The FCO Cockpit
Global Bubble Status Report
February 2021

Entrepreneurial Risks

ETH *zürich*

Contents

ETH zürich

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 **crowded** and to what degree they 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 applied to 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.

FCO Market Outlook

In line with our August 2020 FCO monthly report, a large number of active retail investors flood into the equity market, aggressively betting on leveraged and risky stocks while institutions have been net sellers of the very same stocks. Such a striking and pervasive divergence between amateurs and professionals became much more pronounced recently.

One hot case is Melvin capital, a sub-fund of Steven Cohen (Showtime series Billions Bobby Axelrod's prototype), who has been short-selling a struggling video game retailer, GameStop Corp.(US: GME). Many well-known investors such as Jim Chanos, who gained his name from his famous short-sell of Enron in 2000, Andrew Left who is the founder of Citron Research, and Citadel who ranks No.9 in AUM of all hedge fund firms, are also involved, all betting on a terminal closure of GME. Interestingly, GME's stock price did not go the way these tycoons bet and Melvin capital was forced to close its short position a few days ago, recording a 53% loss in January 2021, triggering a rushed $2.7 billion bailed out from Citadel and Point72 one week ago.

The stock prices of AMC, Nokia, Blackberry, etc. all skyrocketed similarly to GME, pushed by a large number of high-spirited retail investors, led by some key opinion leaders (KOLs) such as Keith Gill, Chamath Palihapitiya, Michael Burry. from some social media platforms (YouTube, Reddit's r/wallstreetbets, etc.). Tesla CEO Elon Musk's public support on Twitter also fuelled the fire. After a few weeks of fierce battle, Andrew Left of Citron research announced he will discontinue the short-selling report and Steven Cohen decided to close his Twitter account. The domino effect from the short squeeze of GME and such short-selling targets as AMC, Nokia, etc. has pushed a large number of long/short hedge funds to close their short positions as well as their Long positions (on mainly large profitable firms) to reduce their portfolio exposures. This creates more instabilities in the market: since many L/S hedge funds and quantitative funds are using factor models, which are mainly built by longing the top quantile good /quality/profitable stocks and shorting bottom quantile bad/struggling/value-destructing stocks. If these funds are forced to leave one side of their positions, they will have to close the opposite side. Besides, the rebalancing process caused by the short squeeze might also lead to higher volatilitiy i.e. high VIX, which might also push some funds to reduce equity exposure.
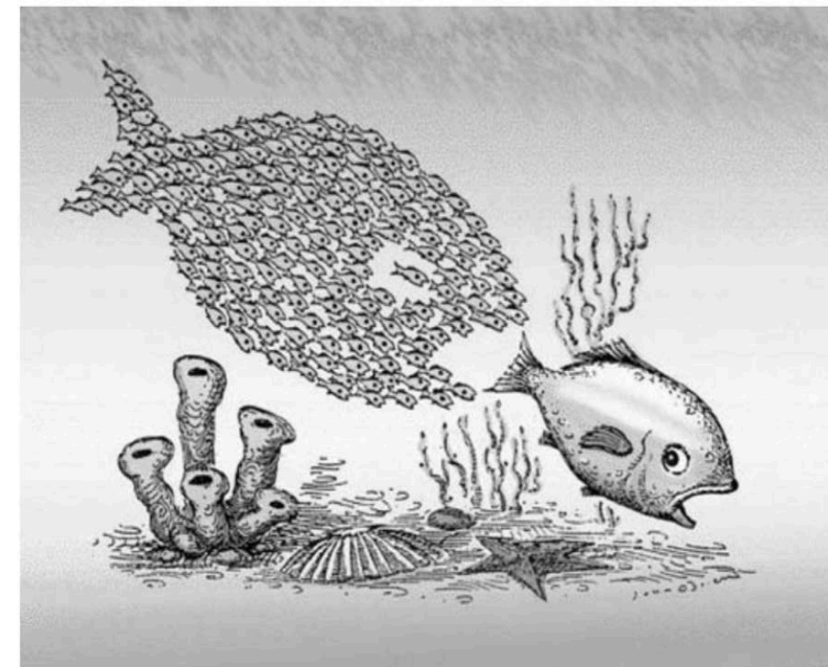
《Why Stock Markets Crash》 PP.123

The recent short squeeze, led by the crowded retail traders or day traders, is a typical self-reinforcing imitative and herding behavior. Such behavior is an example of the self-organization mechanism leading to complex emergent behaviors. The control parameter of cooperative behavior is the "coupling strength" between the agents in the interactive system, which quantifies their imitation propensity, forming a herd (like a cluster, an army, or a gang). When many active amateur investors flood into the stock markets, as in the past few months, most of them have limited financial knowledge and information. Under the condition of information asymmetry, the optimal strategy for the agents is to imitate their "neighbors" (or some authoritative information sources). With the stock forums on social platforms already available, small retail investors can copy other investors' (we consider some of them as key opinion leaders (KOLs)) "homework": i.e. Retail investors buy the same stocks as those KOLs do, even if they have no idea about the business fundamental or market valuation. Generally speaking, if the KOLs are not "strong", or not many followers copy KOLs' "homework", the crowd cannot be sustained for long. But this time, a number of conditions were met that accentuated the crowd phenomenon: (i) .COVID-19 makes lots of people stay at home and look for some occupation to fight their boredom, (ii) Some KOLs have lots of fans (such as Elon Musk). (iii) The prevalence of the smartphone make information easily accessible. (iv) An astonishing amount of liquidity is injected by the Fed. (v) Some long side KOLs are very professional (CFA Charter holders, ex-giant technology company (Facebook) senior manager, well-known professional investors). (vi) "Lottery-like pay-off" with the exiting slogan "You only live once" (YOLO) can easily ignite the animal spirits. Put them together and we get something similar to what happened in the 2000 (dot-com bubble).

At that time, Julian Robertson, the legendary value investor and founder of Tiger Management, had to close his fund due to big losses. He had short positions of some zombie companies just like today's Jim Chanos and Steven Cohen. But the madness of people (quote from Sir Isaac Newton) drove the junky stocks up to the sky and forced Julian to close his short positions. Interestingly, at that time, many retail investors exchange information and opinions in the Yahoo chat rooms, like Silicon Investor and RagingBull.com, mutually brainwashing each other and dreaming tomorrows. Yesterday once more!

Here are a few interesting questions: What exactly is a bubble? Are there any fund managers, who can leave the bubble when his/her fund is benefiting from it? Are there any fund managers who would dare to constantly say that he/she will not be impacted by his/her peers whose performance has been inflated by a bubble for many years? Who dares to fight bubbles and persistently win through his/her entire career? We will also be happy to ask Prof. Eugene Fama: if participants are irrational from time to time, how can we claim that the market is efficient?

General Results – The Big Picture

Fraction of Positive / Negative Bubble Signals for different Asset Classes
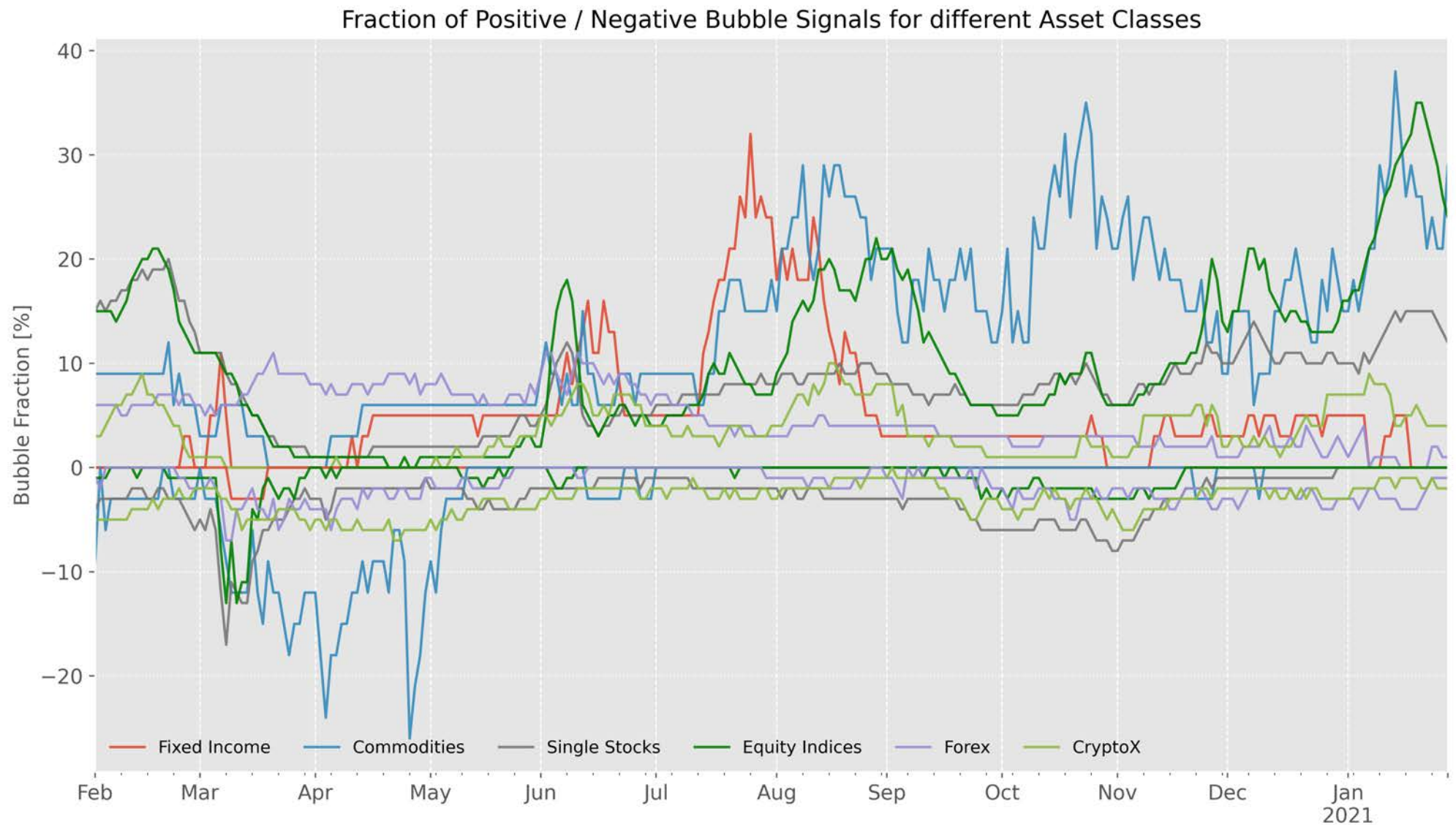
General Results – This Month's Overview

	Region	Analyzed Assets	Fraction of Pos. Bubbles [%]	Fraction of Neg. Bubbles [%]
Fixed Income		38	0	0
Commodities		34	29	0
Single Stocks		1613	11	0
	Europe	937	9	1
	United States	670	15	0
Equity Indices		891	22	0
	Europe	57	18	0
	United States	378	20	0
	Global	386	24	0
Forex		100	0	1
CryptoX		569	4	2

▸ Over January 2021, a general increase in positive bubble activity of single stocks, equity indices and commodities was observed. From mid January, this was followed by a drop of the fraction of bubbles.

▸ The positive bubble activity for the remaining asset classes, as well as all negative bubble activity, are below 5% this month. Thus, there is a general bias towards positive market trends and bubbles (which is a general and standard observation).

Multiscale Indicators

▸ In the following, we will analyze different types of bubble signals that are obtained by our LPPLS bubble detection procedure for each asset.

▸ The four different signal types are the respective versions of the DS LPPLS Confidence Indicators, the so-called multiscale indicators.

▸ In the tables, for each asset, only the strongest signal is listed.

▸ The strongest signal is determined as the one for which the geometric average of the corresponding bubble characteristics is maximized.

▸ The multiscale indicators differ in the range of time-windows that they are computed for.

▸ The different ranges are:

— Super-Short (SS) Scale: [40,183] days

— Short (S) Scale: [40,365] days

— Medium (M) Scale: [365,730] days

— Long (L) Scale: [730,1460] days

▸ Thus, if for instance the strongest signal is the super-short-scale Confidence Indicator, this can be interpreted as a strong short-term in the price time series of the asset.

▸ Similarly, for instance for the long-scale, a respective bubble is identified to exist for several years already, with strong bubble growth over the entire time frame.

▸ This slide shall serve as a reference for readers to map the range of windows that the abbreviation refers to.

Single Stocks - Europe

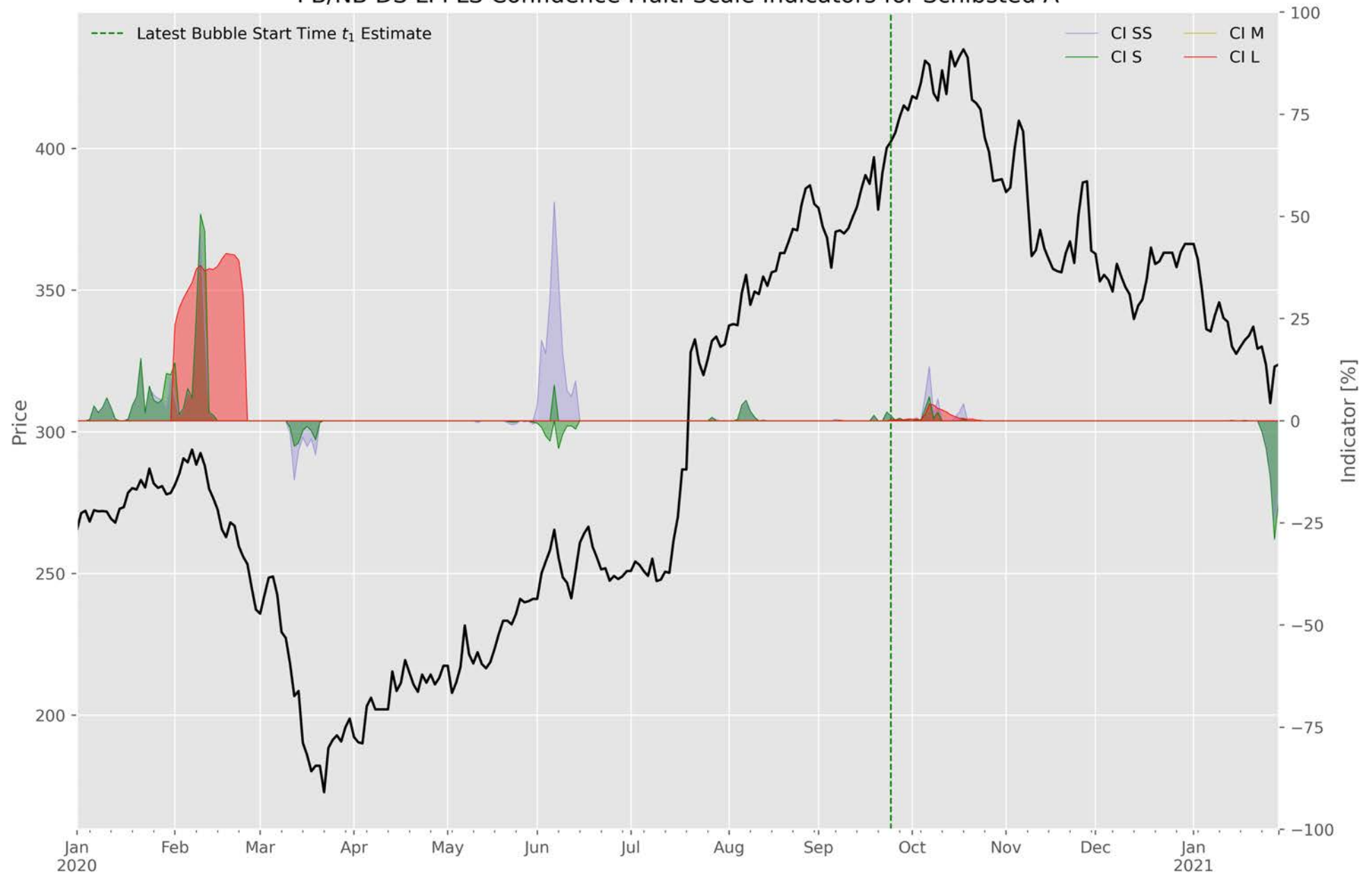|	Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [$days$]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{ci \cdot bg \cdot bp}$ [%]	Critical Time $\bar{t}_c$	Scenario Probability [%]
Positive Bubbles										
1	Royal Mail	Short-Term	57.0	203.0	254.0	221.0	86.0	107.0	2021-03-07	100.0
2	Logitech Intl. (Nas)	Short-Term	47.0	92.0	143.0	185.0	94.0	86.0	2021-02-10	100.0
3	Sinch	Long-Term	35.0	1795.0	159.0	780.0	98.0	82.0	2021-02-13	67.0
Negative Bubbles										
1	Schibsted A	Super-Short	16.0	-20.0	-45.0	92.0	98.0	42.0	2021-01-31	100.0
2	Atlantia	Super-Short	26.0	-16.0	-34.0	108.0	67.0	39.0	2021-03-24	93.0
3	Iliad	Super-Short	14.0	-12.0	-26.0	113.0	69.0	29.0	2021-03-21	100.0

▶ The analysis starts with the subclass of European single stocks. The fraction of positive (negative) bubble signals of the total of 937 analyzed stocks is about 9% (1%). The corresponding three strongest positive and negative bubbles are listed in the table above.

