bubble Data						Cluster Analysis		
	Name	Bubble Size bs [%]	Duration [<i>days</i>]	DS LPPL Confidence ci [%]	Geometric Average $\sqrt{bs \cdot ci} \ [\%]$		Critical Time Prediction μ_{t_c}	σ _{tc} [days]	Scenario Probability [%]
Positive Bubbles									
1	S&P500 Multi-Line Insurance	44	230	62	2	52	2019-08-03	4	86
2	S&P500 Restaurants	34	203	7	5	50	2019-08-05	9	86
3	S&P500 Commercial Serv & Supp In	38	211	63	3	49	2019-08-06	8	91
4	S&P500 Coml/Prof Svs	37	212	58	3	47	2019-08-15	15	93
5	S&P500 Metal & Glass Cont	55	202	34	1	43	2019-08-12	15	80

Cluster Analysis

We observe bubble signals for several US indices. Indicator values range from 34-75%. The estimated bubble sizes are quite high for all reported assets, at 34-55%. The largest bubble size is estimated for the Metal & Glass Container Index, which has risen by more than 80% year-over-year and more than 50% year-to-date. The index was already listed in the previous report. In comparison, the Confidence Indicator value has slightly dropped from 42% to 34%, but at the current size of the bubble, this index should be carefully monitored.





















	Bubble Data	1			Cluster Analysis						
	Name	Bubble Size bs [%]	Duration [days]	DS LPPL Confidence ci [%]	Geometric Ave $\sqrt{bs\cdot ci}$ [%]	erage	Critical Time Prediction μ_{t_c}	σ _{tc} [days]	Scenario Probability [%]		
Positive Bubbles											
1	REER Index Egypt	18	237		26	22	2019-07-28	3	56		

We find one positive signal for the Egyptian Real Effective Exchange Rate Index in the currency sector (The Egyptian currency has appreciated against the USD and other major currencies). The reported confidence value is quite low, but the estimated bubble size is unusually large, considering that the underlying asset is a currency.





Cryptocurrencies



	Bubble I	Data				Cluster Analysis				
	Name	Bubble Size bs [%]	Duration [<i>days</i>]	DS LPPL Confidence <i>ci</i> [%]	Geometric Average $\sqrt{bs \cdot ci} \ [\%]$	Critical Time Prediction μ_{t_c}	σ _{tc} [days]	Scenario Probability [%]		
Positive Bubbles										
1	Tether	130	270	73	97	2019-07-28		54		
2	Huobi- Token	285	250	15	66	2019-07-29	2	82		

We report strong positive bubble activity for Tether and Huobi-Token. We suspect that the Tether bubble has in part been connected to illicit manipulation activity on Bitfinex, the currently largest Cryptocurrency exchange in terms of revenue, based in Hong-Kong. See for instance [1] for more information on these activities.

Besides the two current bubbles, we also depict plots for some of the cryptocurrencies that we have highlighted in the previous report. These, although partly having undergone corrections, continue to grow to higher levels at highly volatile returns.

[1]: <u>https://medium.com/coinmonks/bitcoin-welcome-to-bitfinexs-second-tether-bubble-29e69126257e</u>



















For 824 stocks, we calculate the bubble warning indicators as well as two financial strength indicators, which indicate the fundamental value of the stock and the growth capability respectively.

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



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

- A <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 growth score that has characteristics similar to the PEG ratio, which is the Price to Earnings ratio normalized by the expected growth of the EPS (Earnings per Share).

