The FCO Cockpit
Global Bubble Status Report
December 2019

A collaboration of the Chair of Entrepreneurial Risks, ETH Zurich and Systematic Investment Management AG

Contents

ETH FCO and SIMAG Join Forces

The Financial Crisis Observatory (FCO) is…	Systematic Investment Management AG (SIMAG) is …
▪ **Part of** the Chair of Entrepreneurial Risks at the Department of Management, Technology and Economics at the **ETH** Zurich ▪ A **scientific platform** aimed at quantifying in a systematic way the hypothesis that financial markets exhibit a degree of inefficiency and a **potential for predictability**, especially during regimes when **bubbles** develop ▪ Aiming to **provide warnings** at different time scales (week, month, quarter) on the development of future financial instabilities	▪ A **Joint Venture** between **Credit Suisse Asset Management** and an **ETH Zurich spin off** ▪ A **FINMA-licensed Investment Manager** for collective investment schemes. ▪ Relying on a **proprietary machine learning engine** specifically designed for **financial markets** ▪ The first and only investment manager globally which can **systematically leverage ETH's Financial Crisis Observatory (FCO) research insights**

Together we are able to provide you with richer investment content and deeper research insights

Purpose and Benefits

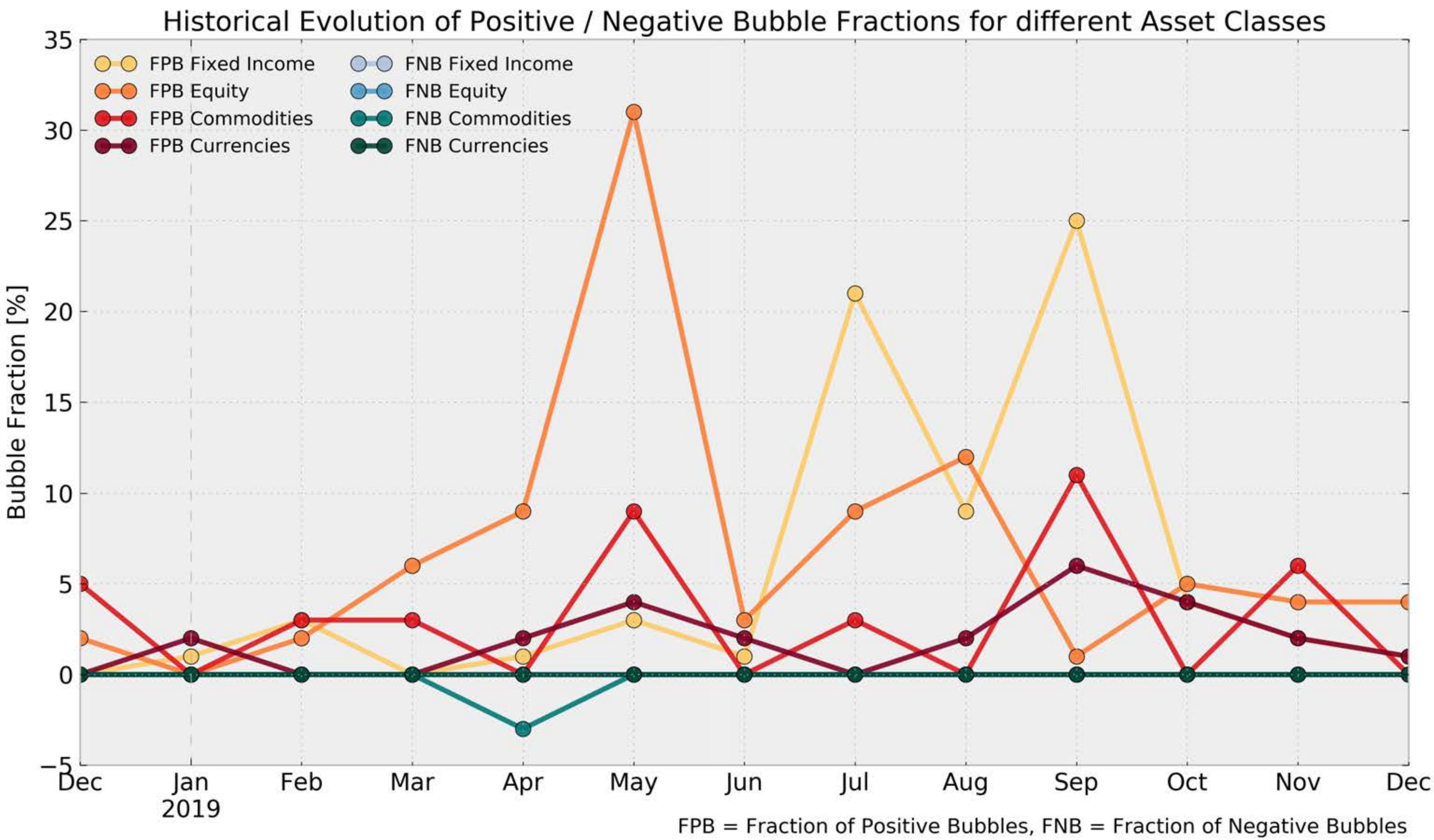
- The **Financial Crisis Observatory (FCO)** monthly report discusses the historical evolution of bubbles in and between different asset classes and geographies. The purpose of the FCO report is to ascertain which asset classes and sectors are deemed to be **crowded** and to what degree they can develop contagion risks.
- Today, the report is **used by 600+ institutions world-wide**, including universities, think tanks, sovereign wealth funds, hedge funds, family offices, private banks and pension funds.
- It delivers the big picture in terms of growing bubbles and instabilities in today's financial markets for **Chief Investment Officers**, **Senior Researchers**, **Fund Managers**, and **Independent Financial Advisors**, and all parties with **investment performance responsibility** or **managing financial risks**.
- The report 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.
- To new readers, we recommend proceeding to the appendix for more detailed information about the methodology and procedures applied in this report.

Access to the FCO analysis data can be granted upon request. Please contact info@simag.com or visit https://www.simag.com/insights/fco-cockpit/

General Results – Key Take Aways

- At the beginning of December 2019, **the low positive bubble activity** amongst the various analyzed asset classes continues, However, some of the bubble signals found in previous reports reappear this month. There are no new signals for the Commodity and Cryptocurrency sectors. The fraction of negative bubbles amongst all asset classes remains zero.

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	1	0
	Government Bonds	55	4	0
	Finance and Insurance	21	0	0
	Corporate Bonds	79	0	0
Equity		291	4	0
	Country Indices	64	3	0
	Europe	36	0	0
	United States	191	5	0
Commodities		36	0	0
Forex		77	1	0

The big picture: Macro economic developments in November

In November global debt growth continued to outpace global economic growth. This is surprising for some, because according to classical economic growth models, more debt should normally trigger additional growth in the real economy. This is only partially correct, because at the end of a credit cycle, one can observe that the credit market has largely decoupled from the real economy, because more attractive return opportunities are found within the financial economy. But why is that?

In the long term, financial market returns are derived from future expected profits in the real economy. These future profits are in turn based on investments in the future productive base of the companies. The zero-interest rate policy of central banks provide companies with more and more incentive to use loans for investments others that those that can catalyse real business activities. Corporate investment activity has been shrinking for a long time now. Companies do not invest in new productive assets because, in the short term, the returns on buying back their own shares are much more predictable and, above all, much more attractive. It is perfectly rational for corporates to increase their leverage, when everyone else in their industry is doing so. Those who do not participate in the game of musical chairs will end up as takeover candidates. Many large companies are buying up their competitors with cheap money and thus reducing the pressure of competition. This phenomenon can be observed across all sectors and regions, from the US based discount broker Charles Schwab to the French luxury goods company LVMH to the Japanese company Mitsubishi. At the same time, the number of so-called zombies firms (companies which are unable to generate enough earnings to cover their interest costs) only survive on extension of loans) is increasing. According to analysts from Arbor Research, this affects nearly 30% of US companies with a market capitalization below 1 billion.

During the reporting period we had more bad news coming from India. After more than a year watching its shadow-banking sector's slow-motion crash, the Indian Central Bank took far-reaching measures in November to stem the spread of the credit crunch from Dewan Housing Finance, a key shadow bank lender, to other lenders. Indian banks and shadow banks groan under the burden of bad loans which make them vulnerable to economic shocks and therefore extremely risk averse. When banks limit the availability of credit in the financial and real economy for fear of future loan defaults, the credit transmission to the economy no longer works. This applies to banks in India, Europe, the USA and above all China, the world's largest banking market.

Medium and smaller banks are particularly affected by the loss of confidence in the Chinese interbank market. Some banks were already forced to raise their deposit rates during November to attract additional client deposits to fund their short-term liquidity needs. Another warning sign caught market participants unprepared in November with the default of the first Chinese state-owned company on its US Dollar denominated debt. Beijing's decision to let a state-owned company fail has wide implications for global credit markets and hence liquidity supply in the system, which should not be underestimated.

The danger now is that this default could cause a conflagration, because this questionable usability of the collateral securities in turn triggers a feedback on the perceived solvency of the banks. And this feedback loop will intensify and accelerate the more it comes to light on which thin ice the Chinese banks are moving with their speculative credit portfolios. Everyone basically knows that the Chinese housing market has shown clear signs of bubble development. That is, the expectation of future house price increases is one of the key drivers of demand for mortgage loans, driving up the value of house prices. If expectations of future price increases fail, both supply and demand for loans will fall and end the price increases. But it is just the essence of a bubble to expand. Without expansion, the feedback loop turns into reverse and then forces banks to become even more restrictive in their lending policy, which further tightens liquidity in the system, pulling the bottom out of speculation and leading to more defaults among the speculators with the largest leverage. It is this pro-cyclical behavior of the banks which triggers a systemic risk.

The big picture: Macro economic developments in November

Market observers fear that Chinese policymakers could lose control of the credit deflation that has begun. Without confidence in the value of the collateral, a basic condition for granting credit, the entire financial system will no longer function.

The central banks globally are aware of the dangers of credit deflation and will continue to do everything in their power to stabilize asset prices, as falling collateral prices lead to problems in short-term funding requirements of banks with negative effects for the real economy. This leads to the belief that the central banks, with their low interest rate policy, are consequently guarantors that debt levels and thus also asset prices can continue to rise. This seems valid, at least for a while, because the ultra-low interest rates make it impossible for the financial industry to survive from a profit perspective, without significant adjustment of their business. In particular, yield starved banks are forced to expand lending to high-risk business, such as the property market as the German Bundesbank warns in its November report. The Bundesbank is worried that Germany's export led economy has barely grown over the last quarters as global trade has slowed down and states at the same time that house prices in many German cities could be overvalued by 15% to 30%. The Bundesbank is joined by the European Central Bank which sees an erosion of financial market stability caused by its own loose monetary policy.

Credit expansion and asset price inflation go hand in hand at the end of the credit cycle, with more and more speculative leverage is needed for the bubble to continue to expand. Because credit inflation is jammed in the asset markets, there is a risk that the credit money could eventually pour unrestrained into the circulatory system of the real economy and thus lead to a massive erosion of the purchasing power of money. The consequences would be enormous, because it is precisely this belief in the stability of the purchasing power of money, which has so far allowed central banks to salvage insolvent banks worldwide by artificially stabilizing their asset prices.

Ten years of continued central bank stimulus, especially from the Chinese central bank, has likely prevented a worldwide depression. But it is also true that without this credit inflation many structural problems would have emerged much earlier, but now they have exacerbated the imbalances in the world.

However, despite all the dangers, there were also optimistic signals in November. Statistics from the Chinese Bureau of Statistics suggest that production has rebounded for the first time in six months and the construction and services sectors continued to expand. The purchasing manager index (PMI), closely followed by many market observers, rose from 49.3 in October to 50.2 in November, beating expectations. The hope for an early settlement of the tariff dispute between the US and China contributed to the fact that a lot of bank economists have become cautiously optimistic for a recovery in world trade and thus growth of the world economy.

Globally, signs are mounting that the slowdown in the manufacturing sector of Western economies is slowly picking up and that spill-over can be prevented in the important service sector, where most jobs are located. This especially true for the euro-zone where the unemployment rate has fallen to its lowest level since July 2008. The unemployment rate for the entire currency bloc declined in October from 7.6% in the previous month to 7.5%. During the month, the number of unemployed fell by 31,000 to 12.33 million, according to official numbers.

China remains key to the health of the global economy. And here we should not forget that China is very experienced in handling banking crisis. Its leaders have been very successful in handling systemic crises in the past.

