



The FCO Cockpit Global Bubble Status Report January 2021



Incomplete version
(due to Eikon connection issues to be
resolved at ETH Zurich)

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Purpose and Benefits

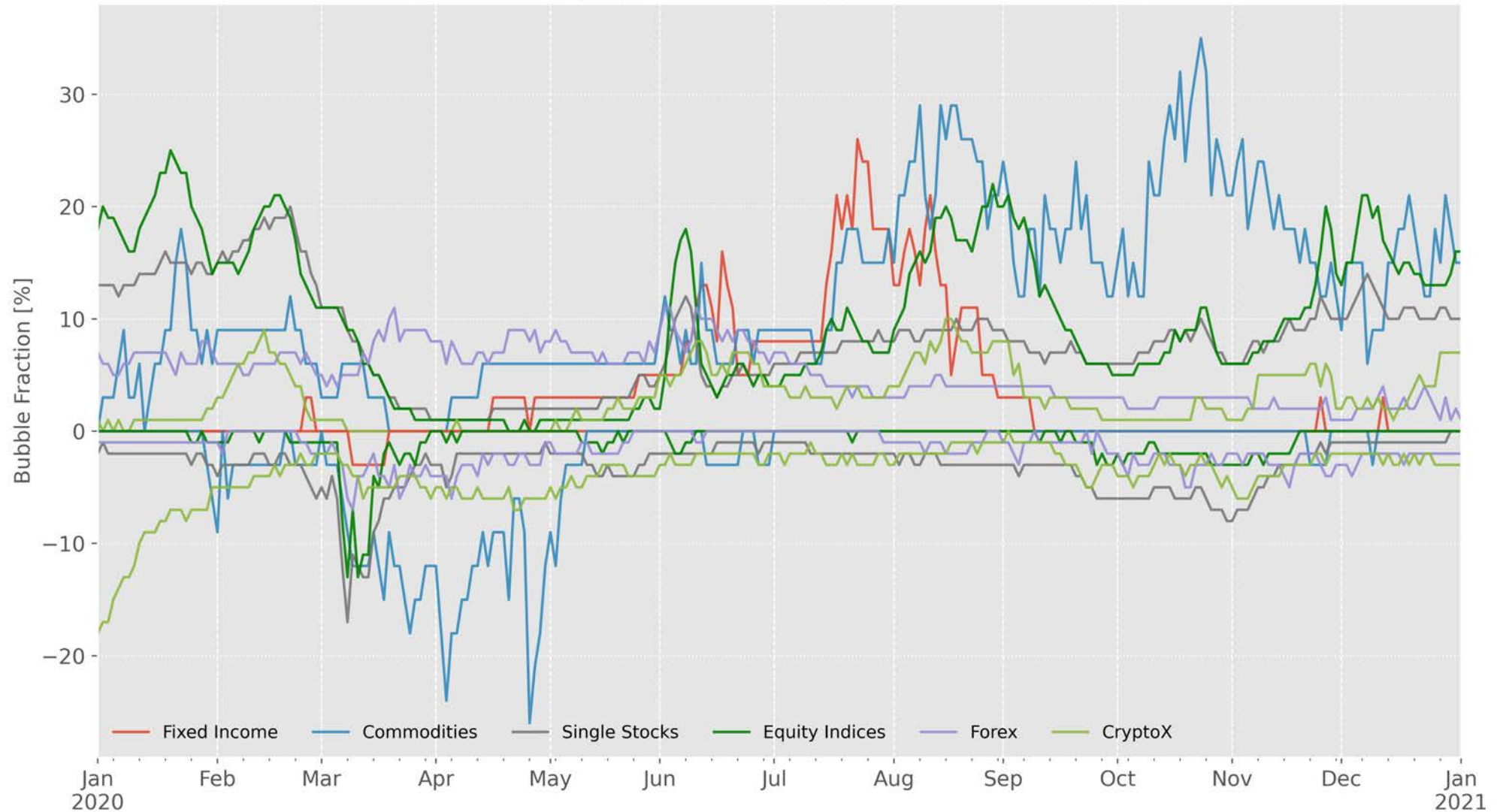
- ▶ The **Financial Crisis Observatory (FCO)** monthly report discusses the historical evolution of bubbles in and between different asset classes and geographies. The purpose of the FCO report is to ascertain which asset classes and sectors are **crowded** and to what degree they develop contagion risks.
- ▶ 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.

Announcement

- ▶ After the previous month's update of the asset class structure and introduction of LPPLS multiscale Confidence Indicators and other metrics, we now add the class CryptoX to the overview plot and table.
- ▶ CryptoX summarizes all crypto-commodities, crypto-currencies and crypto-assets in general, comprising more than 500 different top cryptos, ranked according to their current total market capitalization.

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	15	0
Single Stocks		1612	10	0
	Europe	937	9	1
	United States	669	12	0
Equity Indices		891	16	0
	Europe	57	12	0
	United States	378	13	0
	Global	386	20	0
Forex		100	1	2
CryptoX		569	7	3

FCO Market Outlook

2020 was a complicated year for investors. Many things happened during the year and the market was painful, unsettling, wired, exciting, diverging, irrational.... The COVID-19 not only creates a distanced world, but also a negative-growth, ultra-low interest-rate economic environment. The pandemic, as a strong technology catalyst, enables those companies who can deliver growth or telling promising stories (mainly the “stay-at-home” businesses) to absorb disproportionate attention from both consumers and investors.

The current second wave of lockdowns and the mutations of the virus add some risks and uncertainty, but the long-awaited second CARES Act might bring some hopes. However, according to Biden, the delay of massive vaccination might still cast some shadow on the recovery.

Lets' discuss some asset classes:

Fixed income: During the past 4 decades, the bond was the leading hero of investment portfolios. Mostly negatively correlated with equities, bonds generated steady high risk-adjusted returns and thus provided attractive diversification benefits. Ray Dalio from Bridgewater, Bill Gross from PIMCO, and others built their empires on the decades-long yield-declining trend. But with ultra-low or even negative interest rates, what percentage of capital should institutions allocate into an asset class with almost no positive expected returns? Although the risk of a bond is lower than that of a stock, can the current returns be sufficient to compensate for the existing risks, compared with cash? Apparently not. So maybe reducing the strategic allocation target of bonds and increasing alternative asset class allocation might be a good option. With a new round of fiscal stimulus and massive vaccination approaching, the inflation and economic recovery will gradually come and put upward pressure on the interest rate.

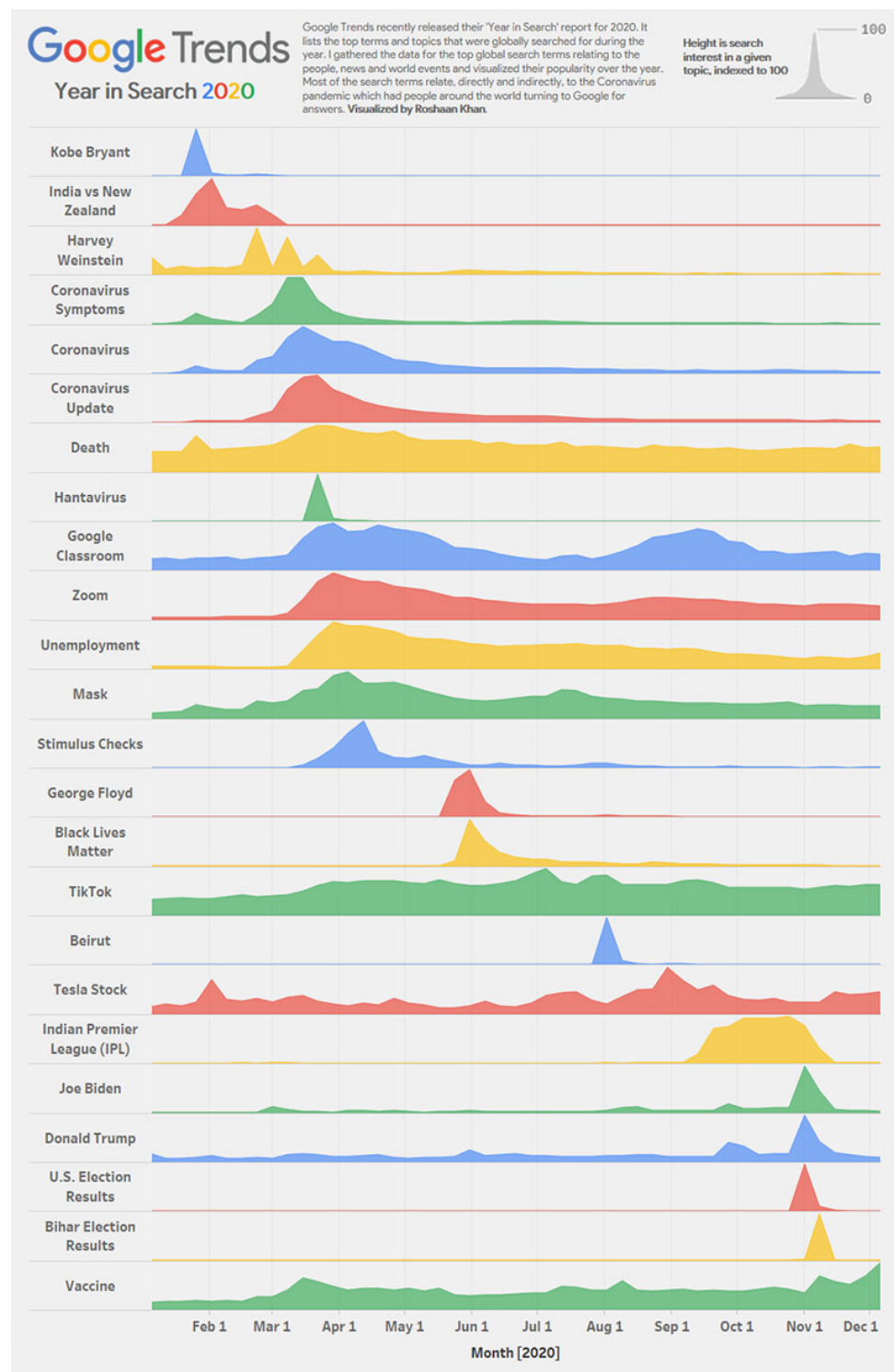
Equity: The market darlings in the US enjoy impressive revenue growth and an extremely high valuation (also with the help of astonishing liquidity provided by the Fed, “the versatile mother”). In contrast, the median stock price only increased by 1.5% in the whole US stock universe, compared with 6.5% increase in median stock prices in Dow Jones; 15.5% for S&P500; 43.8% for Nasdaq, 61% for FAAMG. In a word, big (tech giants) becomes bigger and the average (normal businesses) suffers.

Emerging markets: Due to the early effective measures and heavy stimulation, the Chinese economy has recovered from its bottom. Especially due to the strict control of foreign travelers in late 2020, the Chinese manufactory supply chain has been protected. With the IPO registration coming, the funds still tend to invest into blue-chip stocks. It is believed that, in the coming years, the size effect will be diminishing and the bottom 50% stocks will have less transaction volume, as in a developed market.

Commodities: Most of the hard commodities (e.g. copper, iron ore, Aluminum) and battery/storage materials have kept increasing since our last report. However, Iron ore, copper, and coal price have passed their critical points and might experience some corrections. Besides, the lumber price has increased again since November, booking a 120% yearly gain in 2020. The lockdown has caused a sharp demand for lumber as people are doing more home improvement projects at home while the shutdowns at mills hit supplies. Given the second lockdown continuation, the lumber price is expected to increase in the next few months. In addition, the rubber price has increased 50%, due to the demand for medical gloves, recovery of the auto industry, and output drops in the main producing area (dry winter season).

Currencies and cryptocurrencies: In line with our Dec. FCO report, the US dollar has suffered selling pressure for the whole of December, touching its lowest level in 32 months at 89.6. Rising concerns of debt-monetization and unprecedented spending lead to larger current account deficits (the second wave of lockdown hits production in the US, which leads to more import from other countries), thus making the greenback less attractive. Besides, we notice the alarm signals of Bitcoin and we expected a correction soon.

Real estate: Pandemic has forced millions of Americans to work from home, which leads people to seek out homes with more space. However, due to the lockdown, there might be a shortage of houses for sell (the big price increase of lumber can reflect the shortage), which might still put some upward pressure for the next quarter.



“Long live the Value Investing”

People from both academia and industries argue a lot about “the return of the Value factor”. We would like to share our understanding. The value indicator, P/B ratio or BM (book-to-market) ratio, has been deficient from its very introduction. Recall that it uses the historical balance sheet number (total asset) as a valuation proxy factor to measures the expensiveness of companies. There are fundamental financial and accounting reasons for rejecting the value of this value indicator (pun intended), and for instance, Warren Buffett, the most famous value investor in the world, does not accept the book value as the real value factor. So those who only use the BM factor (or PB ratios) to invest and in this way claim to be value investors do not really come from the village of Graham-and-Doddsville and are not Buffett-style value investors (they are just academic-papers byproduct ratio investors). We also reckon that, to some extent, the argument about value investing is about the divergence of future scenarios.

There are three problems with the academic papers byproduct value factor (BM factor):

- **It ignores the current accounting features.** Under the US GAAP, R&D costs within the scope of ASC 730 are expensed as incurred while under the IFRS (IAS 38), research costs are expensed and only some specific items (high level of technical feasibility) of development costs can be capitalized. Based on these criteria, the *internally developed intangible assets* of the big tech giants, due to the high degree of uncertainty about future economic benefits, *cannot be recognized as assets in the financial balance sheet* and those incurred costs have to be recognized as expense accordingly. For instance, due to the US GAAP accounting principles, Amazon, the largest R&D spender in the whole world did not have much net income for the past 20 years and that is also the reason why many technology companies have very high gross margin but still ridiculous high PE ratios. Moreover, for many tech giants, their most valuable assets are a) their talented algorithm engineers, programmers and the advanced algorithms or codes they wrote, b) their big user-network (many of these businesses are more like a platform) c) their clients’ data. All of *those intangible assets cannot even be priced* by the current accounting rules. So, even if they are not internally developed, the BM ratio still can not reflect the value of the firm. To illustrate, how much is a very functional e-commerce online-product recommendation algorithm of Amazon worth, compared to hundreds of lines of codes (with many bugs) written by a junior student? It is very hard to say and thus makes the use of book value questionable.
- **It does not reflect the consumption transition from physical products to digital products.** People’s *consumption appetite is also changing*. Generation Z (people born from 1995 to 2010), unlike their parents and their grandparents, are born with APPLE smartphone (or their Android counterparts) at hand while their parents used Nokia and Motorola and their grandparents only used the landline telephone. Their grandpa like Harley-Davidson, summer house close to the beach, and luxury cars while Gen Z likes Pokemon, Tiktok and to make friends on Instagram, to buy things on Amazon and never go to Macy’s. The new generation is having a more digitalized life compared with their parents and Toys “R” Us is no longer an ideal gift for Gen Z’s birthday.
- **It does not consider the evolution of the business organizations.** With technological advancement, *intangible assets are becoming more dominant*. Indeed, decades ago, businesses used to rely on heavy assets (property, industrial plants), expensive machines and trucks (Equipment), a large amount of rare materials and inventories to do business, and complex corporate structure requires numbers of MBA-graduated managers, engineers, workers, administrators, sellers to cooperate and maintain the business channels. While, recently, dozens of silicon valley geeks can set up a multi-billion business in their garage with merely some high-performance computers (e.g. in 2014, Facebook acquired WhatsApp for 19 billion dollars with only 55 employees) and this year many tech businesses are even considering not to rent offices (work from home). Besides, *globalization contributes to a low-tangible-asset balance sheet*. Many global corporations in the US and European countries can take advantage of the cheap means of productions in emerging countries. They set up sub-ordinary companies or outsourcing those mid products (upper supply chains) to China, Indian, East-Asian (Vietnam, etc.), and Africa as those countries have very competitive replacement costs, pollution treatment costs and labor costs, etc. (E.g. Apple has 200 suppliers and over 800 production facilities internationally). Thus, the heavy PPE (Property, Plants, and Equipment) are “out of the balance sheet” of those big companies but the P/B ratio does not reflect this globalization.

Gen Z will be a key driver of AR/VR technological adoption

Generation	Greatest /Silent	Baby Boomers	Gen X	Millennials	Gen Z
Years Born	1923 - 1945	1946-1964	1965-1980	1981-1997	1998-2016
Age in 2016	71-93Y	52-70Y	36-51Y	19-35Y	0-18Y
Population (Global)	0.3bn	1.1bn	1.5bn	2bn	2.4bn
% of Global Population	5%	15%	20%	27%	32%
Life-Defining Events	World War I and II Great Depression Electric Appliances	Cold War Moon Landing Transistor Invented	End of Cold War Live Aid First Personal Computer	9/11 Terrorist Attacks Iraq War Advent of Social Media	Post-Great Recession Arab Spring Rise of AI
Communication Style	Letter	Telephone	Email /SMS	Instant Message	Emojis
Key Technology	Car	TV	PC	Smartphone	AR/VR
Hobby	Reading	Watching TV	Surfing the Internet	Video Games	Music Streaming
Digital Proficiency	Pre-Digital	Digital Immigrants	Early Digital Adopters	Digital Natives	Digital Innates
Iconic Figure	Franklin D. Roosevelt	John F. Kennedy	Kurt Cobain	Mark Zuckerberg	Mulala
Music	Jazz Swing	Elvis Beatles	Nirvana Madonna	Britney Spears Justin Timberlake	Justin Bieber Taylor Swift
How They Get Around	'55 Ford Thunderbird	SUV	Bicycle / Car	Uber / Lyft	Mom's Prius
Current Living Situation	Retirement Home	Semi Detached House	Own Small Apartment	Sharing an Apartment	Parents' House
Social network other than Facebook	The Rotary Club	Match.com	LinkedIn	Tinder	Snapchat
Deepest Fear	The world in 2016	No longer center of attention	What about my generation	Paying off student debt	Low batteries
Key Life Question	How did the country go so wrong?	Where's the Viagra?	What's the point?	What's a career?	What's a landline?
Defining Condition	Permanently Aggrieved	Erectile Dysfunction	ADHD	Gluten-Intolerant	Peanut Allergy
What They Spend On	Oklahoma Community Dinner Theater	VIP tickets to The Rolling Stones	Burning Man	Coachella	Minecraft

Source: iKinetic, McCrindle, Pew Research, Bruce Feirstein - Vanity Fair, various sources, BofA Merrill Lynch Global Research

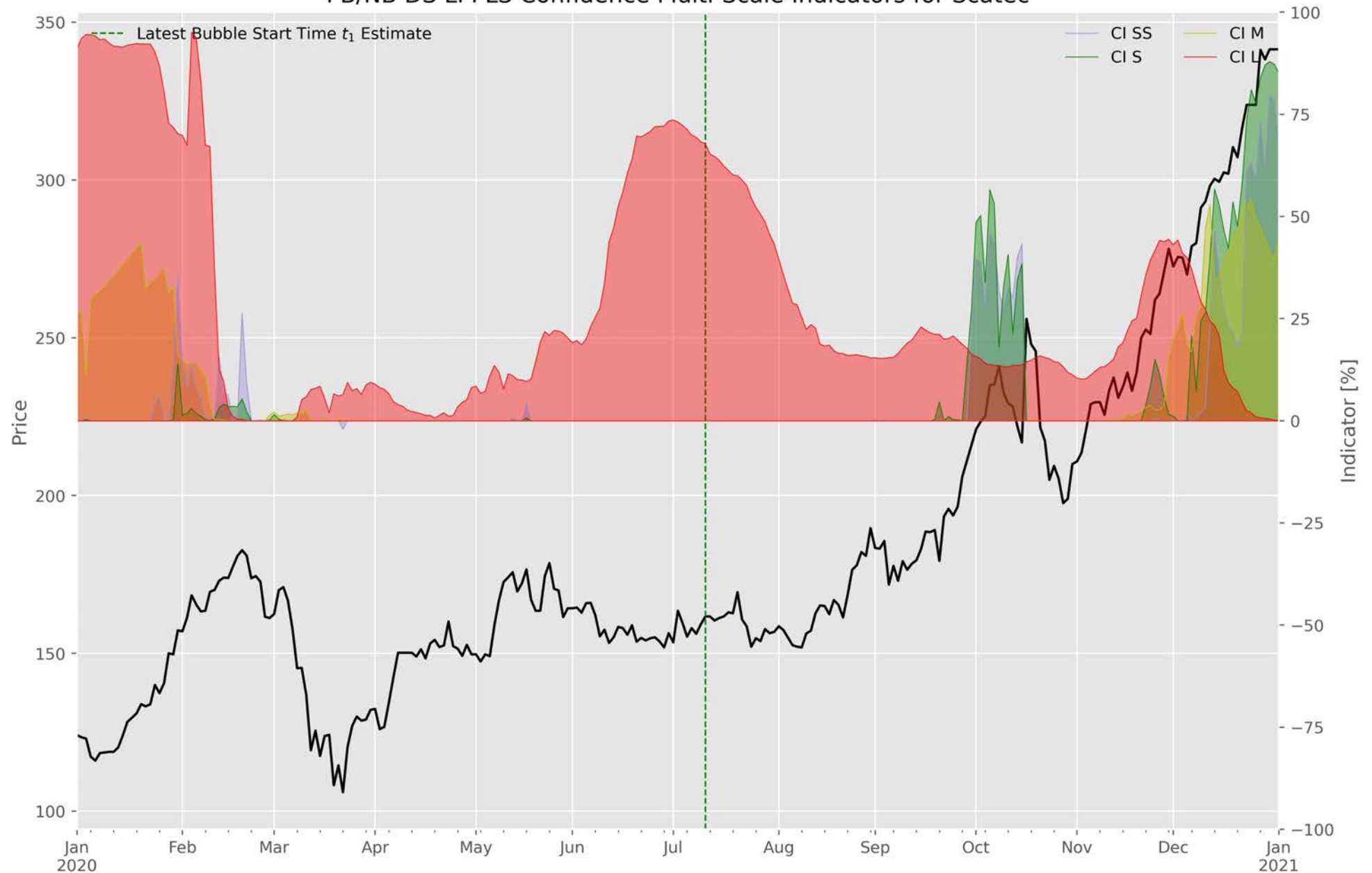
Thus, what is the real value of investing? We think that the answer is simple and straightforward: “Investing in those companies that create great value for clients but at a relatively cheap price”. Of course, you need comprehensive analyses and careful judgments. Next time when people are discussing the return of the value investing, you can ask them “what value are you talking about?”