Single Stocks





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

- Quadrant 1: Stocks with a strong positive bubble score and a strong value score (e.g. AT&T Inc);
- Quadrant 2: Stocks with a strong positive bubble score and a weak value score (e.g. Safran SA);
- Quadrant 3: Stocks with a strong negative bubble score and a weak value score (e.g. Cimarex Energy Co);
- <u>Quadrant 4:</u> Stocks with strong negative bubble score and a strong financial strength (e.g. Kroger Co)

*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



Quadrants 1 and 2 (stocks)

Strong positive bubble signals with strong (respectively weak) fundamentals



Single Stocks



Quadrants 3 and 4 (stocks)

Strong negative bubble signals with weak (respectively strong) fundamentals





Quadrant 1 stocks: strong positive bubble signals with strong fundamentals

	Country of Headquarters	GICS Industry Group Name	Yearly	Bubble	Bubble Stort	Bubble	Value	Growth
Verbund AG	Austria	Utilities	51.2%	20.0%	Feb-19	67.2%	83.4%	29.0%
Novartis AG	Switzerland	Pharmaceuticals, Biotechnology & Life Sciences	25.3%	26.5%	6 Aug-18	39.6%	74.6%	69.4%
Compagnie Financiere Richemont SA	Switzerland	Consumer Durables & Apparel	-3.5%	23.6%	6 Nov-18	15.2%	61.9%	97.0%
Orsted A/S	Denmark	Utilities	49.4%	29.2%	5 Feb-19	60.3%	93.6%	21.1%
Altran Technologies SA	France	Software & Services	68.8%	68.8%	á Aug-18	9.5%	90.4%	18.0%
Schneider Electric SE	France	Capital Goods	12.7%	12.7%	6 Aug-18	22.2%	67.5%	12.7%
Edenred SA	France	Commercial & Professional Services	27.5%	38.0%	6 Nov-18	56.0%	95.8%	68.8%
Elis SA	France	Commercial & Professional Services	-16.0%	20.2%	Jan-19	61.6%	67.7%	93.2%
Smiths Group PLC	United Kingdom	Capital Goods	-0.4%	20.6%	ó Oct-18	38.8%	60.3%	36.8%
AVEVA Group PLC	United Kingdom	Software & Services	49.0%	56.8%	ó Oct-18	7.5%	77.1%	40.0%
InterContinental Hotels Group PLC	United Kingdom	Consumer Services	20.5%	40.1%	ó Oct-18	79.8%	85.8%	83.0%
Informa PLC	United Kingdom	Media & Entertainment	9.4%	36.5%	jan-19	44.9%	62.0%	33.4%
Medtronic PLC	Ireland; Republic of	Health Care Equipment & Services	11.8%	23.6%	jan-19	75.2%	87.7%	46.6%
Johnson Controls International PLC	Ireland; Republic of	Capital Goods	13.7%	28.9%	ó Oct-18	18.9%	79.1%	16.7%
ICA Gruppen AB	Sweden	Food & Staples Retailing	47.7%	22.2%	5 Feb-19	29.5%	75.4%	72.3%
AT&T Inc	United States of America	Telecommunication Services	4.8%	12.2%	jan-19	16.6%	81.8%	24.9%
Abbott Laboratories	United States of America	Health Care Equipment & Services	34.7%	31.5%	jan-19	59.4%	72.0%	68.7%
Entergy Corp	United States of America	Utilities	26.7%	31.7%	Sep-18	44.3%	63.6%	15.5%
Fidelity National Information Services Inc	United States of America	Software & Services	24.6%	34.0%	5 Dec-18	74.0%	62.1%	66.0%
Thermo Fisher Scientific Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	19.1%	19.1%	43313	20.0%	70.5%	53.5%
Western Union Co	United States of America	Software & Services	11.0%	15.6%	43374	64.0%	82.0%	54.7%



Quadrant 1 stocks: strong positive bubble signals with strong fundamentals Example: InterContinental Hotels Group 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 green shaded period is the strong positive bubble we identified. The Bubble Score of this ten month bubble has reached 79.8% with a bubble size 40.1%.

Single Stocks - Quadrant 1 stocks



Last month example: strong positive bubble signals with strong fundamentals, Orsted A/S.

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. The stock started a correction recently after a further draw up in the beginning of the past month, which is in agreement with the strong fundamentals, and with our DS LPPLS indicator.