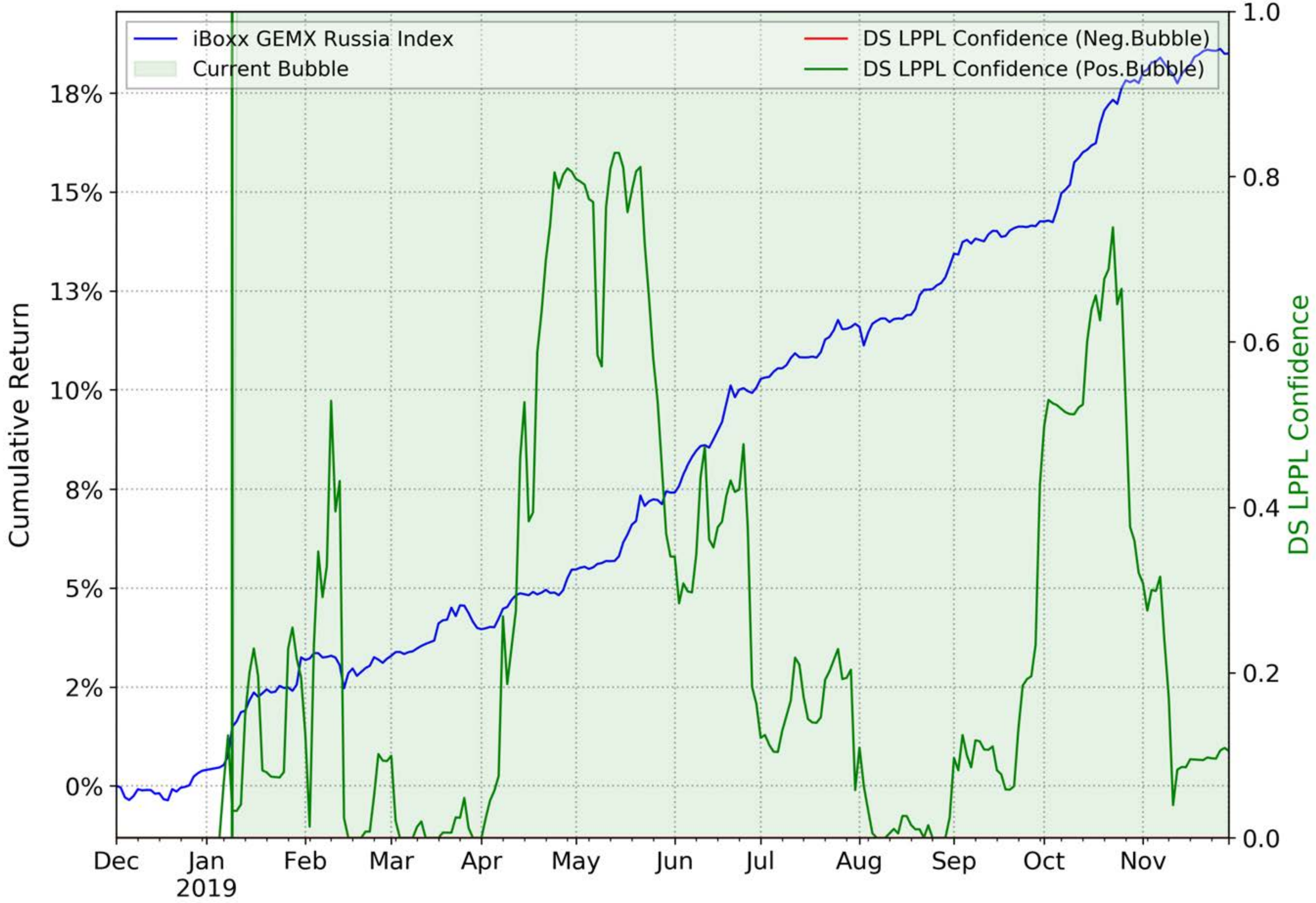
Add to this more fiscal stimulus and the dream of restructuring entire industries in the West within a decade to stop climate change and you have a growing horde of optimists which do not see a recession for the year 2020, at best a year of weak growth.

Fixed Income – Government Bonds

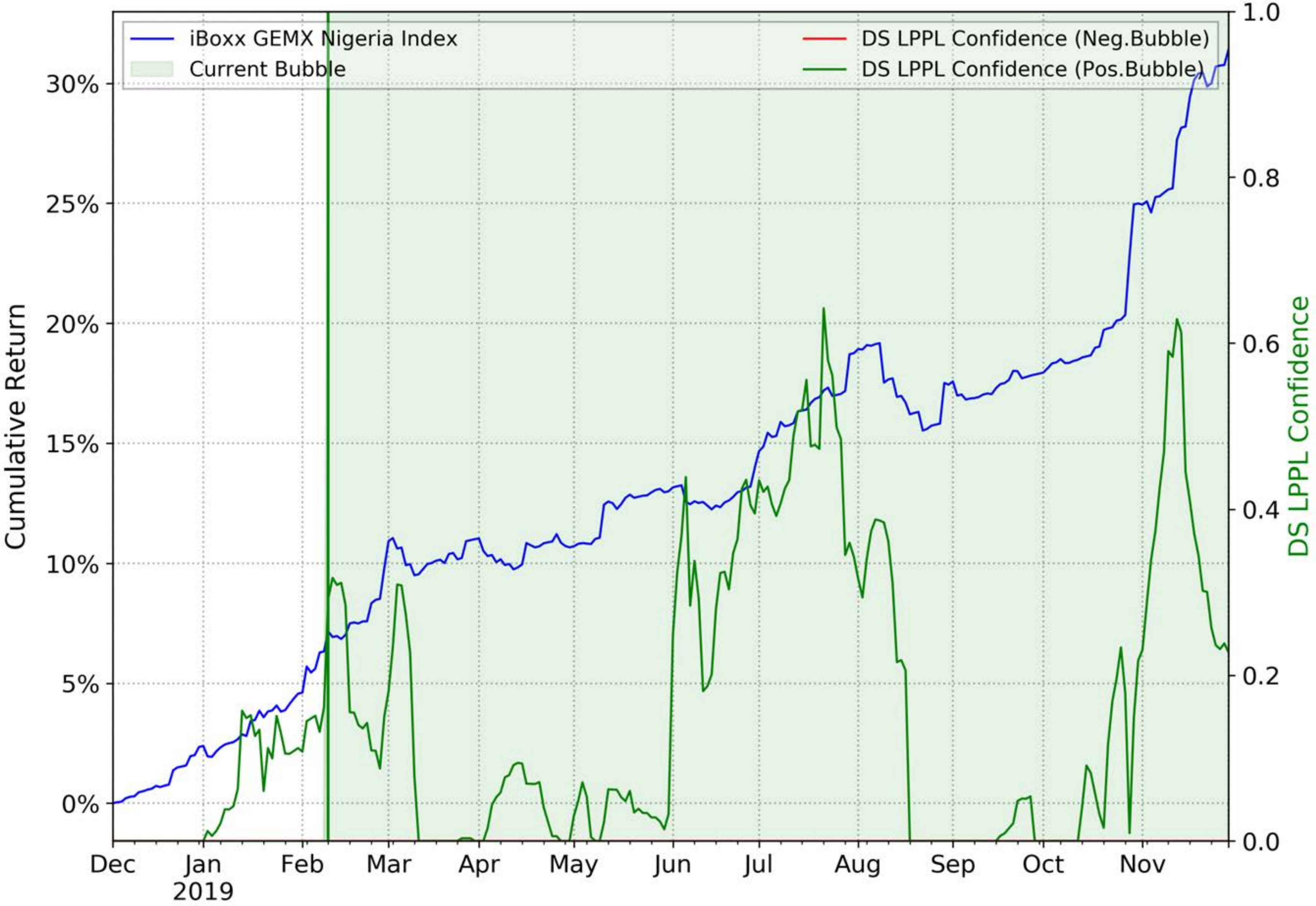
	Bubble Data					Cluster Analysis		
	Name	Bubble Size bs $[\%]$	Duration $[days]$	DS LPPL Confidence ci $[\%]$	Geometric Average $\sqrt{bs \cdot ci}$ $[\%]$	Critical Time Prediction μ_{t_c}	σ_{t_c} $[days]$	Scenario Probability $[\%]$
Positive Bubbles								
1	iBoxx GEMX Nigeria Index	13	104	23	17	2020-02-15	5	36
2	iBoxx GEMX Russia Index	17	324	11	13	2020-05-27	1	27

- Newly, at the top of the list, we find the Nigeria Index, with a bubble size of 13% over 104 days. The confidence indicator is at a low level with 23%. For several months now, we detect bubble signals on the iBoxx GEMX Russia Government Bond Index. The bubble size has increased slightly from 16% to 17%. And the estimated duration of the bubble has increased by approximately one month, indicating that the determined bubble start time is robust with respect to the changing time of analysis. The confidence indicator has decreased to one third of its previous value, at 11%. Time series plots for both indices are shown on the next slides.