▶ Most of the signals are on the short- to super-short term (see the reference Slide 7). Thus, recent strong market momentum is detected by our analysis.

▶ The top positive bubble signal is Royal Mail, with a bubble size estimated to be approximately 200% and a confidence indicator of 57%. The bubble is predicted to be 86% matured. This amounts to predicting the crash to occur on ~ 7th March 2021, given the bubble duration of 221 days. The corresponding indicator plot is provided on the next slide.

▶ The top negative bubble signal, which is of type super-short, is for Schibsted (Norway, Media). The detected bubble size is -20% at a low confidence indicator level of 16%. Thus, the signal is relatively weak. The corresponding plot is also provided in the following. The start of the bubble, as indicated by the vertical green dashed line, is a bit before a prior peak.

PB/NB DS LPPLS Confidence Multi-Scale Indicators for Royal Mail
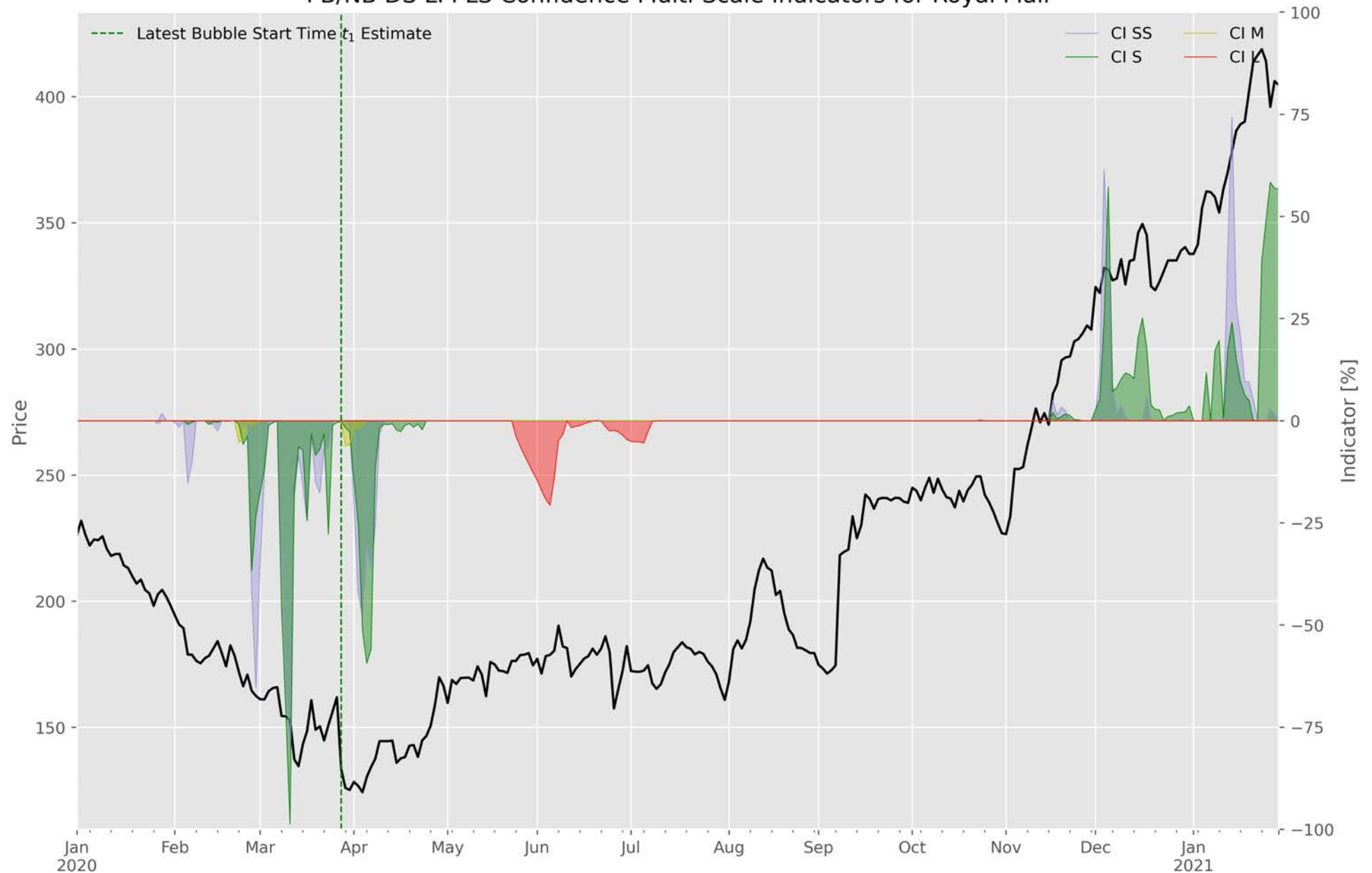
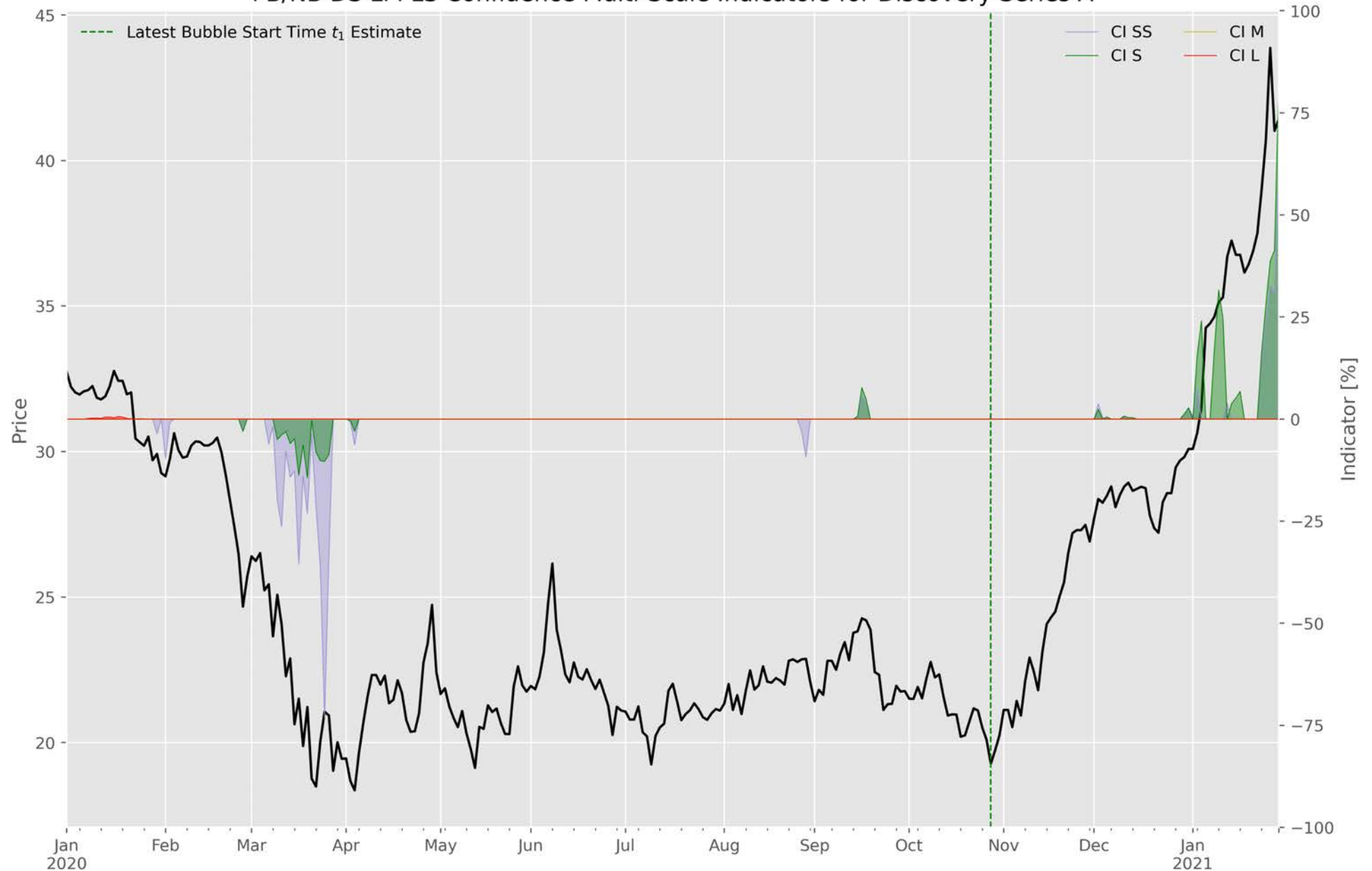PB/NB DS LPPLS Confidence Multi-Scale Indicators for Schibsted A
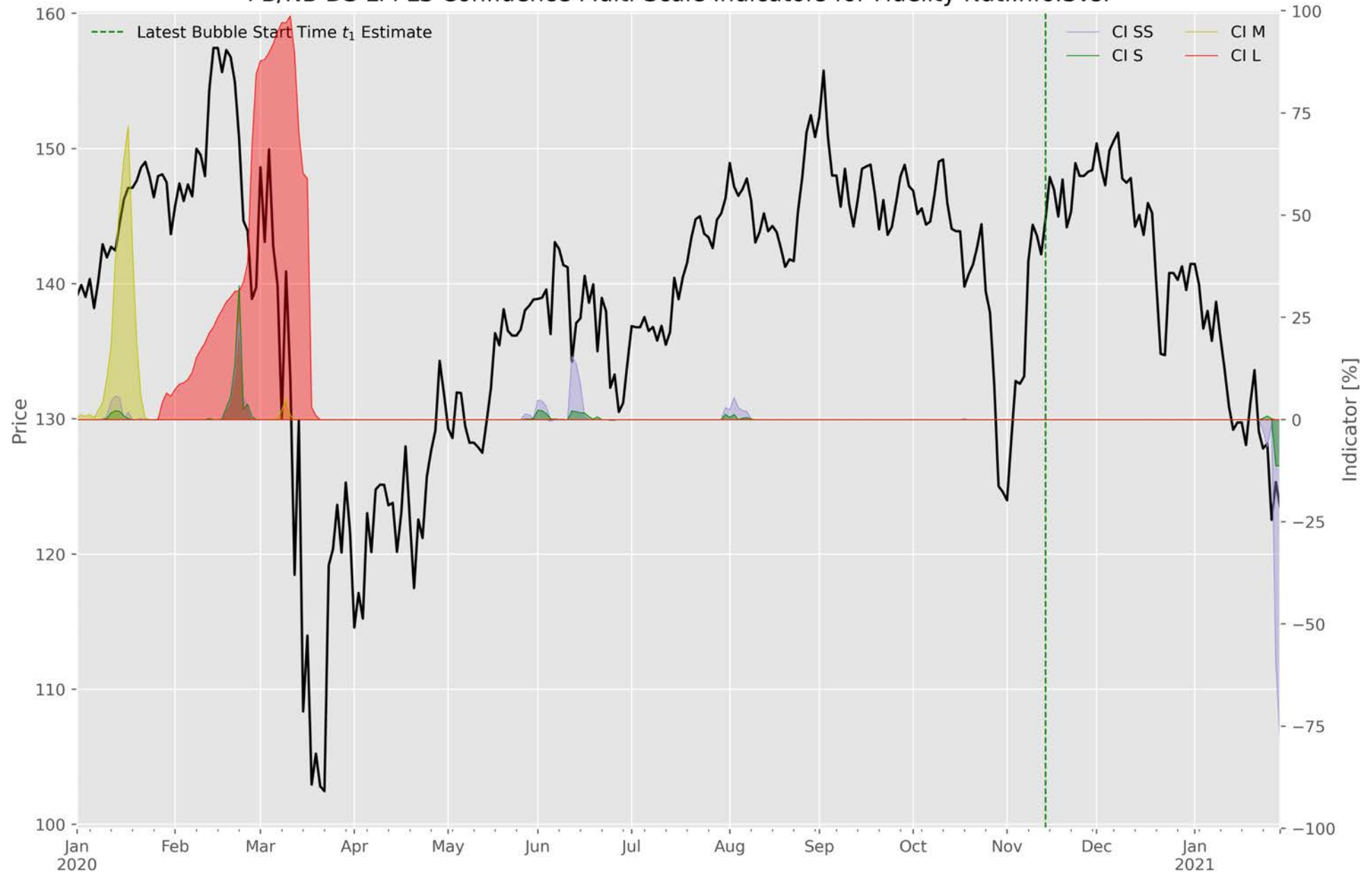
Single Stocks – United States

	Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [$days$]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{ci \cdot bg \cdot bp}$ [%]	Critical Time $\bar{t}_c$	Scenario Probability [%]
Positive Bubbles										
1	Discovery Series A	Super-Short	61.0	115.0	1604.0	68.0	95.0	210.0	2021-02-02	100.0
2	Unisys	Super-Short	51.0	130.0	852.0	93.0	67.0	143.0	2021-03-16	83.0
3	Viacomcbs B	Super-Short	54.0	85.0	242.0	126.0	97.0	108.0	2021-02-02	60.0
Negative Bubbles										
1	Fidelity Nat.Info.Svs.	Super-Short	79.0	-15.0	-51.0	56.0	83.0	70.0	2021-02-09	100.0
2	Cintas	Super-Short	39.0	-12.0	-43.0	60.0	95.0	54.0	2021-02-01	100.0

▸ For US Single Stocks, with 15%, the fraction of positive bubbles is higher than for the European stocks sector. The fraction of negative bubbles is close to zero, as there are very few signals. All signals correspond to the super-short scale (see Slide 7).

▸ Positive (negative) DS LPPLS Confidence Indicator values range in 51%-61% (39%-79%) and are therefore in the medium range. Positive bubble sizes are fairly large, estimated between 85%-115% (-12% - -15%) at durations of 68-126 (56-60) trading days. Combining the size of the bubbles with their duration corresponds to yearly compound growth rates (CAGR) ranging in 242%/year-1604%/year (-43%/year - -50%/year). Of course it is quite unlikely for this growth to be sustained throughout a full year, as indicated by the bubble progress and critical time predictions. All critical times are estimated to occur before the end of March 2021. This is the hallmark of a heated market phase, with huge day-to-day gains that however ultimately will have to come to a stop with a change of regime.

▸ The indicator plots for the top positive (Discovery, US, Media) and negative bubble (Fidelity NIS, US, Information Services) signals are provided in the following.

PB/NB DS LPPLS Confidence Multi-Scale Indicators for Discovery Series A

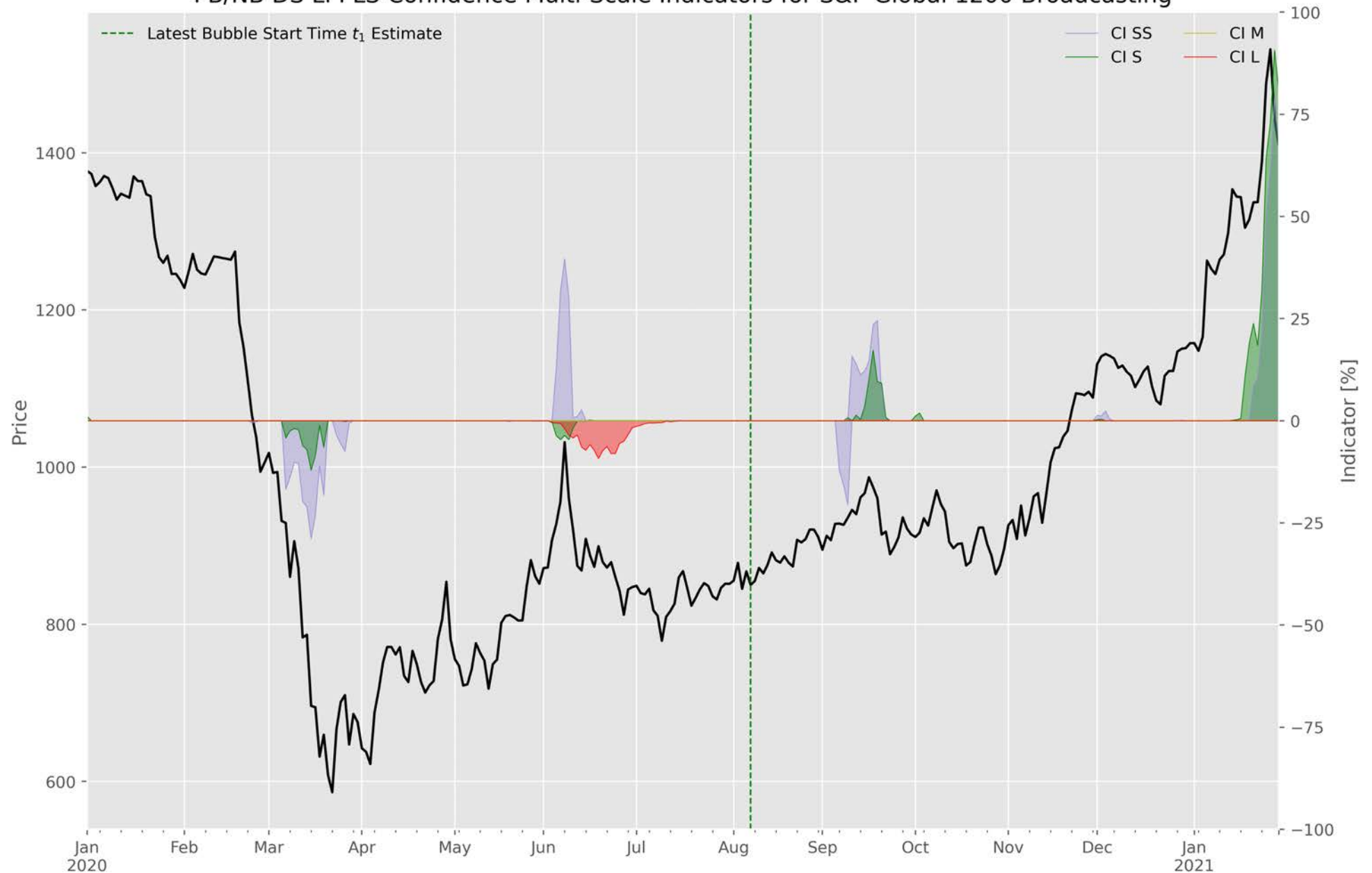PB/NB DS LPPLS Confidence Multi-Scale Indicators for Fidelity Nat.Info.Svs.