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
Galapagos NV	Belgium	Pharmaceuticals, Biotechnology & Life Sciences	61.1%	86.9%	Jan-19	14.8%	6.9%	7.0%
Belimo Holding AG	Switzerland	Capital Goods	28.2%	29.9%	Oct-18	8.9%	10.4%	81.1%
Vifor Pharma AG	Switzerland	Pharmaceuticals, Biotechnology & Life Sciences	-21.6%	18.0%	Jan-19	56.3%	17.4%	26.5%
Carl Zeiss Meditec AG	Germany	Health Care Equipment & Services	43.4%	54.3%	Nov-18	7.5%	13.6%	56.3%
Puma SE	Germany	Consumer Durables & Apparel	47.1%	42.5%	Oct-18	5.9%	11.0%	79.0%
Safran SA	France	Capital Goods	20.4%	11.9%	Oct-18	7.9%	38.6%	79.5%
Air Liquide SA	France	Materials	15.4%	17.1%	Nov-18	16.1%	25.6%	41.9%
LVMH Moet Hennessy Louis Vuitton SE	France	Consumer Durables & Apparel	23.9%	23.9%	Aug-18	18.8%	15.4%	48.3%
Sartorius Stedim Biotech SA	France	Pharmaceuticals, Biotechnology & Life Sciences	35.4%	53.7%	Nov-18	54.7%	3.6%	33.9%
Rentokil Initial PLC	United Kingdom	Commercial & Professional Services	30.0%	25.1%	Mar-19	10.0%	12.0%	46.8%
Compass Group PLC	United Kingdom	Consumer Services	24.1%	22.9%	Feb-19	57.9%	9.8%	67.5%
Recordati Industria Chimica e Farmaceutica SpA	Italy	Pharmaceuticals, Biotechnology & Life Sciences	24.9%	21.2%	Feb-19	76.9%	26.0%	76.9%
Amplifon SpA	Italy	Health Care Equipment & Services	19.8%	52.9%	Nov-18	15.4%	18.0%	66.5%
Wolters Kluwer NV	Netherlands	Commercial & Professional Services	19.0%	13.0%	Feb-19	7.6%	22.6%	40.5%
Ferrari NV	Italy	Automobiles & Components	34.8%	48.7%	Nov-18	1.5%	3.8%	80.7%
AAK AB (publ)	Sweden	Food, Beverage & Tobacco	35.1%	63.2%	Dec-18	100.0%	22.3%	72.7%
Adobe Inc	United States of America	Software & Services	17.8%	17.8%	Aug-18	23.5%	4.4%	87.9%
Advanced Micro Devices Inc	United States of America	Semiconductors & Semiconductor Equipment	59.4%	31.9%	Jan-19	84.4%	2.7%	44.4%
Alliant Energy Corp	United States of America	Utilities	15.8%	17.3%	Sep-18	39.9%	32.9%	69.8%
Atmos Energy Corp	United States of America	Utilities	19.5%	14.2%	Nov-18	23.7%	24.9%	56.2%
Ball Corp	United States of America	Materials	73.3%	32.6%	Feb-19	64.7%	20.8%	48.8%
CMS Energy Corp	United States of America	Utilities	20.2%	14.1%	Nov-18	15.4%	28.8%	71.0%
Cintas Corp	United States of America	Commercial & Professional Services	23.2%	50.9%	Jan-19	78.8%	12.3%	60.8%
Copart Inc	United States of America	Commercial & Professional Services	29.2%	55.2%	Oct-18	18.2%	9.7%	73.9%
Costco Wholesale Corp	United States of America	Food & Staples Retailing	26.3%	37.1%	Dec-18	26.7%	12.1%	66.9%