iBoxx GEMX Russia Index



iBoxx GEMX Nigeria Index

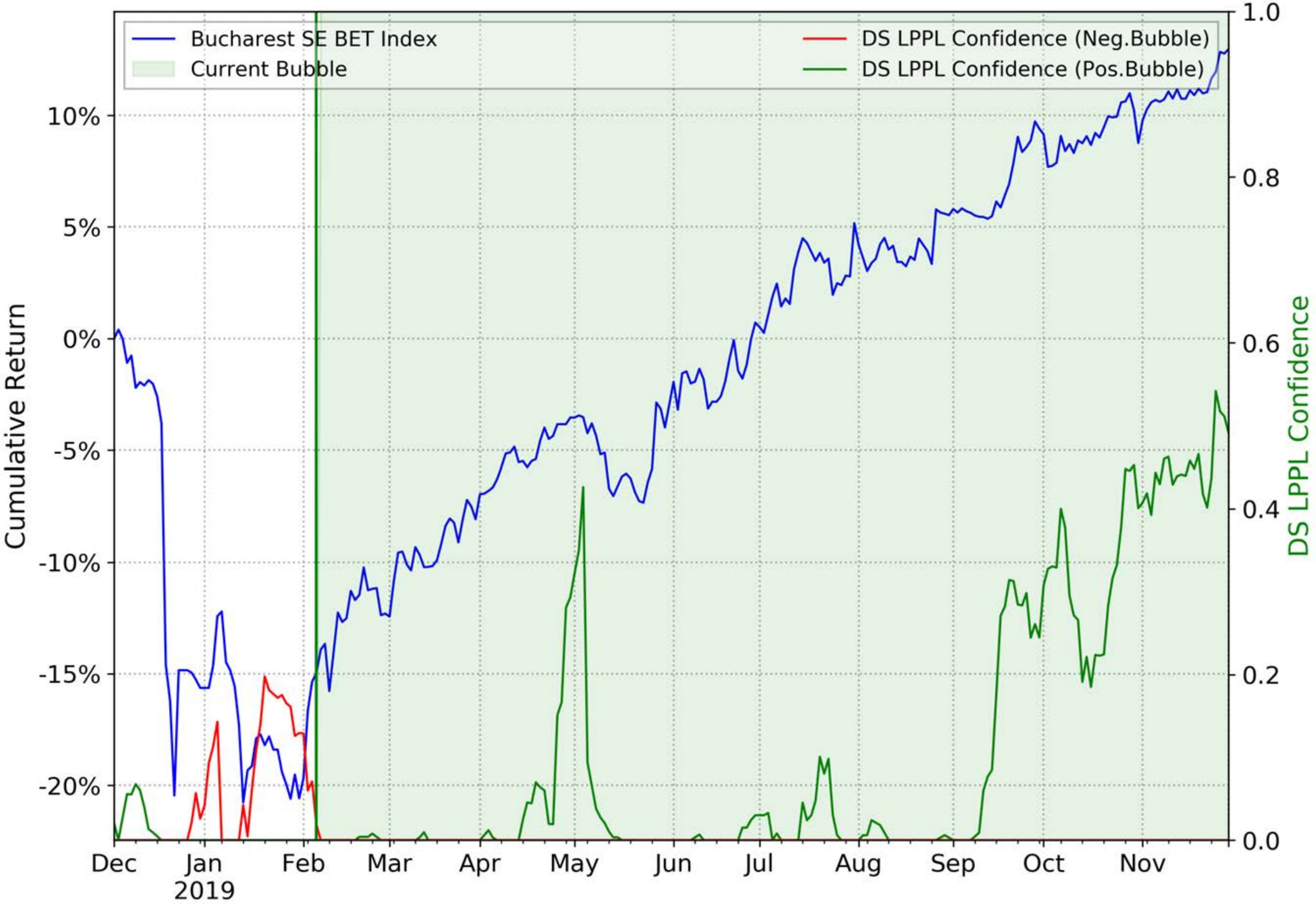


Equities – Country Indices

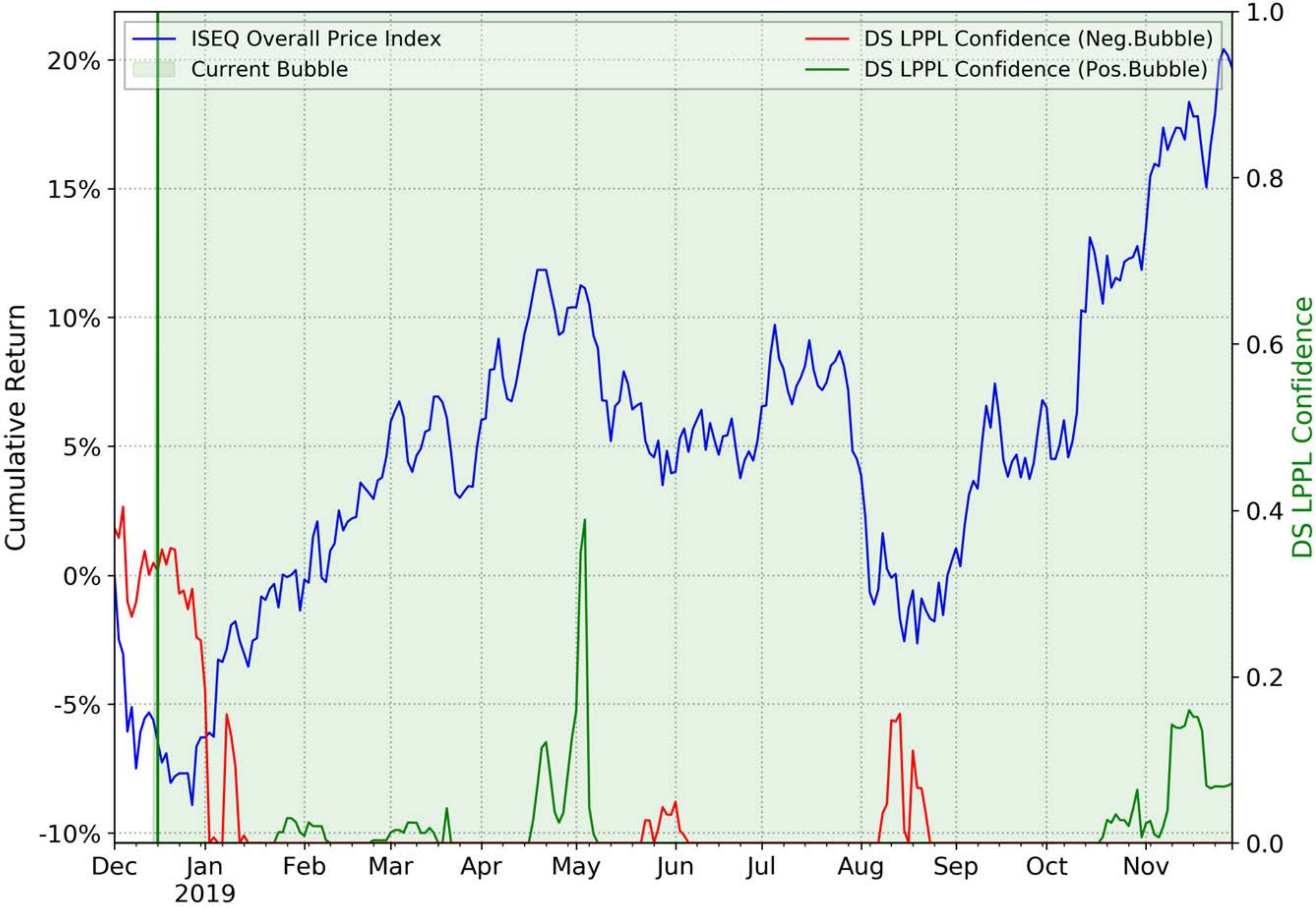
		Bubble Data				Cluster Analysis		
	Name	**Bubble Size** bs $[\%]$	**Duration** $[days]$	**DS LPPL Confidence** ci $[\%]$	**Geometric Average** $\sqrt{bs \cdot ci}$ $[\%]$	**Critical Time Prediction** μ_{t_c}	σ_{t_c} $[days]$	**Scenario Probability** $[\%]$
Positive Bubbles								
1	Bucharest SE BET Index	33	296	49	40	2019-12-01	2	58
2	ISEQ Overall Price Index	20	118	26	23	2019-12-01	2	63

- In the equity sector, the Bucharest Equity Market Index is again found to be in a positive bubble as in the previous several months. Bubble size and duration remain approximately the same as in the previous report, while the confidence indicator has risen from 24% to 40%. The confidence indicator has increased to 49% from a previous level of 40%. Furthermore, a positive bubble signal for the ISEQ Overall Price Index of Ireland is detected. Both indices are shown on the following slides.

Bucharest SE BET Index



ISEQ Overall Price Index



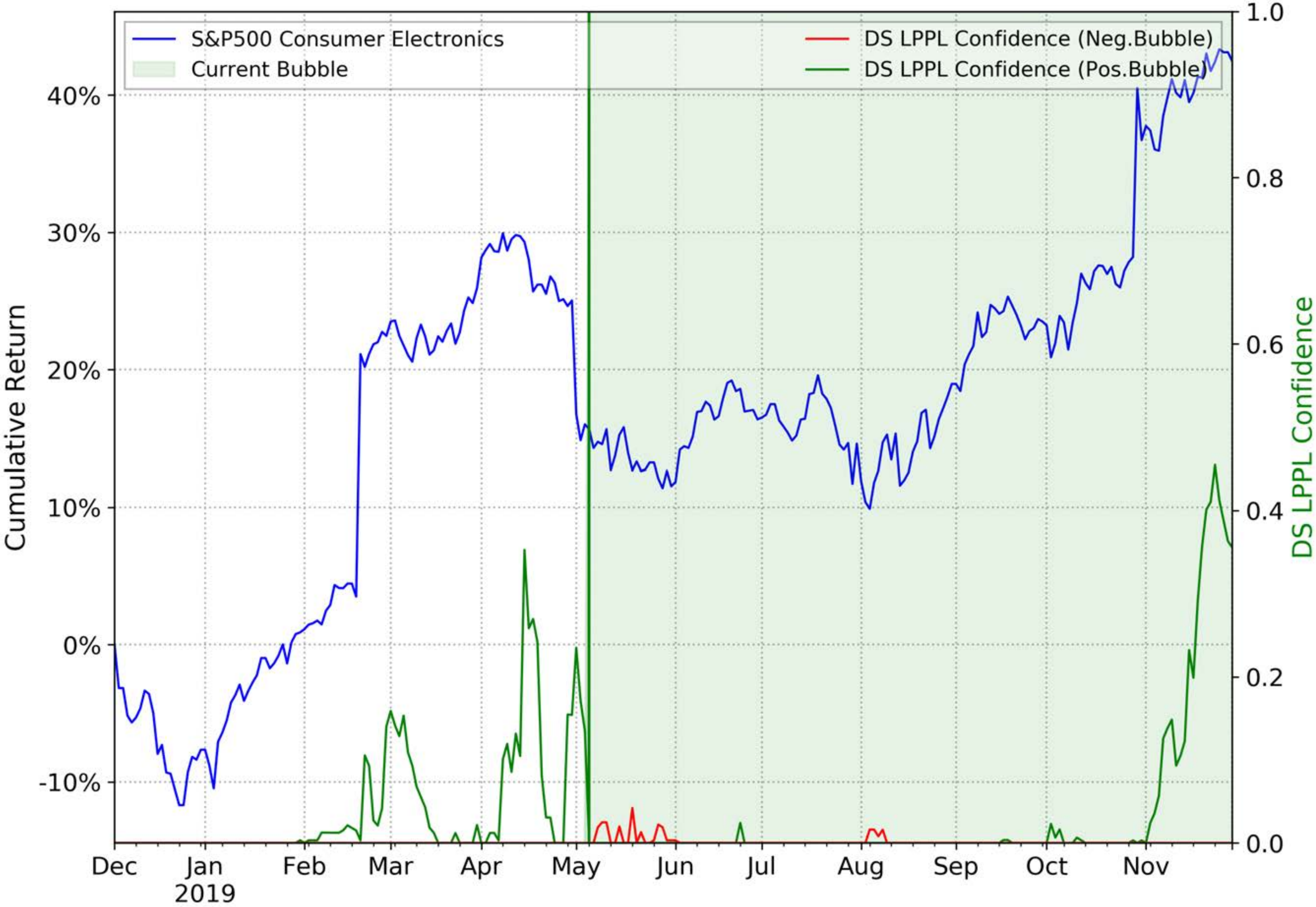
Equities – United States Indices

	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&P 500 Vix Futures T-S Index Er	19	100	65	35	2019-12-02	2	56
2	S&P500 Consumer Electronics	23	209	36	29	2019-12-09	1	32
3	S&P500 Health Care Supplies	17	118	45	28	2019-12-01	2	55
4	S&P500 Ind Pwr&Ren Elec Pr	17	118	38	25	2019-12-20	1	72
5	S&P500 Ind.Power Prod & Energy Si	17	118	38	25	2019-12-20	1	72

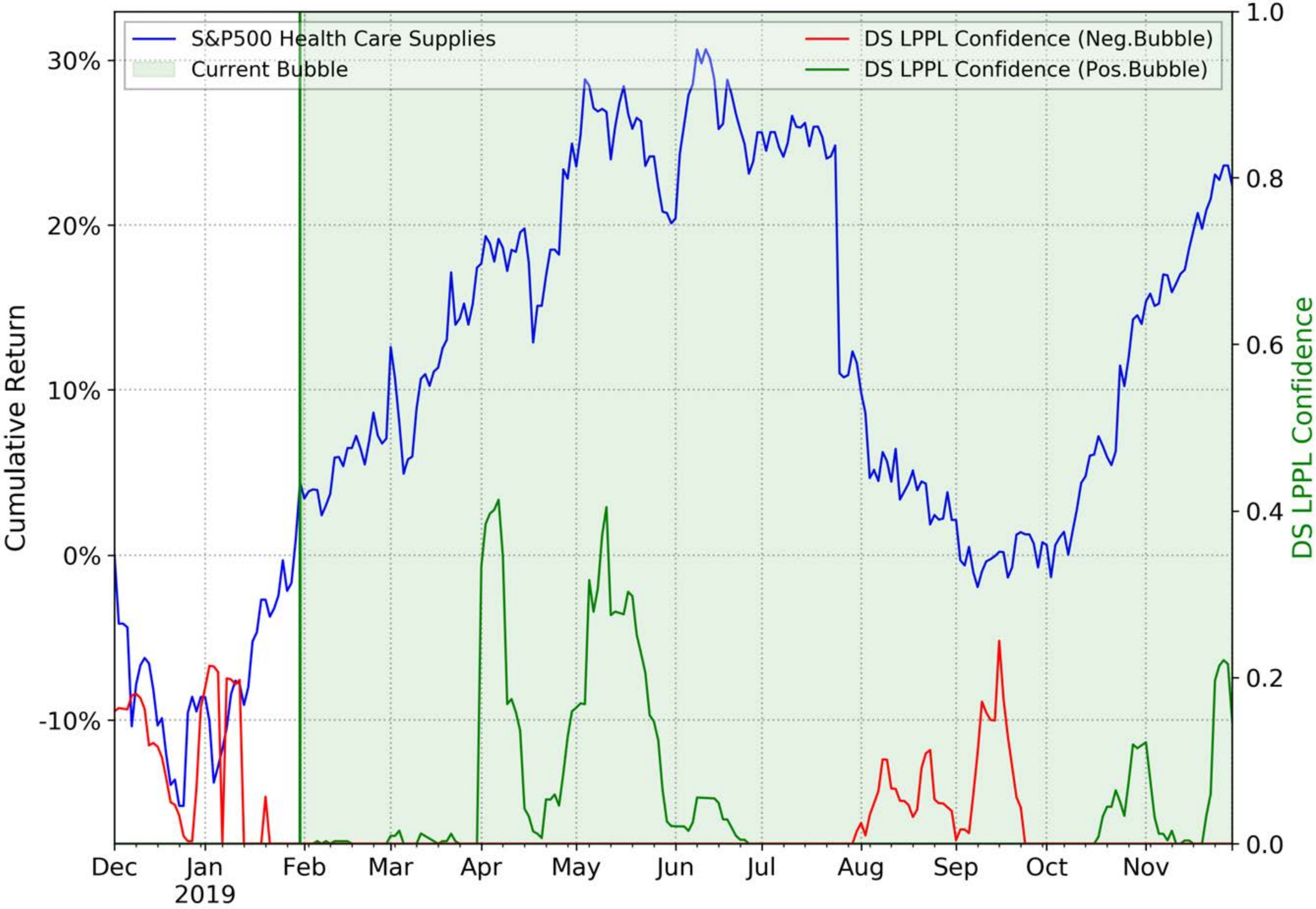
- The strong positive bubble activity on the S&P 500 VIX Futures T-S Index remains the top signal at the beginning of December 2019. Furthermore, bubble activity is detected for several other S&P500 sub-indices. Bubble sizes range from 17%-23%, durations from 100-209 days and the indicator from 36%-65%. The top three bubbles are shown on the next slides.