Equity Indices - Global

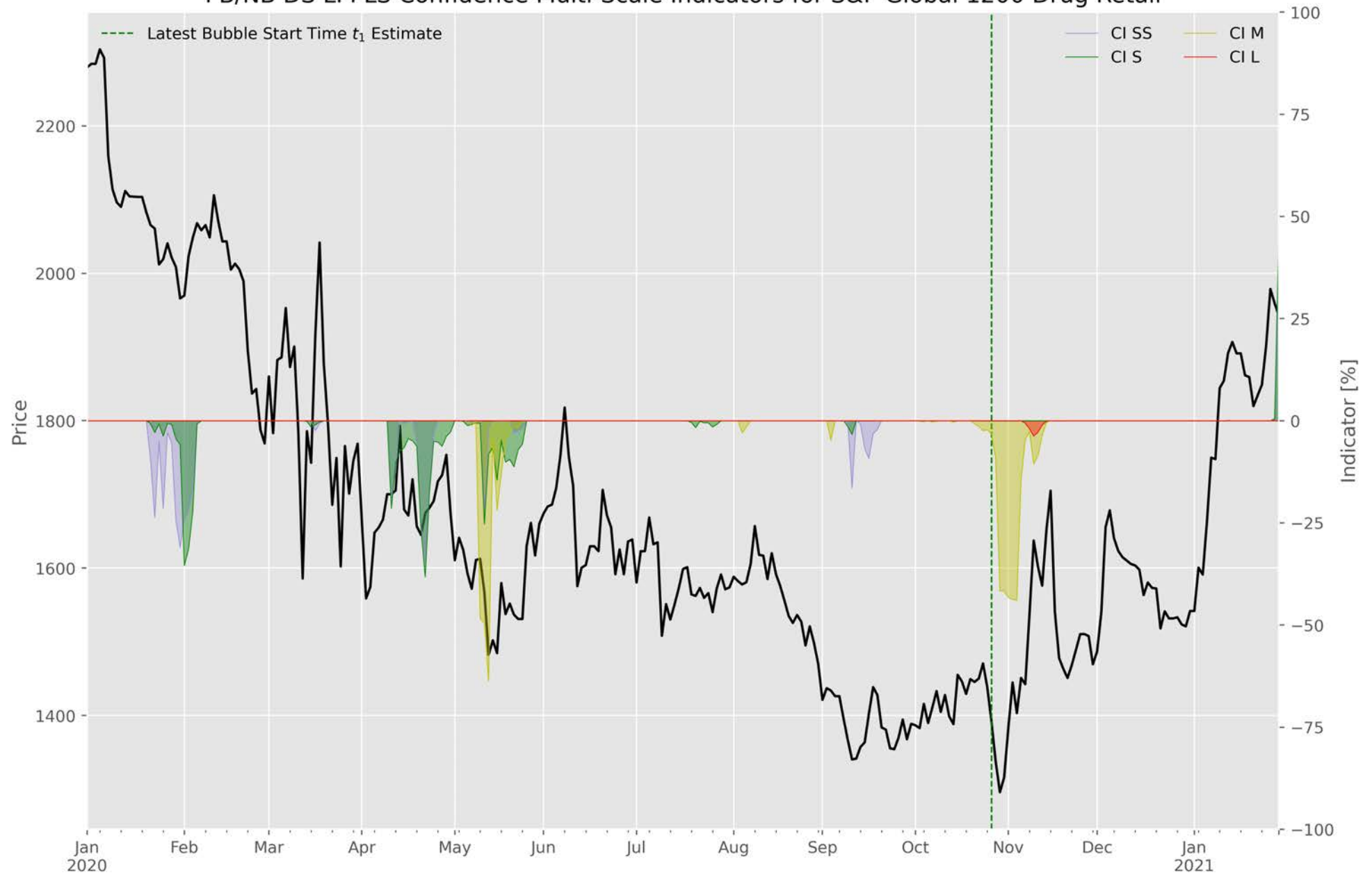|	Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [$days$]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{\dfrac{ci \cdot bg}{\cdot bp}}$ [%]	Critical Time $\bar{t}_c$	Scenario Probability [%]
Positive Bubbles										
1	S&P Global 1200 Broadcasting	Super-Short	68.0	66.0	175.0	126.0	96.0	105.0	2021-02-03	94.0
2	S&P Global 1200 Drug Retail	Super-Short	34.0	40.0	238.0	69.0	98.0	92.0	2021-01-30	100.0
3	S&P Global 1200 Tec Hard St & Periph	Short-Term	33.0	106.0	125.0	224.0	98.0	74.0	2021-02-02	100.0

▸ We turn to a broader analysis of stocks grouped into sections in the S&P 1200 Global series. For this index series, no negative bubble signals are detected. The positive bubble activity involves almost a quarter of the 386 analyzed indices.

▸ The top positive bubble signals are found in the Broadcasting and Drug Retail Sector. The indicator plots for these two are also depicted on the following slides.

▸ Again, all signals occur on the super-short and short scale, with confidence indicators ranging from 33% to 68%.

▸ Also here, the estimated bubble progress is above 95% for all of them, warning of imminent changes of regime or crashes.

PB/NB DS LPPLS Confidence Multi-Scale Indicators for S&P Global 1200 Broadcasting

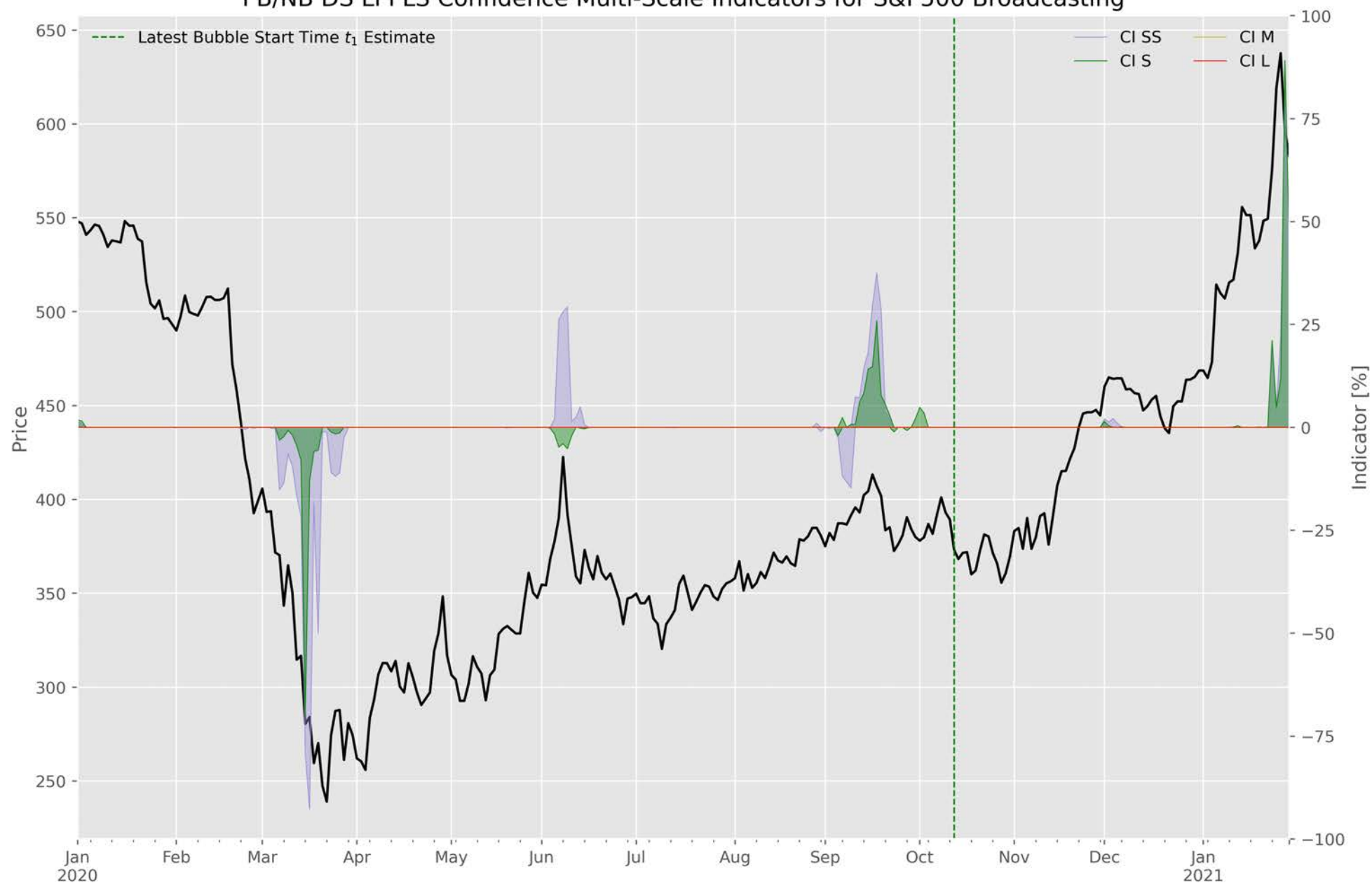PB/NB DS LPPLS Confidence Multi-Scale Indicators for S&P Global 1200 Drug Retail
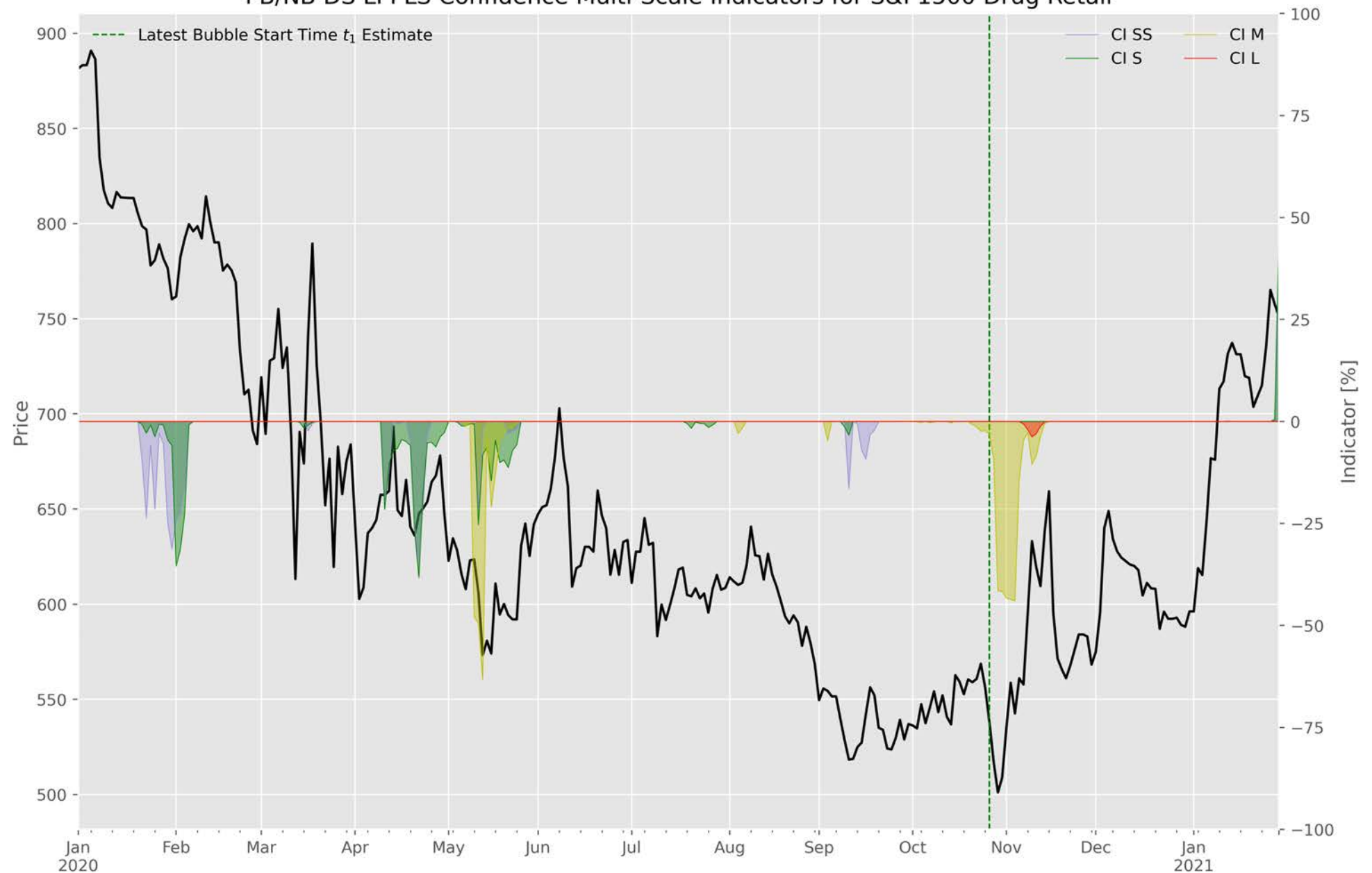
Equity Indices – United States

	Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [$days$]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{ci \cdot bg \cdot bp}$ [%]	Critical Time $\bar{t}_c$	Scenario Probability [%]
Positive Bubbles										
1	S&P500 Broadcasting	Super-Short	32.0	56.0	314.0	79.0	95.0	98.0	2021-02-02	97.0
2	S&P1500 Broadcasting	Super-Short	48.0	51.0	201.0	95.0	96.0	97.0	2021-02-02	97.0
3	S&P1500 Drug Retail	Super-Short	34.0	40.0	238.0	69.0	98.0	92.0	2021-01-30	100.0

▸ Focusing on the US Equity indices, as covered by the S&P 500 and 1500 Index series, again, the broadcasting and drug retail indices appear at the top, with similar bubble characteristics as previously determined in the global analysis.

▸ As the S&P 500 Broadcasting and S&P 1500 Broadcasting indices are highly correlated, we only show the first one on the next slide and, in addition, the Drug Retail index.