Quadrant 2 stocks: strong positive 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
Darden Restaurants Inc	United States of America	Consumer Services	11.1%	9.4%	Aug-18	9.1%	30.3%	56.4%
Dollar General Corp	United States of America	Retailing	30.1%	19.9%	Nov-18	9.3%	33.7%	65.7%
Ecolab Inc	United States of America	Materials	36.5%	20.6%	Feb-19	38.1%	7.0%	69.3%
Edwards Lifesciences Corp	United States of America	Health Care Equipment & Services	53.0%	36.7%	Oct-18	7.2%	9.1%	64.4%
Equifax Inc	United States of America	Commercial & Professional Services	8.3%	33.4%	Jan-19	51.0%	16.5%	49.3%
FMC Corp	United States of America	Materials	10.5%	35.8%	Dec-18	42.2%	26.3%	24.5%
Hasbro Inc	United States of America	Consumer Durables & Apparel	23.2%	50.5%	Dec-18	61.7%	17.6%	45.0%
Home Depot Inc	United States of America	Retailing	7.9%	18.4%	Oct-18	31.5%	27.3%	49.5%
IDEXX Laboratories Inc	United States of America	Health Care Equipment & Services	15.3%	43.4%	Nov-18	17.7%	15.5%	57.8%
Estee Lauder Companies Inc	United States of America	Household & Personal Products	39.4%	39.4%	Aug-18	16.4%	11.4%	54.4%
Marriott International Inc	United States of America	Consumer Services	15.1%	13.8%	Oct-18	1.2%	10.0%	62.9%
Mastercard Inc	United States of America	Software & Services	33.7%	33.7%	Aug-18	37.6%	30.9%	63.0%
Mcdonald's Corp	United States of America	Consumer Services	32.3%	21.3%	Dec-18	51.9%	8.1%	43.4%
Mettler-Toledo International Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	31.5%	31.5%	Aug-18	3.2%	9.5%	61.3%
Nextera Energy Inc	United States of America	Utilities	21.3%	24.2%	Sep-18	41.6%	25.0%	75.5%
NiSource Inc	United States of America	Utilities	12.0%	19.3%	Sep-18	17.8%	31.2%	40.9%
Northrop Grumman Corp	United States of America	Capital Goods	18.6%	41.8%	Dec-18	77.9%	39.9%	8.6%
Resmed Inc	United States of America	Health Care Equipment & Services	19.1%	36.1%	Jan-19	14.7%	23.2%	62.4%
Sempra Energy	United States of America	Utilities	18.0%	19.3%	43466	37.9%	26.2%	26.6%
Starbucks Corp	United States of America	Consumer Services	82.4%	36.6%	43497	100.0%	15.8%	63.1%
Tractor Supply Co	United States of America	Retailing	34.2%	20.4%	43525	45.7%	24.8%	55.1%
Verisk Analytics Inc	United States of America	Commercial & Professional Services	30.0%	30.0%	43313	21.7%	7.9%	70.5%
Visa Inc	United States of America	Software & Services	27.1%	27.4%	43405	23.1%	8.0%	58.5%
WEC Energy Group Inc	United States of America	Utilities	27.6%	26.4%	43435	30.1%	35.4%	56.9%
Yum! Brands Inc	United States of America	Consumer Services	36.0%	25.8%	43405	5.0%	10.3%	87.0%
Zoetis Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	24.3%	28.1%	43313	39.3%	13.2%	59.3%



Quadrant 2 stocks: strong positive bubble signals with weak fundamentals Example: AAK AB (publ).



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 positive bubble we identified. The Bubble Score of this eight month bubble has reached 100% with a bubble size 63.2%. The strong positive bubble signals and weak fundamentals indicate a high probability of correction in the future.



Last month example: strong positive bubble signals with weak fundamentals, IMCD NV.