Single Stocks - Europe

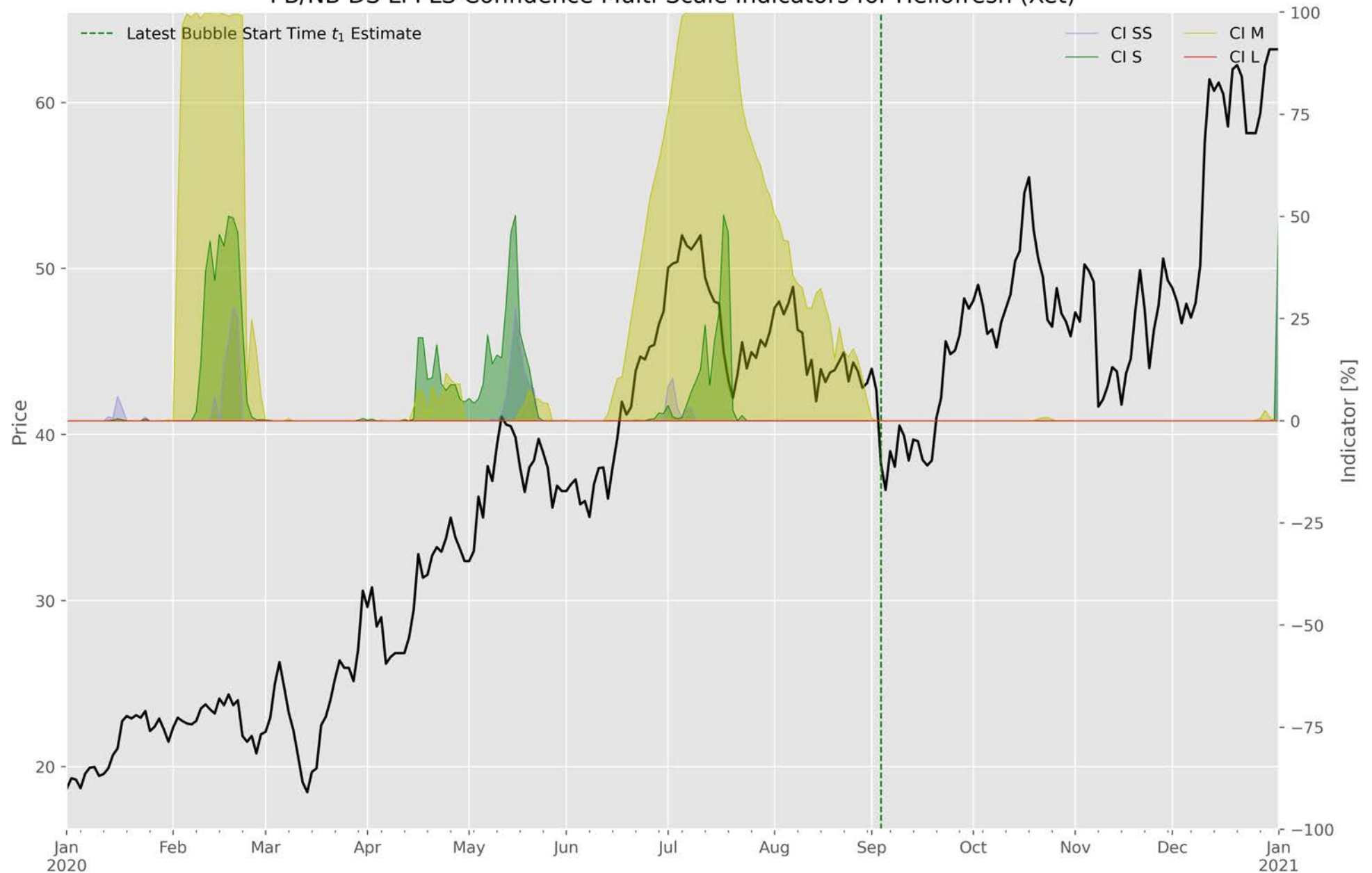
	Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [days]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{ci \cdot bg \cdot bp}$ [%]	Critical Time \bar{t}_c	Scenario Probability [%]
Positive Bubbles										
1	Scatec	Super-Short	68	111	346	126	94	130	2021-01-09	100
2	Hellofresh (Xet)	Super-Short	44	65	329	87	99	113	2021-01-02	100
3	Siemens Gamesa Renewable Energy	Super-Short	54	83	245	123	67	96	2021-03-03	99
Negative Bubbles										
1	Dorma Kaba Hold	Long-Term	37	-49	-18	864	97	40	2021-02-01	80

- ▶ The analysis begins with the top positive and negative bubble signals detected amongst European and United States single stocks. The overall fraction of positive bubble signals is at 10% at the beginning of 2021.
- ▶ The table above lists all European stock signals that pass the bubble filtering criteria. The criteria ensure a minimum strength of and thus confidence in reported signals.
- ▶ As top positive bubbles, the stocks of Scatec (Norway, Solar Energy) and Hellofresh (Germany, Food Delivery) and Siemens Gamesa Renewable Energy (Spain, Wind Energy) are listed. The confidence indicator ranges between 44% - 68%, while the estimated bubble sizes are between 65% - 111%. All three stocks started trending up from the third quarter of 2020 on. For all three stocks, the mean critical time of the crash is predicted to occur in the first quarter of 2021.
- ▶ A single negative bubble signal is determined on Dorma Kaba (Switzerland, Security Solutions). The stock has already declined by 50% from its peak stock price in Oct. 2017 of about 1000 Swiss Francs. As the indicator plot on one of the following slides shows, recently, the negative, long-term bubble indicator has increased to a level of now 37%.

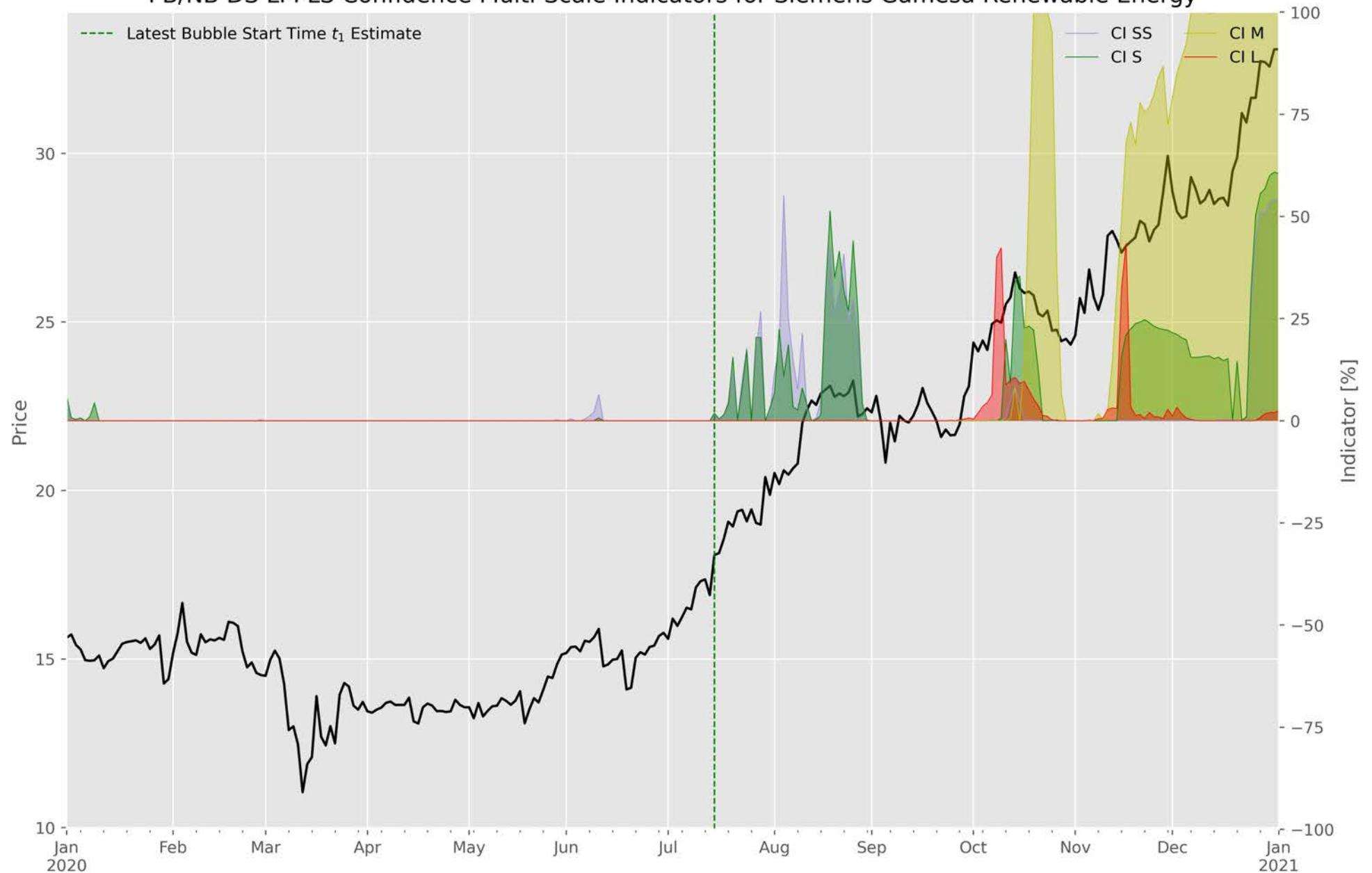
PB/NB DS LPPLS Confidence Multi-Scale Indicators for Scatec



PB/NB DS LPPLS Confidence Multi-Scale Indicators for Hellofresh (Xet)



PB/NB DS LPPLS Confidence Multi-Scale Indicators for Siemens Gamesa Renewable Energy



PB/NB DS LPPLS Confidence Multi-Scale Indicators for Dorma Kaba Hold

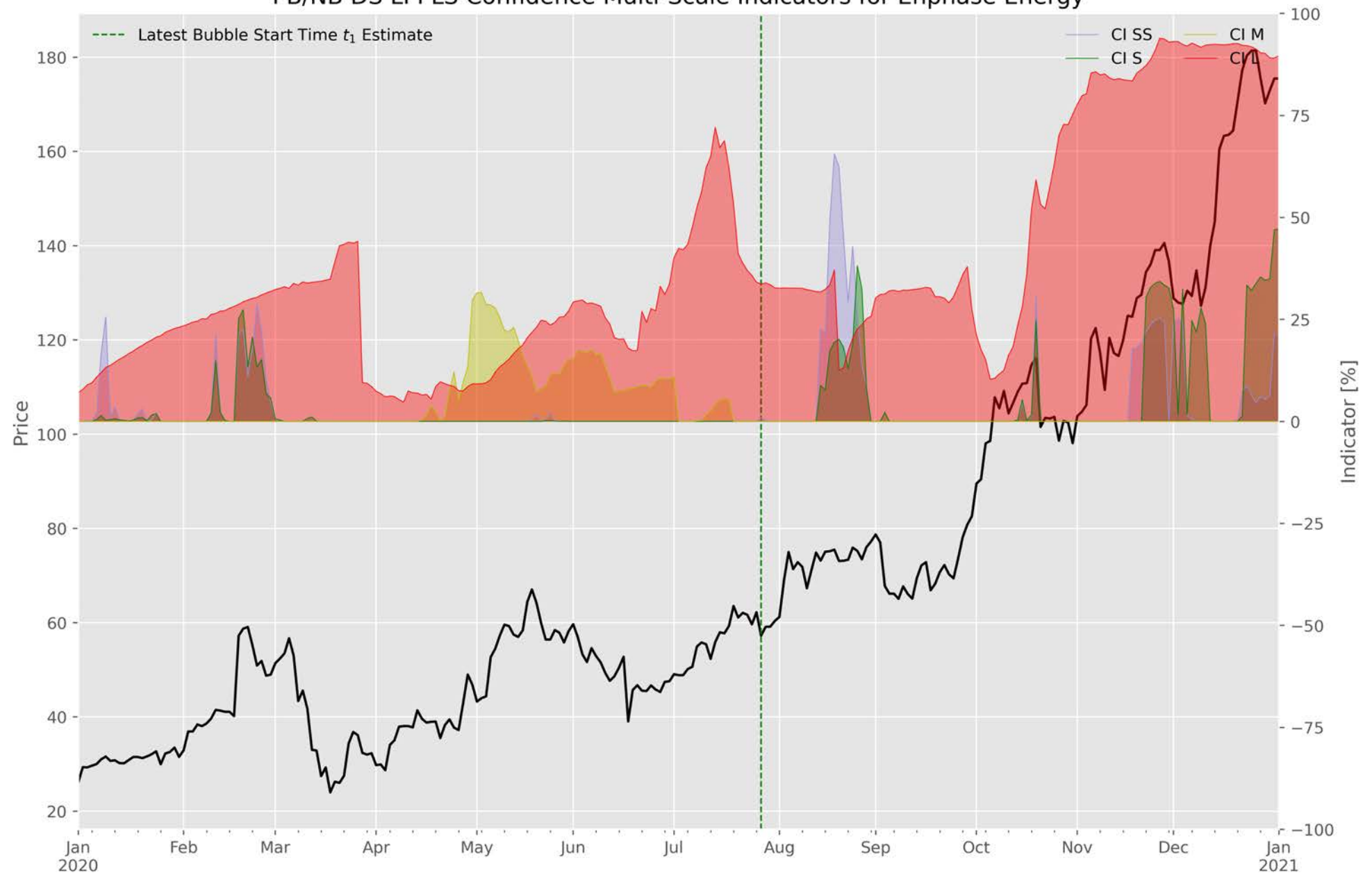


Single Stocks – United States

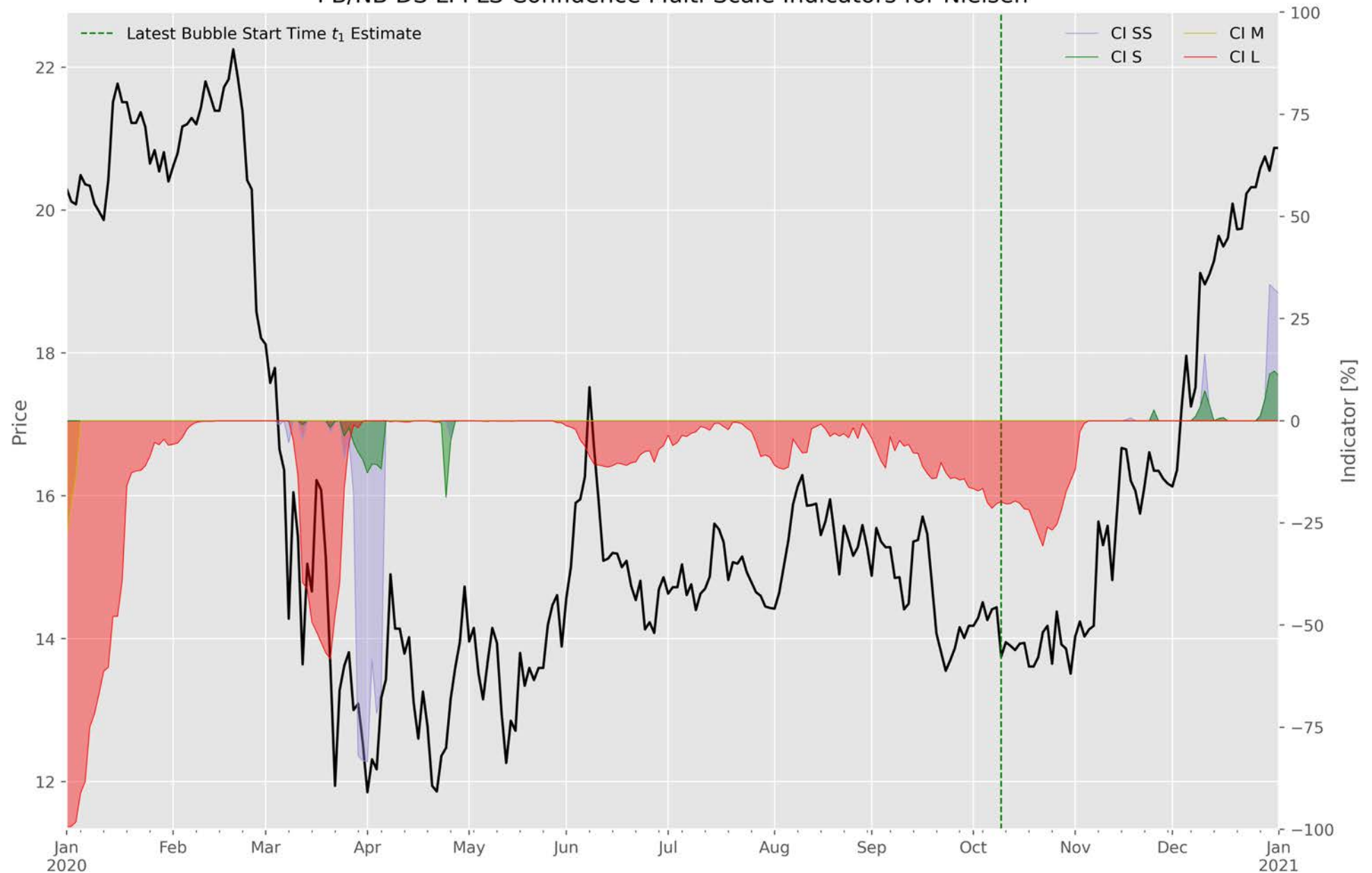
	Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [days]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{ci \cdot bg \cdot bp}$ [%]	Critical Time \bar{t}_c	Scenario Probability [%]
Positive Bubbles										
1	Enphase Energy	Super-Short	21	207	1090	114	74	119	2021-02-11	100
2	Nielsen	Super-Short	31	52	461	61	81	105	2021-01-16	100
3	Tesla	Medium-Term	38	1373	382	431	67	99	2021-08-04	91

- ▶ Turning to US stocks, we find three positive bubble signals, Enphase Energy, Nielsen and Tesla.
- ▶ For the first two stocks, the strongest signal is detected on the super short scale, i.e. about a month to half a year. For Tesla, the medium-term signal is the most relevant.
- ▶ Notice that the indication of the scale (“Strongest Signal” column) solely indicates the scale on which the strongest bubble characteristics were estimated. Obviously, the ensemble of indicators should be interpreted as a whole. For instance, as visible on the next slide, for Enphase, simultaneously, the short- and long-term indicators, not only the super-short, have peaked. Together, this indicates that the stock might be more likely in a long-term bubble, with superimposed short-term momentum over the past months.
- ▶ The bubble size determined for Tesla is about 1373% at a confidence indicator value of 38%. This is by far the largest bubble size determined in a single stock, so far. Tesla has meanwhile become the highest valued car manufacturer in the world, with its capitalization exceeding that of the entire German car industry. In parallel, this has catapulted its founder Elon Musk to the top of the list of wealthiest people in the world. Over the past months, as visible in the corresponding indicator plot, the medium-term confidence indicator has slowly risen.