S&P 500 Vix Futures T-S Index

S&P 500 Consumer Electronics



S&P 500 Health Care Supplies

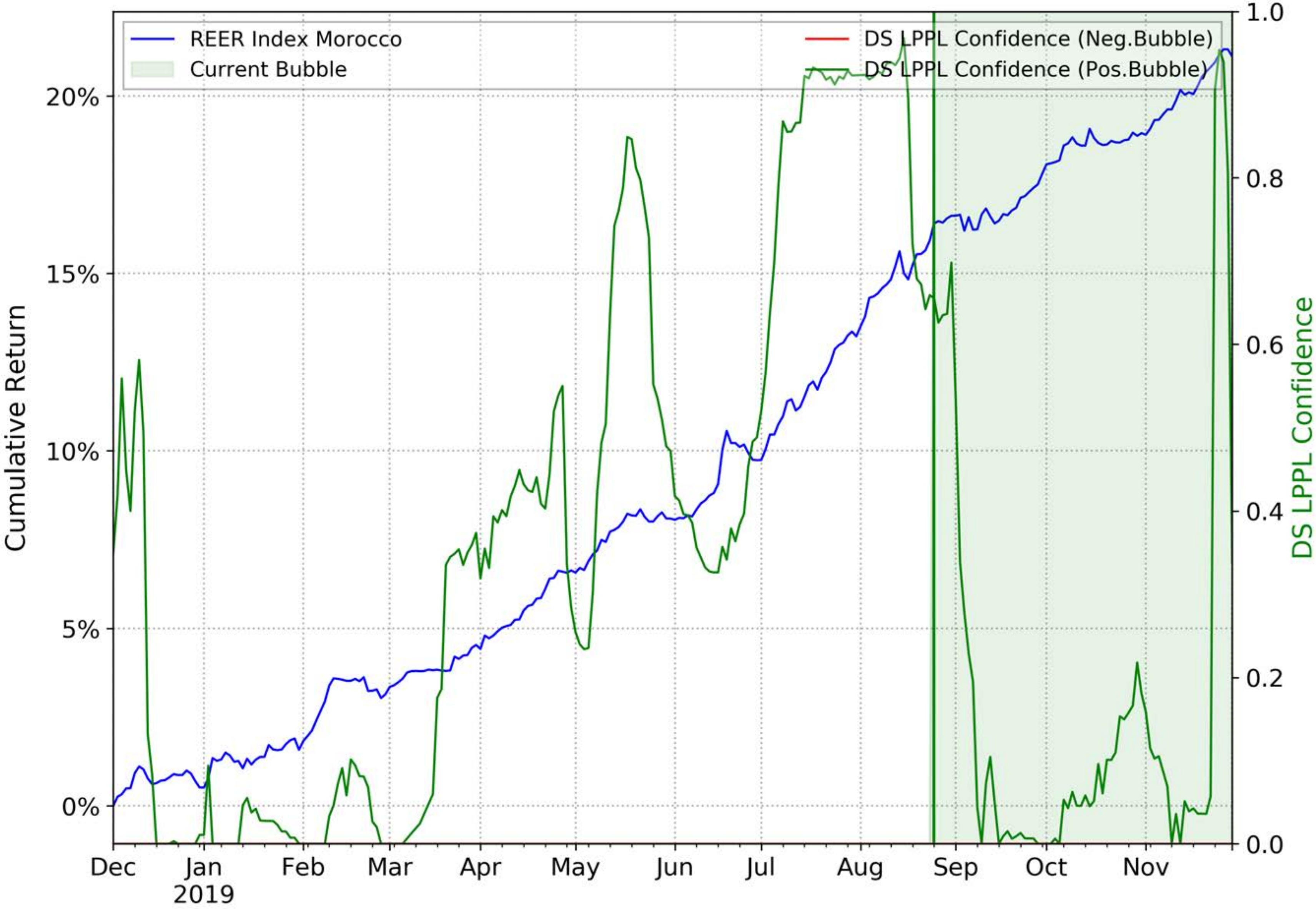


Currencies

	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	REER Index Morocco	14	223	25	19	2020-05-12	19	48

- A single positive bubble is detected on the Real Effective Exchange Rate Index of the Moroccan Dirham currency. The bubble size is estimated at 14% over a duration of 223 days. The confidence indicator is at 25%. As visible on the next slide, the indicator has recently sharply dropped from about 90% back to the current lower level. The average critical time of the biggest cluster of LPPLS fits is predicted to occur in May 2020, this is in line with a lower confidence indicator, as the risk of an imminent crash seems to be lower.

REER Index Morocco

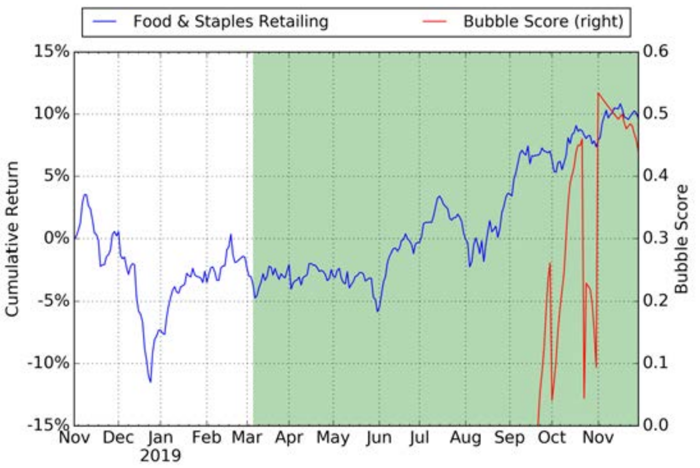


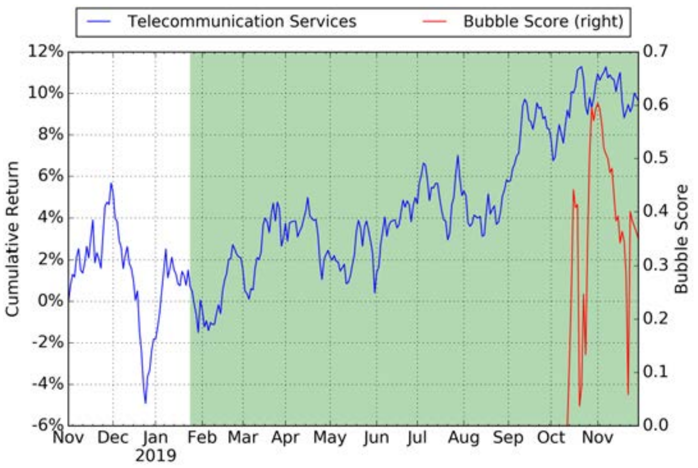
Sectors

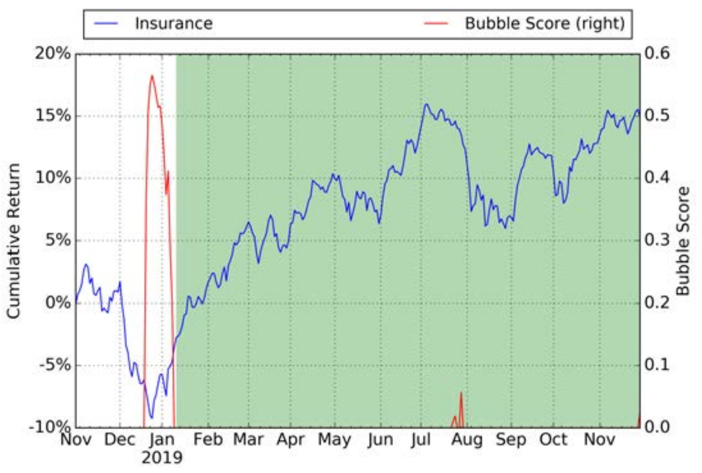
GICS Industry Group Name	Yearly Return		Bubble Size		Bubble Score		Value Score		Growth Score	
	Dec 1st	Nov 1st	Dec 1st	Nov 1st	Dec 1st	Nov 1st	Dec 1st	Nov 1st	Dec 1st	Nov 1st
Pharmaceuticals, Biotechnology & Life Sciences	8.8%	6.2%	0.0%	0.0%	0.0%	0.0%	64.6%	66.6%	53.0%	52.7%
Consumer Services	14.6%	12.3%	0.0%	0.0%	0.0%	0.0%	31.4%	33.5%	49.4%	49.7%
Retailing	15.6%	12.5%	0.0%	0.0%	0.0%	0.0%	20.4%	20.8%	55.4%	55.6%
Transportation	14.4%	6.1%	0.0%	0.0%	0.0%	0.0%	50.2%	53.3%	49.1%	49.4%
Consumer Durables & Apparel	26.9%	17.8%	0.0%	0.0%	0.0%	0.0%	36.2%	34.5%	55.4%	56.3%
Semiconductors & Semiconductor Equipment	37.4%	30.3%	0.0%	0.0%	0.0%	0.0%	60.9%	62.0%	35.9%	34.8%
Technology Hardware & Equipment	33.1%	21.4%	0.0%	0.0%	0.0%	0.0%	68.5%	61.3%	40.0%	41.1%
Automobiles & Components	5.8%	3.5%	0.0%	0.0%	0.0%	0.0%	74.7%	75.1%	57.1%	57.3%
Telecommunication Services	7.7%	7.7%	8.9%	8.9%	35.0%	59.4%	60.4%	64.2%	41.9%	42.5%
Energy	-4.9%	-8.8%	0.0%	0.0%	0.0%	0.0%	53.4%	54.4%	48.5%	48.5%
Software & Services	30.4%	24.7%	0.0%	0.0%	0.0%	0.0%	33.1%	36.9%	46.9%	44.9%
Materials	13.4%	6.6%	0.0%	0.0%	0.0%	0.0%	54.0%	54.4%	50.6%	50.3%
Health Care Equipment & Services	15.6%	9.2%	0.0%	0.0%	0.0%	0.0%	57.5%	58.5%	50.2%	49.6%
Capital Goods	20.4%	12.3%	0.0%	0.0%	0.0%	0.0%	49.2%	49.4%	48.1%	47.9%
Media & Entertainment	22.8%	15.2%	0.0%	0.0%	0.0%	0.0%	31.6%	29.6%	43.4%	43.5%
Commercial & Professional Services	25.9%	24.0%	0.0%	0.0%	0.0%	0.0%	29.8%	30.6%	53.3%	53.6%
Food & Staples Retailing	11.9%	5.8%	13.8%	12.6%	44.0%	9.4%	47.0%	48.0%	54.3%	54.5%
Household & Personal Products	14.2%	18.4%	0.0%	0.0%	0.0%	0.0%	34.2%	33.2%	46.8%	47.0%
Food, Beverage & Tobacco	9.5%	6.7%	0.0%	0.0%	0.0%	0.0%	46.7%	46.5%	54.0%	53.4%
Utilities	9.5%	15.6%	0.0%	7.9%	0.0%	4.1%	50.1%	50.4%	45.2%	45.2%
Insurance	20.9%	12.0%	18.2%	0.0%	2.4%	0.0%	-	-	-	-
Real Estate	12.6%	15.7%	0.0%	11.1%	0.0%	59.6%	-	-	-	-
Diversified Financials	18.5%	6.9%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Banks	11.4%	2.1%	0.0%	0.0%	0.0%	0.0%	-	-	-	-

Sectors

- We use the MSCI World Industry Group Indices to calculate bubble size and bubble score of the corresponding sectors. To determine the value scores and growth scores of the sectors, we average over the corresponding values for each stock of a given sector, weighted by market cap.
- This month, we find 3 industry groups with a positive bubble score: Food & Staples Retailing, Telecommunication Services and Insurance, two of which were already identified last month. The bubble signal of the Insurance industry group is weak, indicating that the bubble is at an early stage and may or may not continue to develop.