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





Quadrant 3 stocks: strong negative 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
Telefonica Deutschland Holding AG	Germany	Telecommunication Services	-39.1%	-37.1%	Nov-18	-40.4%	24.2%	99.4%
Wartsila Oyj Abp	Finland	Capital Goods	-39.0%	-20.7%	Jan-19	-68.1%	20.4%	77.5%
Apache Corp	United States of America	Energy	-43.6%	-20.9%	Jan-19	-1.9%	18.7%	72.6%
Biomarin Pharmaceutical Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	-22.3%	-22.3%	Aug-18	-2.6%	1.8%	52.5%
Cabot Oil & Gas Corp	United States of America	Energy	-18.6%	-24.4%	Mar-19	-82.7%	4.9%	77.7%
Cimarex Energy Co	United States of America	Energy	-43.0%	-31.5%	Jan-19	-42.0%	25.2%	15.7%
EOG Resources Inc	United States of America	Energy	-29.8%	-29.8%	Aug-18	-14.6%	6.2%	60.4%
TripAdvisor Inc	United States of America	Media & Entertainment	-19.8%	-34.0%	43405	-6.0%	7.5%	84.3%

Single Stocks - Quadrant 3 stocks



Quadrant 3 stocks: strong negative bubble signals with weak fundamentals Example: Cabot Oil & Gas Corp.



The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period is the negative bubble we identified. The Bubble Score of this five month bubble has reached 82.7% with a bubble size -24.4%.

Single Stocks - Quadrant 3 stocks



Last month example: strong negative bubble signals with weak fundamentals, TripAdvisor Inc.

The figure below plots the one year cumulative return of the stock (blue), S&P 500 (green) and LPPLS Bubble Score (red line on the right y-axis). The red shaded period is the strong negative bubble we identified and reported in last month. The stock had went into a plateau since last month, which is in agreement with the DS LPPLS indicator, notwithstanding the weak fundamentals. There is still downside risks as the negative bubble is not yet matured.





Quadrant 4 stocks: strong negative bubble signals with strong fundamentals

						Bubble	Value	Growth
Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Score	Score	Score
Deutsche Lufthansa AG	Germany	Transportation	-37.9%	-32.5%	Jan-19	-13.4%	98.9%	0.2%
Societe BIC SA	France	Commercial & Professional Services	-18.6%	-32.1%	Dec-18	-14.7%	67.6%	3.6%
Renault SA	France	Automobiles & Components	-30.7%	-17.4%	Jan-19	-17.6%	86.2%	9.7%
Electricite de France SA	France	Utilities	-15.9%	-20.1%	Aug-18	-31.1%	92.6%	0.8%
BT Group PLC	United Kingdom	Telecommunication Services	-15.6%	-12.2%	Feb-19	-13.1%	77.9%	23.9%
Equinor ASA	Norway	Energy	-26.4%	-16.5%	Dec-18	-6.1%	72.7%	84.7%
AbbVie Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	-30.2%	-20.4%	Nov-18	-2.2%	79.2%	71.4%
Kroger Co	United States of America	Food & Staples Retailing	-29.0%	-31.4%	Nov-18	-41.2%	62.3%	82.9%

Single Stocks - Quadrant 4 stocks



Quadrant 4 stocks: strong negative bubble signals with strong fundamentals Example: Kroger Co.



The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period is the strong negative bubble we identified. The Bubble Score of this six month bubble has reached 41.2% with a bubble size -31.4%. 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, Deutsche Lufthansa 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 stopped its drawdown and shifted into a plateau in the past month, which is in agreement with our DS LPPLS indicator, and the strong fundamentals lead us to expect future increase in the price. There is still some downside risks as the negative bubble may not have yet matured.