PB/NB DS LPPLS Confidence Multi-Scale Indicators for S&P500 Broadcasting

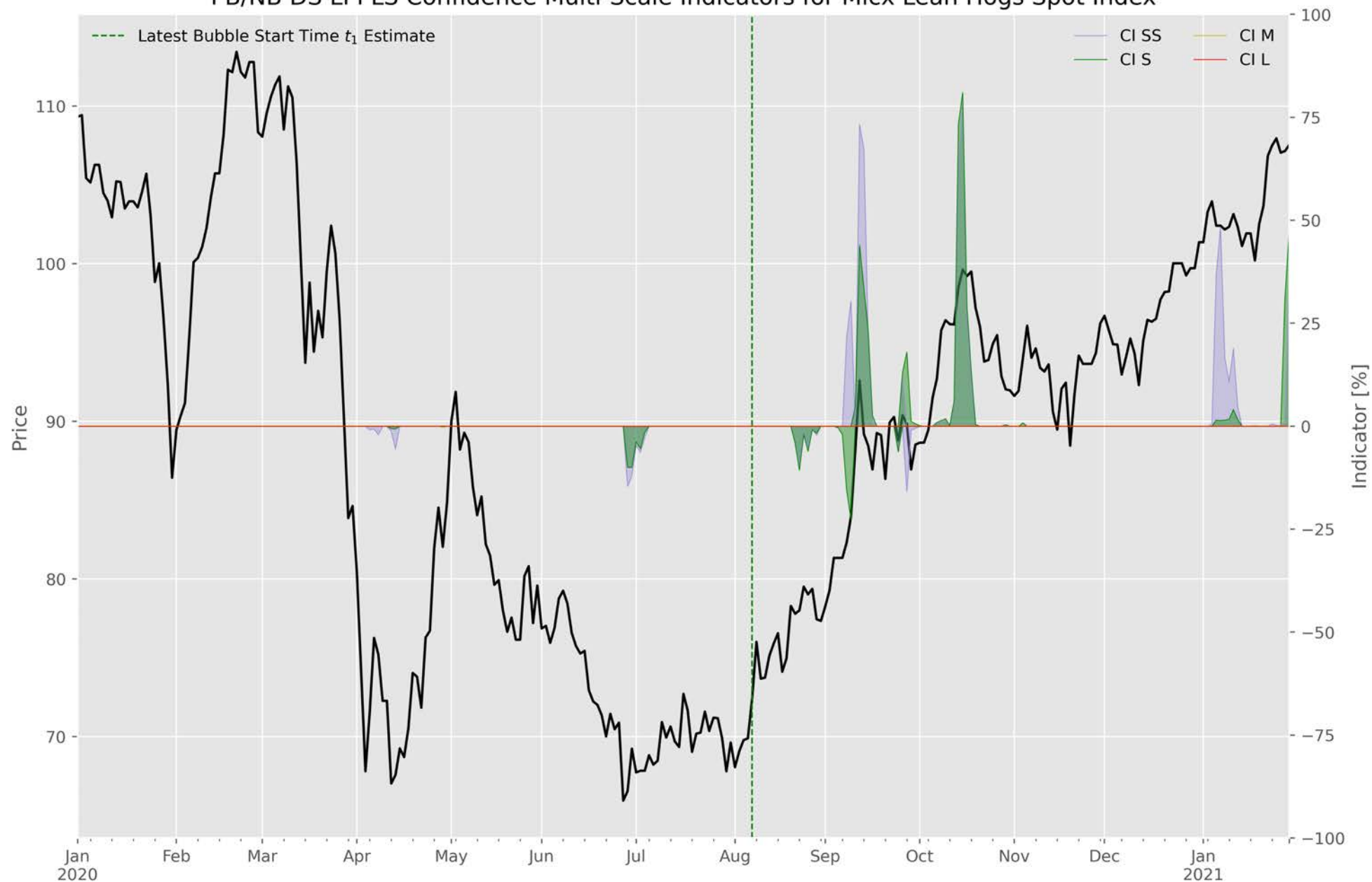## PB/NB DS LPPLS Confidence Multi-Scale Indicators for S&P1500 Drug Retail

ETH zürich

Commodities

	Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [$days$]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{ci \cdot bg \cdot bp}$ [%]	Critical Time $\bar{t}_c$	Scenario Probability [%]
Positive Bubbles										
1	Mlcx Lean Hogs Spot Index	Super-Short	36.0	48.0	120.0	126.0	96.0	74.0	2021-02-03	100.0
2	Mlcx - Soybean Oil Spot Index	Super-Short	35.0	43.0	104.0	126.0	70.0	63.0	2021-03-25	100.0
3	Mlcx Livestock Spot Index	Short-Term	44.0	26.0	36.0	188.0	95.0	53.0	2021-02-07	100.0

▸ Our analysis of commodities comprises a selection of 34 indices, of which 29% are found to be in a positive bubble state at the beginning of February 2021.

▸ At the top, we find the MLCX Lean Hogs, Soybean Oil and Livestock Spot Indices. In the previous report, the Soybean Index had already appeared as the single top signal.

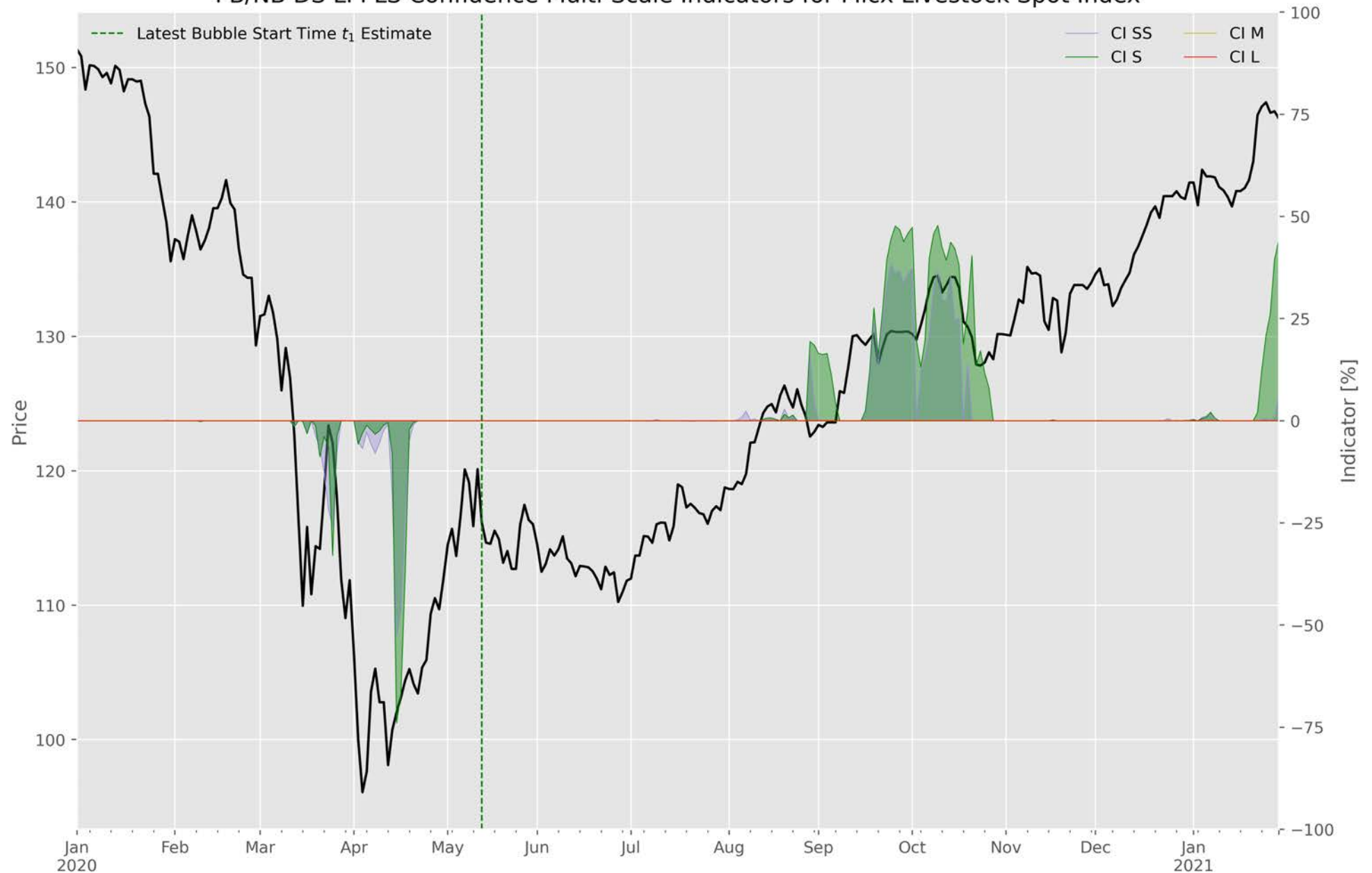▸ For all three indices, the indicator plots are displayed on the following slides.

PB/NB DS LPPLS Confidence Multi-Scale Indicators for Mlcx Lean Hogs Spot Index

PB/NB DS LPPLS Confidence Multi-Scale Indicators for Mlcx - Soybean Oil Spot Index

ETH zürich
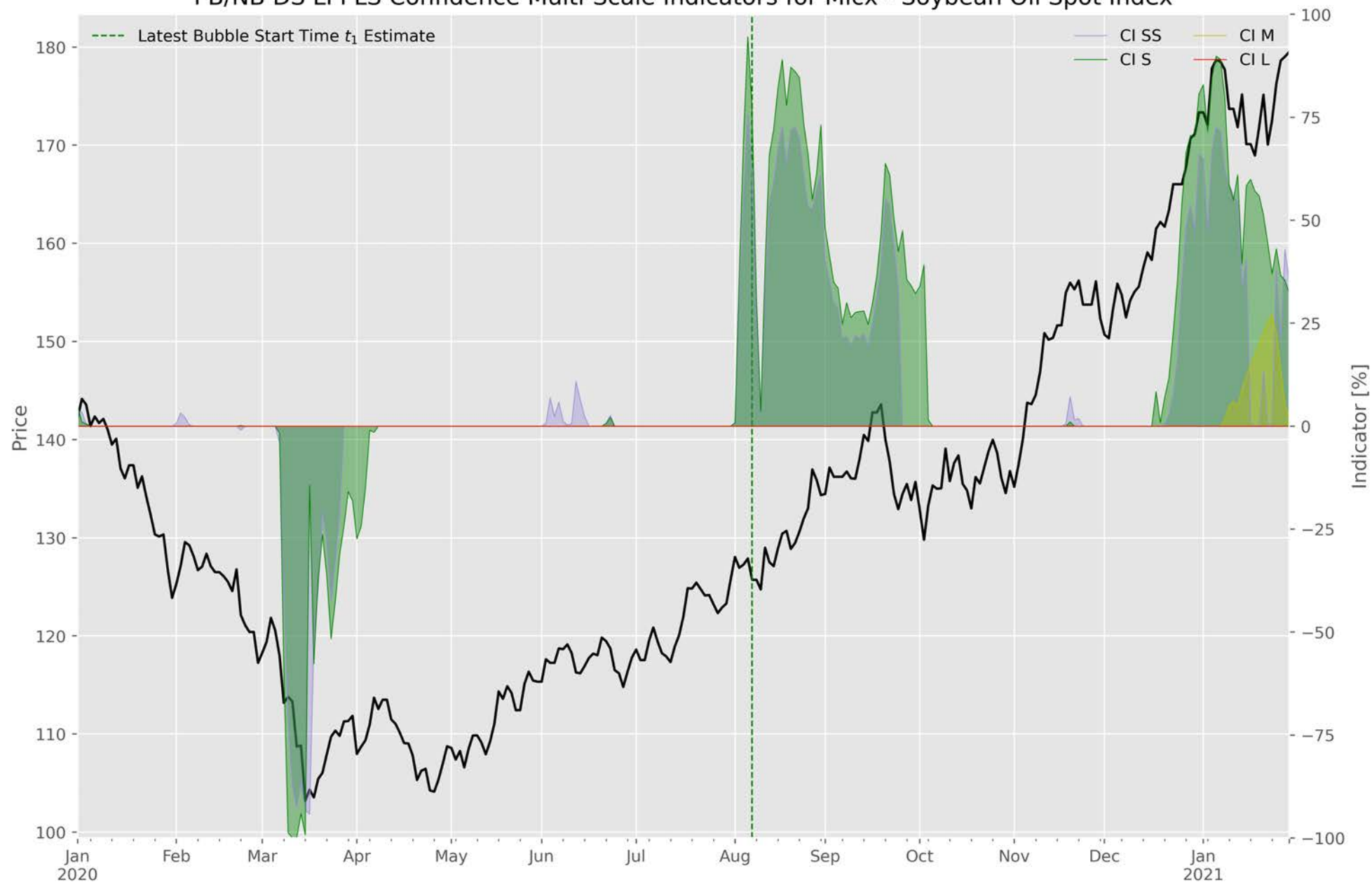
PB/NB DS LPPLS Confidence Multi-Scale Indicators for Mlcx Livestock Spot Index

Forex

	Name	Strongest Signal	DS LPPLS Confidence c_i [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [days]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{\frac{c_i \cdot bg}{\cdot bp}}$ [%]	Critical Time $\bar{t}_c$	Scenario Probability [%]
Negative Bubbles										
1	Jpm Hong Kong Reer Ppi (2010=100)	Medium-Term	15.0	-10.0	-5.0	504.0	100.0	20.0	2021-01-30	100.0

PB/NB DS LPPLS Confidence Multi-Scale Indicators for Jpm Hong Kong Reer Ppi (2010=100)
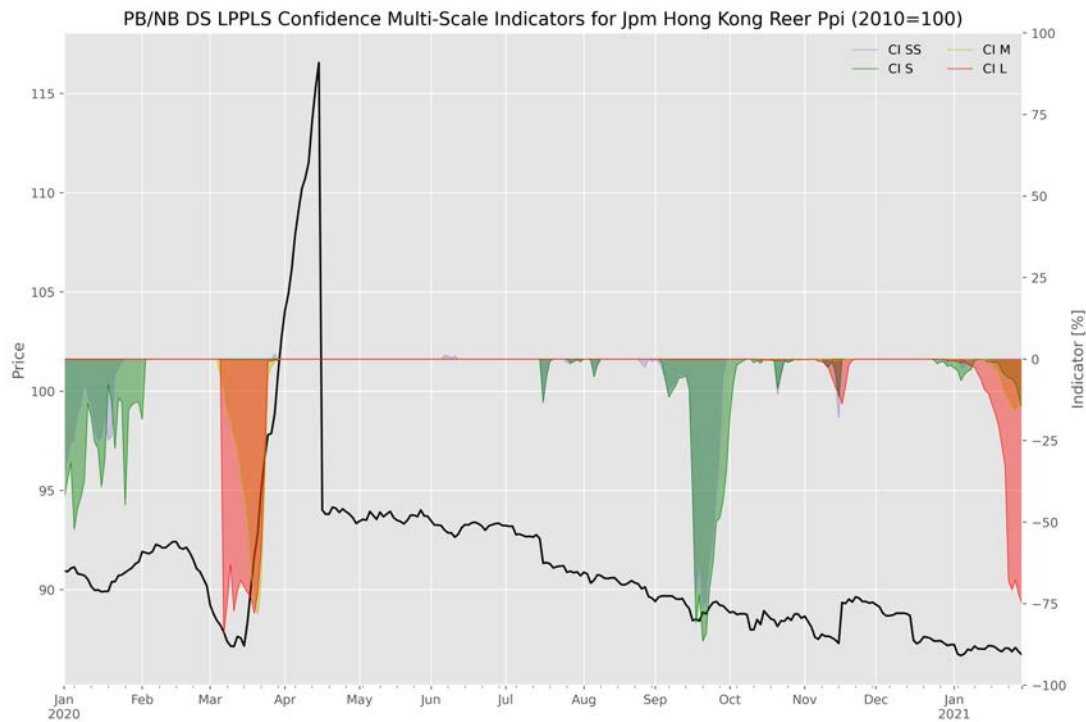
▸ The analysis of Real Effective Exchange Rate (REER) Indices reveals a single negative bubble signal, this month, on the Hong Kong ReeR.

▸ The scale of the signal is medium-term, with an identified bubble duration of 504 trading days.

▸ On the left side, the indicator plot is shown. The long-term indicator peaks at a larger value than that of the medium term indicator. Nevertheless, the geometric average, as listed in the table above, is strongest for the medium-term signal. Therefore, the bubble characteristics corresponding to that signal are listed in the table, but all four indicators are shown in the time series plot.

CryptoX

| Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [days]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{ci \cdot bg \cdot bp}$ [%]	Critical Time $\bar{t}_c$	Scenario Probability [%]
Positive Bubbles									
1 Decred/USD	Short-Term	26.0	487.0	2909.0	131.0	67.0	171.0	2021-04-04	96.0
2 Gifto/USD	Short-Term	48.0	310.0	986.0	149.0	98.0	167.0	2021-02-01	100.0
3 NEM/USD	Medium-Term	100.0	564.0	217.0	413.0	88.0	124.0	2021-03-29	95.0
Negative Bubbles									
1 CasinoCoin/USD	Medium-Term	64.0	-89.0	-74.0	414.0	97.0	77.0	2021-02-10	100.0
2 Po.et/USD	Medium-Term	14.0	-98.0	-73.0	730.0	98.0	47.0	2021-02-12	100.0
3 EDUCare/USD	Short-Term	15.0	-64.0	-60.0	288.0	80.0	42.0	2021-04-09	99.0

▸ The CryptoX sector is composed of 569 different cryptocurrencies, cryptocommodities, stablecoins and other types of cryptoassets. The fraction of positive (negative) bubbles at the beginning of February is quite low at 4% (2%).

▸ Nevertheless, as typical for the strongly volatile prices of cryptocurrencies, the bubble signals are quite strong, especially for the positive bubbles, with the confidence indicator hitting up to 100% on the medium-term scale for NEM/USD. The bubble sizes range between 310%-564% and from -64% to -98% for positive and negative bubbles, respectively.