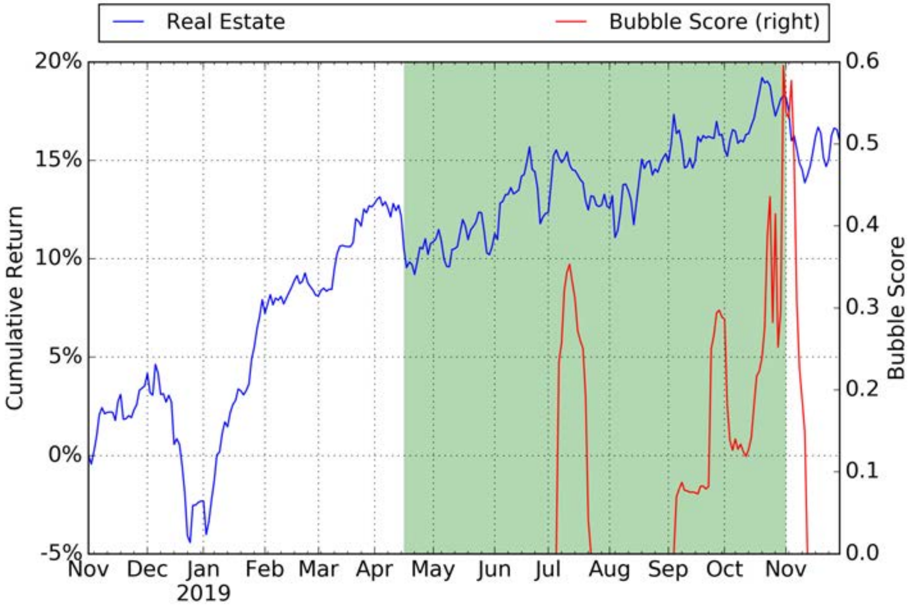


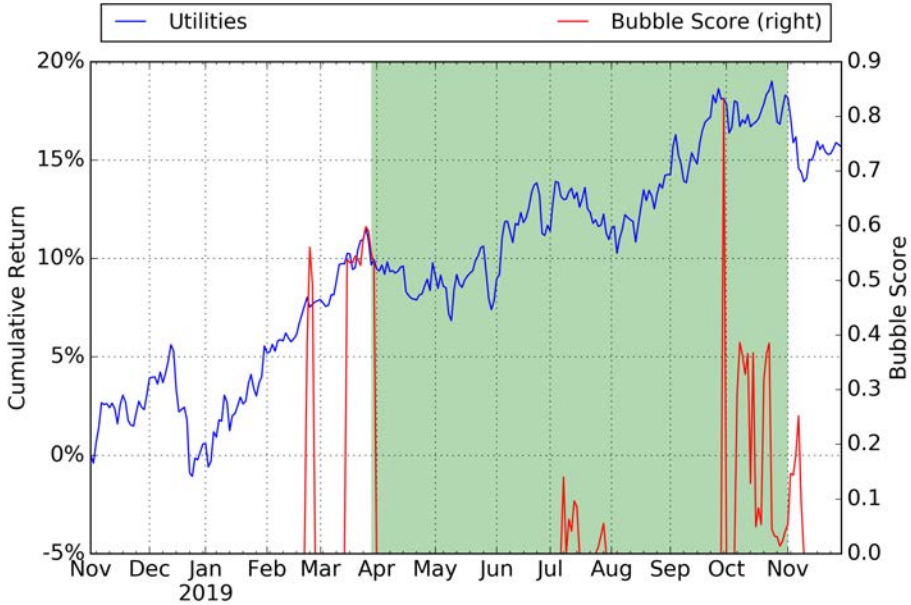




Sectors

- For the other two industry groups with positive bubbles we identified last month (Utilities, Real Estate), we observe a regime shift for both of these defensive industry groups in the past month.





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

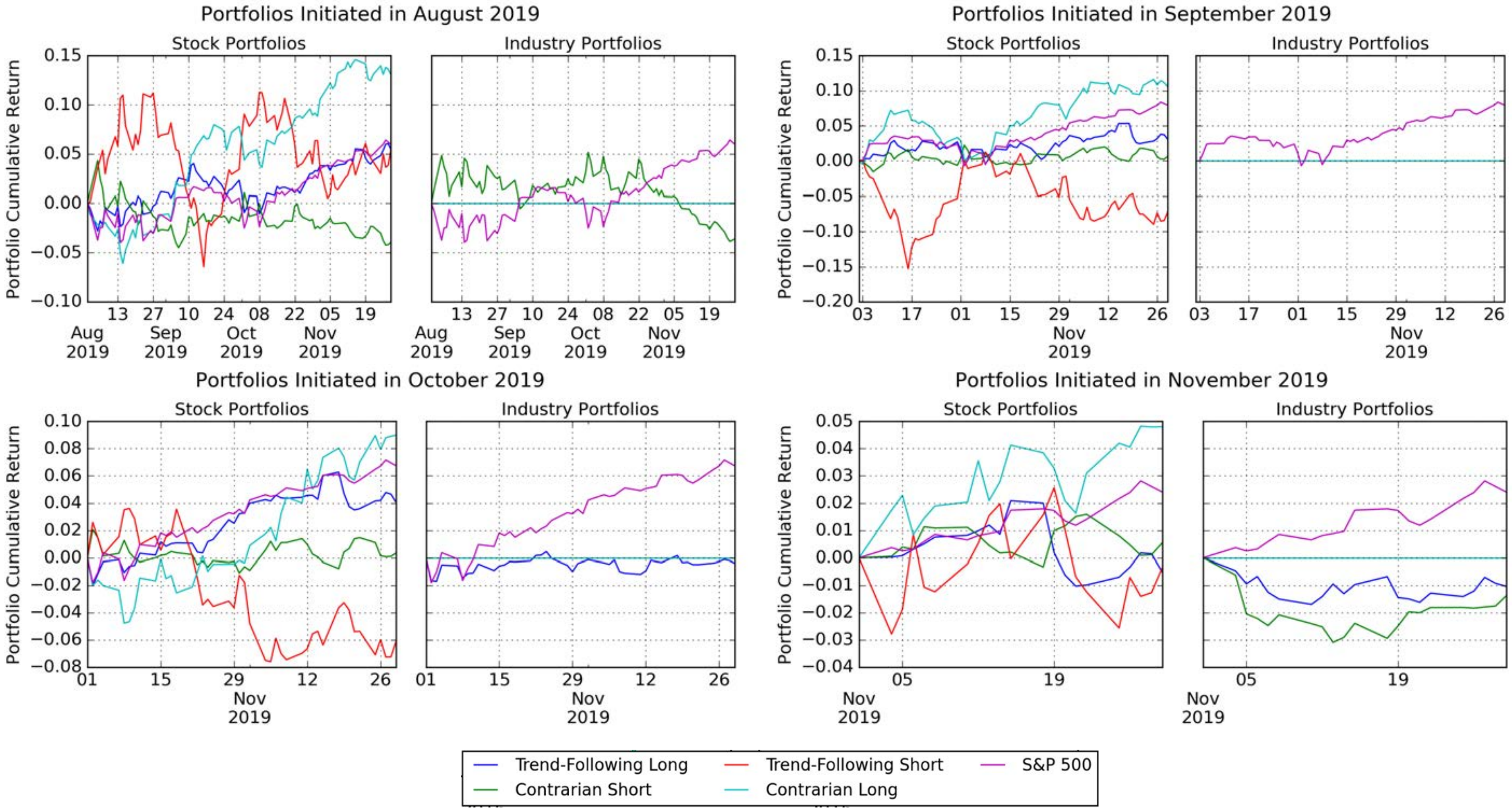
Portfolio Construction & Performance

- 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.

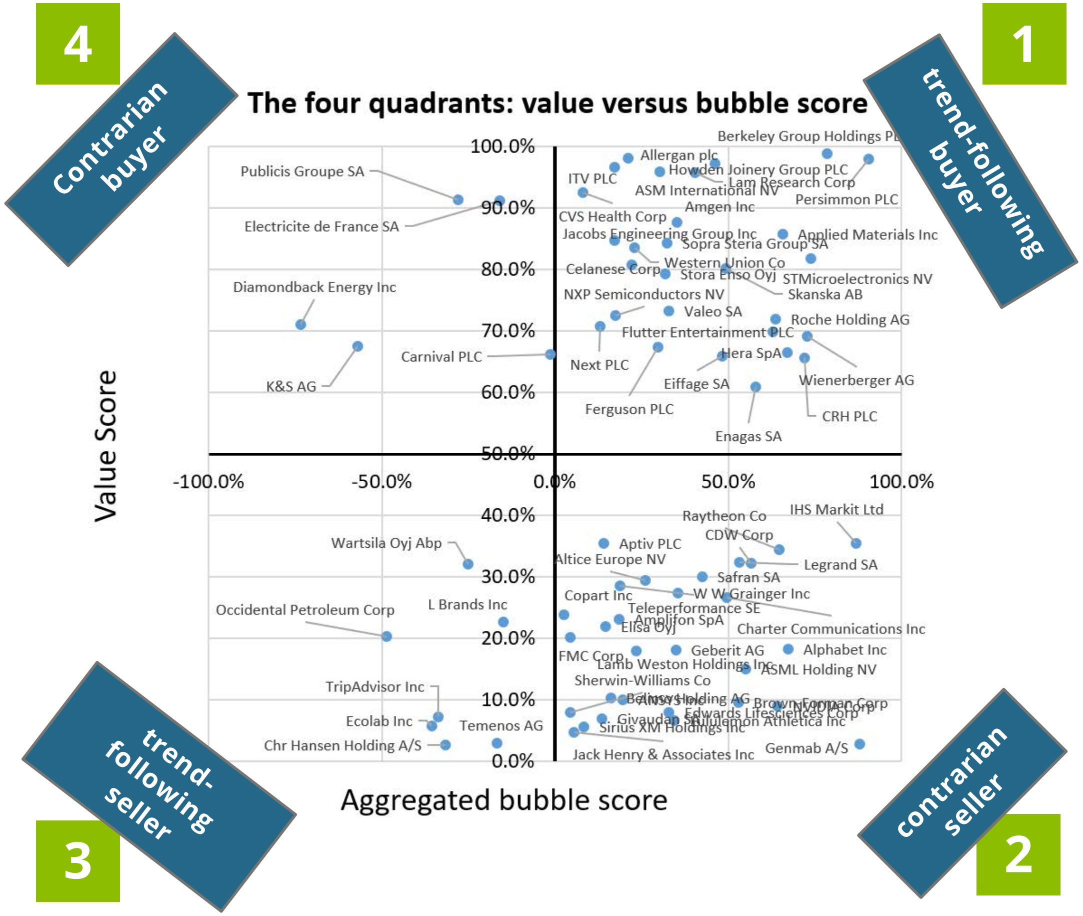
Portfolio Construction & Performance

- With the market achieving new highs this month, we find that the Contrarian Long Stock Portfolios have outperformed most of the portfolios, while the Contrarian Short Portfolios have poor performances. Contrarian Portfolios are more delicate to use due to their sensitivity to timing the expected reversal and exhibit very volatile performances, indicating that most of bubbles in the market are still dominating and that fundamentals have not yet played out. We expect trend-following positions to perform in the months following the position set-up and then contrarian positions to over-perform over longer time scales as the predicted corrections play out.



Single Stocks

We can divide the stocks into four quadrants[1)]



1) A strong positive bubble signal is identified if bubble score is positive, and a strong negative bubble signal is identified if bubble score is negative.
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%.

- **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**. E.g. ITV PLC
- **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**. E.g. Alphabet Inc
- **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**. E.g. L Brands Inc
- **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**. E.g. K&S AG

Single Stocks

- For 825 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.
- 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).
- 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.