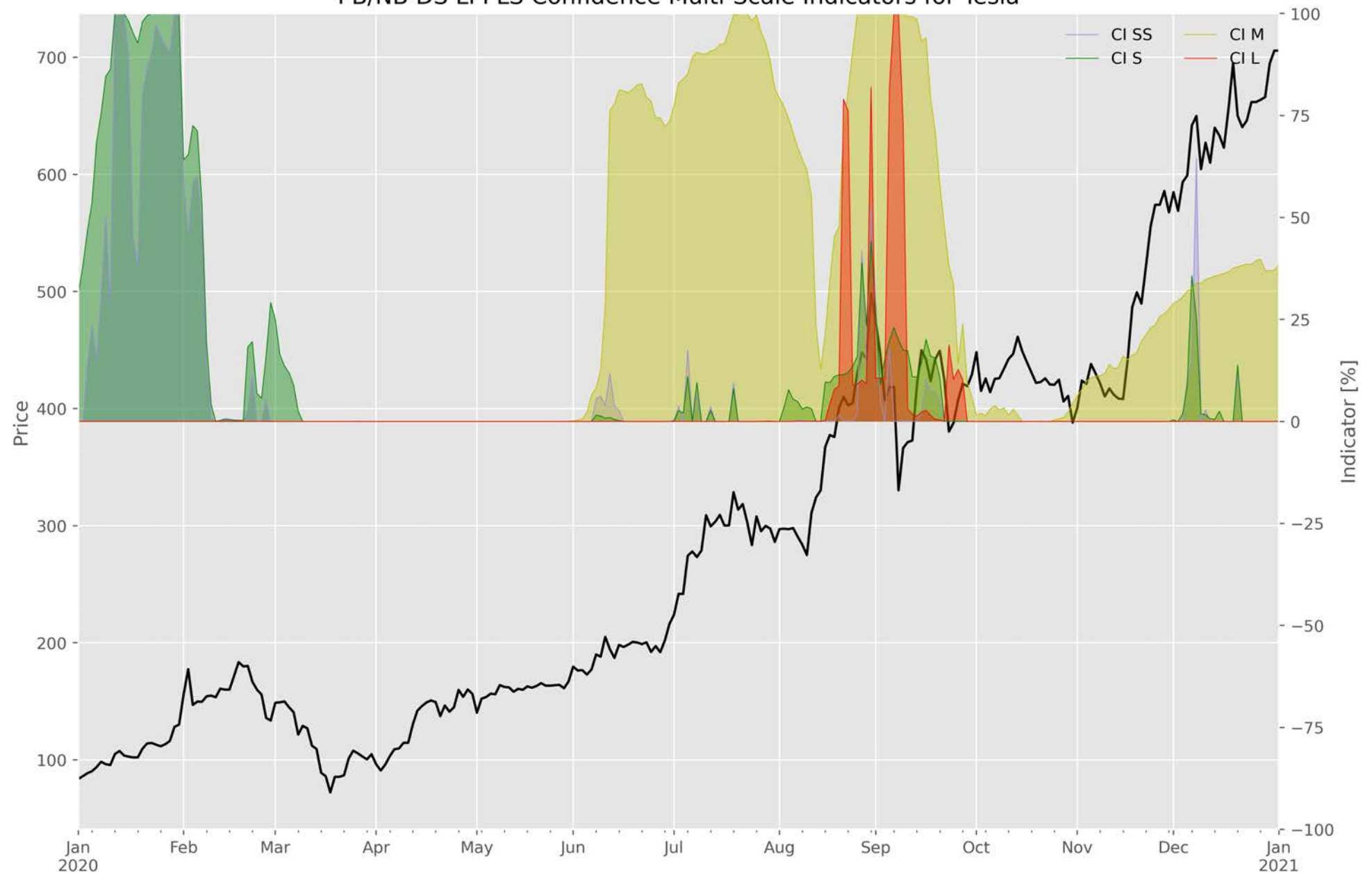
PB/NB DS LPPLS Confidence Multi-Scale Indicators for Enphase Energy



PB/NB DS LPPLS Confidence Multi-Scale Indicators for Nielsen



PB/NB DS LPPLS Confidence Multi-Scale Indicators for Tesla

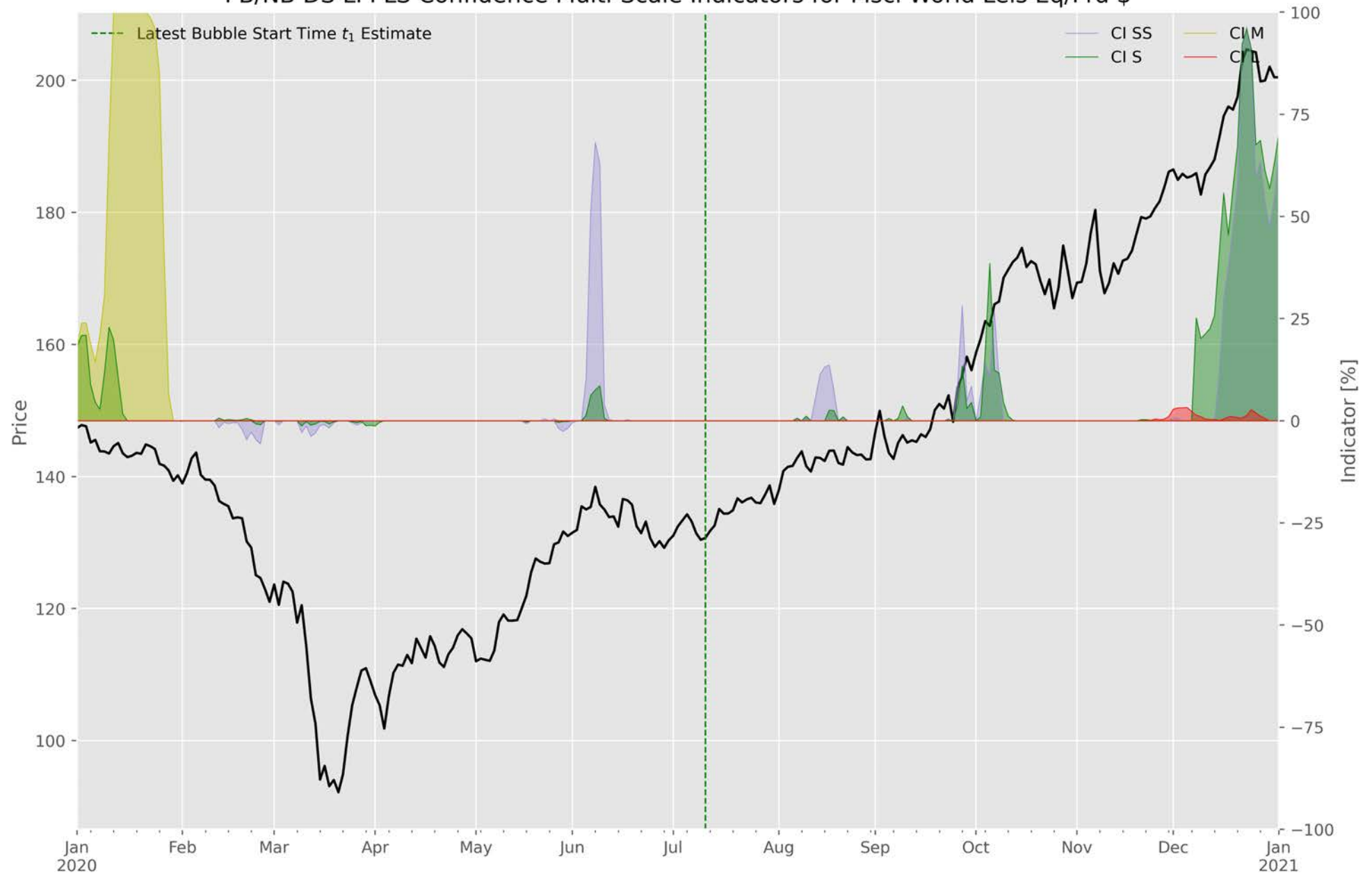


Equity Indices - Global

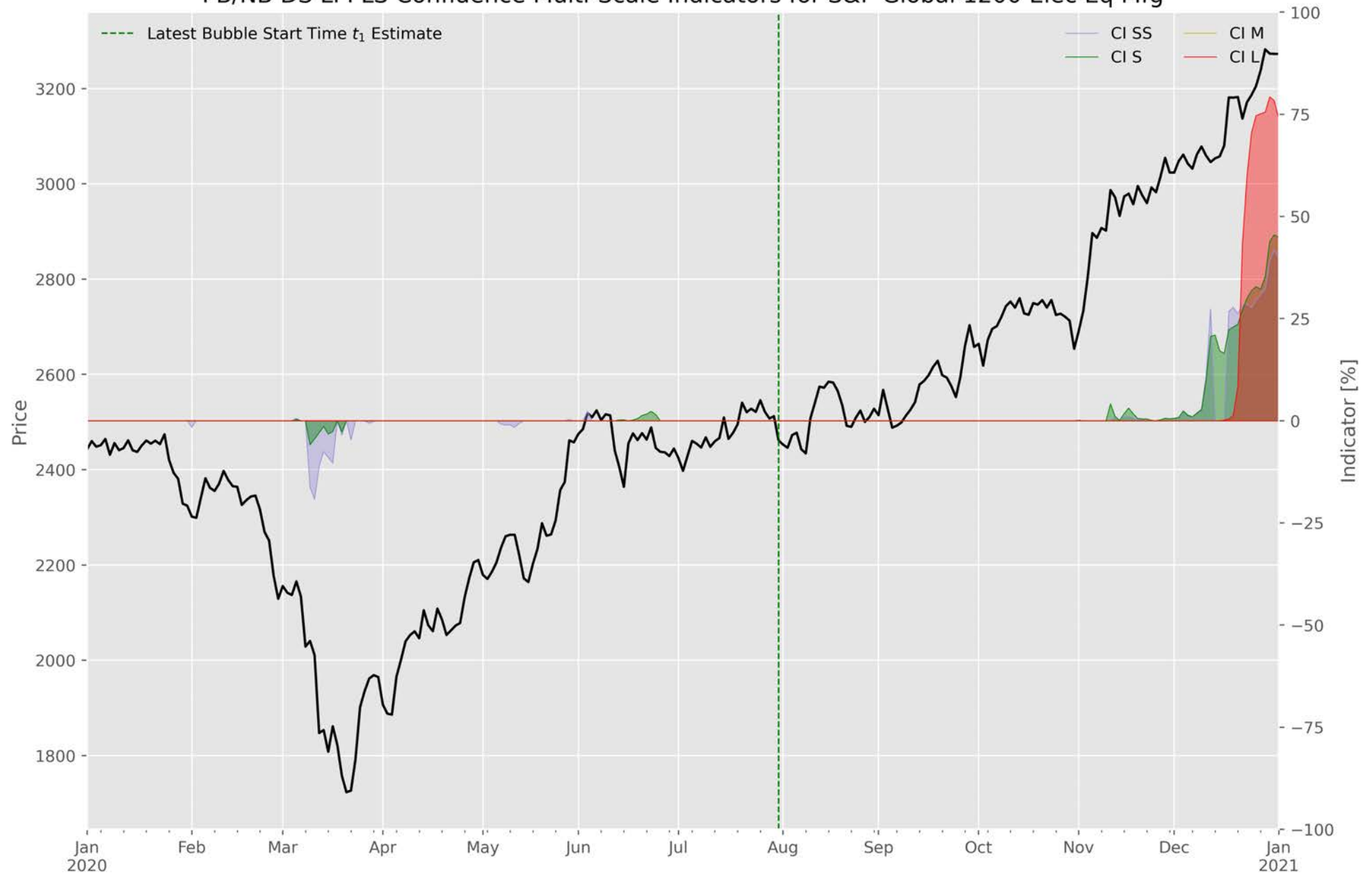
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Positive Bubbles										
1	Msci World Leis Eq/Prd \$	Super-Short	65	53	135	126	88	92	2021-01-19	58
2	S&P Global 1200 Elec Eq Mfg	Super-Short	40	33	91	111	93	70	2021-01-09	100
3	S&P Global 1200 Elec Mfg Svs	Super-Short	27	28	133	73	84	67	2021-01-15	66

- ▶ We turn to the global equity index analysis, which considers indices of the MSCI world and S&P Global 1200 series. Overall, about 20% of all analyzed global indices were found to show positive bubble characteristics, and none negative.
- ▶ There are three positive bubble signals, all with strongest resonance on the super-short scale.
- ▶ The confidence indicator ranges from 27% to 65%, bubble sizes from 28% to 53%, the implied growth rate, or bubble CAGR from 91% to 135% per year and the durations between 73 and 126 days. The resulting geometric averages of our three percentage metrics (confidence indicator, bubble CAGR and bubble progress) thus range from 67% to 92%, which is quite large.
- ▶ Again, the mean predicted end times of the bubbles are in early 2021, more specifically already in January.
- ▶ Interestingly, all bubble start times (indicated by the vertical green dashed lines in the plots) were in the third quarter of 2020 and are located at price levels close to the individual pre-Corona price levels of the indices. Thus, the determined bubble sizes in all cases are determined exactly as the excess return of the indices compared to their pre-crisis levels.
- ▶ All in all, these results suggest a significant short-term acceleration of prices over the past months and the potential, fast build-up of another bubble that might come to an end already in early 2021.

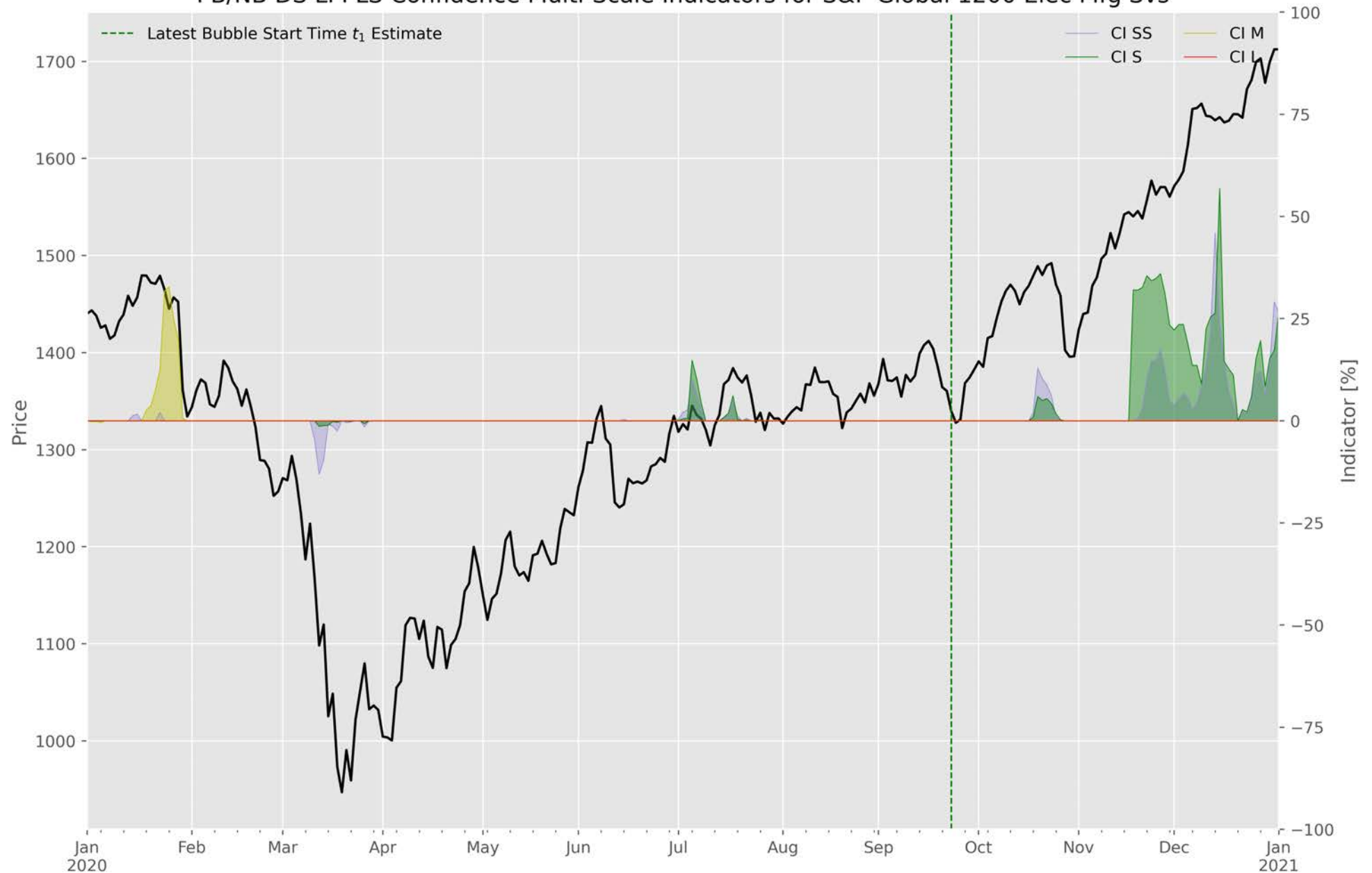
PB/NB DS LPPLS Confidence Multi-Scale Indicators for Msci World Leis Eq/Prd \$



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



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

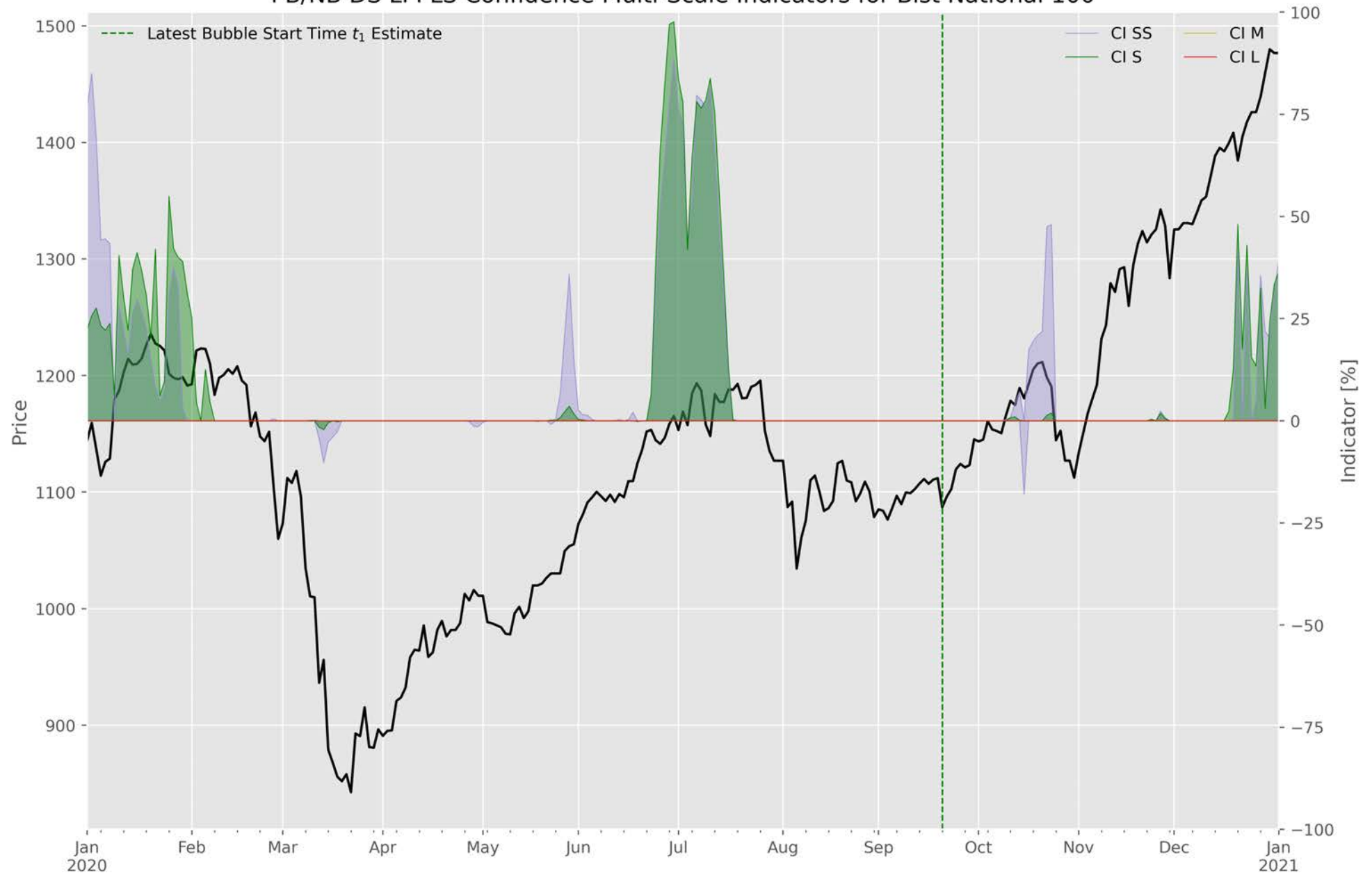


Equity Indices - Europe

	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	Bist National 100	Short-Term	36	36	180	75	88	83	2021-01-11	100
2	Omx Iceland All Share	Super-Short	68	23	94	80	67	75	2021-02-10	99
3	Oslo Exchange All Share	Super-Short	21	20	43	126	99	44	2021-01-03	100

- ▶ The European market and the US market both show a similar fraction of positive bubble signals of 12% and 13%, respectively.
- ▶ In the Europe equity index sector, three super-short to short-term signals are listed. The indices follow the Turkish, Iceland and Norwegian stock markets.
- ▶ Again, the mean critical times are predicted to occur in January 2021, with a high agreement between the fits in different time windows, as expressed by the large scenario probabilities.
- ▶ On the next slides, all three positive bubbles are shown. For all of them, the indicators have only recently increased in activity. Again, all bubble are estimated to have started in the second half of 2020.