▸ The predicted crash / rebound times range between the start of February and mid April, with high associated scenario probabilities exceeding 95%.

▸ The following slides present the corresponding indicator plots for the top signals, as well as for BTC/USD. For Bitcoin, the Confidence Indicator peaked strongly during the growth phase of the recent bubble that began approximately in October 2020. During the past month, then, a crash with a following volatile side-movement followed.

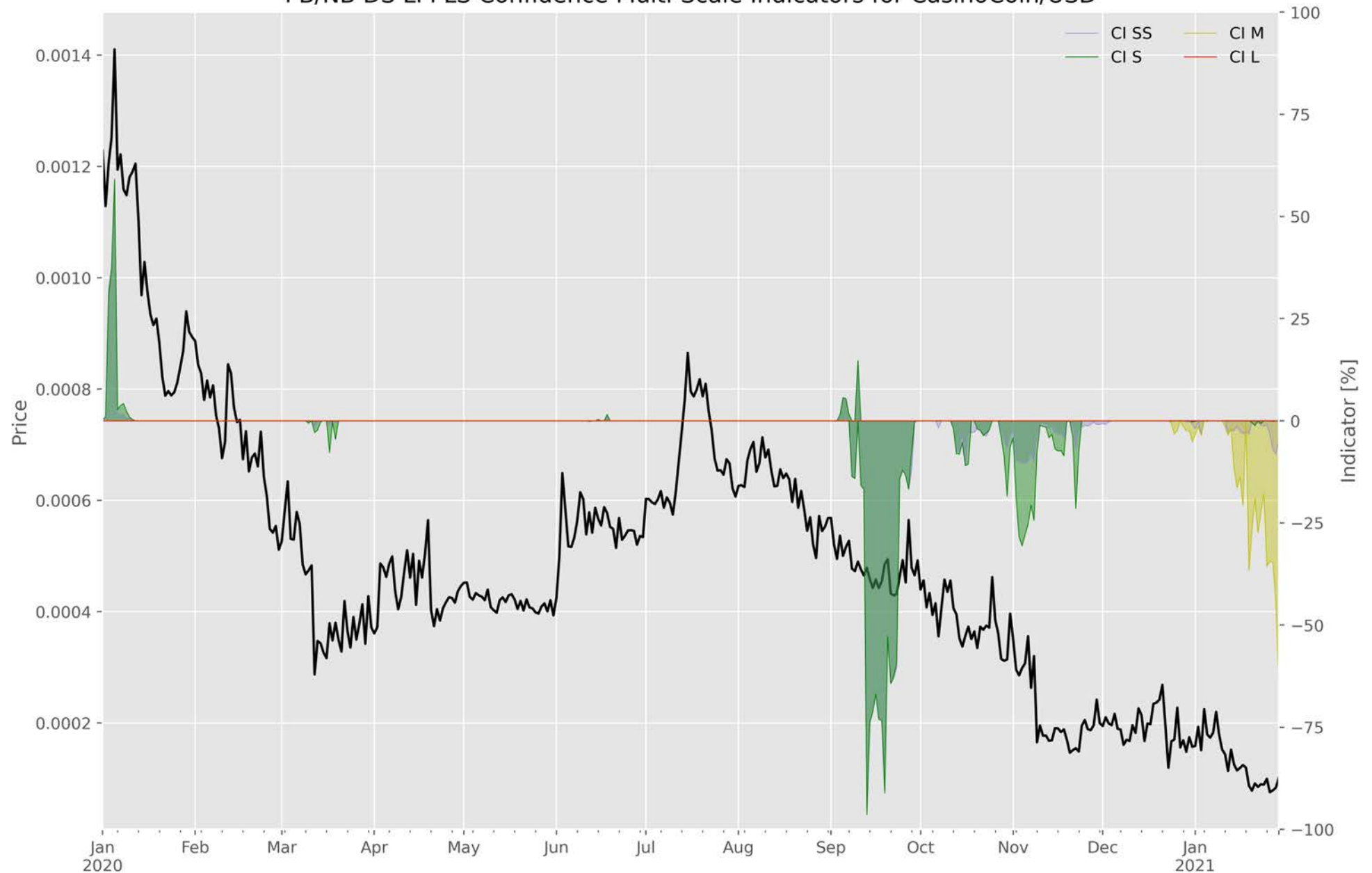# PB/NB DS LPPLS Confidence Multi-Scale Indicators for Bitcoin/USD

ETH zürich
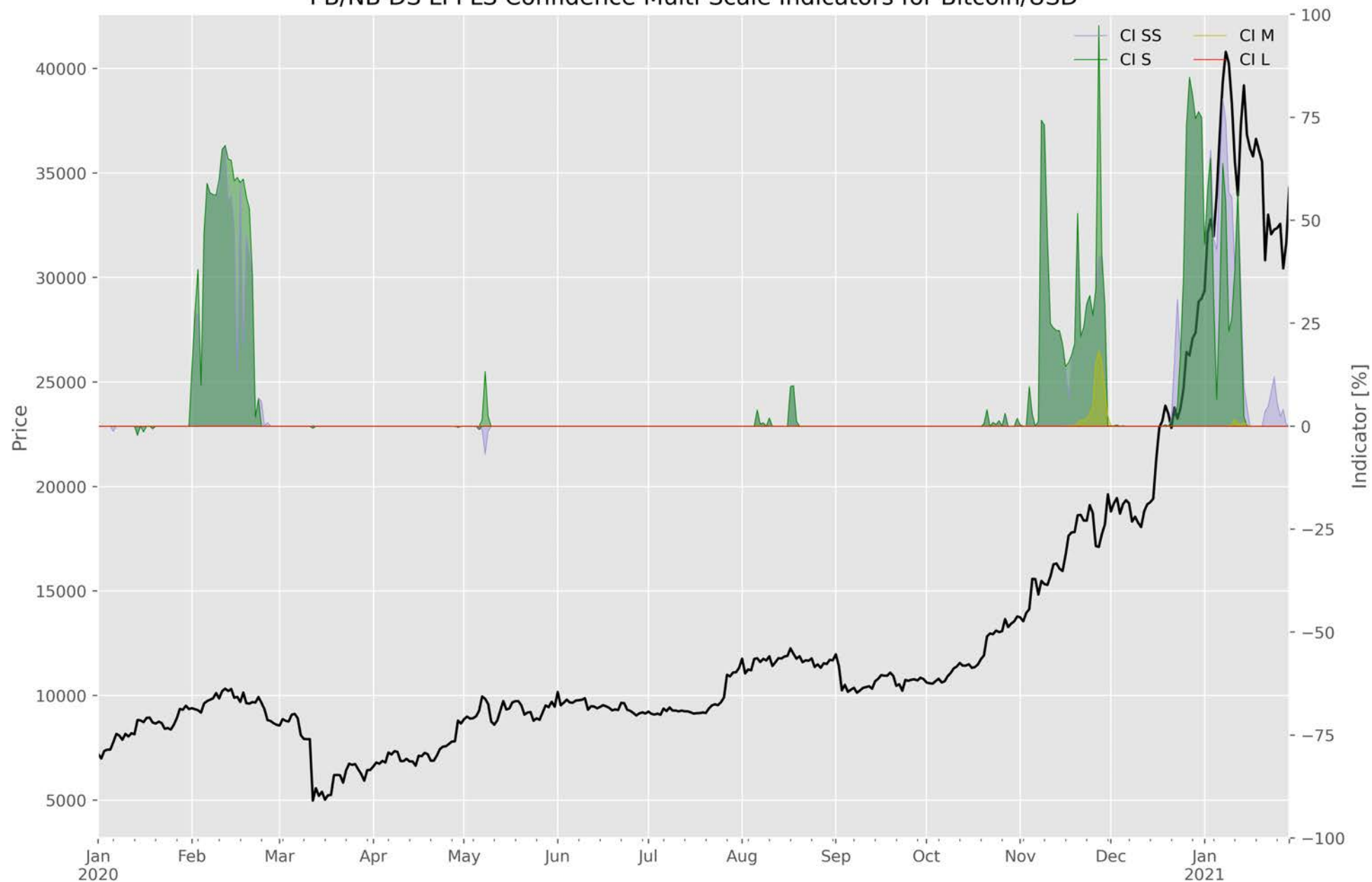
PB/NB DS LPPLS Confidence Multi-Scale Indicators for Decred/USD
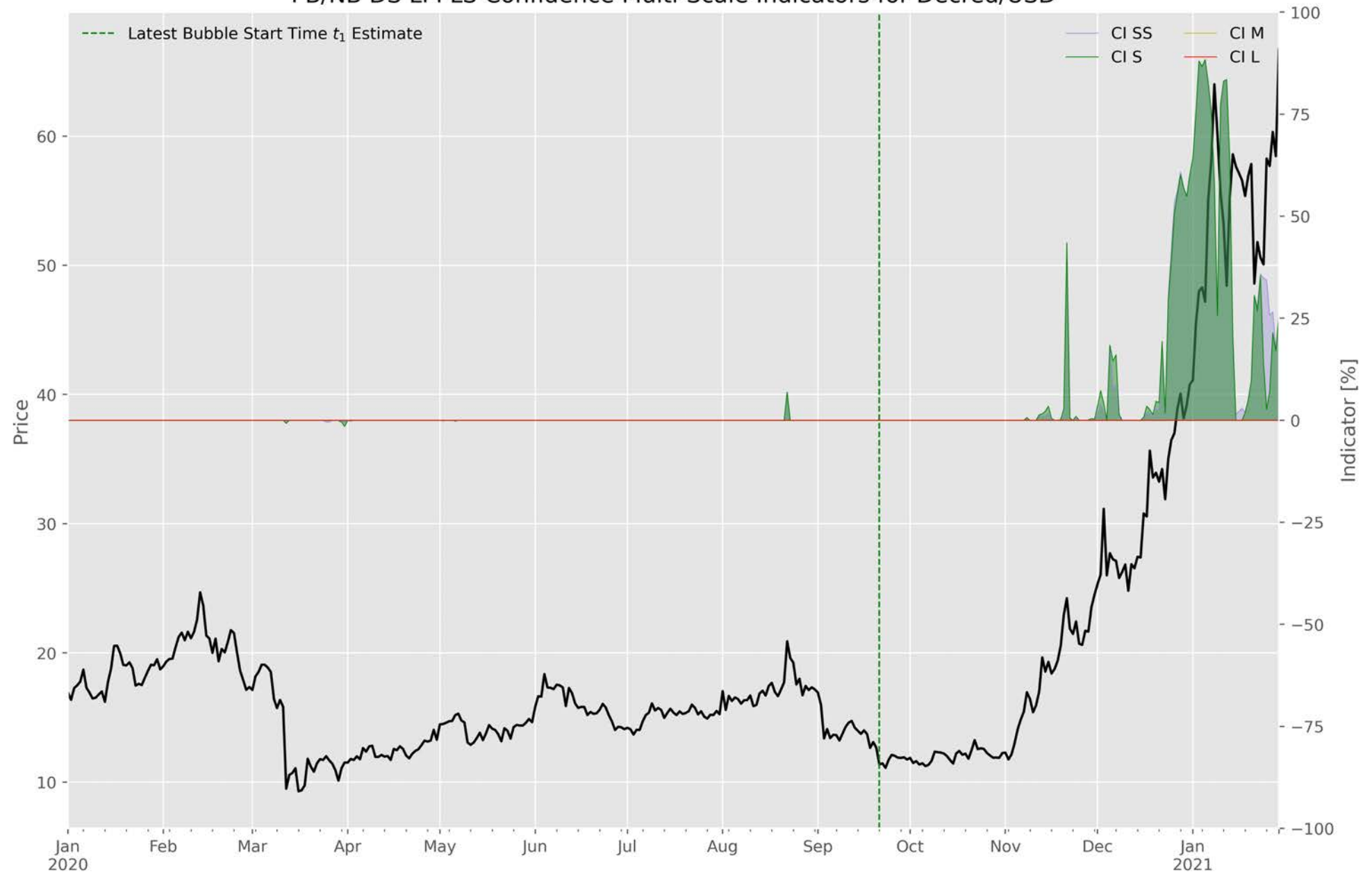
PB/NB DS LPPLS Confidence Multi-Scale Indicators for CasinoCoin/USD

Sectors

| GICS Industry Group Name	Yearly Return		Bubble Size		Bubble Score		Value Score		Growth Score	
	Feb 1st	Jan 1st	Feb 1st	Jan 1st	Feb 1st	Jan 1st	Feb 1st	Jan 1st	Feb 1st	Jan 1st
Pharmaceuticals, Biotechnology & Life Sciences	7.7%	5.7%	0.0%	0.0%	0.0%	0.0%	66.6%	65.4%	49.3%	48.7%
Consumer Services	-5.6%	-1.7%	0.0%	57.7%	0.0%	33.5%	24.0%	26.5%	53.6%	45.0%
Retailing	33.5%	43.3%	0.0%	0.0%	0.0%	0.0%	21.6%	22.2%	51.2%	49.2%
Transportation	9.5%	13.7%	0.0%	0.0%	0.0%	0.0%	46.6%	56.0%	49.7%	48.4%
Consumer Durables & Apparel	17.5%	18.8%	0.0%	0.0%	0.0%	0.0%	34.3%	32.7%	53.5%	61.9%
Semiconductors & Semiconductor Equipment	39.4%	43.5%	0.0%	0.0%	0.0%	0.0%	63.4%	61.0%	32.1%	37.9%
Technology Hardware & Equipment	44.1%	46.8%	79.4%	0.0%	32.0%	0.0%	68.2%	65.0%	45.8%	44.8%
Automobiles & Components	68.9%	63.6%	64.8%	0.0%	17.6%	0.0%	68.0%	73.1%	61.3%	57.6%
Telecommunication Services	-4.2%	-1.0%	0.0%	0.0%	0.0%	0.0%	63.2%	60.9%	41.1%	43.7%
Energy	-26.3%	-34.2%	0.0%	0.0%	0.0%	0.0%	54.4%	52.5%	61.7%	63.9%
Software & Services	18.9%	31.1%	0.0%	0.0%	0.0%	0.0%	31.5%	33.3%	50.2%	50.2%
Materials	18.8%	19.1%	0.0%	0.0%	0.0%	0.0%	50.6%	50.9%	55.3%	53.0%
Health Care Equipment & Services	14.6%	16.4%	0.0%	0.0%	0.0%	0.0%	55.2%	53.5%	49.7%	53.5%
Capital Goods	4.4%	6.5%	0.0%	0.0%	0.0%	0.0%	48.0%	48.4%	49.6%	47.1%
Media & Entertainment	23.7%	26.5%	0.0%	0.0%	0.0%	0.0%	29.1%	26.1%	31.1%	35.7%
Commercial & Professional Services	0.9%	9.6%	0.0%	0.0%	0.0%	0.0%	27.3%	29.1%	54.0%	54.2%
Food & Staples Retailing	9.1%	12.0%	0.0%	0.0%	0.0%	0.0%	42.6%	42.8%	58.0%	57.8%
Household & Personal Products	3.3%	10.3%	0.0%	0.0%	0.0%	0.0%	36.4%	33.3%	49.2%	49.4%
Food, Beverage & Tobacco	-4.8%	-0.4%	0.0%	0.0%	0.0%	0.0%	46.7%	49.2%	53.9%	54.0%
Utilities	-5.6%	0.5%	0.0%	0.0%	0.0%	0.0%	47.2%	47.6%	45.1%	45.2%
Insurance	-10.2%	-4.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Real Estate	-12.1%	-8.5%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Diversified Financials	4.8%	8.3%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Banks	-13.6%	-12.4%	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.