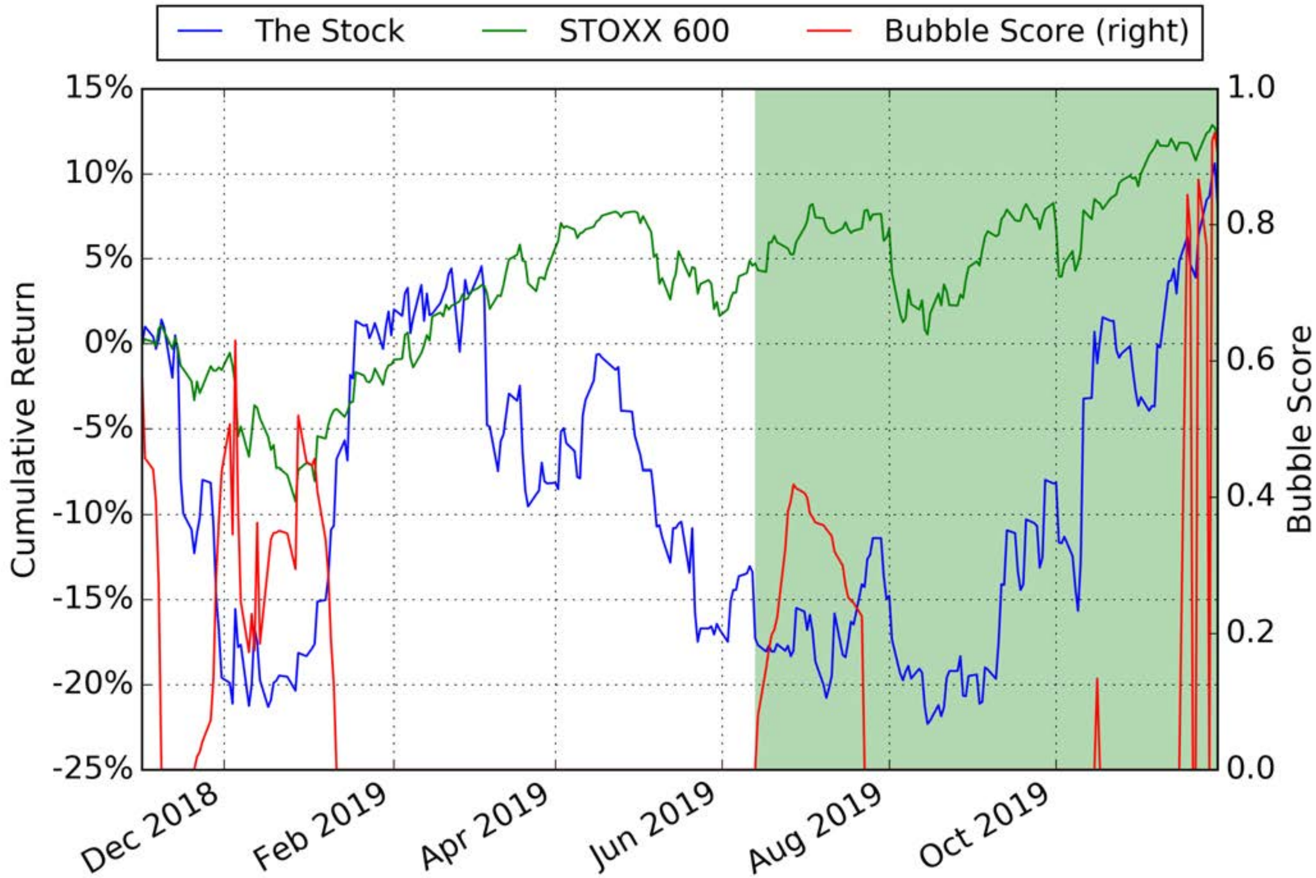
Single Stocks

Quadrant 1 stocks: strong positive bubble signals with strong fundamentals

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Wienerberger AG	Austria	Materials	39.8%	16.9%	Jun-19	72.7%	69.1%	9.0%
Roche Holding AG	Switzerland	Pharmaceuticals, Biotechnology & Life Sciences	24.7%	18.5%	May-19	63.6%	71.9%	41.5%
Enagas SA	Spain	Utilities	-6.5%	15.7%	Jul-19	58.0%	61.0%	22.4%
Stora Enso Oyj	Finland	Materials	17.8%	32.8%	Jun-19	31.8%	79.3%	6.9%
Sopra Steria Group SA	France	Software & Services	64.6%	32.8%	Feb-19	32.4%	84.2%	93.3%
Eiffage SA	France	Capital Goods	32.8%	16.0%	May-19	48.4%	65.9%	12.0%
Valeo SA	France	Automobiles & Components	47.5%	47.8%	May-19	32.9%	73.3%	98.9%
Howden Joinery Group PLC	United Kingdom	Capital Goods	45.8%	26.8%	Apr-19	46.1%	97.2%	56.8%
Persimmon PLC	United Kingdom	Consumer Durables & Apparel	37.5%	30.8%	Jun-19	90.5%	98.1%	11.2%
Next PLC	United Kingdom	Retailing	46.4%	41.2%	Jan-19	13.0%	70.8%	61.1%
ITV PLC	United Kingdom	Media & Entertainment	15.2%	37.9%	Jun-19	17.1%	96.6%	10.5%
Berkeley Group Holdings PLC	United Kingdom	Consumer Durables & Apparel	42.0%	28.9%	May-19	78.5%	98.9%	2.9%
CRH PLC	Ireland; Republic of	Materials	48.7%	18.4%	May-19	72.1%	65.6%	8.6%
Flutter Entertainment PLC	Ireland; Republic of	Consumer Services	41.0%	46.4%	May-19	62.8%	69.9%	49.5%
Allergan plc	Ireland; Republic of	Pharmaceuticals, Biotechnology & Life Sciences	21.4%	35.4%	Dec-18	21.2%	98.2%	38.1%
Hera SpA	Italy	Utilities	65.9%	22.5%	May-19	66.9%	66.5%	18.4%
Ferguson PLC	United Kingdom	Capital Goods	39.8%	32.6%	Apr-19	29.8%	67.4%	86.9%
STMicroelectronics NV	Switzerland	Semiconductors & Semiconductor Equipment	91.8%	62.5%	May-19	73.8%	81.8%	20.7%
ASM International NV	Netherlands	Semiconductors & Semiconductor Equipment	194.0%	110.0%	Mar-19	30.2%	96.0%	60.8%
NXP Semiconductors NV	Netherlands	Semiconductors & Semiconductor Equipment	52.1%	37.2%	Jan-19	17.3%	72.5%	36.4%
Skanska AB	Sweden	Capital Goods	56.9%	28.0%	Apr-19	49.3%	80.2%	96.1%
Amgen Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	20.9%	28.6%	Apr-19	35.1%	87.8%	55.9%
Applied Materials Inc	United States of America	Semiconductors & Semiconductor Equipment	69.4%	52.1%	Mar-19	65.6%	85.8%	45.8%
CVS Health Corp	United States of America	Health Care Equipment & Services	2.6%	37.0%	Mar-19	8.1%	92.6%	32.1%
Celanese Corp	United States of America	Materials	39.9%	27.9%	Mar-19	22.2%	80.7%	64.2%
Jacobs Engineering Group Inc	United States of America	Capital Goods	56.5%	27.5%	Mar-19	17.1%	84.7%	23.2%
Lam Research Corp	United States of America	Semiconductors & Semiconductor Equipment	93.6%	48.3%	Jun-19	40.5%	95.8%	33.1%
Western Union Co	United States of America	Software & Services	46.9%	42.0%	43556	22.9%	83.6%	56.7%

Single Stocks

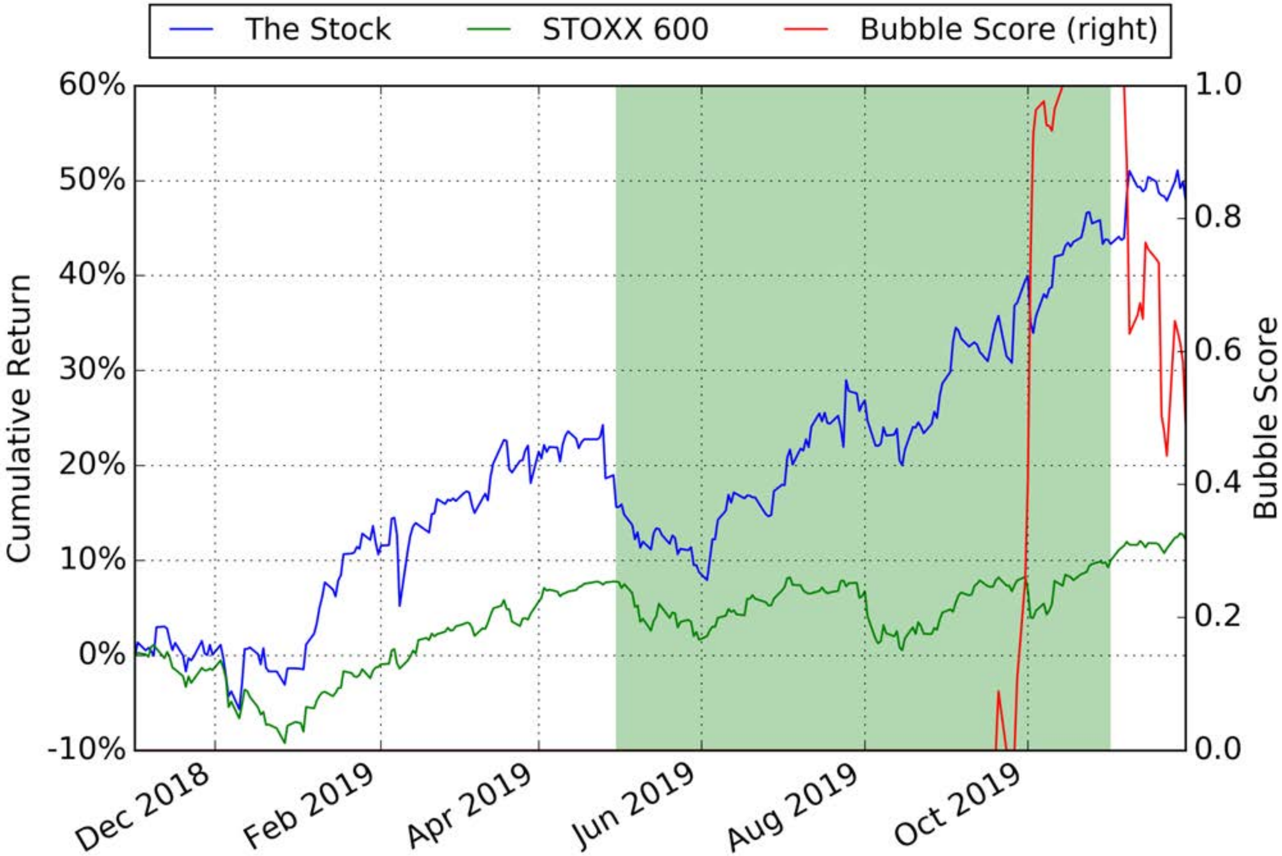
Quadrant 1 Stocks Current Month Example – Persimmon PLC.



- 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 delineates the time interval within which the strong positive bubble is identified. The Bubble Score of this six month bubble has reached 90.5% with a bubble size 30.8%.

Single Stocks

Quadrant 1 Stocks Last Month Example – Skanska AB.



- The figure above 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 delineates the time interval within which a strong positive bubble has been identified and reported last month. The peak of the DS LPPLS indicator (bubble score) coincided with the change of regime to a plateau.