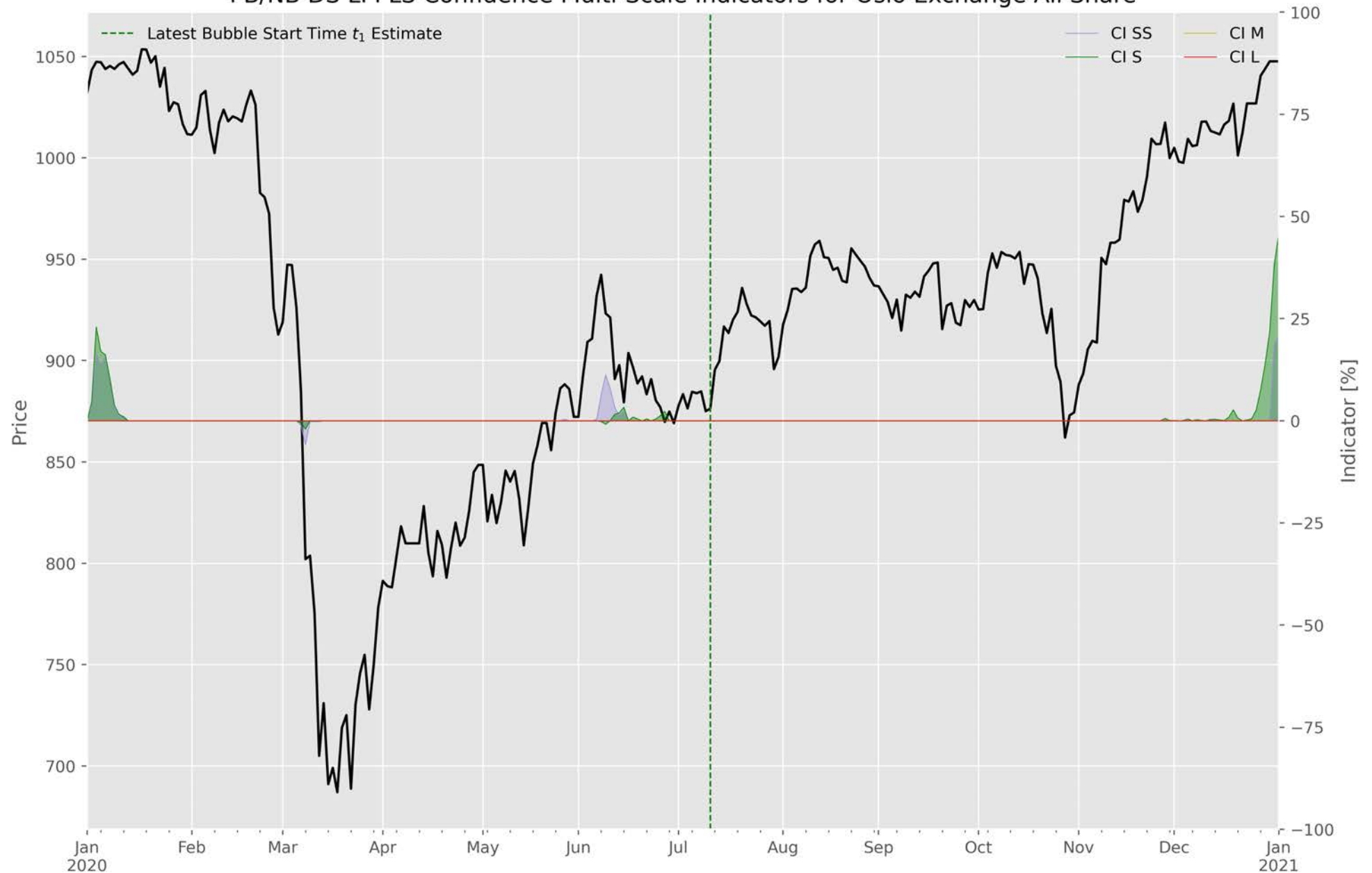
PB/NB DS LPPLS Confidence Multi-Scale Indicators for Bist National 100



PB/NB DS LPPLS Confidence Multi-Scale Indicators for Omx Iceland All Share



PB/NB DS LPPLS Confidence Multi-Scale Indicators for Oslo Exchange All Share



Equity Indices – United States

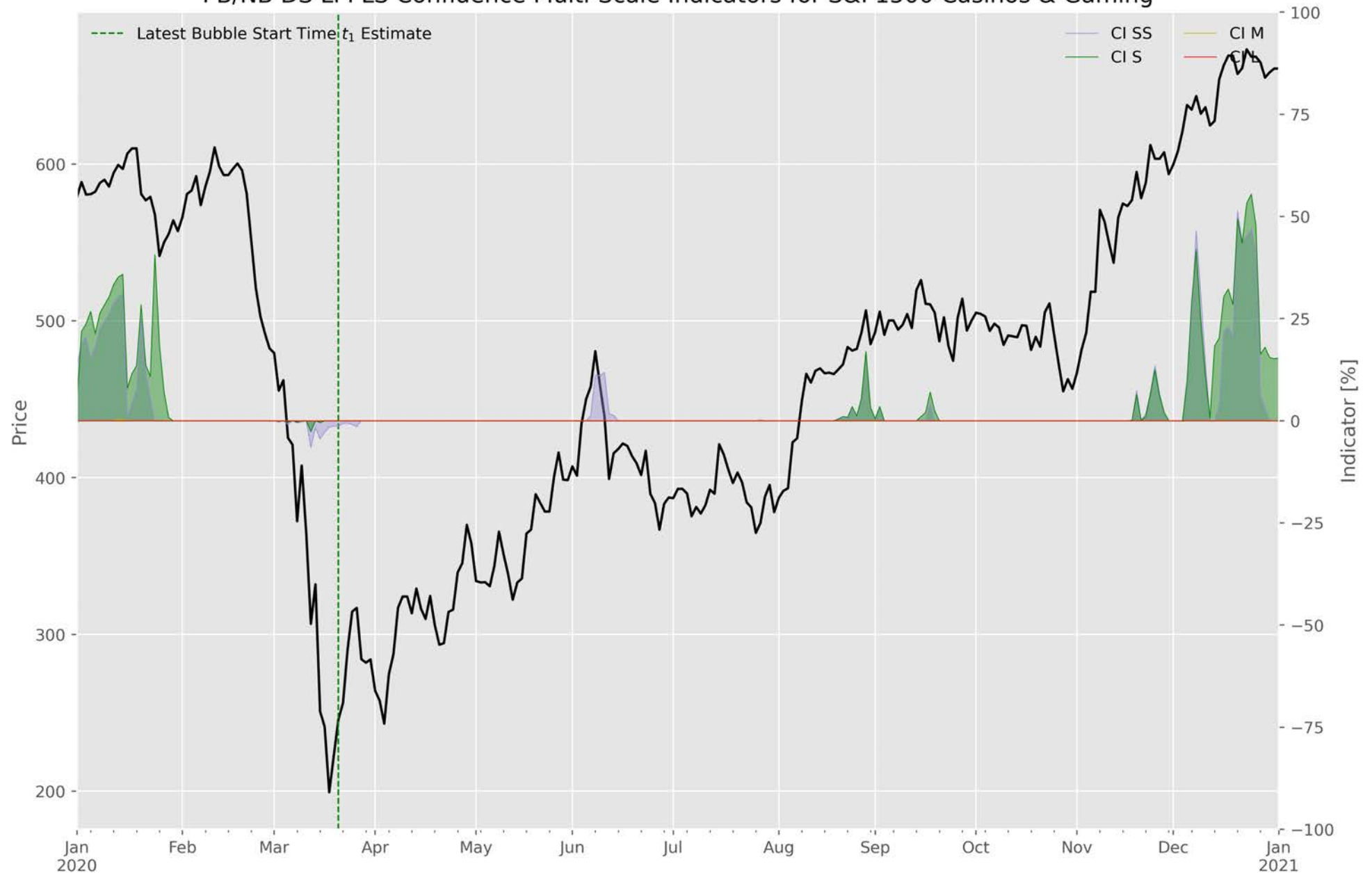
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Positive Bubbles										
1	S&P1500 Personal Products	Super-Short	36	35	87	119	97	67	2021-01-05	100
2	S&P1500 Personal Products Si	Super-Short	36	35	87	119	97	67	2021-01-05	100
3	S&P1500 Casinos & Gaming	Short-Term	15	169	235	206	67	62	2021-04-14	100

- ▶ The analysis of the US S&P 1500 Index class reveals three top bubble signals. The time series of the first two personal products indices are almost equivalent. Therefore, the indicator plot for only one of them is depicted in the following.
- ▶ The Casinos & Gaming index follows a trajectory quite similar to the personal products sector. Therefore, the resulting indicator series are also qualitatively similar, with peaks before Corona, small activity around September 2020 and recent activity.
- ▶ A striking difference between the two is the bubble start time, which is again located in the third quarter of 2020 for the personal products sector, but around the trough after the Corona crash for the C&G index.

PB/NB DS LPPLS Confidence Multi-Scale Indicators for S&P1500 Personal Products



PB/NB DS LPPLS Confidence Multi-Scale Indicators for S&P1500 Casinos & Gaming

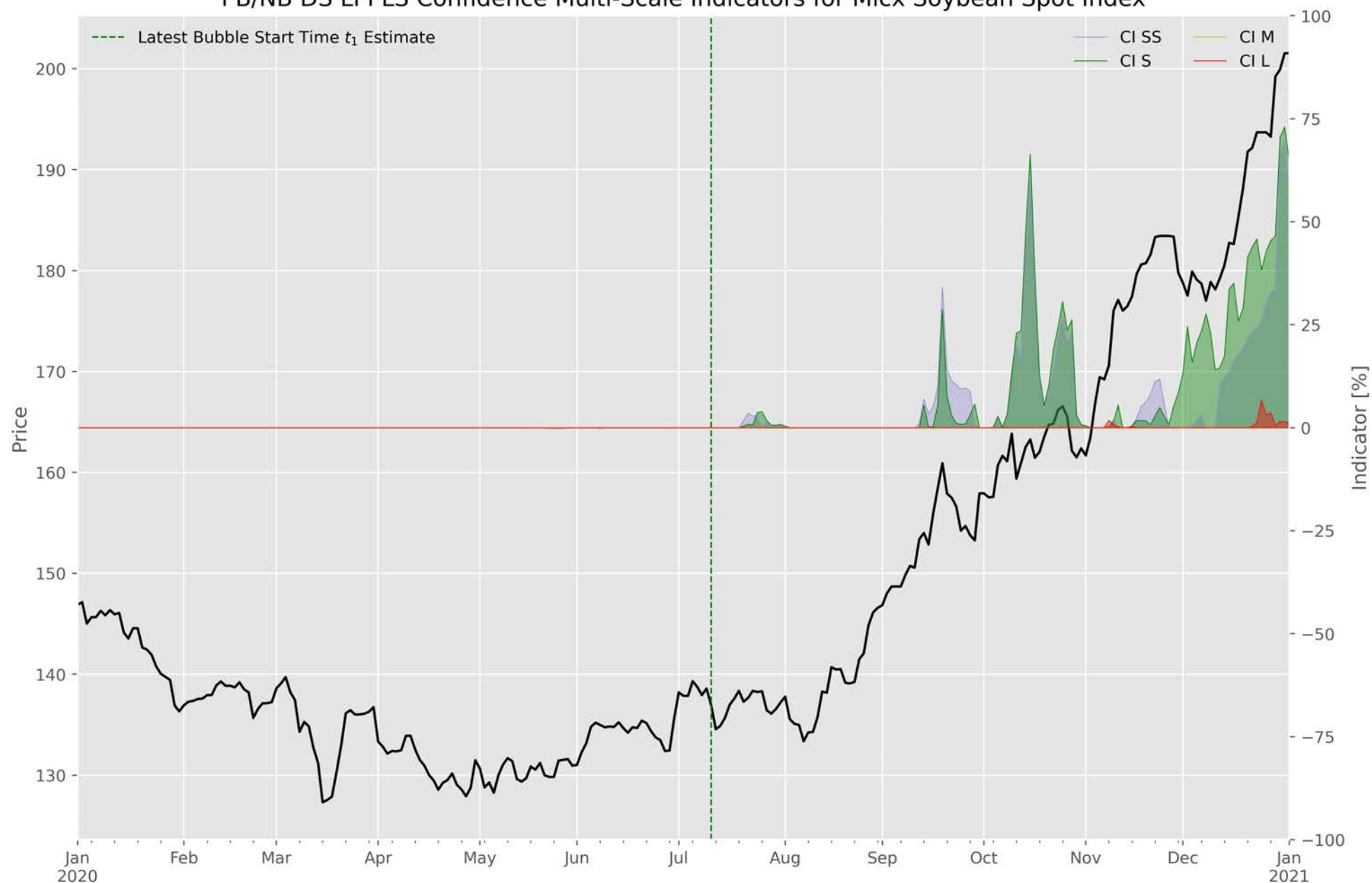


Commodities

	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	Micx Soybean Spot Index	Super-Short	57	47	117	126	67	76	2021-03-05	63

- ▶ The positive bubble activity amongst the 34 analyzed commodity indices is about 15% (previous month: 12%), with a single signal passing the top signal filtering criteria.
- ▶ The positive bubble signal is detected for the Soybean Spot Index for the second month in a row. The SS-confidence indicator has risen from prior 13% to now 57%. Meanwhile, the bubble size has grown from 39% to 47%. The predicted end of the bubble is in March 2021.
- ▶ As visible on the indicator plot, the index has successively appreciated in value since mid 2020, with bubble activity forming over the past months.

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

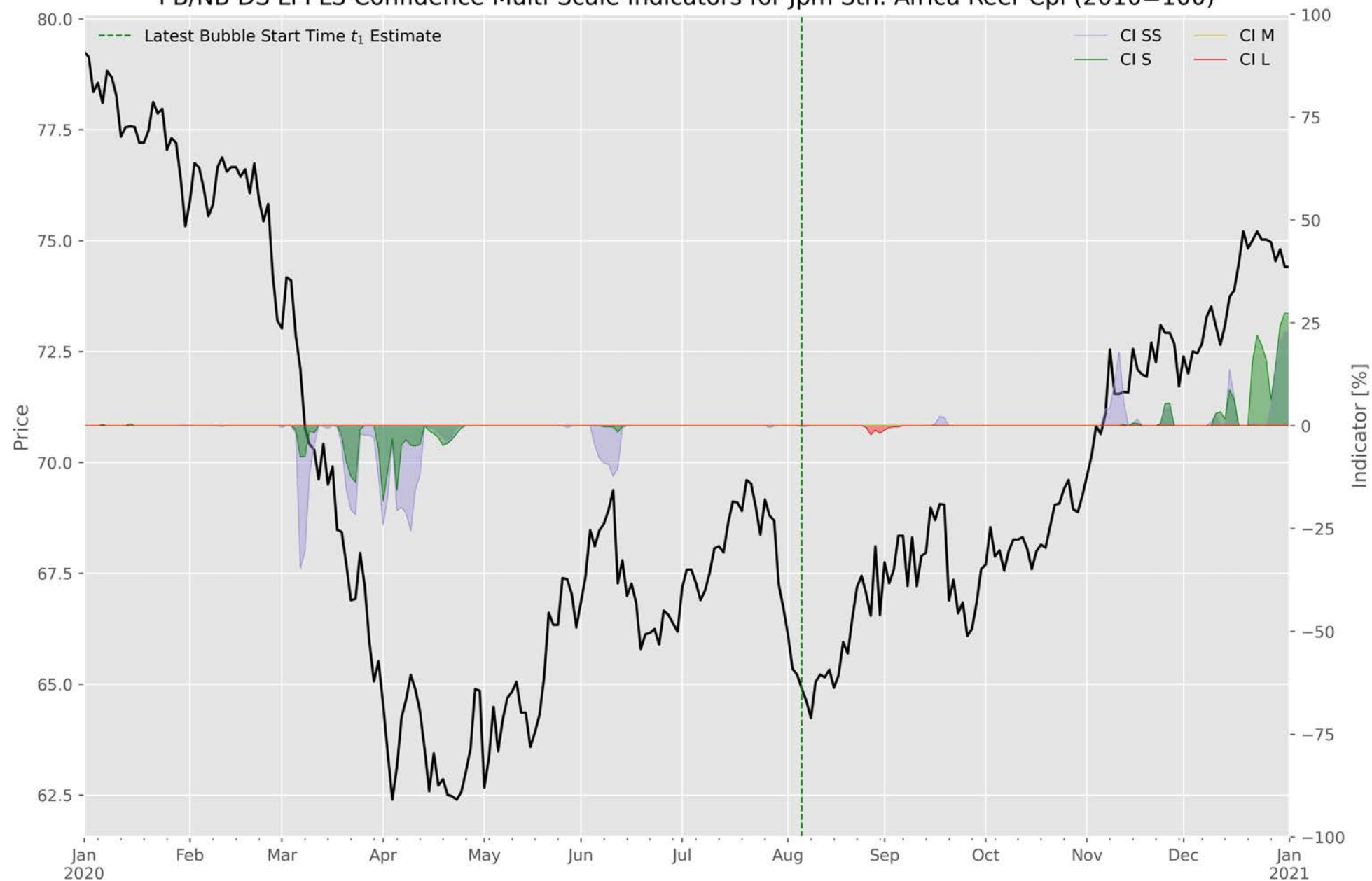


Forex

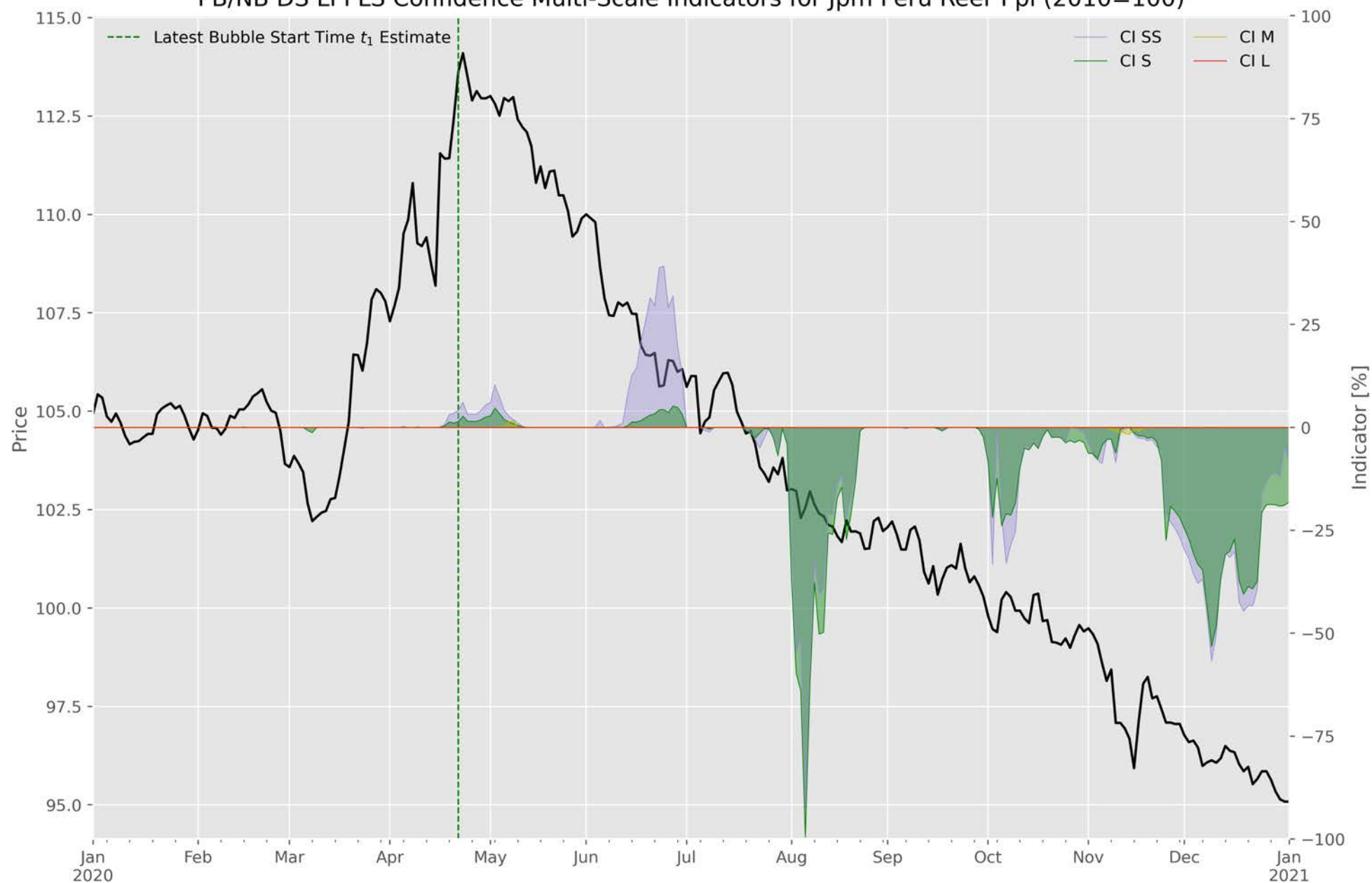
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Positive Bubbles										
1	Jpm Sth. Africa Reer Cpi (2010=100)	Super-Short	23	15	38	107	87	42	2021-01-18	97
Negative Bubbles										
1	Jpm Peru Reer Ppi (2010=100)	Short-Term	18	-16	-22	183	95	33	2021-01-11	100

- ▶ The analysis of 100 exchange rate value indices reveals a positive (negative) bubble activity of 1% (2%).
- ▶ The resulting two top bubble signals are listed above.
- ▶ The Africa Real Effective Exchange Rate (REER) Index is reported for the first time, with a low confidence indicator value of 23%.
- ▶ The negative bubble on the Peru REER Index is listed for the second time. Compared to the previous month, however, the confidence indicator has decreased from 23% to now 18%. The bubble size has grown from -16% to -19%. As visible, the estimated bubble start time approximately coincides with the peak of the index in April 2020, from which on, it started a phase of decline.