▸ There are two positive bubbles identified in the 24 MSCI World Industry Group Indices: *Technology Hardware & Equipment,* and *Automobiles & Components.* The high bubble scores indicate that this industry index may face a high probability of correction in the near future. We identified last month that the *Consumer Services* industry group has a significant bubble, and it has been developing into a correction in the past month, as showed below.
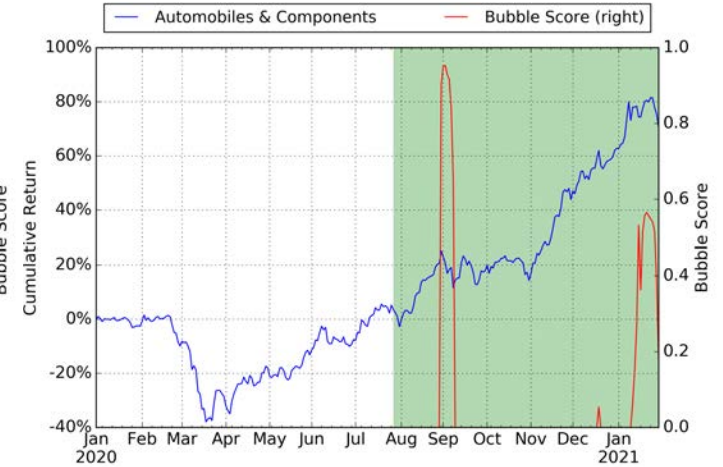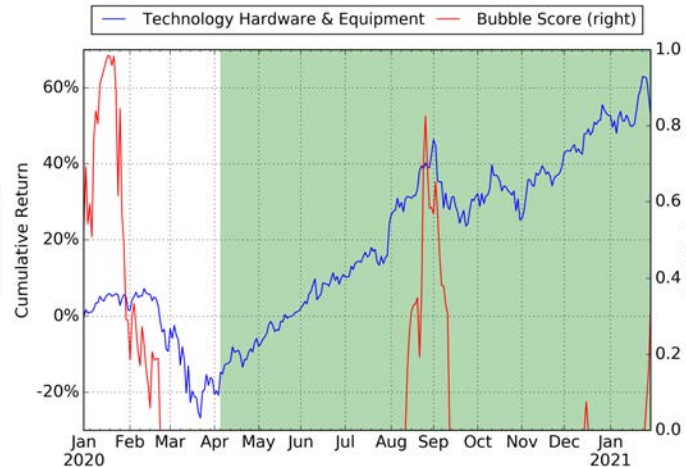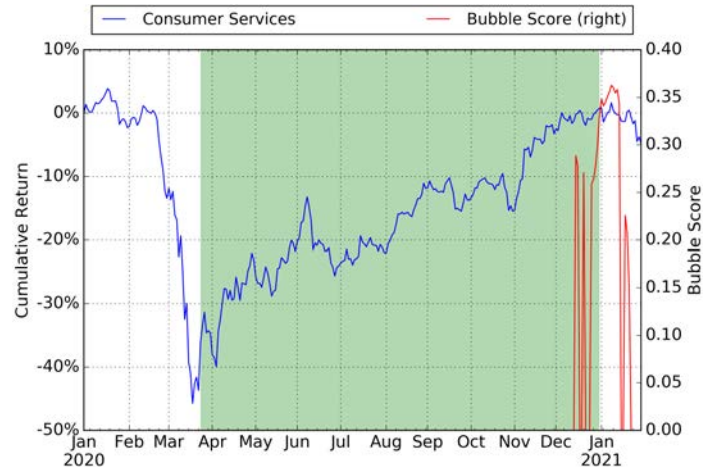
Portfolio Construction & Performance

▸ 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.

ETH *zürich*

Portfolio Construction & Performance

▶ The Long portfolios have continued to outperform other portfolios while we have seen signs of lost of momentums of the market. Contrarian Portfolios are more delicate to use due to their sensitivity to timing the expected reversal and exhibit very volatile performances. We expect trend-following positions to perform in the months following the position set-up and then contrarian positions to over-perform over longer time scales over which the predicted corrections play out.
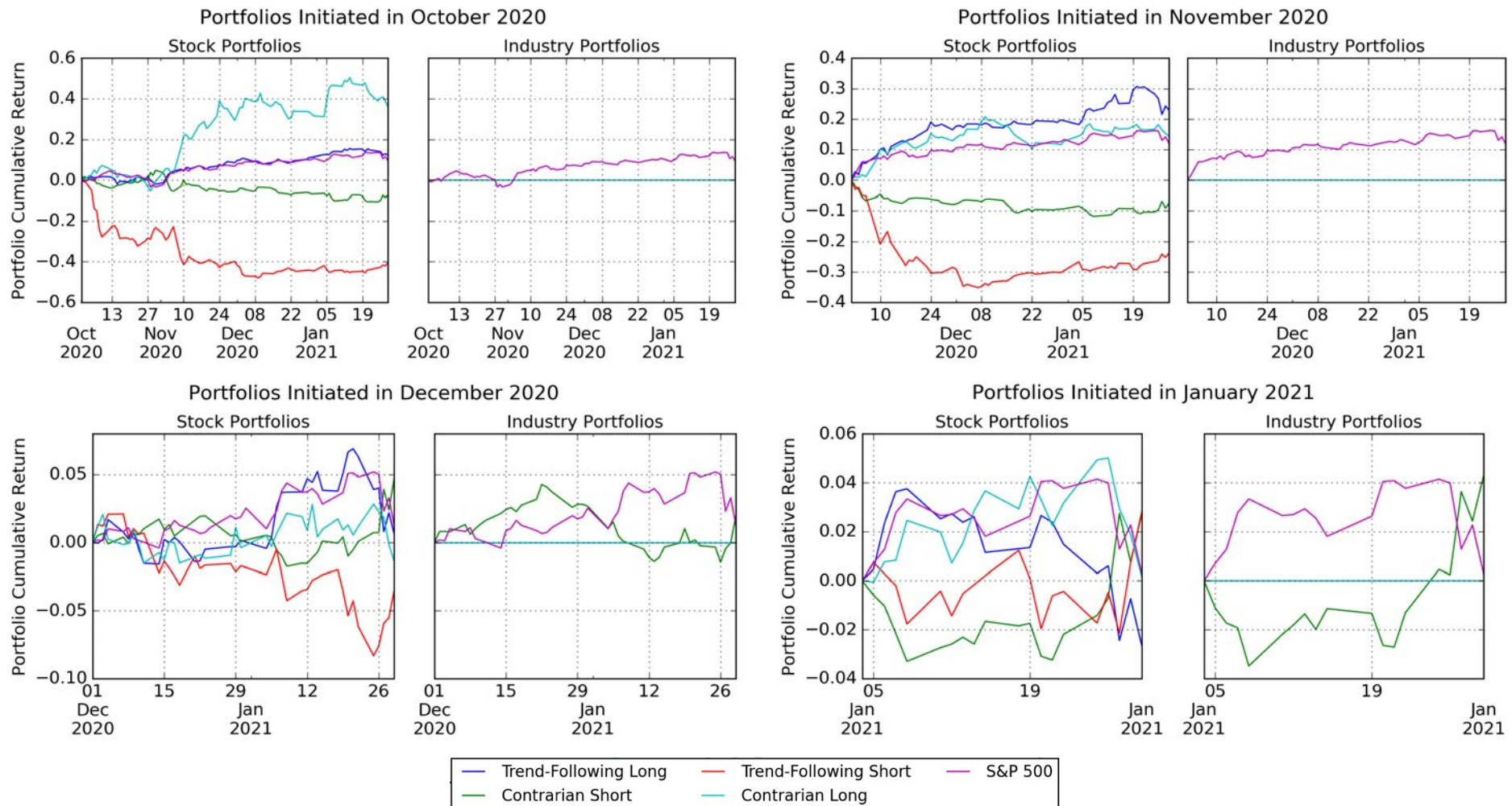
Single Stocks

We can divide the stocks into four quadrants[1]

The four quadrants: value versus bubble score
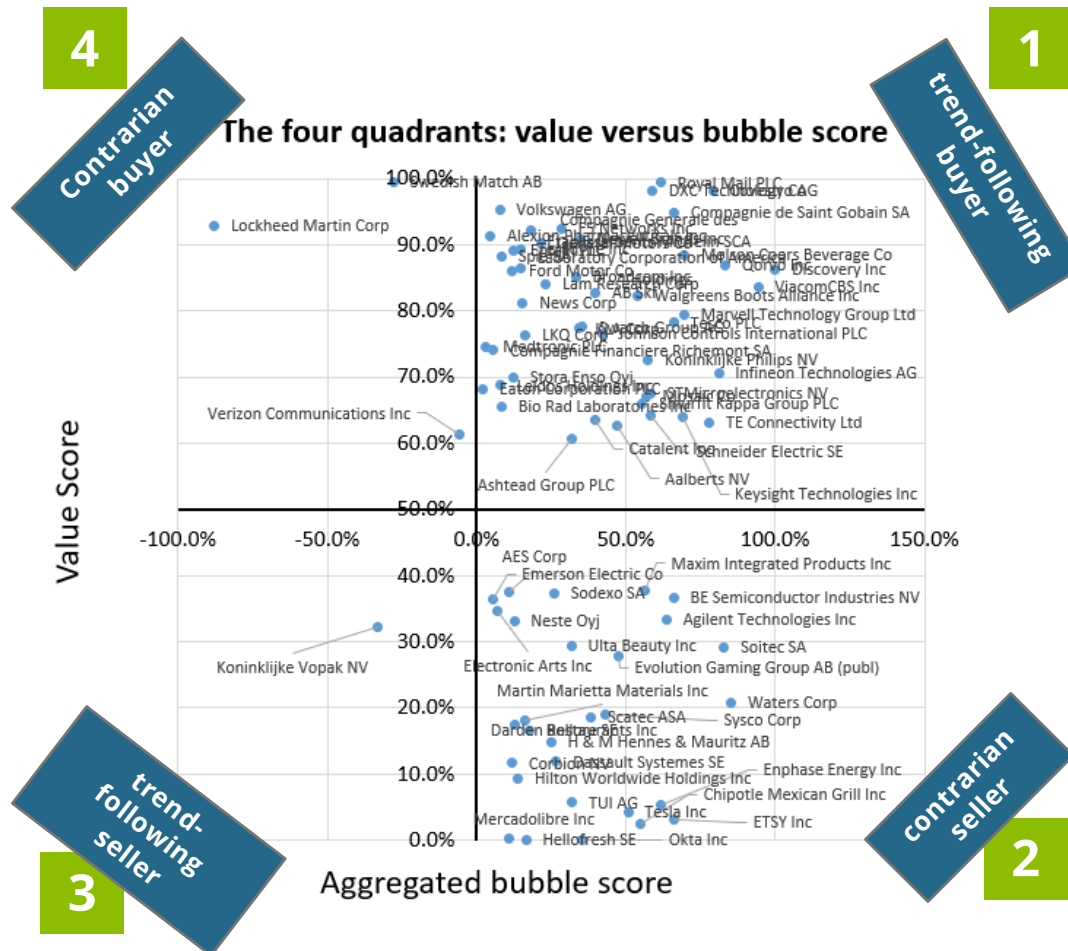
- ▶ **Quadrant 1**: Stocks with a strong value score are cheap relative to their earnings potential. The strong positive bubble signal should be interpreted as a momentum indicator possibly the consequence of a repricing based on the fundamentals. As an investor, one could be a **trend-following buyer**. E.g. Volkswagen AG.

- ▶ **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. Sysco Corp.

- ▶ **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. Koninklijke Vopak NV

- ▶ **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. Lockheed Martin Corp

*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%.

Single Stocks

▸ For 823 stocks, we calculate the **bubble warning indicators** as well as two financial strength indicators, which indicate the **fundamental value** of the stock and the **growth capability** respectively.

▸ 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
Marvell Technology Group Ltd	Bermuda	Semiconductors & Semiconductor Equipment	113.1%	42.3%	Jul-20	69.4%	79.4%	64.8%
Swatch Group AG	Switzerland	Consumer Durables & Apparel	1.7%	35.7%	Jun-20	35.3%	77.6%	93.9%
TE Connectivity Ltd	Switzerland	Technology Hardware & Equipment	29.2%	49.3%	May-20	78.0%	63.2%	25.0%
Compagnie Financiere Richemont SA	Switzerland	Consumer Durables & Apparel	12.0%	46.7%	Jul-20	5.6%	74.0%	96.2%
Covestro AG	Germany	Materials	48.0%	60.8%	May-20	79.1%	98.2%	49.2%
Infineon Technologies AG	Germany	Semiconductors & Semiconductor Equipment	52.5%	109.7%	Apr-20	81.0%	70.6%	59.4%
Volkswagen AG	Germany	Automobiles & Components	-4.8%	38.5%	Apr-20	7.6%	95.3%	95.6%
Stora Enso Oyj	Finland	Materials	23.2%	62.2%	Mar-20	12.4%	69.9%	88.3%
Compagnie Generale des Etablissements Michelin SCA	France	Automobiles & Components	6.7%	28.6%	Jun-20	17.9%	92.2%	92.6%
Schneider Electric SE	France	Capital Goods	26.8%	33.1%	Jun-20	58.1%	64.2%	14.2%
Compagnie de Saint Gobain SA	France	Capital Goods	16.9%	47.6%	May-20	66.1%	94.8%	11.0%
Spie SA	France	Commercial & Professional Services	1.5%	35.6%	Apr-20	8.4%	88.1%	22.7%
Ashtead Group PLC	United Kingdom	Capital Goods	39.3%	76.2%	Apr-20	31.9%	60.7%	84.4%
Tesco PLC	United Kingdom	Food & Staples Retailing	-6.8%	9.5%	Aug-20	66.0%	78.2%	21.8%
Royal Mail PLC	United Kingdom	Transportation	129.4%	203.1%	Mar-20	61.6%	99.4%	15.9%
Smurfit Kappa Group PLC	Ireland; Republic of	Materials	13.3%	66.3%	Mar-20	55.6%	66.0%	88.5%
Eaton Corporation PLC	Ireland; Republic of	Capital Goods	14.4%	28.0%	Jun-20	2.1%	68.2%	68.2%
Medtronic PLC	Ireland; Republic of	Health Care Equipment & Services	-6.7%	22.5%	Jun-20	3.2%	74.5%	79.6%
Johnson Controls International PLC	Ireland; Republic of	Capital Goods	22.9%	48.4%	Jun-20	41.9%	76.5%	46.0%
Entain PLC	Isle of Man	Consumer Services	37.0%	102.9%	Apr-20	12.4%	89.0%	87.3%
Koninklijke Philips NV	Netherlands	Health Care Equipment & Services	3.4%	9.4%	Aug-20	57.4%	72.5%	8.8%
STMicroelectronics NV	Switzerland	Semiconductors & Semiconductor Equipment	20.7%	48.8%	Apr-20	58.2%	67.6%	21.9%
Aalberts NV	Netherlands	Capital Goods	-9.7%	69.0%	Mar-20	47.1%	62.5%	3.0%

Single Stocks

Quadrant 1 stocks: strong positive bubble signals with strong fundamentals (cont'd)

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
AB Skf	Sweden	Capital Goods	19.0%	31.6%	Jul-20	39.7%	82.7%	16.3%
Alexion Pharmaceuticals Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	51.8%	42.0%	Jul-20	4.6%	91.3%	25.7%
Bio Rad Laboratories Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	55.2%	24.6%	May-20	8.4%	65.4%	71.6%
Broadcom Inc	United States of America	Semiconductors & Semiconductor Equipment	43.4%	51.1%	Jun-20	33.2%	85.1%	54.4%
Catalent Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	94.0%	30.6%	Jul-20	39.6%	63.6%	35.7%
DXC Technology Co	United States of America	Software & Services	-10.8%	90.9%	Jun-20	58.8%	98.1%	3.5%
Discovery Inc	United States of America	Media & Entertainment	38.9%	103.5%	Jul-20	100.0%	86.3%	68.1%
F5 Networks Inc	United States of America	Technology Hardware & Equipment	54.4%	42.0%	Jul-20	28.4%	92.4%	52.5%
Ford Motor Co	United States of America	Automobiles & Components	30.6%	110.2%	Mar-20	11.9%	86.0%	91.6%
General Motors Co	United States of America	Automobiles & Components	48.0%	140.1%	Mar-20	21.4%	90.3%	12.2%
KLA Corp	United States of America	Semiconductors & Semiconductor Equipment	65.8%	88.6%	Apr-20	34.1%	77.3%	36.3%
Keysight Technologies Inc	United States of America	Technology Hardware & Equipment	49.8%	49.1%	Sep-20	69.1%	64.1%	29.9%
LKQ Corp	United States of America	Retailing	5.7%	29.8%	May-20	16.4%	76.3%	55.4%
Laboratory Corporation of America Holdings	United States of America	Health Care Equipment & Services	24.7%	43.4%	Apr-20	14.8%	86.5%	57.1%
Lam Research Corp	United States of America	Semiconductors & Semiconductor Equipment	51.3%	105.9%	May-20	23.2%	84.1%	29.1%
Leidos Holdings Inc	United States of America	Software & Services	-4.1%	19.9%	Jul-20	7.9%	68.7%	32.0%
Molson Coors Beverage Co	United States of America	Food, Beverage & Tobacco	-13.3%	45.7%	Jun-20	69.6%	88.5%	7.7%
Mosaic Co	United States of America	Materials	30.9%	107.5%	Jun-20	56.6%	67.1%	90.0%
Newell Brands Inc	United States of America	Consumer Durables & Apparel	19.0%	50.8%	Jun-20	34.7%	90.8%	13.4%
News Corp	United States of America	Media & Entertainment	41.0%	69.4%	May-20	15.4%	81.1%	12.9%
Qorvo Inc	United States of America	Semiconductors & Semiconductor Equipment	62.2%	40.7%	Sep-20	83.3%	86.9%	30.9%
Teradyne Inc	United States of America	Semiconductors & Semiconductor Equipment	60.9%	96.2%	May-20	14.8%	89.3%	30.3%
ViacomCBS Inc	United States of America	Media & Entertainment	41.8%	102.1%	Jun-20	94.2%	83.6%	93.8%
Walgreens Boots Alliance Inc	United States of America	Food & Staples Retailing	-5.9%	36.7%	Sep-20	53.8%	82.2%	34.2%