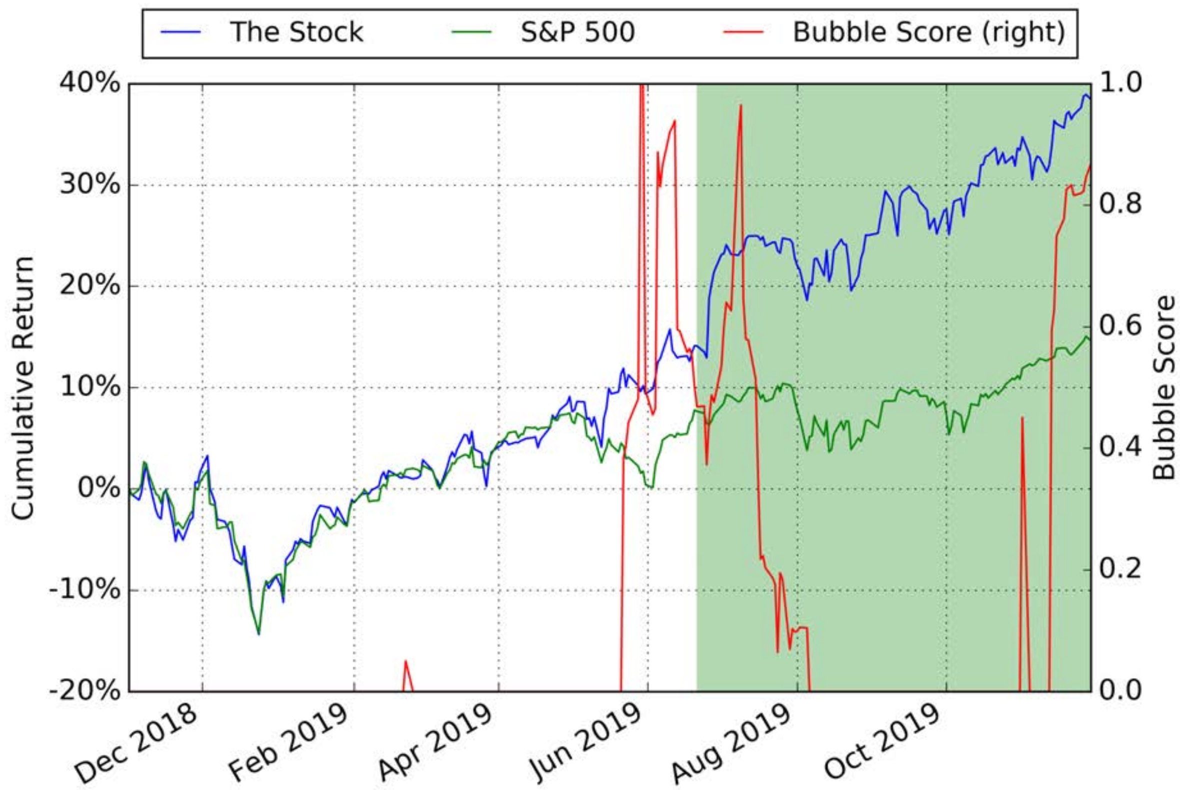
Single Stocks

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
IHS Markit Ltd	United Kingdom	Commercial & Professional Services	43.0%	16.5%	Jun-19	86.9%	35.4%	53.1%
Belimo Holding AG	Switzerland	Capital Goods	70.8%	70.8%	Dec-18	16.1%	10.3%	80.2%
Givaudan SA	Switzerland	Materials	24.4%	24.4%	Dec-18	13.5%	6.9%	22.3%
Geberit AG	Switzerland	Capital Goods	43.9%	36.0%	Feb-19	34.9%	18.1%	77.7%
Genmab A/S	Denmark	Pharmaceuticals, Biotechnology & Life Sciences	54.1%	34.4%	Jun-19	88.1%	2.8%	22.1%
Elisa Oyj	Finland	Telecommunication Services	34.8%	25.7%	Apr-19	14.6%	21.9%	19.5%
Teleperformance SE	France	Commercial & Professional Services	54.6%	46.3%	Jan-19	18.7%	28.5%	95.8%
Safran SA	France	Capital Goods	44.8%	23.6%	Mar-19	42.4%	30.1%	78.1%
Legrand SA	France	Capital Goods	44.1%	13.9%	Jul-19	53.3%	32.4%	89.6%
Amplifon SpA	Italy	Health Care Equipment & Services	75.7%	34.9%	May-19	18.4%	23.0%	67.0%
Aptiv PLC	Ireland; Republic of	Automobiles & Components	43.7%	29.5%	Jun-19	14.1%	35.5%	49.8%
ASML Holding NV	Netherlands	Semiconductors & Semiconductor Equipment	75.6%	55.0%	Mar-19	55.0%	15.0%	34.8%
Altice Europe NV	Netherlands	Media & Entertainment	177.8%	199.3%	Dec-18	26.1%	29.5%	0.0%
Alphabet Inc	United States of America	Media & Entertainment	25.5%	20.8%	Jun-19	67.3%	18.2%	37.8%
ANSYS Inc	United States of America	Software & Services	65.0%	35.9%	Apr-19	19.6%	9.9%	24.7%
Brown-Forman Corp	United States of America	Food, Beverage & Tobacco	46.2%	46.2%	Dec-18	52.8%	9.6%	62.1%
CDW Corp	United States of America	Technology Hardware & Equipment	49.0%	32.0%	May-19	56.7%	32.2%	46.8%
Charter Communications Inc	United States of America	Media & Entertainment	48.9%	35.0%	Mar-19	49.7%	26.7%	62.2%
Copart Inc	United States of America	Commercial & Professional Services	84.1%	25.4%	May-19	2.5%	23.9%	68.4%
Edwards Lifesciences Corp	United States of America	Health Care Equipment & Services	51.3%	36.2%	Jun-19	32.9%	8.0%	64.8%
FMC Corp	United States of America	Materials	42.4%	32.4%	Feb-19	4.4%	20.1%	25.2%
W W Grainger Inc	United States of America	Capital Goods	11.1%	19.5%	Jul-19	35.4%	27.4%	23.0%
Jack Henry & Associates Inc	United States of America	Software & Services	12.7%	18.0%	Dec-18	5.4%	4.7%	51.0%
Lamb Weston Holdings Inc	United States of America	Food, Beverage & Tobacco	14.5%	35.2%	May-19	23.4%	17.9%	58.7%
Lululemon Athletica Inc	Canada	Consumer Durables & Apparel	96.2%	48.4%	Jan-19	34.5%	6.7%	53.7%
NVIDIA Corp	United States of America	Semiconductors & Semiconductor Equipment	42.7%	47.1%	May-19	64.1%	9.0%	31.2%
Raytheon Co	United States of America	Capital Goods	27.0%	27.1%	Jul-19	64.7%	34.4%	61.7%
Sherwin-Williams Co	United States of America	Materials	48.2%	31.4%	43556	4.4%	7.9%	54.1%
Sirius XM Holdings Inc	United States of America	Media & Entertainment	12.6%	19.7%	43647	8.4%	5.6%	75.4%

Single Stocks

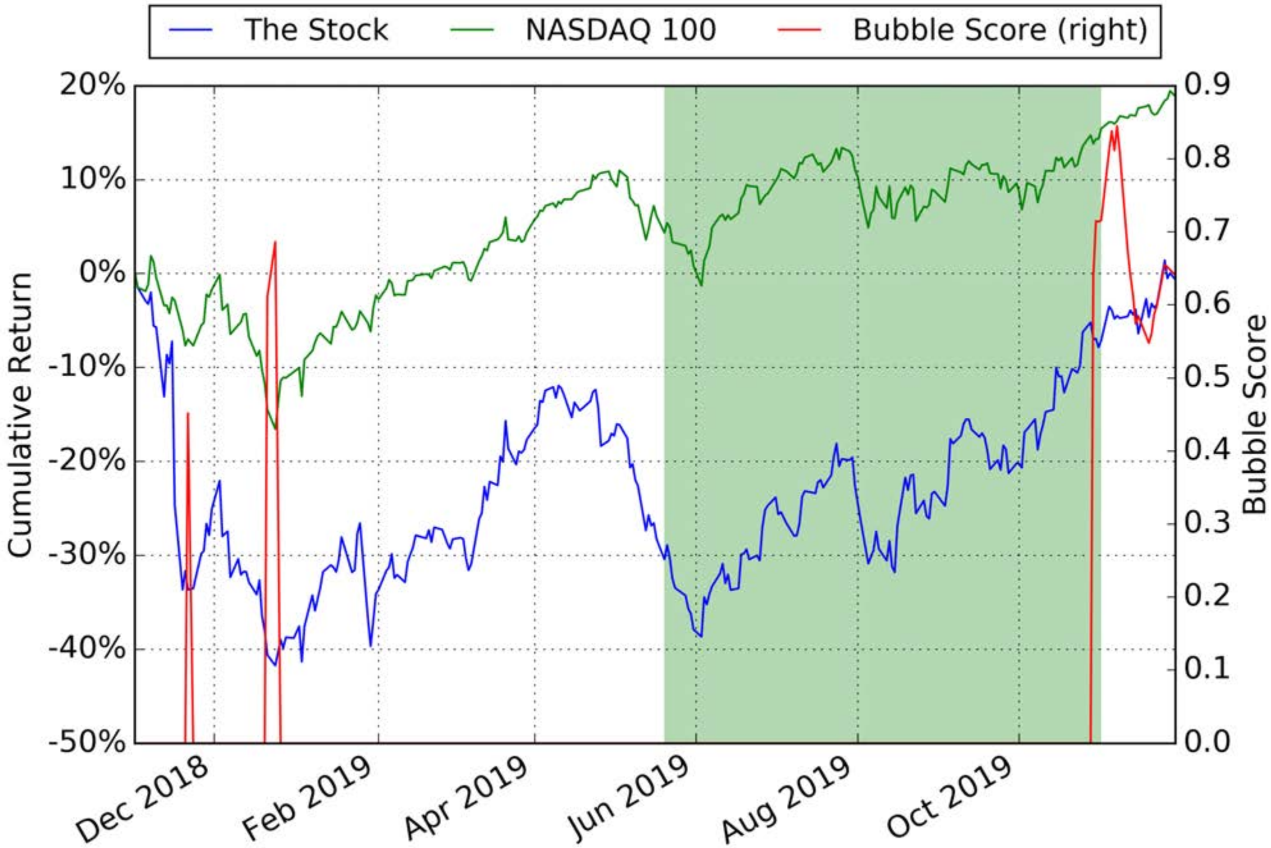
Quadrant 2 Stocks Current Month Example – IHS Markit Ltd.



- The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period delineates the time interval within which the positive bubble is identified. The Bubble Score of this six month bubble has reached 86.9% with a bubble size 16.5%. The strong positive bubble signals and weak fundamentals indicate a high probability of correction in the future.

Single Stocks

Quadrant 2 Stocks Last Month Example – NVIDIA Corp.



- The figure above 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 delineates the time interval within which the strong positive bubble was identified and reported last month. Note that the stock price continues to appreciate and one should be cautious given the stock is still identified with strong positive bubble signals this month.

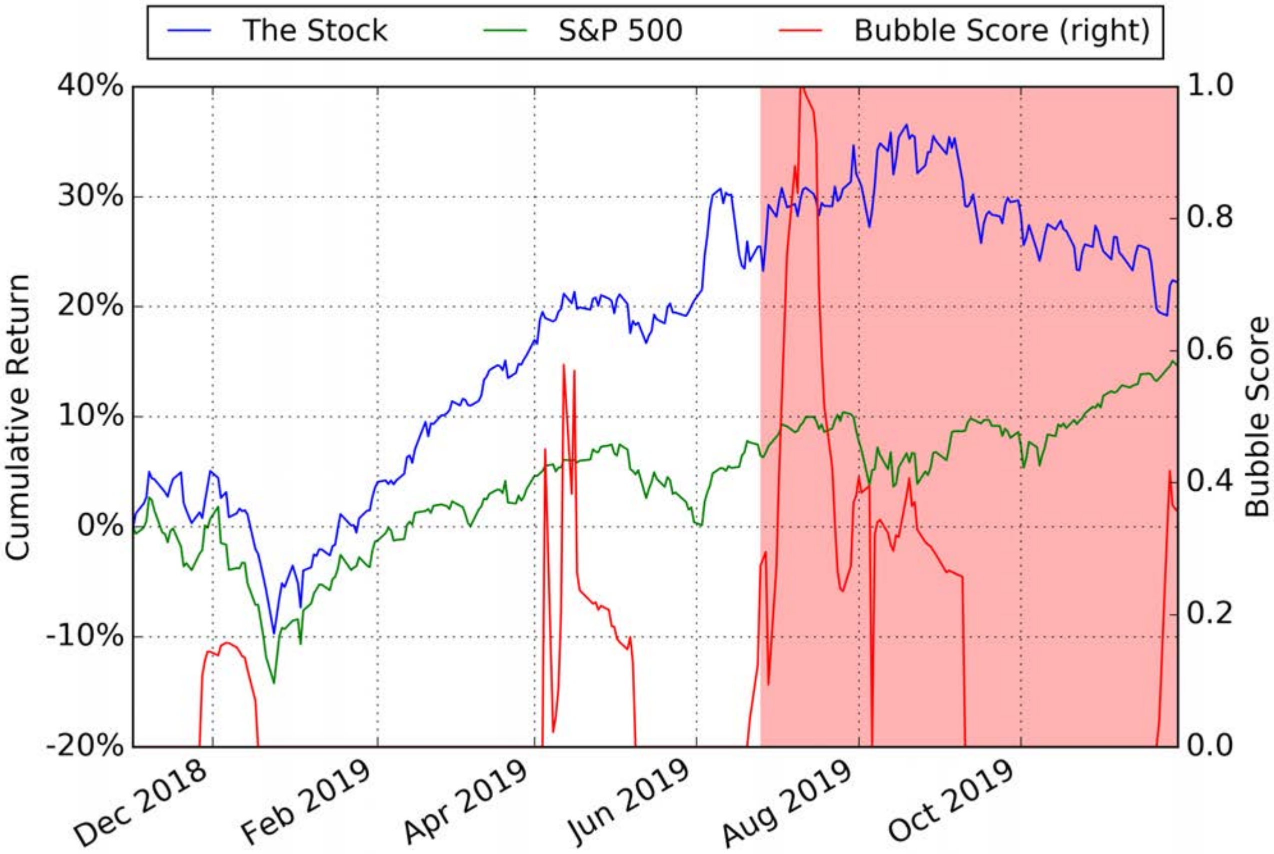
Single Stocks

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
Temenos AG	Switzerland	Software & Services	30.4%	-8.6%	Apr-19	-16.9%	2.9%	62.8%
Chr Hansen Holding A/S	Denmark	Materials	-12.7%	-17.5%	Jun-19	-31.5%	2.7%	75.9%
Wartsila Oyj Abp	Finland	Capital Goods	-32.6%	-31.3%	May-19	-25.2%	32.1%	79.0%
Ecolab Inc	United States of America	Materials	20.7%	-5.5%	Jun-19	-35.6%	5.7%	69.8%
L Brands Inc	United States of America	Retailing	-40.2%	-40.2%	Dec-18	-15.0%	22.7%	8.1%
Occidental Petroleum Corp	United States of America	Energy	-40.1%	-39.1%	Apr-19	-48.6%	20.2%	32.6%
TripAdvisor Inc	United States of America	Media & Entertainment	-47.7%	-39.0%	43525	-33.6%	7.3%	88.0%