PB/NB DS LPPLS Confidence Multi-Scale Indicators for Jpm Sth. Africa Reer Cpi (2010=100)



PB/NB DS LPPLS Confidence Multi-Scale Indicators for Jpm Peru Reer Ppi (2010=100)

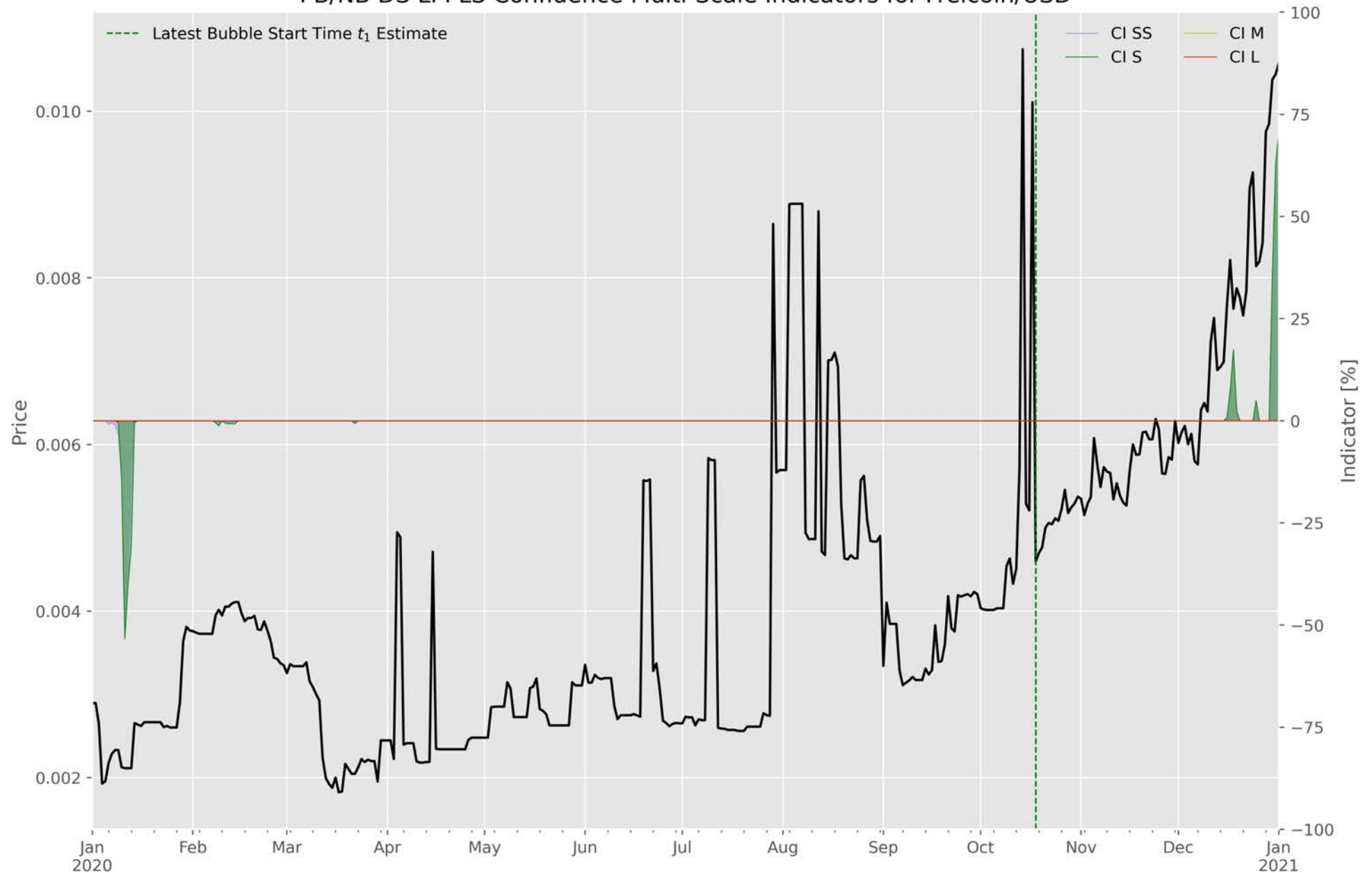


CryptoX

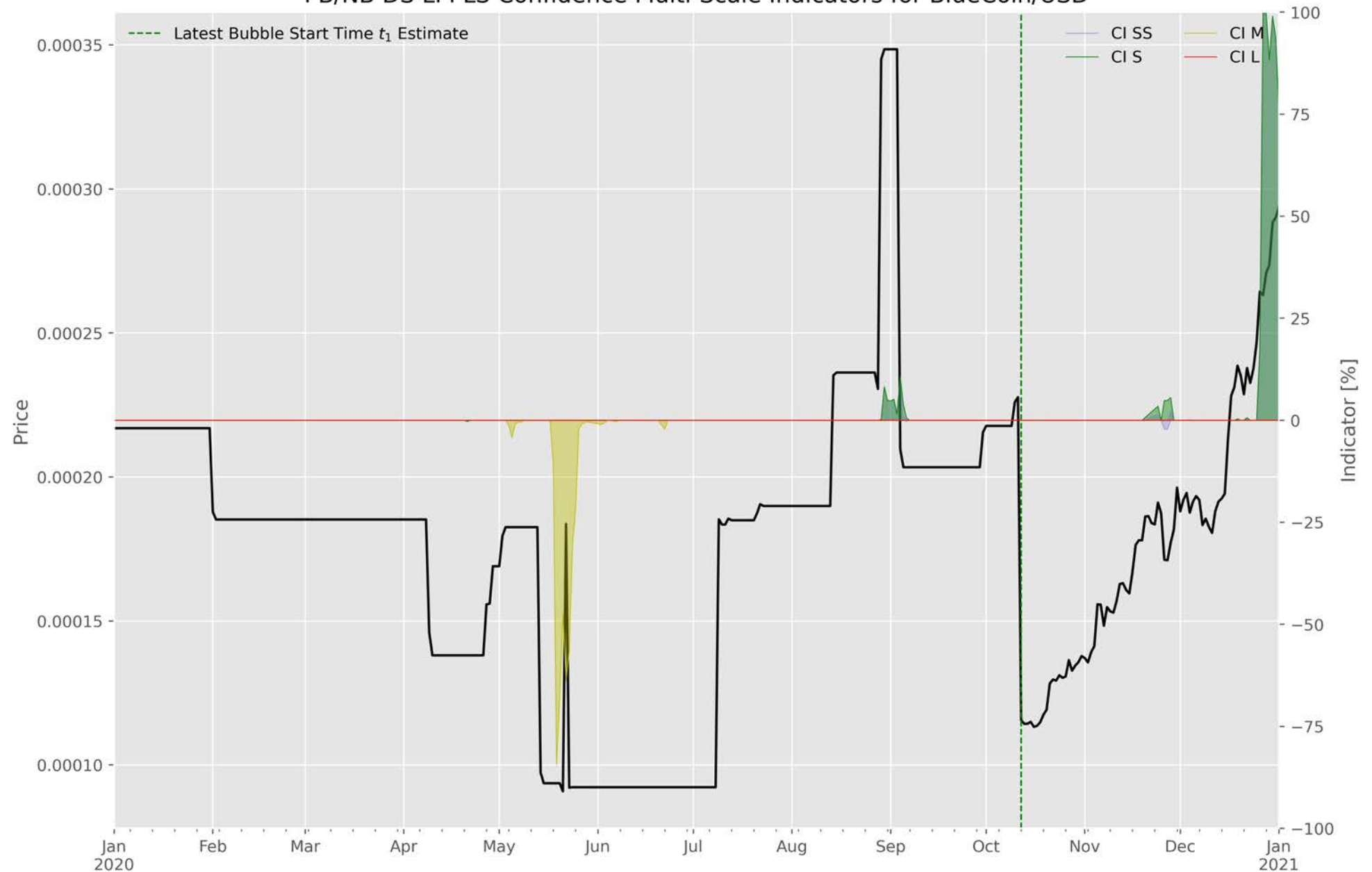
	Name	Strongest Signal	DS LPPLS Confidence ci [%]	Bubble Size bs [%]	Bubble CAGR bg [%]	Duration [days]	Bubble Progress bp [%]	Geometric Average $\sqrt[3]{ci \cdot bg \cdot bp}$ [%]	Critical Time t_c	Scenario Probability [%]
Positive Bubbles										
1	Freicoin/USD	Short-Term	70	130	1488	76	97	216	2021-01-03	93
2	BlueCoin/USD	Short-Term	76	154	1657	82	67	203	2021-02-11	100
3	LiteDoge/USD	Short-Term	72	160	1657	84	67	200	2021-02-12	100
Negative Bubbles										
1	GCN Coin/USD	Long-Term	100	-93	-59	763	97	83	2021-01-23	61
2	Metaverse ETP/USD	Short-Term	75	-63	-90	110	80	81	2021-01-28	97
3	Lunyr/USD	Medium-Term	57	-92	-78	431	96	75	2021-01-19	89

- ▶ We turn to the crypto-realm. As newly visible in the bubble overview plot, the crypto market as a whole has not been very active in terms of bubble activity throughout 2020, with fractions of bubbles remaining below 10% for both positive and negative bubbles.
- ▶ Yet, the outstanding candidate that recently dominates the news is once more Bitcoin. The crypto-prototype has grown immensely throughout December 2020, cracking for the first time not only the 20K USD but also the 30k USD mark and the 40k mark at the beginning of January 2021.
- ▶ Current optimistic market sentiment spreads the feeling that there is even more short- to medium-term growth potential in the cryptocurrency, with even professional analysts releasing incredible price targets.
- ▶ Currently, we determine clear bubble activity in Bitcoin, which is depicted on the next slide. Nevertheless, Bitcoin is not amongst the strongest signals picked up by our analysis procedure and therefore it is not listed in the table above.
- ▶ Besides this, we list a total of six more positive and negative small to medium-sized cryptos valued against the US Dollar.

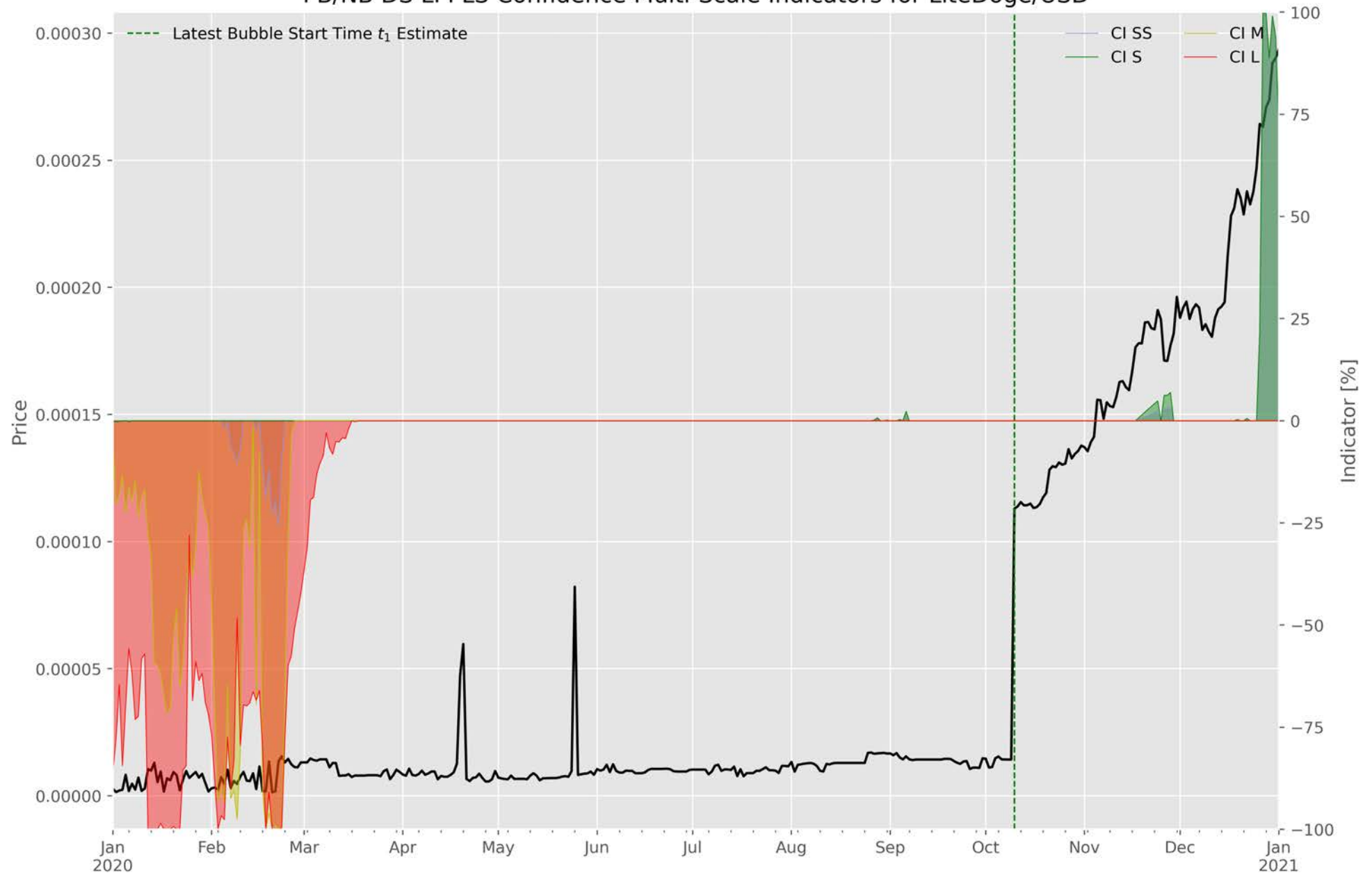
PB/NB DS LPPLS Confidence Multi-Scale Indicators for Freicoin/USD



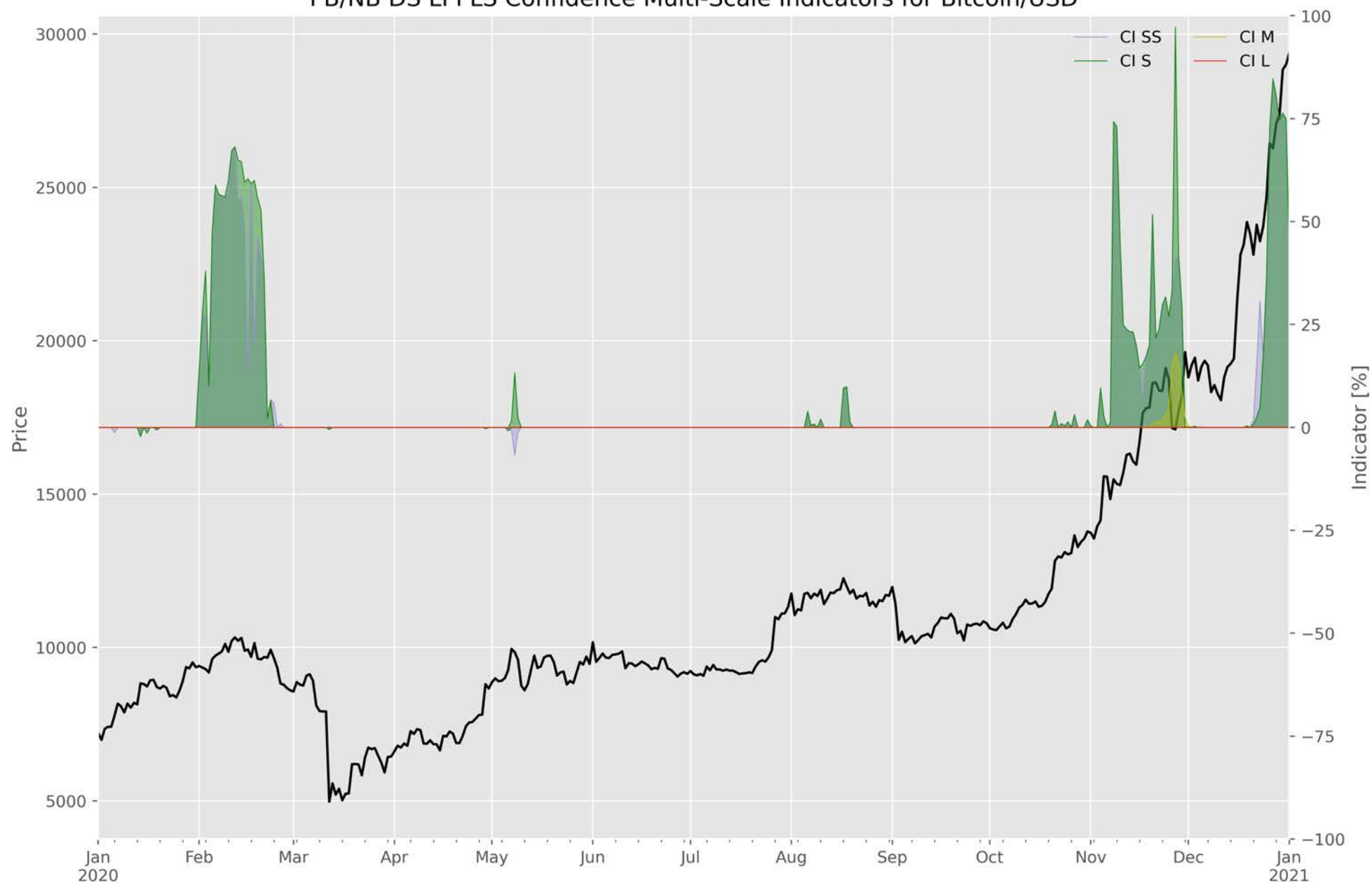
PB/NB DS LPPLS Confidence Multi-Scale Indicators for BlueCoin/USD