Single Stocks

Quadrant 1 Stocks Current Month Example – Discovery Inc.
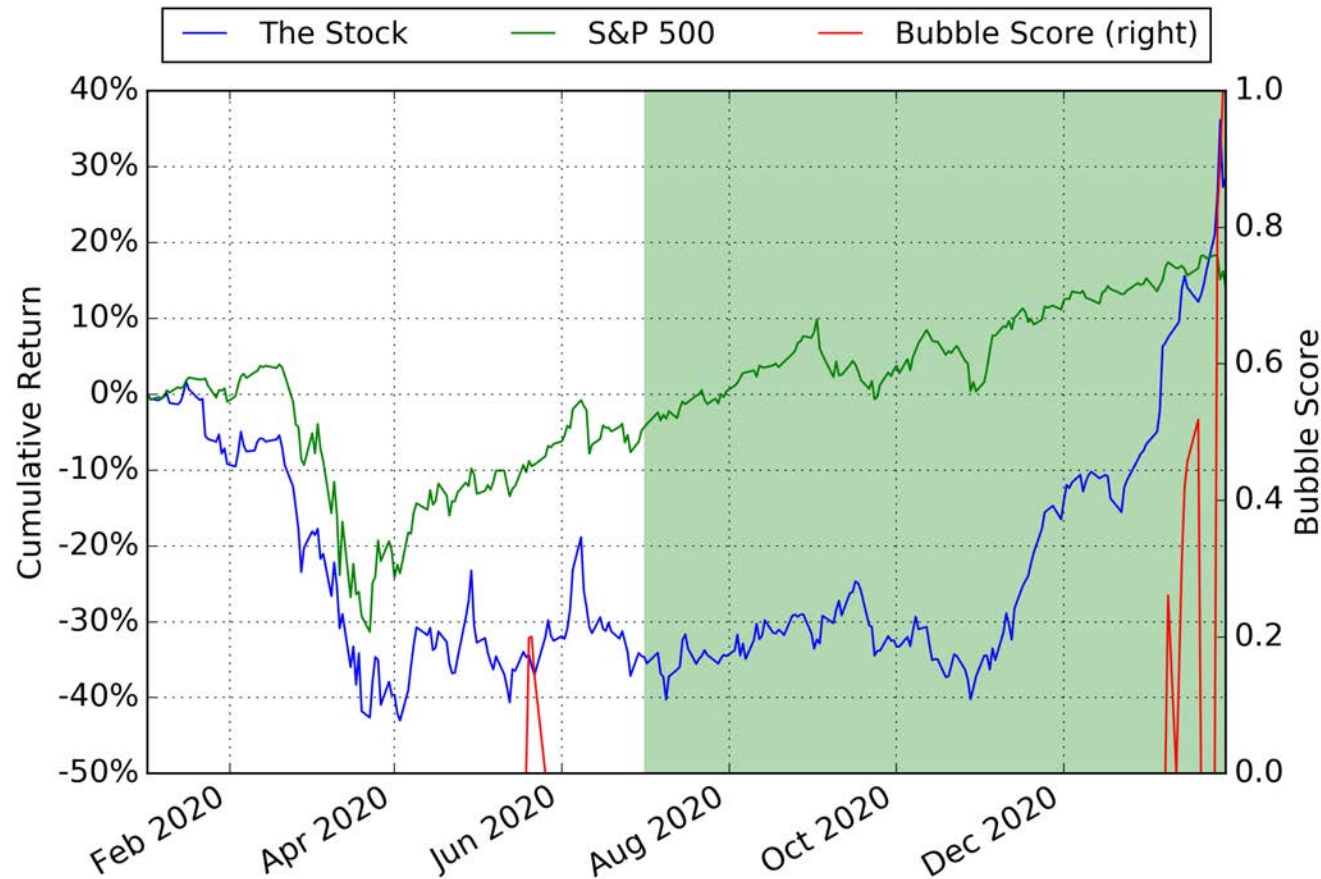
▶ The above graph shows the one-year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period delineates the time interval within which the positive bubble is identified. The Bubble Score of this seven-month bubble has reached 100% with a bubble size 103.5%.

Single Stocks

Quadrant 1 Stocks Last Month Example – Vestas Wind Systems A/S.
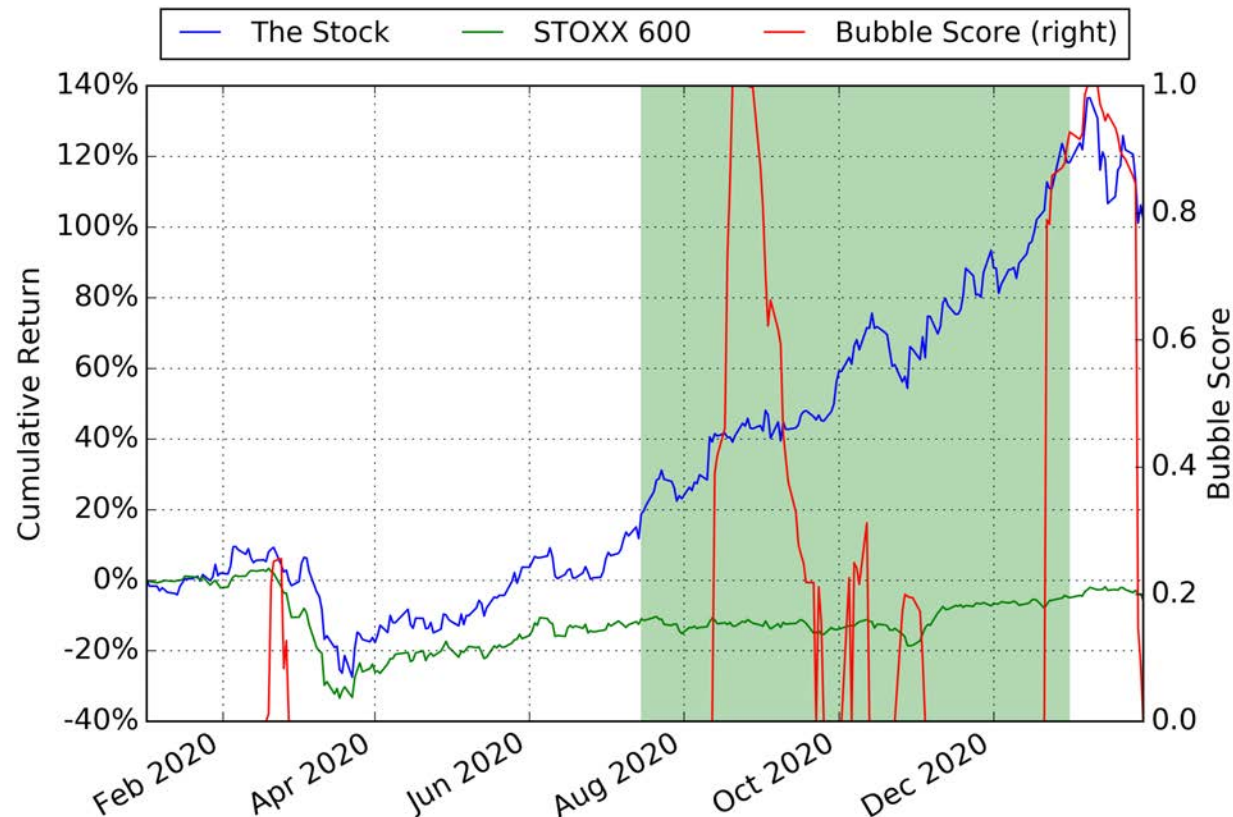
The figure above plots the one-year cumulative return of the stock (blue), STOXX 600 (green) and LPPLS Bubble Score (red lines on the right y-axis). The green shaded period delineates the time interval within which a strong positive bubble has been identified and reported last month. The stock price's regime has shifted with a correction of 30% and a recent disappearance of the DS LPPLS Bubble signal, which is in agreement with our diagnostic last month of a strong LPPLS bubble signal.

Single Stocks

Quadrant 2 stocks: strong positive bubble signals with weak fundamentals

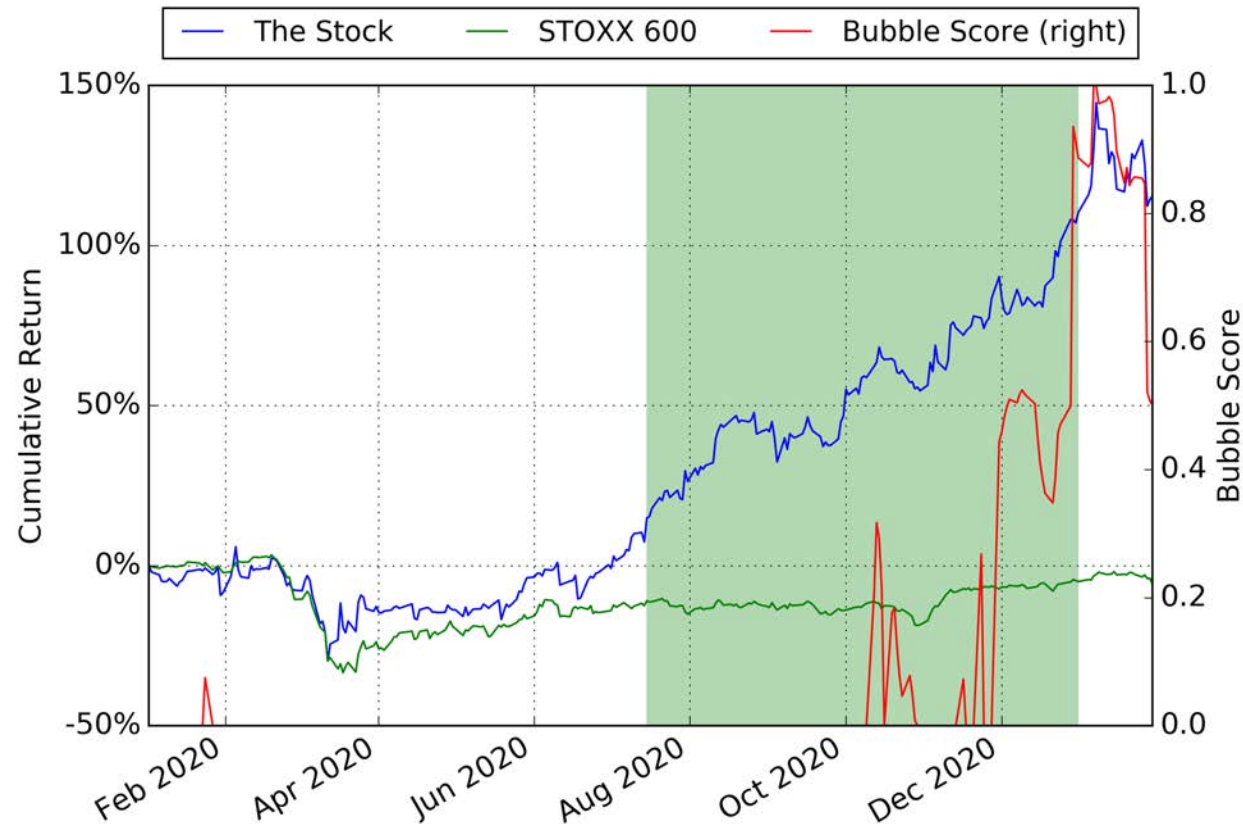| Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Hellofresh SE	Germany	Retailing	206.8%	55.1%	Jul-20	16.5%	0.0%	43.1%
TUI AG	Germany	Consumer Services	-38.2%	66.9%	Jul-20	32.0%	5.7%	99.9%
Neste Oyj	Finland	Energy	52.5%	67.9%	May-20	12.5%	33.0%	19.8%
Bollore SE	France	Media & Entertainment	-10.4%	19.6%	Jun-20	17.7%	16.5%	98.1%
Sodexo SA	France	Consumer Services	-25.3%	20.4%	Jul-20	26.0%	37.3%	9.6%
Dassault Systemes SE	France	Software & Services	5.9%	13.0%	Jul-20	26.7%	11.9%	42.5%
Soitec SA	France	Semiconductors & Semiconductor Equipment	86.2%	121.3%	Apr-20	82.9%	29.1%	17.5%
Corbion NV	Netherlands	Materials	53.7%	47.3%	Apr-20	11.9%	11.6%	80.5%
BE Semiconductor Industries NV	Netherlands	Semiconductors & Semiconductor Equipment	43.9%	48.1%	Sep-20	66.0%	36.6%	23.3%
Scatec ASA	Norway	Utilities	99.4%	101.9%	May-20	38.4%	18.5%	83.2%
H & M Hennes & Mauritz AB	Sweden	Retailing	-12.4%	45.3%	Mar-20	24.9%	14.9%	45.8%
Evolution Gaming Group AB (publ)	Sweden	Consumer Services	159.3%	35.3%	Jul-20	47.3%	27.9%	63.6%
AES Corp	United States of America	Utilities	18.9%	92.7%	Mar-20	10.8%	37.6%	26.2%
Agilent Technologies Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	42.3%	22.7%	Sep-20	63.6%	33.4%	49.4%
Chipotle Mexican Grill Inc	United States of America	Consumer Services	66.2%	52.3%	May-20	54.8%	2.5%	62.5%
Darden Restaurants Inc	United States of America	Consumer Services	-4.0%	98.3%	Apr-20	12.8%	17.4%	17.3%
Electronic Arts Inc	United States of America	Media & Entertainment	31.7%	15.2%	Sep-20	7.0%	34.6%	24.0%
Emerson Electric Co	United States of America	Capital Goods	8.1%	28.2%	May-20	5.6%	36.3%	23.1%
Enphase Energy Inc	United States of America	Semiconductors & Semiconductor Equipment	372.3%	205.7%	Jul-20	61.7%	5.3%	62.0%
ETSY Inc	United States of America	Retailing	295.3%	90.4%	Jul-20	66.2%	3.0%	44.1%
Hilton Worldwide Holdings Inc	United States of America	Consumer Services	-9.0%	34.7%	May-20	13.8%	9.3%	41.6%
Martin Marietta Materials Inc	United States of America	Materials	3.8%	57.9%	Mar-20	16.1%	18.2%	77.4%
Maxim Integrated Products Inc	United States of America	Semiconductors & Semiconductor Equipment	39.2%	28.2%	Aug-20	56.3%	37.7%	66.8%
Mercadolibre Inc	Argentina	Retailing	170.3%	63.7%	Sep-20	10.9%	0.3%	74.0%
Okta Inc	United States of America	Software & Services	90.8%	46.0%	May-20	35.3%	0.1%	61.5%
Sysco Corp	United States of America	Food & Staples Retailing	-7.1%	54.3%	Mar-20	43.3%	19.0%	42.2%
Tesla Inc	United States of America	Automobiles & Components	414.4%	116.6%	Sep-20	50.7%	4.2%	70.7%
Ulta Beauty Inc	United States of America	Retailing	-4.6%	23.9%	Jun-20	31.7%	29.4%	52.2%
Waters Corp	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	20.8%	24.4%	Jul-20	85.2%	20.7%	39.0%

Single Stocks

Quadrant 2 Stocks Current Month Example – Soitec SA.
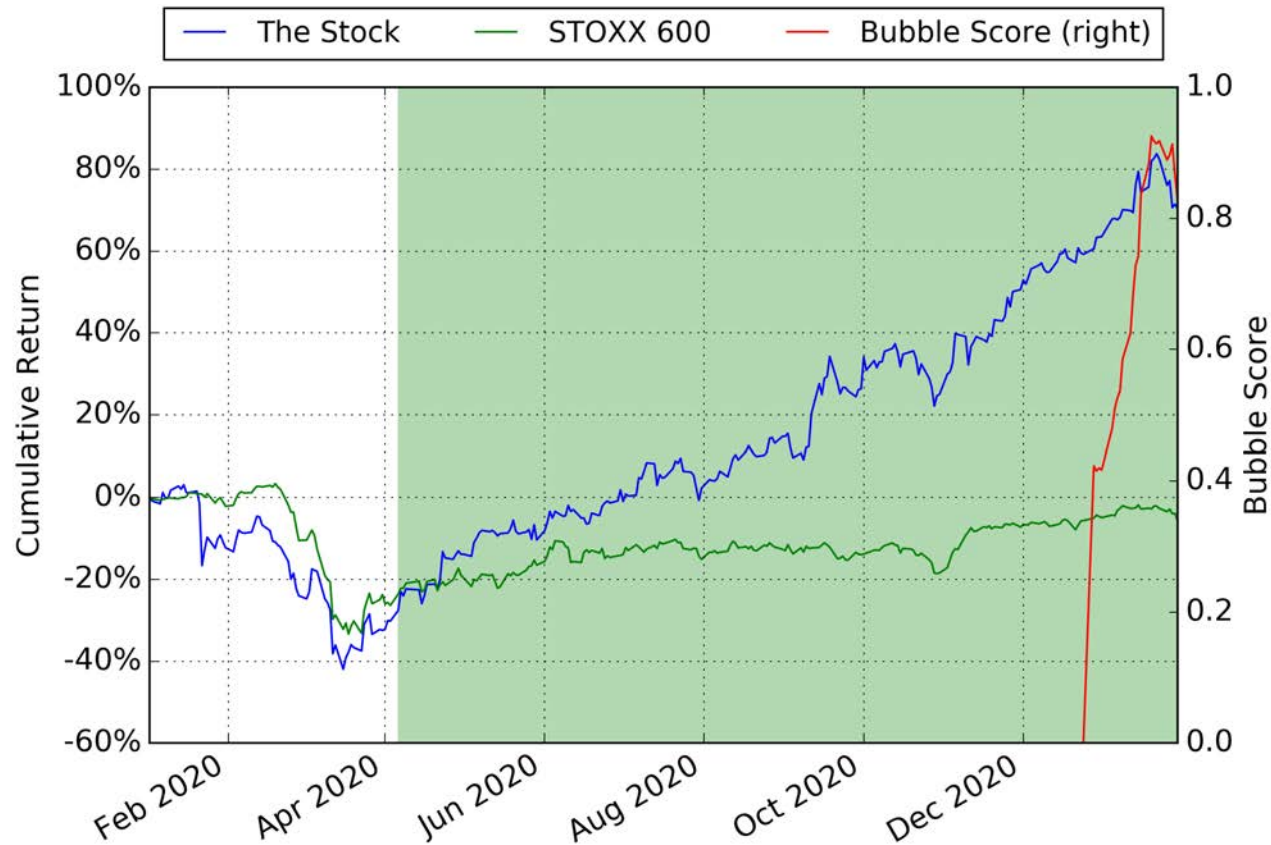
▸ The above graph shows the one-year cumulative return of the stock in blue (left hand scale), STOXX 600 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The green shaded period delineates the time interval within which the positive bubble is identified. The Bubble Score of this ten-month bubble has reached 82.9% with a bubble size 121.3%. The strong positive bubble signal and weak fundamentals indicate a high probability of correction in the future.