Single Stocks

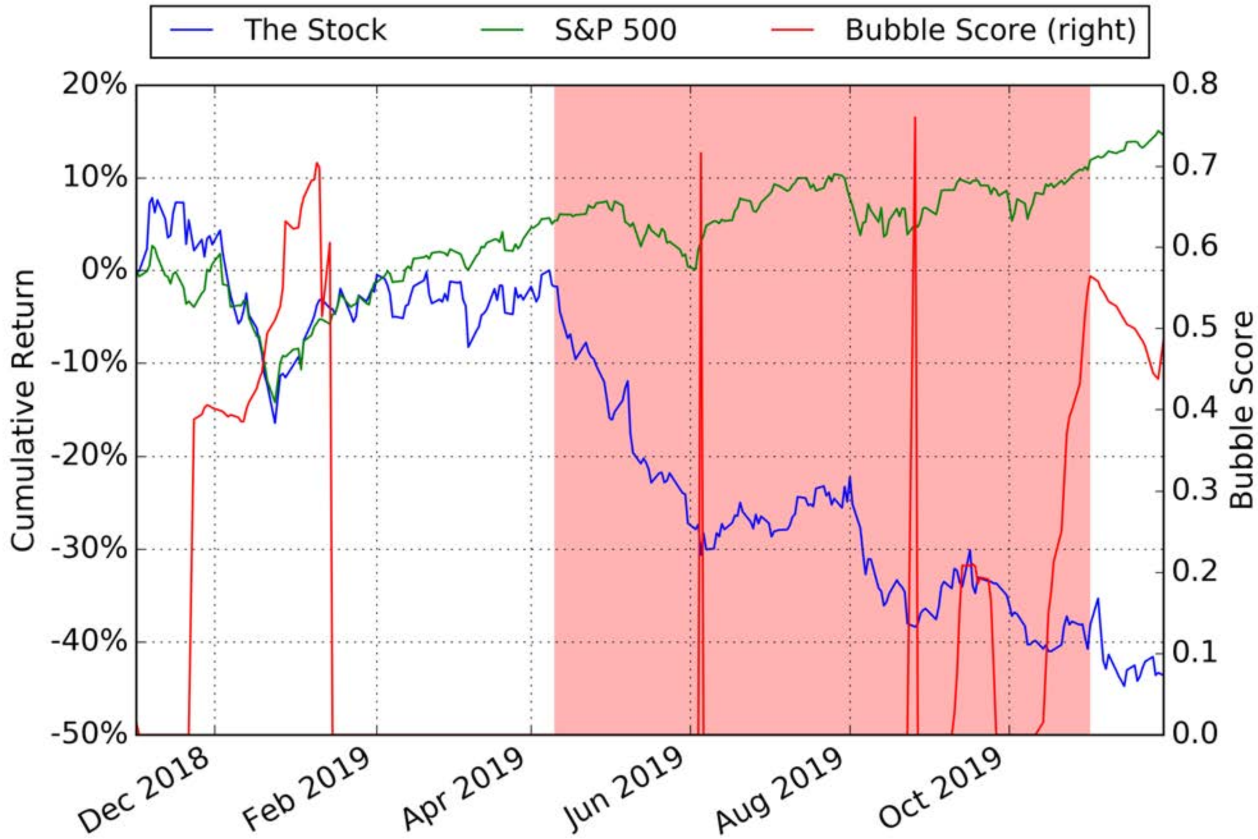
Quadrant 3 Stocks Current Month Example – Ecolab Inc.



- The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period delineates the time interval within which the negative bubble is identified. The Bubble Score of this six month bubble has reached 48.6% with a bubble size -39.1%. Note that this negative bubble is a continuation of the correction of the previous positive bubble.

Single Stocks

Quadrant 3 Stocks Last Month Example – Occidental Petroleum Corp.



- The figure above 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 delineates the time interval within which the strong negative bubble was identified and reported last month. The stock is still a negative bubble regime, identified by the strong bubble score this month. One should be cautious as the negative (downward trending) bubble may continue to develop.

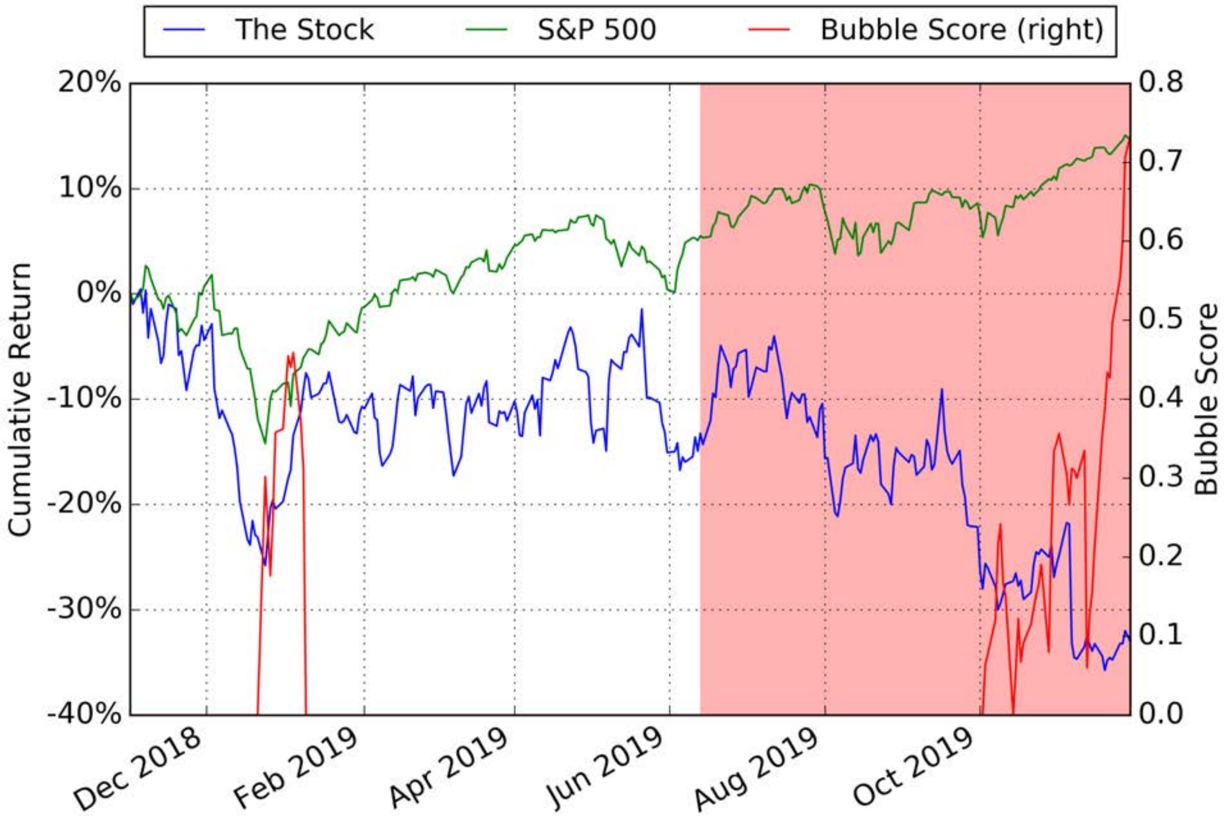
Single Stocks

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
K&S AG	Germany	Materials	-34.2%	-44.3%	Apr-19	-57.0%	67.5%	11.6%
Publicis Groupe SA	France	Media & Entertainment	-17.2%	-18.1%	Feb-19	-27.9%	91.4%	80.7%
Electricite de France SA	France	Utilities	-30.4%	-28.7%	Feb-19	-15.8%	91.3%	0.8%
Carnival PLC	United Kingdom	Consumer Services	-24.4%	-14.4%	Mar-19	-1.3%	66.2%	16.6%
Diamondback Energy Inc	United States of America	Energy	-23.1%	-26.0%	Jun-19	-73.3%	71.0%	93.7%

Single Stocks

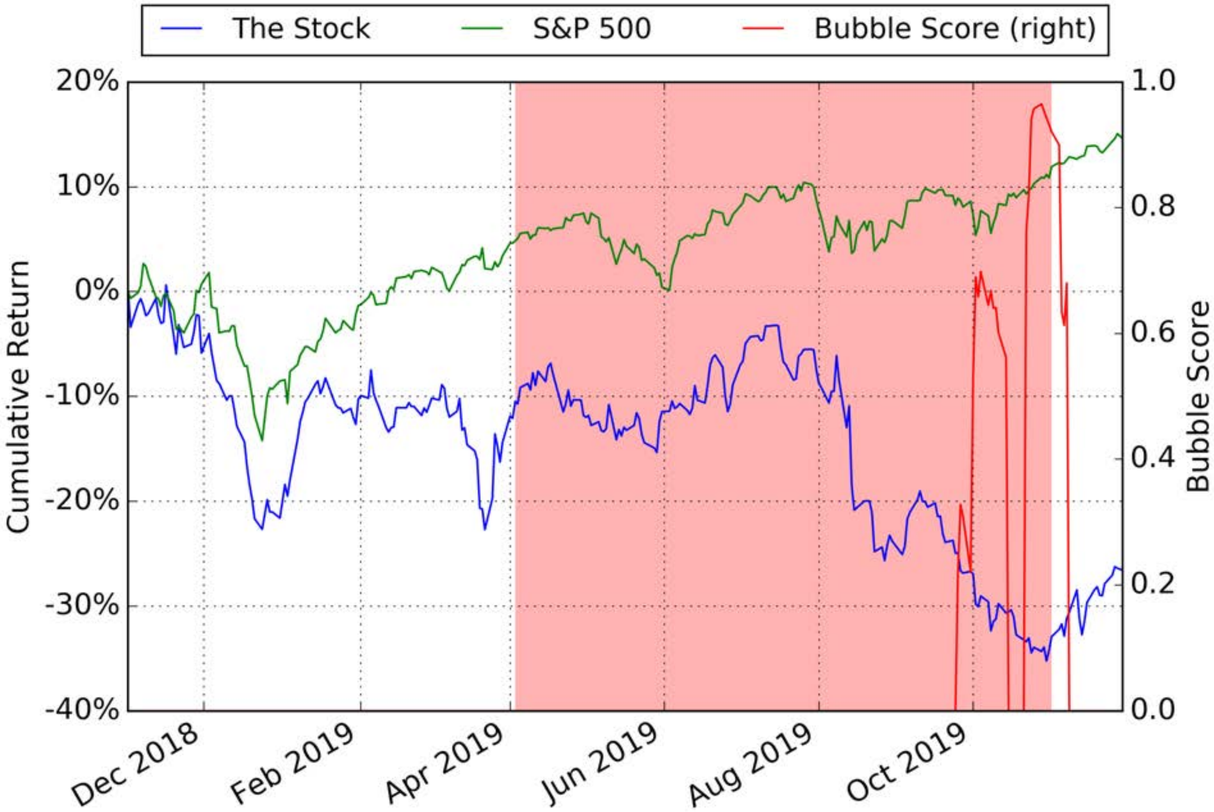
Quadrant 4 Stocks Current Month Example – Diamondback Energy Inc.



- The above graph shows the one year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period delineates the time interval within which the strong negative bubble is identified. The Bubble Score of this six month bubble has reached 73.3% with a bubble size -26.0%. We expect a rebound in the future, which is due to our diagnostic of a negative bubble signal with strong fundamentals, calling for a contrarian buyer position.

Single Stocks

Quadrant 4 Stocks Last Month Example – Viacom Inc.



- The figure above 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 delineates the time interval within which the strong negative bubble was identified and reported last month. The stock has started a strong correction in the past month. This change of regime is in agreement with our DS LPPLS indicator. The strong fundamentals lead us to expect potential future increase in the price.

More Information

- Visit the **Financial Crisis Observatory** for more information

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

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