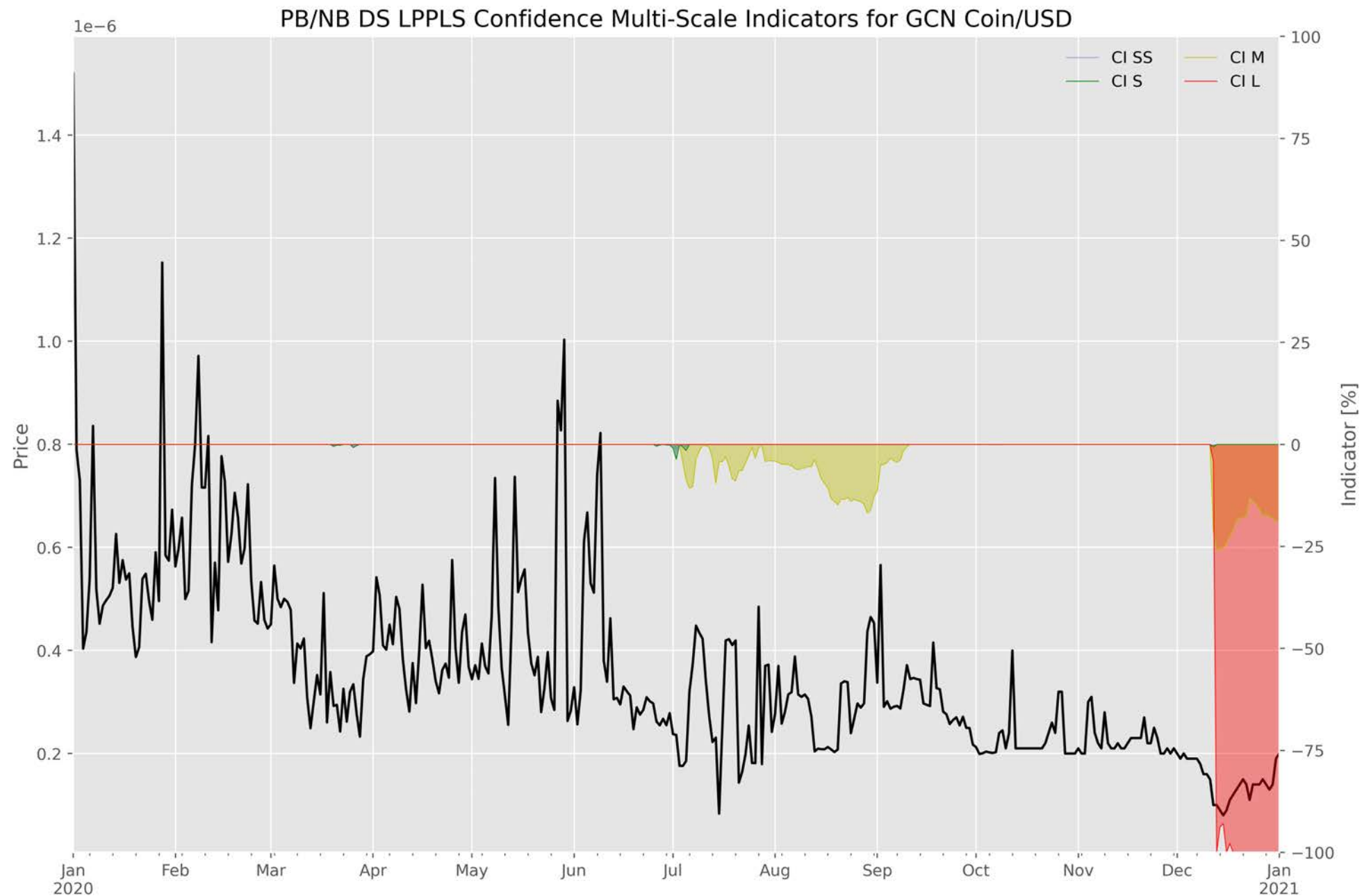


PB/NB DS LPPLS Confidence Multi-Scale Indicators for LiteDoge/USD

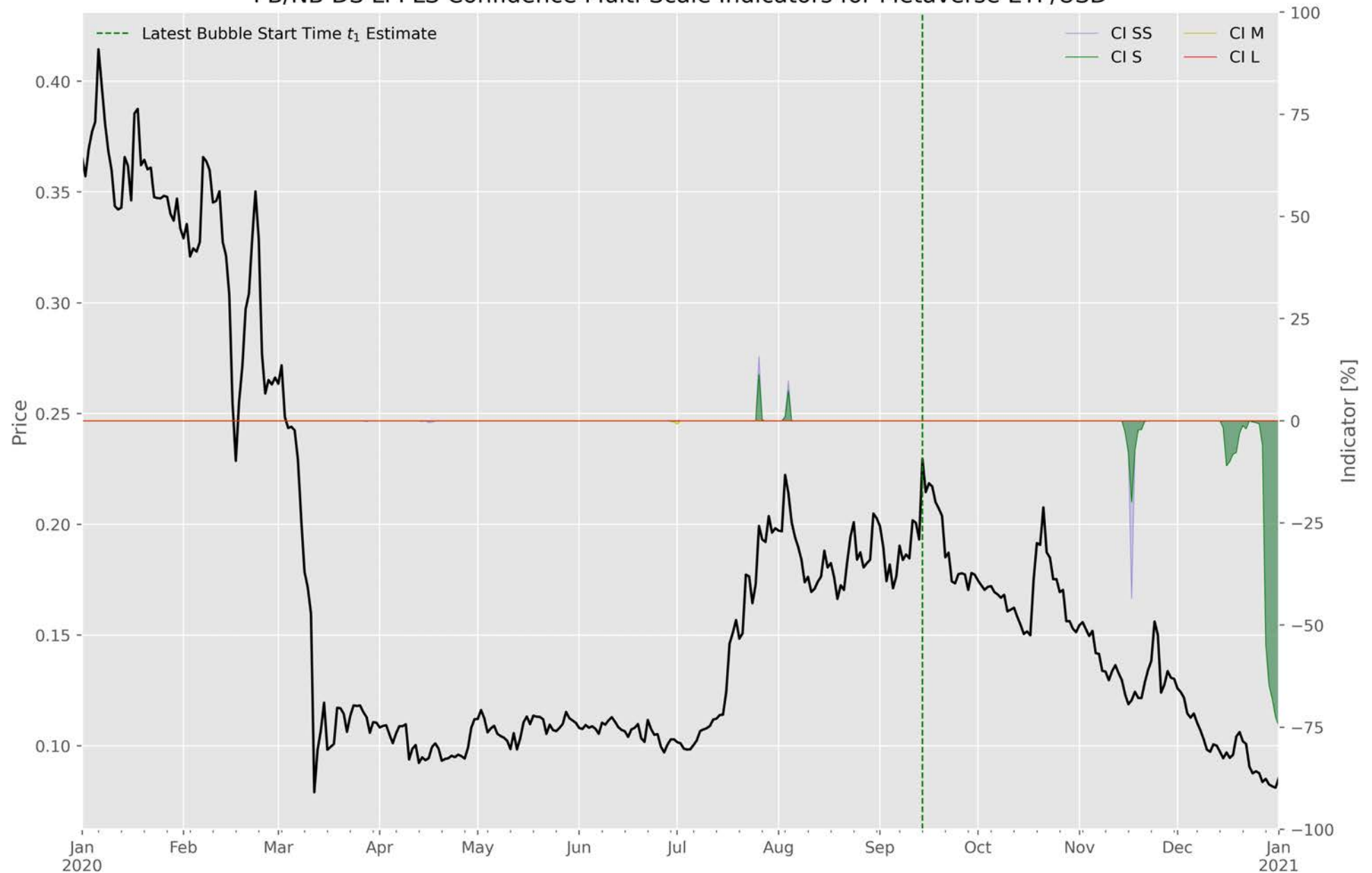


PB/NB DS LPPLS Confidence Multi-Scale Indicators for Bitcoin/USD

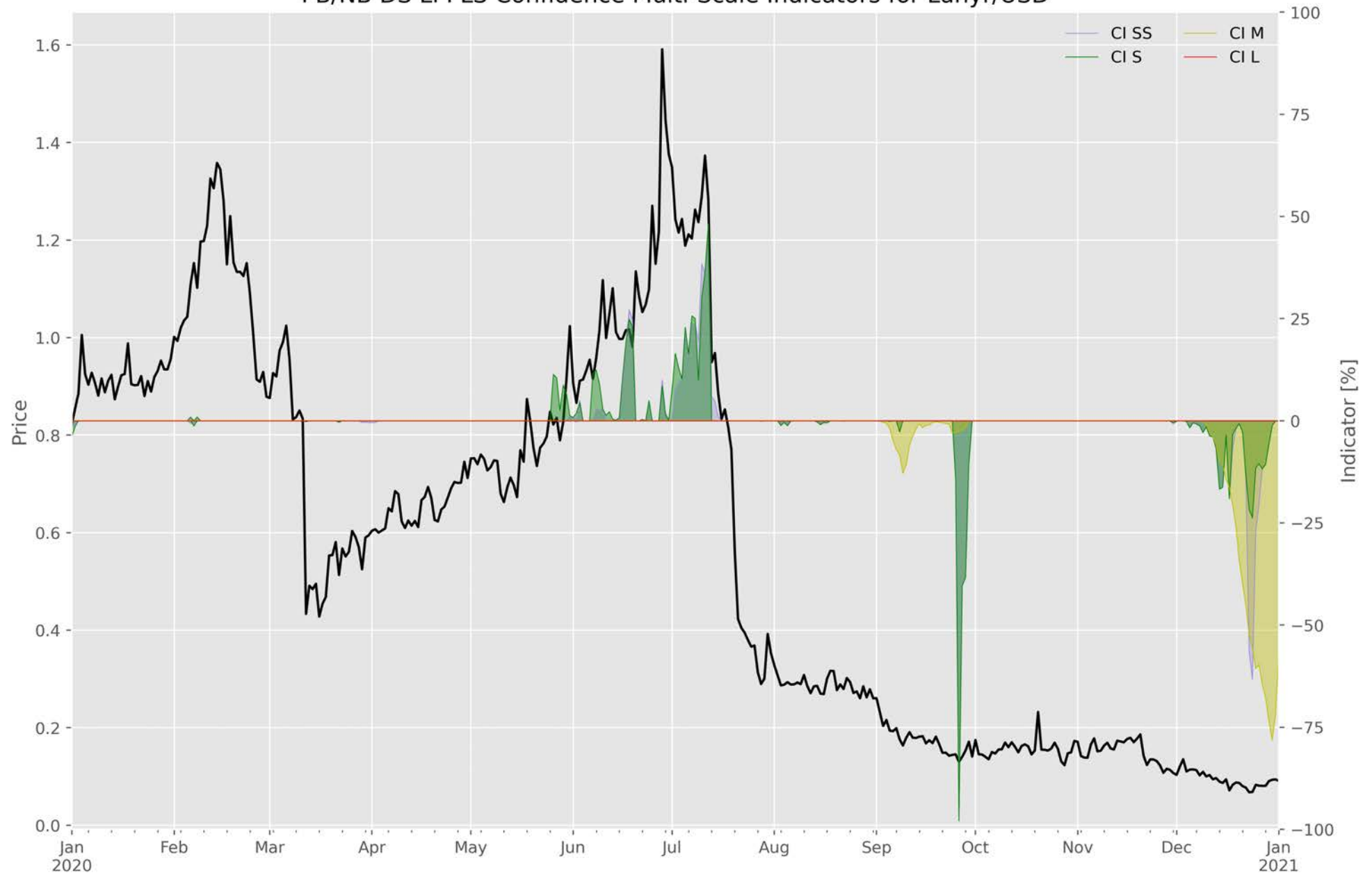




PB/NB DS LPPLS Confidence Multi-Scale Indicators for Metaverse ETP/USD



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

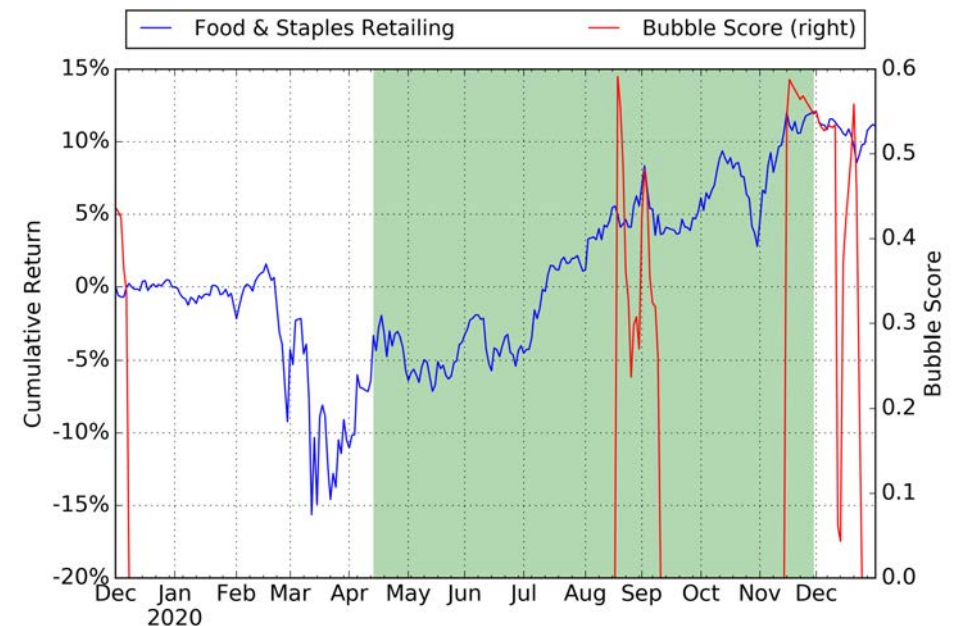
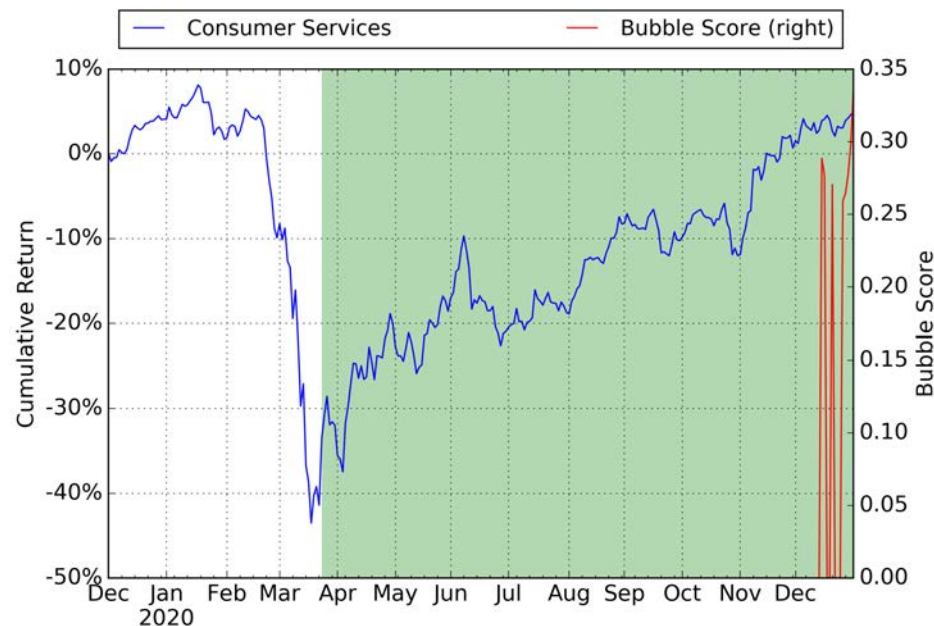


Sectors

GICS Industry Group Name	Yearly Return		Bubble Size		Bubble Score		Value Score		Growth Score	
	Jan 1st	Dec 1st	Jan 1st	Dec 1st	Jan 1st	Dec 1st	Jan 1st	Dec 1st	Jan 1st	Dec 1st
Pharmaceuticals, Biotechnology & Life Sciences	5.7%	7.7%	0.0%	0.0%	0.0%	0.0%	65.4%	64.1%	48.7%	49.0%
Consumer Services	-1.7%	1.0%	57.7%	0.0%	33.5%	0.0%	26.5%	29.0%	45.0%	42.9%
Retailing	43.3%	41.6%	0.0%	0.0%	0.0%	0.0%	22.2%	22.1%	49.2%	49.5%
Transportation	13.7%	16.2%	0.0%	0.0%	0.0%	0.0%	56.0%	54.7%	48.4%	49.2%
Consumer Durables & Apparel	18.8%	19.2%	0.0%	0.0%	0.0%	0.0%	32.7%	33.3%	61.9%	61.8%
Semiconductors & Semiconductor Equipment	43.5%	46.2%	0.0%	0.0%	0.0%	0.0%	61.0%	62.3%	37.9%	37.3%
Technology Hardware & Equipment	46.8%	47.5%	0.0%	0.0%	0.0%	0.0%	65.0%	67.9%	44.8%	44.5%
Automobiles & Components	63.6%	49.1%	0.0%	0.0%	0.0%	0.0%	73.1%	73.5%	57.6%	57.4%
Telecommunication Services	-1.0%	-1.5%	0.0%	0.0%	0.0%	0.0%	60.9%	59.5%	43.7%	45.4%
Energy	-34.2%	-30.2%	0.0%	0.0%	0.0%	0.0%	52.5%	51.3%	63.9%	63.8%
Software & Services	31.1%	32.9%	0.0%	0.0%	0.0%	0.0%	33.3%	33.8%	50.2%	50.8%
Materials	19.1%	16.0%	0.0%	0.0%	0.0%	0.0%	50.9%	52.4%	53.0%	52.1%
Health Care Equipment & Services	16.4%	17.6%	0.0%	0.0%	0.0%	0.0%	53.5%	53.3%	53.5%	53.4%
Capital Goods	6.5%	7.5%	0.0%	0.0%	0.0%	0.0%	48.4%	47.8%	47.1%	47.4%
Media & Entertainment	26.5%	29.7%	0.0%	0.0%	0.0%	0.0%	26.1%	27.7%	35.7%	36.6%
Commercial & Professional Services	9.6%	11.5%	0.0%	0.0%	0.0%	0.0%	29.1%	28.4%	54.2%	55.0%
Food & Staples Retailing	12.0%	11.1%	0.0%	15.0%	0.0%	52.7%	42.8%	42.0%	57.8%	57.4%
Household & Personal Products	10.3%	10.3%	0.0%	0.0%	0.0%	0.0%	33.3%	33.1%	49.4%	45.5%
Food, Beverage & Tobacco	-0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	49.2%	49.2%	54.0%	54.5%
Utilities	0.5%	0.8%	0.0%	0.0%	0.0%	0.0%	47.6%	46.9%	45.2%	46.0%
Insurance	-4.0%	-4.6%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Real Estate	-8.5%	-5.9%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Diversified Financials	8.3%	8.7%	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Banks	-12.4%	-14.5%	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 is one positive bubble identified in the 24 MSCI World Industry Group Indices: *Consumer Services*. 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 *Food & Staples Retailing* industry group has a significant bubble, and it is going into a correction in the past month, as showed below.



Portfolio Construction & Performance

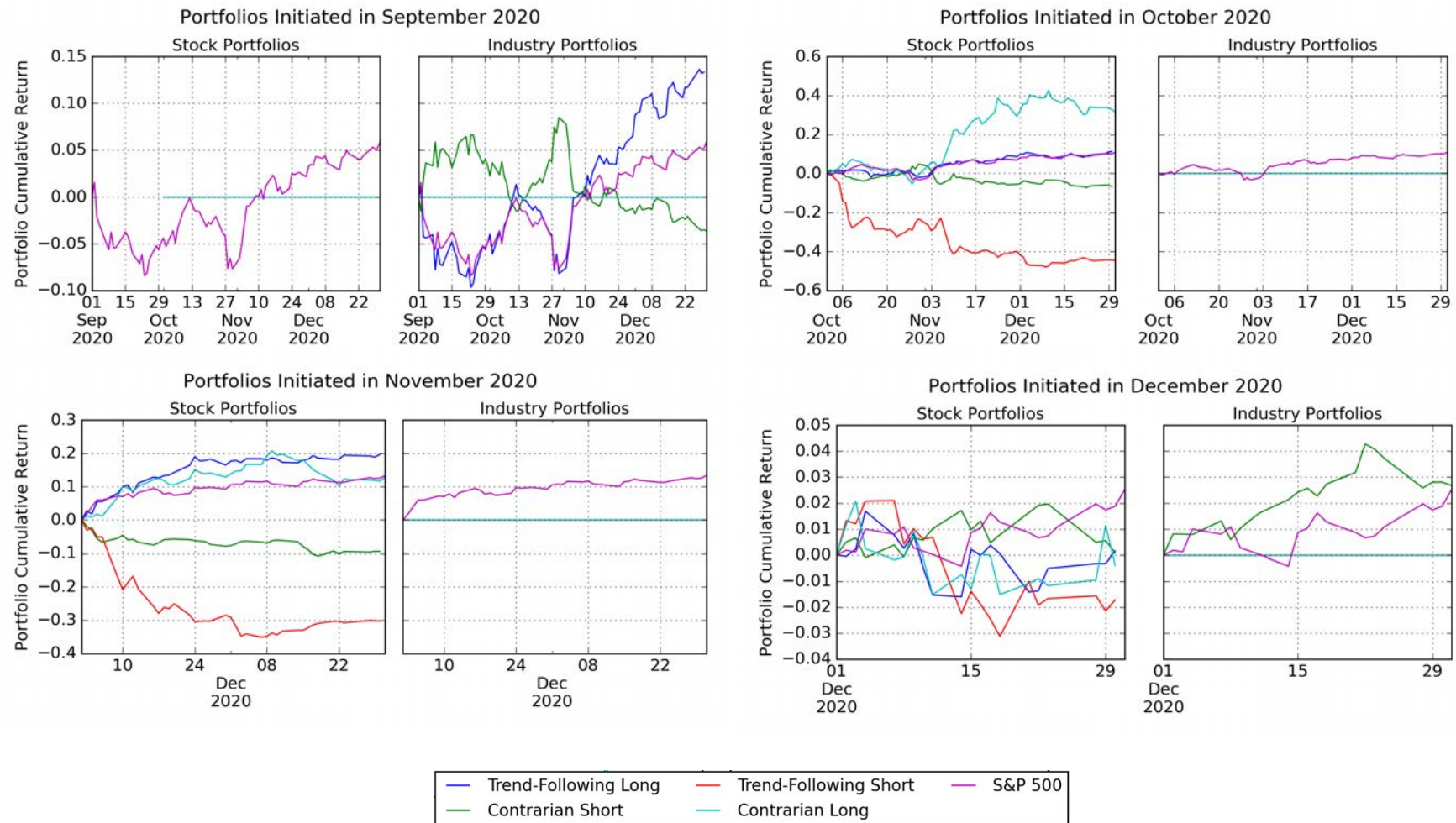
- ▶ Here we illustrate the methodology of the portfolio construction process based on the results of our previous analyses.
- ▶ For individual stocks that we identified in the 4 quadrants, we constructed 4 portfolios based on the 4 quadrants defined in the last report. Each portfolio consists of all 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.

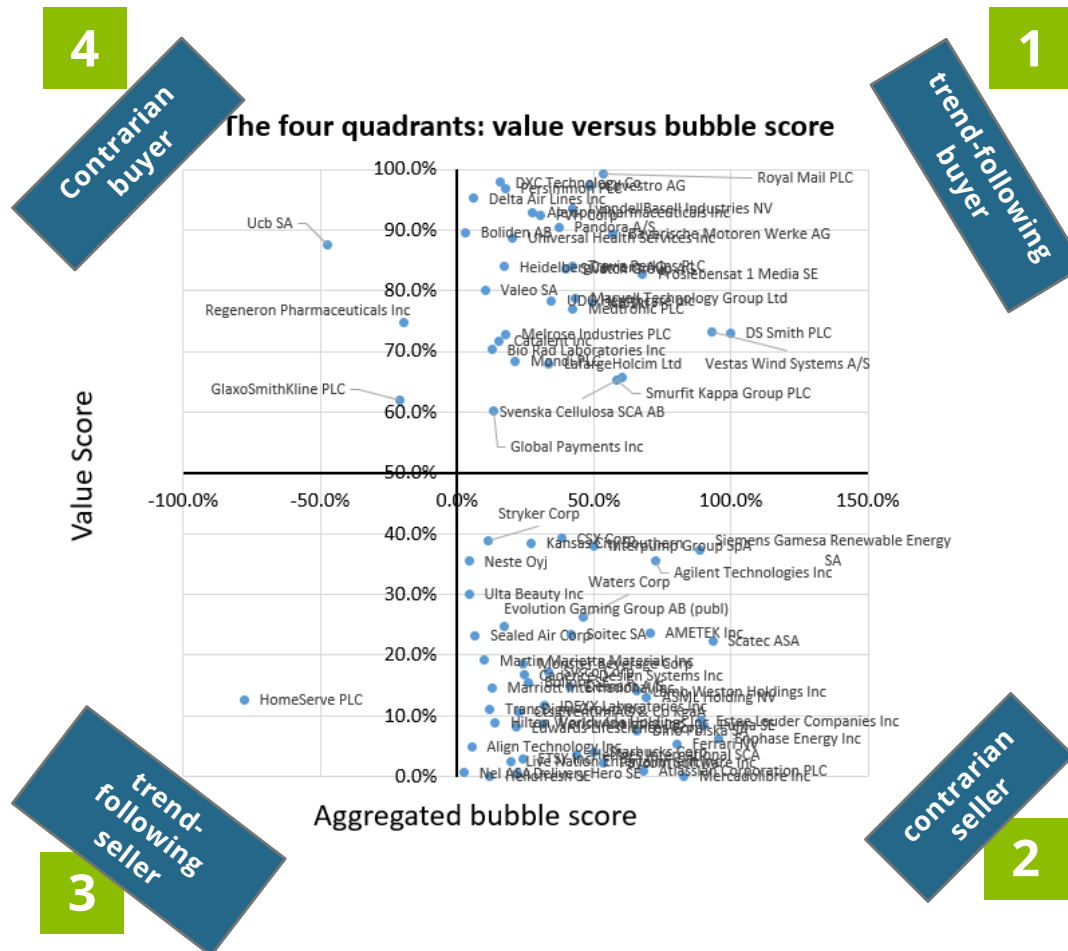
Portfolio Construction & Performance

- The Long portfolios have performed well in the past month due to the market reaction of the positive news of vaccine developments. 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 quadrants¹⁾



- **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. DS Smith 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. Stryker 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. HomeServe PLC
- **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. Ucb SA

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.