Single Stocks

Quadrant 2 Stocks Last Month Example – Siemens Gamesa Renewable Energy SA.

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 stock price's regime has shifted with a correction of 20%, which is in agreement with our diagnostic last 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
Koninklijke Vopak NV	Netherlands	Energy	-14.9%	-13.8%	Jul-20	-33.3%	32.3%	86.0%

Single Stocks

Quadrant 3 Stocks Current Month Example – Koninklijke Vopak NV.
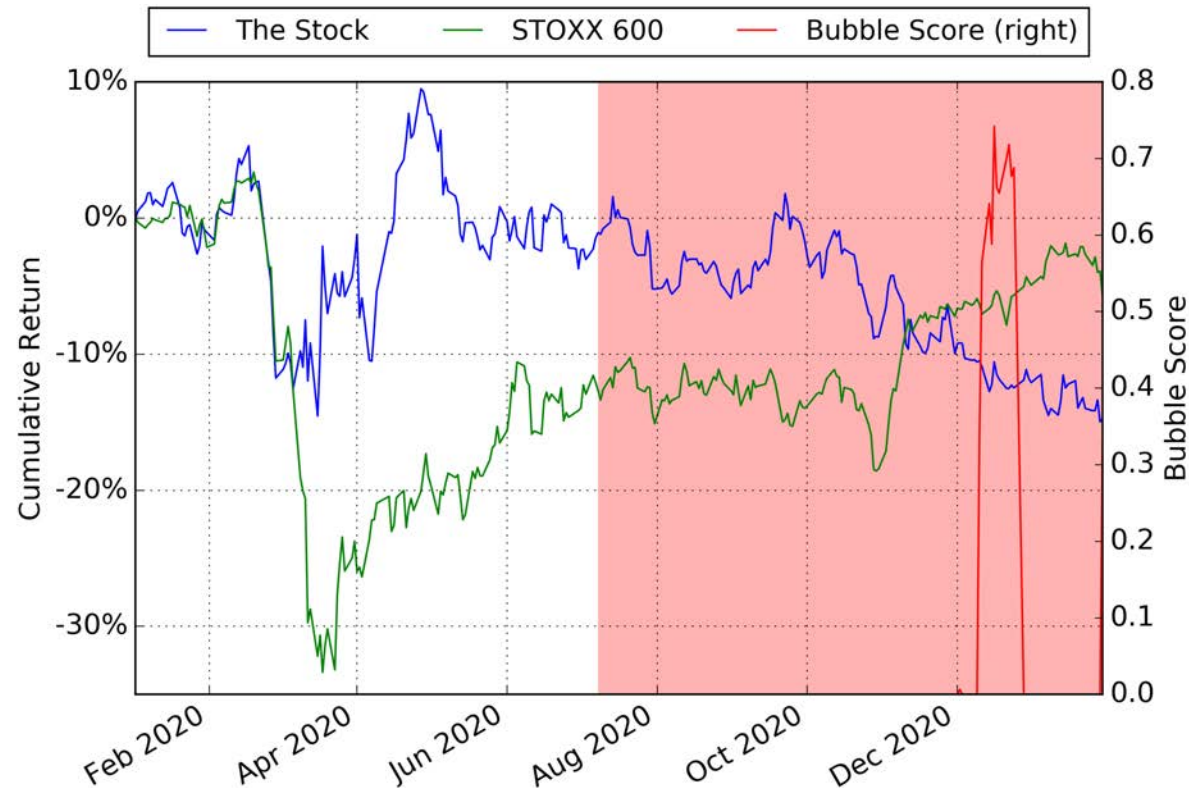
▸ The above graph shows the one-year cumulative return of the stock in blue (left hand scale), STOXX 600 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period delineates the time interval within which the negative bubble is identified. The Bubble Score of this seven-month bubble has reached 33.3% with a bubble size -13.8%. This negative bubble is not yet matured and may continue to develop.

Single Stocks

Quadrant 3 Stocks Last Month Example – HomeServe PLC.
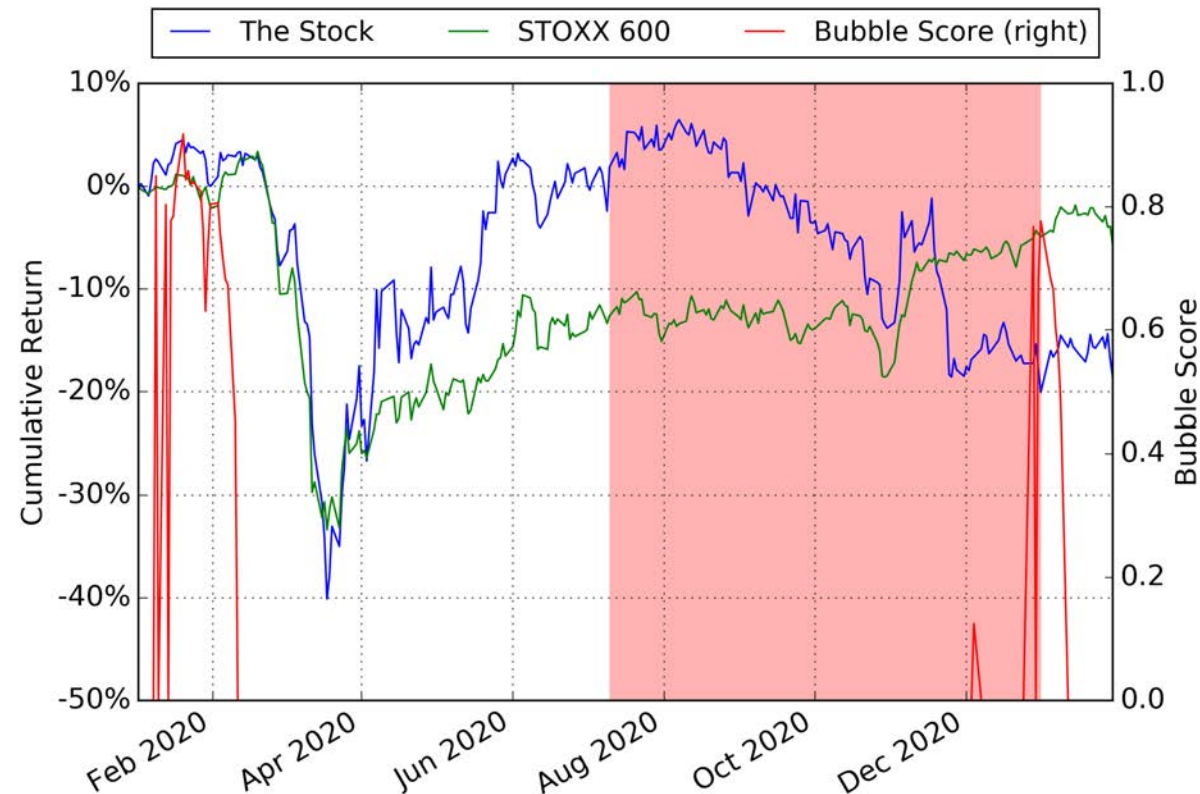
▸ The figure above plots the one-year cumulative return of the stock (blue), STOXX 600 (green) and LPPLS Bubble Score (red line on the right y-axis). The red shaded period delineates the time interval within which the strong negative bubble was identified and reported last month. The stock price has been flat in the past month, with the disappearance of the DS LPPLS Bubble signal. One should remain cautious about this stock given the weak fundamentals.

ETH zürich

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
Swedish Match AB	Sweden	Food, Beverage & Tobacco	16.2%	-8.5%	Sep-20	-27.9%	99.5%	36.9%
Lockheed Martin Corp	United States of America	Capital Goods	-26.8%	-14.2%	Jul-20	-87.8%	92.8%	48.5%
Verizon Communications Inc	United States of America	Telecommunication Services	-9.1%	-9.5%	Sep-20	-5.7%	61.3%	45.1%

Single Stocks

Quadrant 4 Stocks Current Month Example – Lockheed Martin Corp.
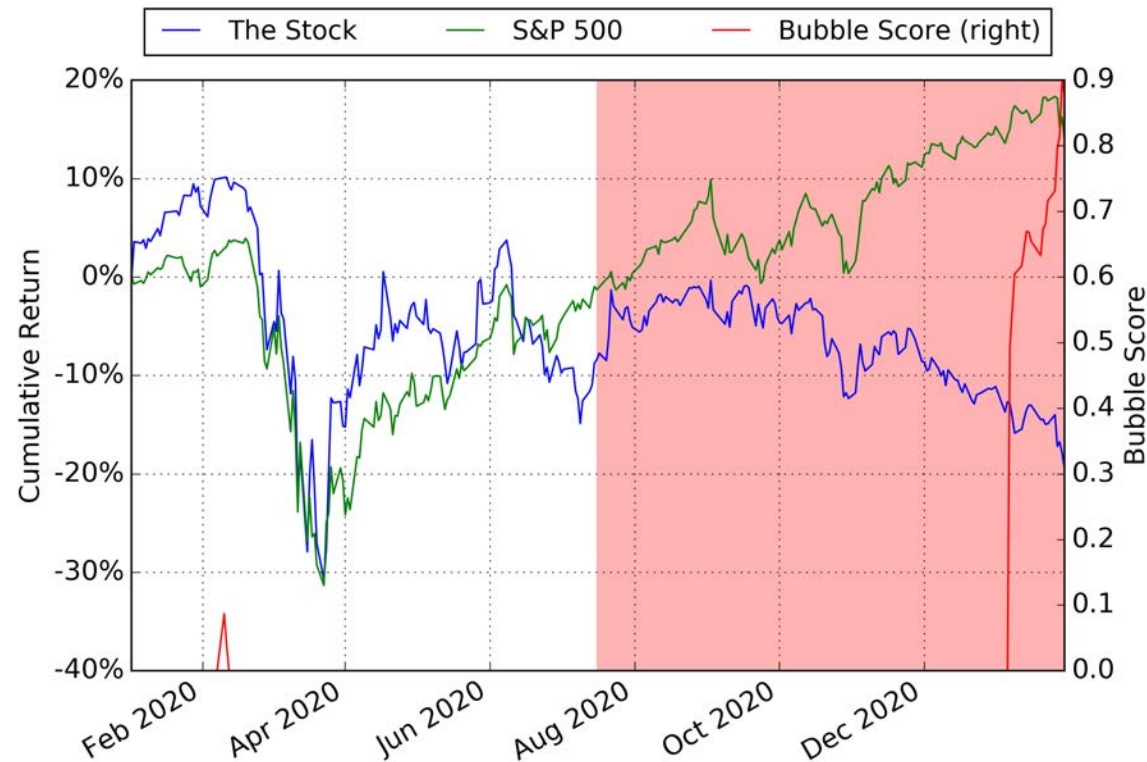
▸ The above graph shows the one-year cumulative return of the stock in blue (left hand scale), S&P 500 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period delineates the time interval within which the strong negative bubble is identified. The Bubble Score of this six-month bubble has reached 87.8% with a negative bubble size -14.2%. We expect a rebound in the future when the bubble is mature, 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 – Ucb SA.
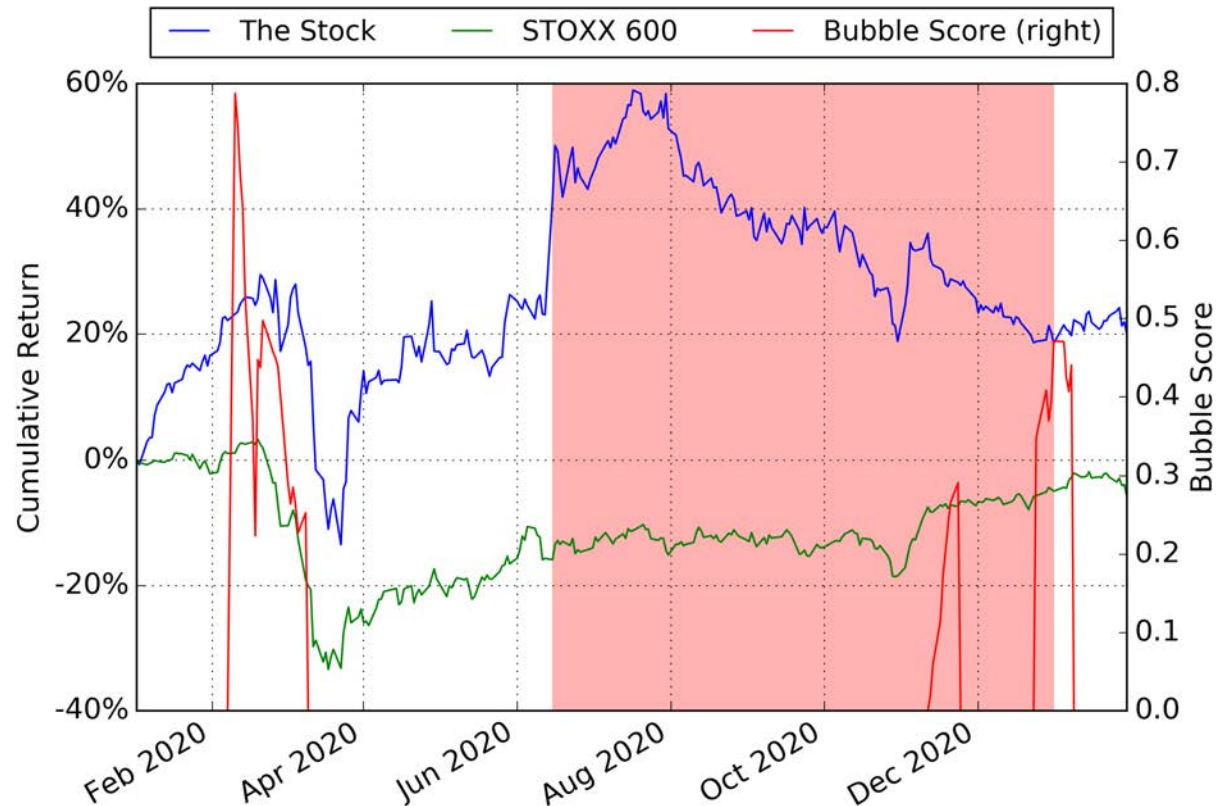
▸ The figure above plots the one-year cumulative return of the stock (blue), STOXX 600 (green) and LPPLS Bubble Score (red line on the right y-axis). The red shaded period delineates the time interval within which the strong negative bubble was identified and reported last month. The stock has entered a low volatility slightly increasing trend in the past month, reversing the previous downward momentum. This is in agreement with our bubble signal and the diagnostic of the strong fundamentals.

More Information

> Visit the **Financial Crisis Observatory** for more information
>
> http://www.er.ethz.ch/financial-crisis-observatory.html

> **Contacts ETH Zurich**
>
> **Jan-Christian Gerlach, Didier Sornette, Ke Wu & Dongshuai Zhao**
>
> Chair of Entrepreneurial Risks
> Department of Management, Technology and Economics
>
> ETH Zurich
> Scheuchzerstrasse 7
> 8092 Zurich, Switzerland