Sectors



	Yearly	Return	Bubble Size		Bubble Score		Value Score		Growth	n Score
GICS Industry Group Name	Aug 1st	July 1st	Aug 1st	July 1st	Aug 1st	July 1st	Aug 1st	July 1st	Aug 1st	July 1st
Pharmaceuticals, Biotechnology & Life Sciences	-0.5%	5.7%	0.0%	0.0%	0.0%	0.0%	70.0%	71.1%	50.3%	50.4%
Consumer Services	16.7%	12.9%	16.7%	12.9%	23.0%	21.5%	32.4%	31.8%	49.0%	48.9%
Retailing	2.5%	4.6%	0.0%	0.0%	0.0%	0.0%	19.3%	19.4%	55.2%	55.4%
Transportation	0.6%	3.6%	0.0%	0.0%	0.0%	0.0%	55.0%	53.8%	49.6%	50.4%
Consumer Durables & Apparel	2.5%	0.4%	0.0%	0.0%	0.0%	0.0%	33.5%	33.8%	55.9%	56.0%
Semiconductors & Semiconductor Equipment	4.7%	-3.6%	0.0%	0.0%	0.0%	0.0%	62.7%	64.3%	33.1%	32.3%
Technology Hardware & Equipment	2.0%	7.4%	0.0%	0.0%	0.0%	0.0%	63.9%	69.5%	43.0%	42.9%
Automobiles & Components	-11.0%	-13.2%	0.0%	0.0%	0.0%	0.0%	73.5%	74.3%	57.7%	57.8%
Telecommunication Services	0.5%	4.2%	0.0%	0.0%	0.0%	0.0%	64.0%	65.3%	42.1%	42.3%
Energy	-13.3%	-13.9%	0.0%	0.0%	0.0%	0.0%	54.0%	53.2%	49.9%	49.9%
Software & Services	16.3%	14.2%	16.3%	0.0%	20.8%	0.0%	36.7%	34.3%	46.6%	47.0%
Materials	-0.8%	-2.9%	0.0%	0.0%	0.0%	0.0%	53.8%	53.2%	47.0%	47.1%
Health Care Equipment & Services	7.4%	7.2%	0.0%	0.0%	0.0%	0.0%	60.5%	59.4%	49.9%	49.7%
Capital Goods	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	49.7%	49.1%	48.3%	48.6%
Media & Entertainment	19.7%	18.4%	0.0%	0.0%	0.0%	0.0%	29.1%	29.8%	44.5%	44.1%
Commercial & Professional Services	13.6%	13.7%	0.0%	20.7%	0.0%	41.4%	30.6%	29.9%	52.0%	52.5%
Food & Staples Retailing	3.3%	6.3%	0.0%	0.0%	0.0%	0.0%	51.8%	54.1%	52.8%	53.1%
Household & Personal Products	15.7%	17.9%	0.0%	17.9%	0.0%	37.6%	30.1%	33.0%	46.0%	47.2%
Food, Beverage & Tobacco	5.3%	4.6%	0.0%	0.0%	0.0%	0.0%	46.5%	46.3%	53.9%	53.7%
Utilities	10.2%	11.0%	0.0%	0.0%	0.0%	0.0%	51.3%	51.5%	44.6%	44.3%
Insurance	8.2%	12.2%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Real Estate	7.8%	10.0%	0.0%	10.0%	0.0%	23.4%	-	-		-
Diversified Financials	-0.5%	-0.9%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Banks	-9.1%	-6.8%	0.0%	0.0%	0.0%	0.0%	-	-		-

Sectors



Since Dec 2017, we are using the MSCI World Industry Group Indices to calculate bubble size and bubble score of the corresponding sectors. To determine the value scores and growth scores of the sectors, we average over the corresponding values for each stock of a given sector, weighted by market cap.

This month, we find 2 industry groups with a positive bubble score: *Consumer Services, and Software & Service,* as plotted below and in the next slide. The other 3 industry groups that we identified last month with a positive bubble score are plotted in the next slide.



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 the market index has outperformed most of the portfolios due to recent market rallies. 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 Aug 2019

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</u> or <u>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>

K-means 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 growth score that has characteristics similar to the PEG ratio, which is the Price to Earnings ratio normalized by the expected growth of the EPS (Earnings per Share).



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