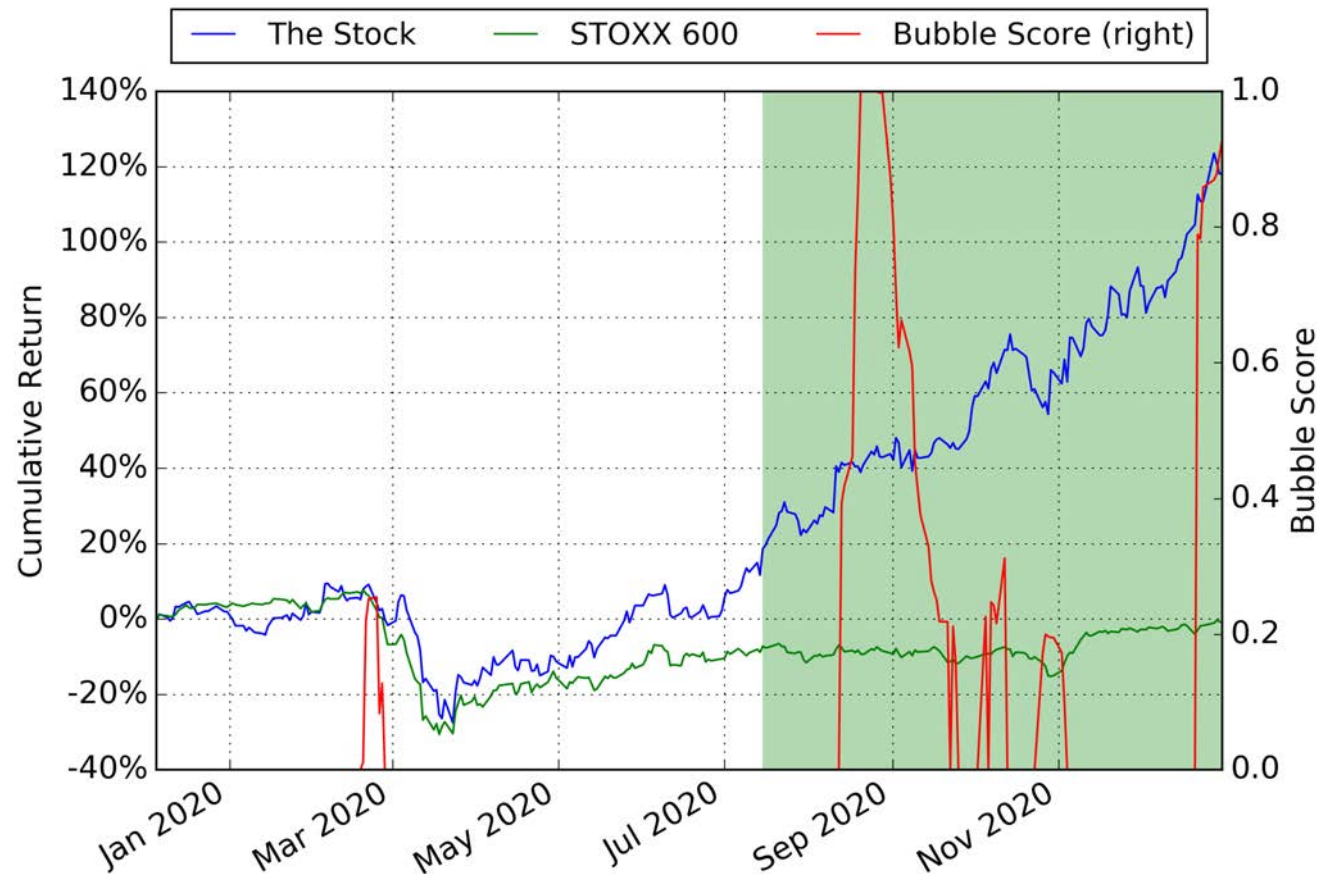
Single Stocks

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	72.7%	45.7%	May-20	43.1%	78.8%	63.6%
LafargeHolcim Ltd	Switzerland	Materials	-7.5%	43.2%	Mar-20	33.4%	68.0%	92.0%
Swatch Group AG	Switzerland	Consumer Durables & Apparel	-9.9%	31.8%	May-20	39.5%	83.7%	94.4%
Bayerische Motoren Werke AG	Germany	Automobiles & Components	-1.9%	48.7%	Apr-20	56.9%	89.4%	43.5%
HeidelbergCement AG	Germany	Materials	-4.5%	65.9%	Mar-20	17.2%	83.9%	96.4%
Covestro AG	Germany	Materials	24.0%	53.5%	May-20	48.3%	97.2%	46.7%
Prosiebensat 1 Media SE	Germany	Media & Entertainment	4.4%	32.7%	Jun-20	67.7%	82.7%	74.4%
Vestas Wind Systems A/S	Denmark	Capital Goods	126.8%	83.8%	Jul-20	92.7%	73.3%	85.2%
Pandora A/S	Denmark	Consumer Durables & Apparel	99.7%	109.8%	May-20	37.1%	90.4%	20.8%
Valeo SA	France	Automobiles & Components	2.0%	49.2%	May-20	10.2%	80.0%	98.7%
Persimmon PLC	United Kingdom	Consumer Durables & Apparel	1.2%	41.5%	Apr-20	17.5%	96.9%	24.8%
Travis Perkins PLC	United Kingdom	Capital Goods	-14.8%	48.0%	Apr-20	42.3%	84.0%	18.6%
DS Smith PLC	United Kingdom	Materials	-0.3%	26.3%	Jul-20	99.7%	73.0%	43.3%
Mondi PLC	United Kingdom	Materials	2.8%	15.4%	May-20	21.2%	68.3%	15.5%
Royal Mail PLC	United Kingdom	Transportation	54.9%	153.0%	Mar-20	53.2%	99.2%	13.8%
Melrose Industries PLC	United Kingdom	Capital Goods	-24.7%	103.5%	Mar-20	17.9%	72.8%	3.1%
UDG Healthcare plc	Ireland; Republic of	Health Care Equipment & Services	-1.7%	12.4%	May-20	34.5%	78.4%	17.5%
Smurfit Kappa Group PLC	Ireland; Republic of	Materials	13.6%	59.4%	Mar-20	58.2%	65.2%	88.4%
Medtronic PLC	Ireland; Republic of	Health Care Equipment & Services	-0.7%	24.5%	Apr-20	42.3%	76.9%	79.2%
LyondellBasell Industries NV	United Kingdom	Materials	0.5%	102.4%	Mar-20	42.3%	93.5%	92.5%
AB Skf	Sweden	Capital Goods	14.1%	65.2%	Mar-20	49.7%	78.0%	16.1%
Svenska Cellulosa SCA AB	Sweden	Materials	53.4%	49.4%	Mar-20	60.1%	65.7%	62.2%
Boliden AB	Sweden	Materials	15.4%	49.4%	Apr-20	3.0%	89.5%	15.0%
Alexion Pharmaceuticals Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	37.1%	36.5%	May-20	27.3%	92.9%	24.3%
Bio Rad Laboratories Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	51.8%	26.6%	May-20	12.7%	70.3%	71.9%
Catalent Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	75.1%	41.6%	May-20	15.1%	71.7%	32.9%
DXC Technology Co	United States of America	Software & Services	-27.6%	106.5%	Mar-20	15.7%	97.8%	4.0%
Delta Air Lines Inc	United States of America	Transportation	-32.4%	27.1%	Jun-20	6.0%	95.2%	5.4%
Global Payments Inc	United States of America	Software & Services	11.4%	32.3%	Apr-20	13.2%	60.2%	60.5%
PVH Corp	United States of America	Consumer Durables & Apparel	-6.3%	130.4%	Mar-20	30.4%	92.4%	31.9%
Universal Health Services Inc	United States of America	Health Care Equipment & Services	-5.1%	56.3%	Mar-20	20.1%	88.8%	27.0%
Xerox Holdings Corp	United States of America	Technology Hardware & Equipment	-37.4%	45.1%	Mar-20	20.3%	98.3%	3.3%

Single Stocks

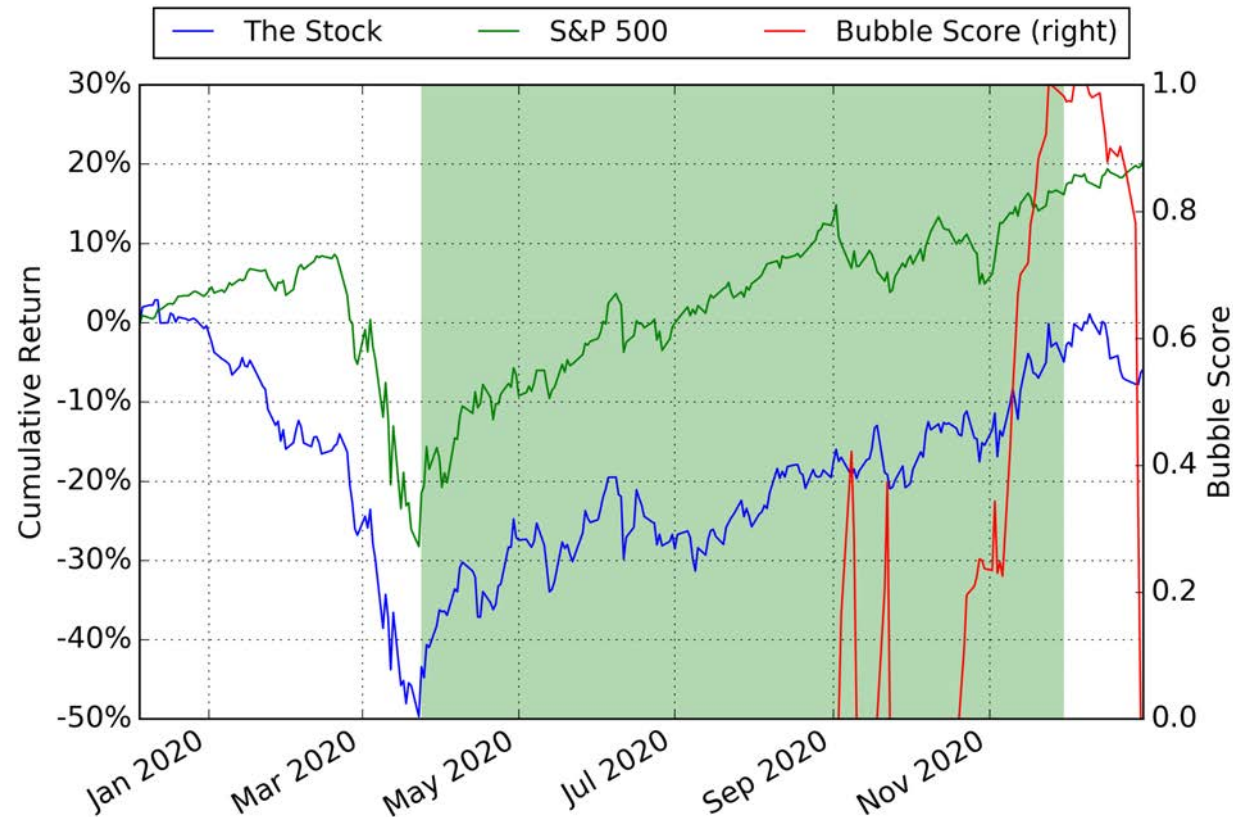
Quadrant 1 Stocks Current Month Example – Vestas Wind Systems A/S.



- 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 six-month bubble has reached 92.7% with a bubble size 83.8%.

Single Stocks

Quadrant 1 Stocks Last Month Example – Nucor Corp.



- The figure above plots the one-year cumulative return of the stock (blue), S&P 500 (green) and LPPLS Bubble Score (red lines on the right y-axis). The green shaded period delineates the time interval within which a strong positive bubble has been identified and reported last month. The regime of this stock price has shifted with a correction of 10% and a disappearance of the DS LPPLS Bubble signal recently, which is in agreement with our diagnostic last month.

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
Cts Eventim AG & Co KgaA	Germany	Media & Entertainment	-6.8%	34.5%	Jun-20	22.4%	10.6%	75.8%
Puma SE	Germany	Consumer Durables & Apparel	25.7%	85.5%	Mar-20	90.1%	8.3%	73.2%
Hellofresh SE	Germany	Retailing	223.1%	205.3%	Jan-20	11.9%	0.0%	40.0%
Delivery Hero SE	Germany	Retailing	93.4%	78.9%	Jan-20	22.1%	0.5%	95.2%
Demant A/S	Denmark	Health Care Equipment & Services	13.4%	67.6%	Mar-20	41.3%	14.9%	88.9%
Siemens Gamesa Renewable Energy SA	Spain	Capital Goods	124.6%	83.0%	Jul-20	88.7%	37.2%	7.1%
Neste Oyj	Finland	Energy	82.3%	128.4%	Mar-20	4.3%	35.4%	19.1%
Bolloré SE	France	Media & Entertainment	-12.1%	23.1%	Jun-20	26.2%	15.5%	98.4%
Hermès International SCA	France	Consumer Durables & Apparel	27.6%	17.8%	May-20	43.5%	3.6%	60.7%
Soitec SA	France	Semiconductors & Semiconductor Equipment	59.1%	112.4%	Apr-20	41.7%	23.5%	14.4%
Atlassian Corporation PLC	United Kingdom	Software & Services	71.9%	43.4%	May-20	68.0%	0.8%	58.0%
Interpump Group SpA	Italy	Capital Goods	40.2%	72.7%	Apr-20	49.7%	38.0%	8.2%
ASML Holding NV	Netherlands	Semiconductors & Semiconductor Equipment	47.8%	28.7%	Jul-20	69.2%	13.1%	56.7%
Ferrari NV	Italy	Automobiles & Components	21.2%	26.7%	Jun-20	80.2%	5.3%	80.2%
Nel ASA	Norway	Capital Goods	215.1%	50.8%	Jul-20	2.5%	0.6%	80.4%
Scatec ASA	Norway	Utilities	187.4%	110.6%	Jun-20	93.3%	22.2%	83.1%
Dino Polska SA	Poland	Food & Staples Retailing	81.2%	55.8%	Jun-20	65.6%	7.5%	71.6%
Evolution Gaming Group AB (publ)	Sweden	Consumer Services	172.8%	32.3%	Jul-20	17.4%	24.7%	62.3%
Agilent Technologies Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	35.5%	39.4%	May-20	72.2%	35.6%	48.9%
Align Technology Inc	United States of America	Health Care Equipment & Services	79.3%	104.8%	Jan-20	5.2%	5.0%	55.4%
AMETEK Inc	United States of America	Capital Goods	19.9%	70.3%	Mar-20	70.4%	23.7%	51.9%
CSX Corp	United States of America	Transportation	21.5%	63.5%	Mar-20	38.1%	39.2%	48.2%
Cadence Design Systems Inc	United States of America	Software & Services	85.9%	54.9%	May-20	24.4%	16.7%	58.9%
Edwards Lifesciences Corp	United States of America	Health Care Equipment & Services	17.3%	34.0%	Jun-20	21.5%	8.1%	70.6%

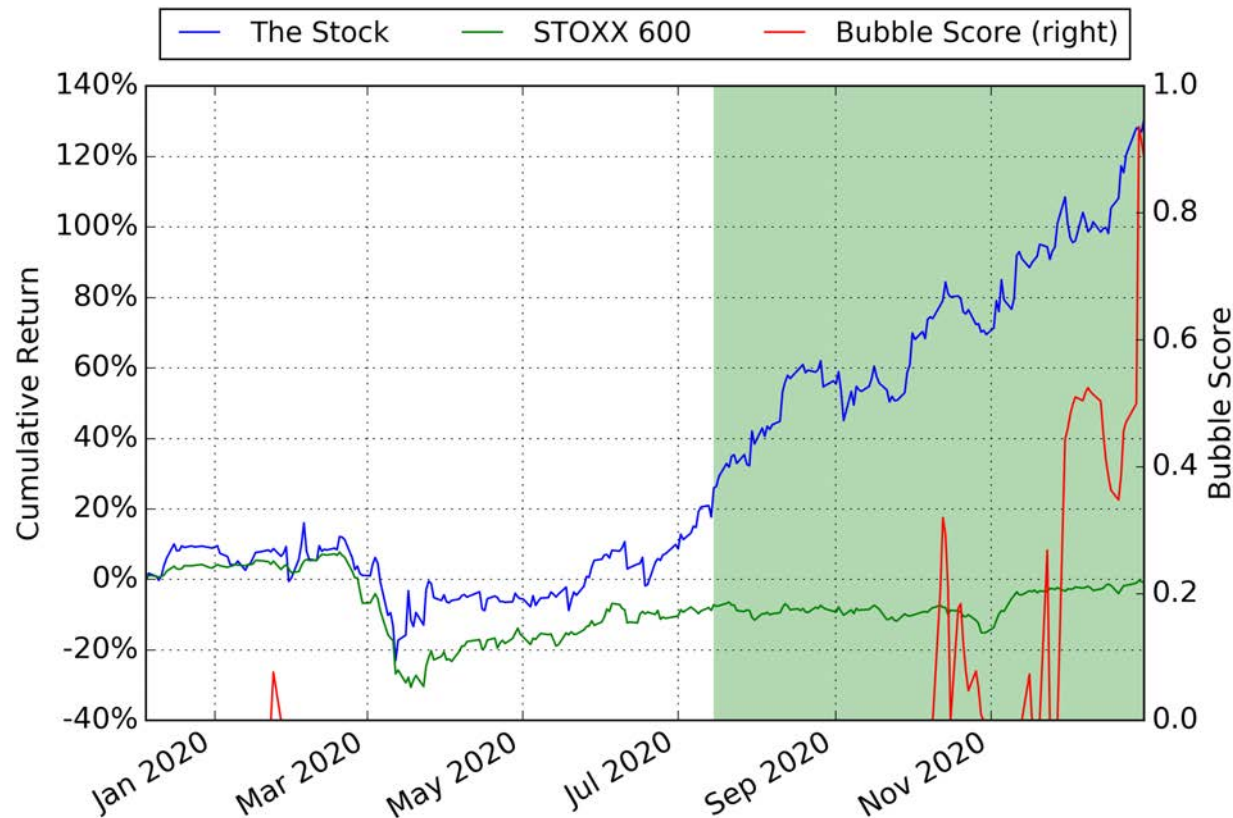
Single Stocks

Quadrant 2 stocks: strong positive bubble signals with weak fundamentals (cont'd)

Company Name	Country of Headquarters	GICS Industry Group Name	Yearly Return	Bubble Size	Bubble Start	Bubble Score	Value Score	Growth Score
Enphase Energy Inc	United States of America	Semiconductors & Semiconductor Equipment	469.9%	194.2%	Jul-20	95.6%	6.3%	61.2%
ETSY Inc	United States of America	Retailing	271.0%	144.4%	May-20	23.8%	2.9%	42.9%
Hilton Worldwide Holdings Inc	United States of America	Consumer Services	1.8%	52.3%	May-20	13.9%	8.8%	40.6%
IDEXX Laboratories Inc	United States of America	Health Care Equipment & Services	77.1%	96.5%	Apr-20	31.9%	11.6%	57.7%
Kansas City Southern	United States of America	Transportation	27.5%	66.8%	Mar-20	27.0%	38.5%	66.3%
Lamb Weston Holdings Inc	United States of America	Food, Beverage & Tobacco	-13.7%	43.1%	Mar-20	65.8%	14.0%	87.1%
Estee Lauder Companies Inc	United States of America	Household & Personal Products	24.7%	42.8%	May-20	88.9%	9.2%	79.7%
Live Nation Entertainment Inc	United States of America	Media & Entertainment	1.5%	59.2%	May-20	19.4%	2.4%	87.7%
Marriott International Inc	United States of America	Consumer Services	-10.1%	75.3%	Mar-20	12.7%	14.5%	35.7%
Martin Marietta Materials Inc	United States of America	Materials	4.3%	56.0%	Mar-20	9.9%	19.1%	77.4%
Mercadolibre Inc	Argentina	Retailing	142.4%	125.5%	May-20	82.8%	0.1%	74.5%
Monster Beverage Corp	United States of America	Food, Beverage & Tobacco	41.1%	59.3%	Apr-20	23.8%	18.5%	73.6%
Paycom Software Inc	United States of America	Software & Services	53.1%	123.2%	Apr-20	53.5%	2.3%	59.6%
Sealed Air Corp	United States of America	Materials	18.5%	43.7%	May-20	6.6%	23.2%	29.5%
Starbucks Corp	United States of America	Consumer Services	17.5%	64.9%	Mar-20	49.9%	4.0%	27.2%
Stryker Corp	United States of America	Health Care Equipment & Services	18.4%	47.9%	Apr-20	11.4%	38.8%	62.8%
Sysco Corp	United States of America	Food & Staples Retailing	-11.3%	62.7%	Mar-20	33.2%	17.2%	42.2%
TransDigm Group Inc	United States of America	Capital Goods	2.4%	42.1%	May-20	12.0%	11.0%	30.4%
Ulta Beauty Inc	United States of America	Retailing	4.2%	27.1%	Jun-20	4.3%	30.1%	51.1%
Verisk Analytics Inc	United States of America	Commercial & Professional Services	31.4%	46.1%	Mar-20	31.4%	8.6%	69.9%
Waters Corp	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	8.1%	14.3%	Jul-20	46.2%	26.2%	36.6%
Xilinx Inc	United States of America	Semiconductors & Semiconductor Equipment	43.3%	61.0%	Jan-20	24.5%	21.0%	44.6%
Xylem Inc	United States of America	Capital Goods	25.2%	55.4%	Mar-20	14.2%	19.2%	69.2%
Yum! Brands Inc	United States of America	Consumer Services	8.2%	35.1%	Apr-20	37.6%	30.5%	90.8%

Single Stocks

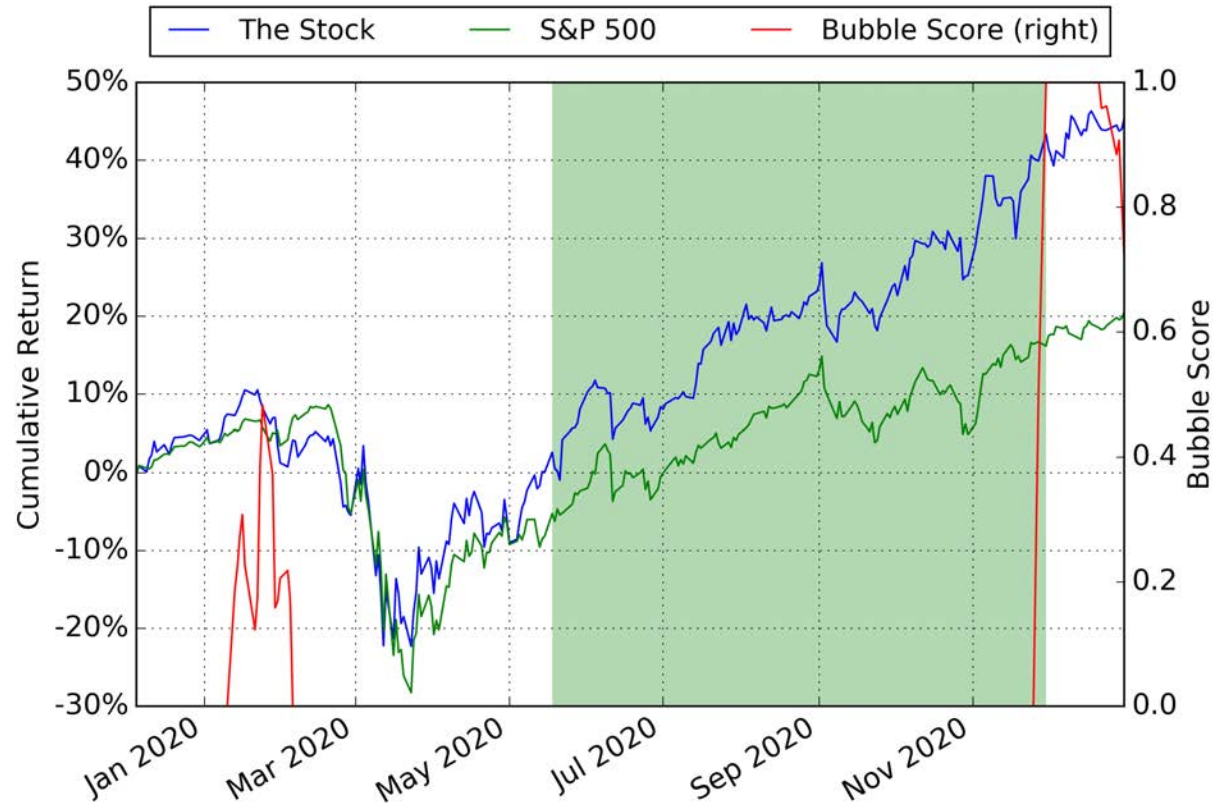
Quadrant 2 Stocks Current Month Example – Siemens Gamesa Renewable Energy SA.



- 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 six-month bubble has reached 88.7% with a bubble size 83%. 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 – Agilent Technologies Inc..



The figure above plots the one-year cumulative return of the stock (blue), S&P 500 (green) and LPPLS Bubble Score (red lines on the right y-axis). The green shaded period delineates the time interval within which a strong positive bubble has been identified and reported last month. The stock has continued to appreciate with a decreasing momentum. The current bubble may soon be reaching its tipping point.

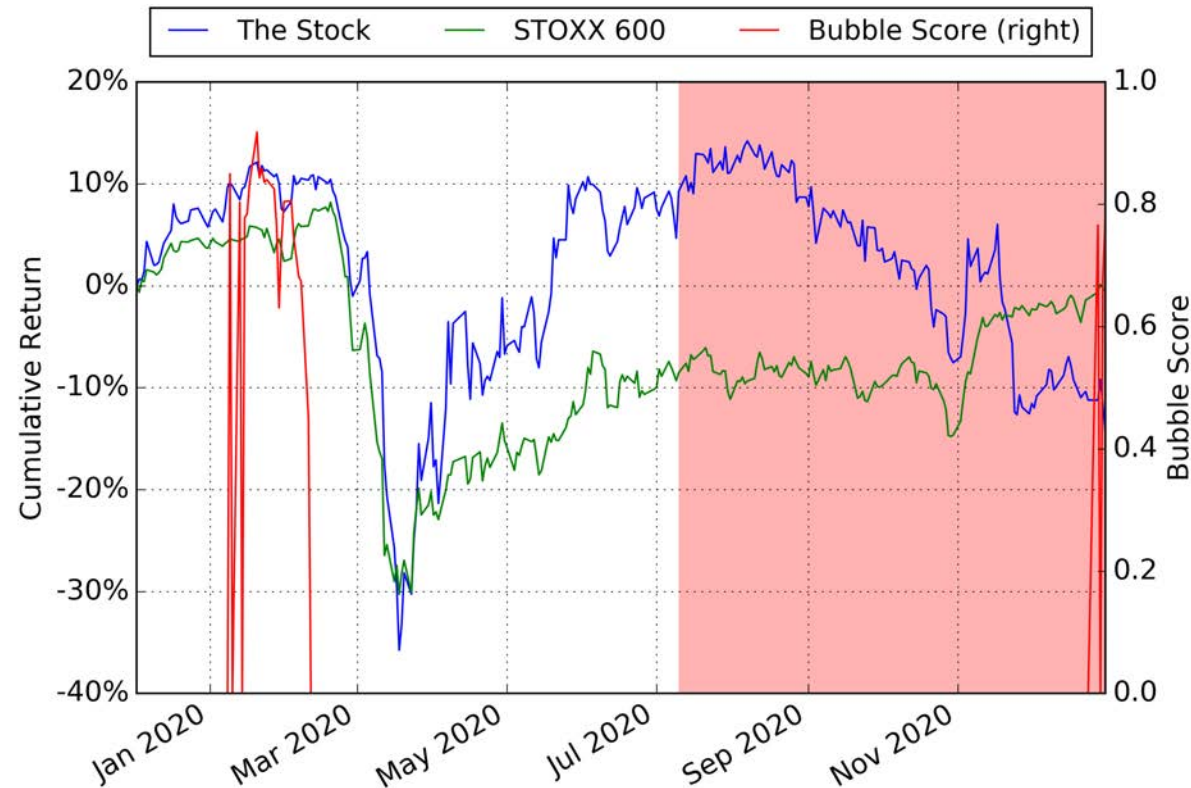
Single Stocks

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
HomeServe PLC	United Kingdom	Commercial & Professional Services	-20.9%	-21.5%	Jul-20	-77.7%	12.6%	48.0%

Single Stocks

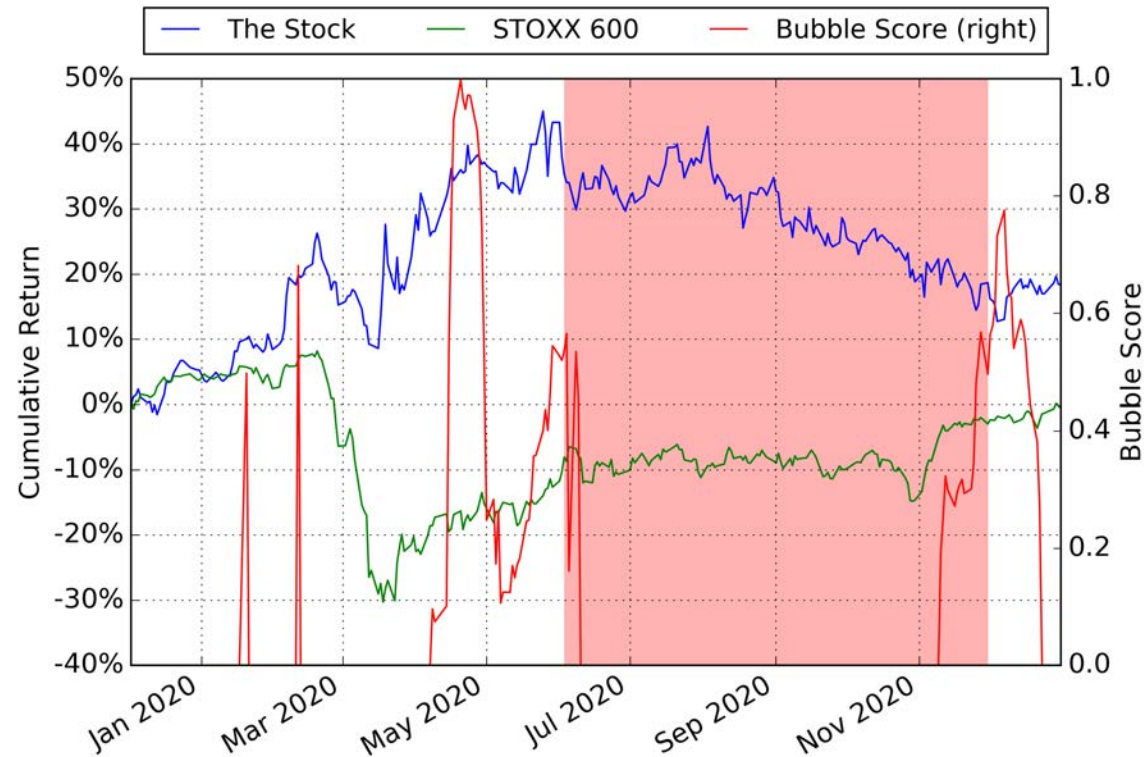
Quadrant 3 Stocks Current Month Example – HomeServe PLC.



- The above graph shows the one-year cumulative return of the stock in blue (left hand scale), STOXX 600 in green (left hand scale) and the calculated DS LPPLS Bubble Score in red (right hand scale). The red shaded period delineates the time interval within which the negative bubble is identified. The Bubble Score of this six-month bubble has reached 77.7% with a bubble size -21.5%.

Single Stocks

Quadrant 3 Stocks Last Month Example – Coloplast A/S.



- 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 started a rebound in the past month, which is in agreement with our DS LPPLS Bubble signal last month. One should however remain cautious about this stock, given the weak fundamentals.

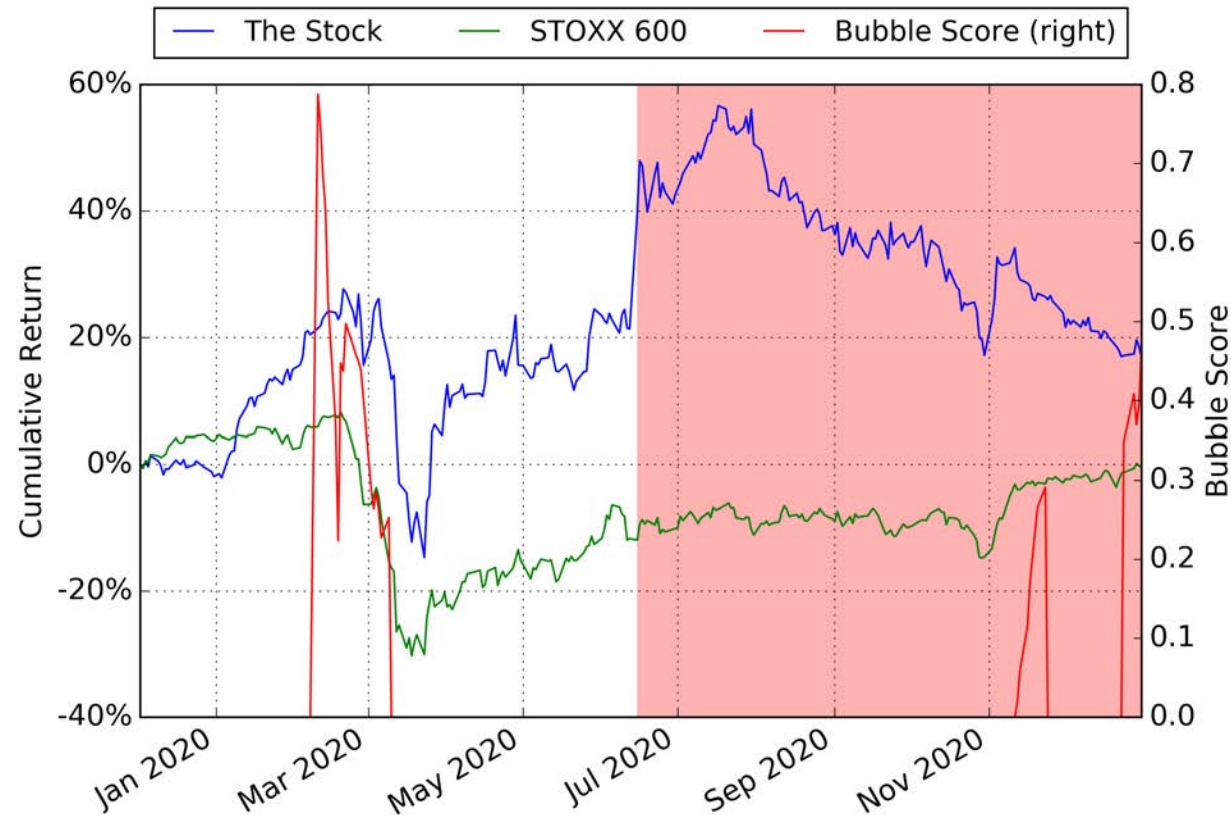
Single Stocks

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
Ucb SA	Belgium	Pharmaceuticals, Biotechnology & Life Sciences	7.0%	-16.2%	Jun-20	-47.1%	87.5%	6.8%
GlaxoSmithKline PLC	United Kingdom	Pharmaceuticals, Biotechnology & Life Sciences	-25.8%	-18.9%	Apr-20	-21.1%	62.0%	18.4%
Regeneron Pharmaceuticals Inc	United States of America	Pharmaceuticals, Biotechnology & Life Sciences	27.5%	-21.2%	May-20	-19.4%	74.7%	20.6%

Single Stocks

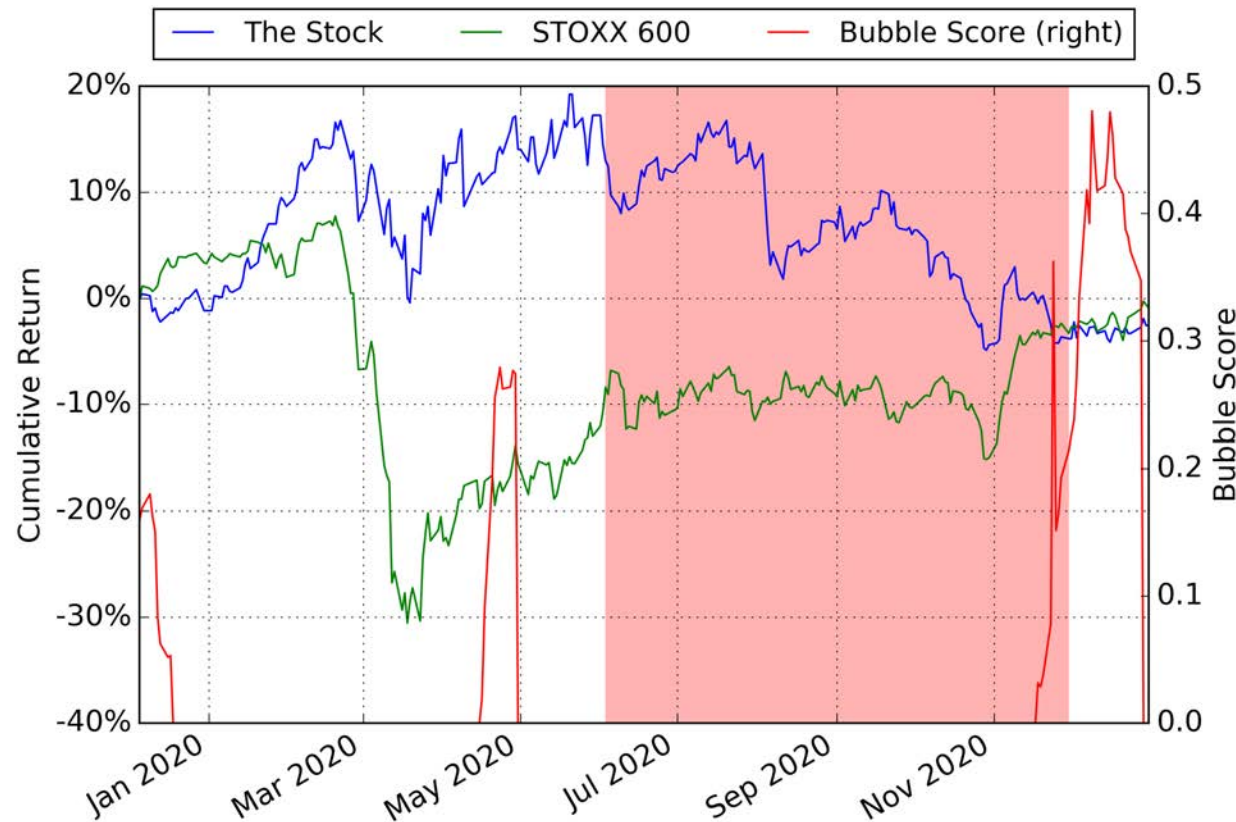
Quadrant 4 Stocks Current Month Example – Ucb SA.



- 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 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 47.1% with a negative bubble size -16.2%. We expect a rebound in the future when the bubble is mature, given our diagnostic of a negative bubble signal with strong fundamentals, calling for a contrarian buyer position.

Single Stocks

Quadrant 4 Stocks Last Month Example – Galenica AG.



- 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 flat platform in the past month, which indicates a stop of the downside momentum. This is in agreement with our bubble signal and the diagnostic of the strong fundamentals.

Appendix: Improvements to the FCO Report

Asset Class Selection:

- ▶ Since December 2020, we base the computation of bubble signals in the first report part on an entirely new, revised and (for some) much larger selection of assets. We add asset class “single stocks” and show the corresponding fractions of positive and negative bubble signals in the bubble overview plot and table for this class, as well. Furthermore, the sub-classification of assets is now done geographically; we present results for Global, European and United States markets, with more geographic regions to be potentially added in future versions.
- ▶ According to this update of the asset selection and classification, we recompute the bubble overview plot that displays the fractions of positive and negative bubbles over time. We also choose a higher, daily, resolution (instead of monthly, as done before) for the overview plot, which allows the reader to study the signals in more detail.

DS LPPLS Multi-Scale Confidence Indicators:

- ▶ Additionally, we extend our methodology of the DS LPPLS Confidence Indicator to the so-called Multi-Scale Confidence Indicators (MCI). The MCI are finer version of the Confidence Indicator, computed in the same way, however based on different, sets of fit windows that describe different “timescales of thinking” of investors. More specifically, we base the computation of the MCI on the following window sets:
 - 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
- ▶ As visible, these different sets range from few months up to several years. For each range, LPPLS signals are computed over all contained fit windows in steps of 1 day. The resulting signals are aggregated into four corresponding versions of the Confidence Indicator. These MCI range from very reactive (SS,S) to more stable (M,L) versions. Observing them simultaneously allows understanding the formation and evolution of speculative bubbles in more detail.
- ▶ Based on these four new indicators, we also update the indicator plots, by showing the detailed positive and negative bubble indicator timeseries for all four of them. In the asset tables, we report only the strongest of the four in the column “DS LPPLS Confidence”. The new column “strongest signal” indicates which of the four indicator this corresponds to.

Improvements to the FCO Report

Additional Bubble Metrics:

- ▶ Furthermore, we update the asset tables that show the top positive and negative bubble signals, as well as the corresponding bubble characteristics.
- ▶ Firstly, a new metric, the “bubble CAGR” (bg) is introduced. It measures the annualized compound bubble growth (bg) of the price during a bubble phase, as implied by the size (bs) and duration (bd) of a bubble.

$$bg = \exp\left(\frac{\ln(bs+1)}{bd}\right)$$

- ▶ Thereby, as before, the bubble size since the bubble start t_1 is $bs = \frac{p_t}{p_1} - 1$ and the bubble duration is $bd = t - t_1$
- ▶ Furthermore, we introduce the bubble progress. By estimation of the start time t_1 and the predicted end time t_c of a bubble, the progress of the bubble at the current time t is computed as:

$$bp = \frac{t - t_1}{t_c - t_1}$$

- ▶ Thus, the bubble progress measures the percentage of time until the predicted end of the bubble that has passed so far (i.e. until t) since the beginning of the bubble. The numerator is the current bubble duration and the divisor $t_c - t_1$ is the “implied bubble duration”, implied by the LPPLS model.

New Ranking Methodology:

- ▶ With the additional metric bubble progress, we now rank top positive and negative bubble signals from our database according to the geometric average of the confidence indicator, the bubble CAGR and the bubble progress:

$$ga = (ci \cdot bg \cdot bp)^{1/3}$$

- ▶ This new geometric average now considers the strength of the bubble signal, the intensity of the bubble (compound growth), as well as the maturity of the bubble. These three metrics characterize the most relevant “dimensions” of a bubble and thus, the geometric average is a reasonable choice to rank bubble signals.

More Information

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

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

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