Volatility trading

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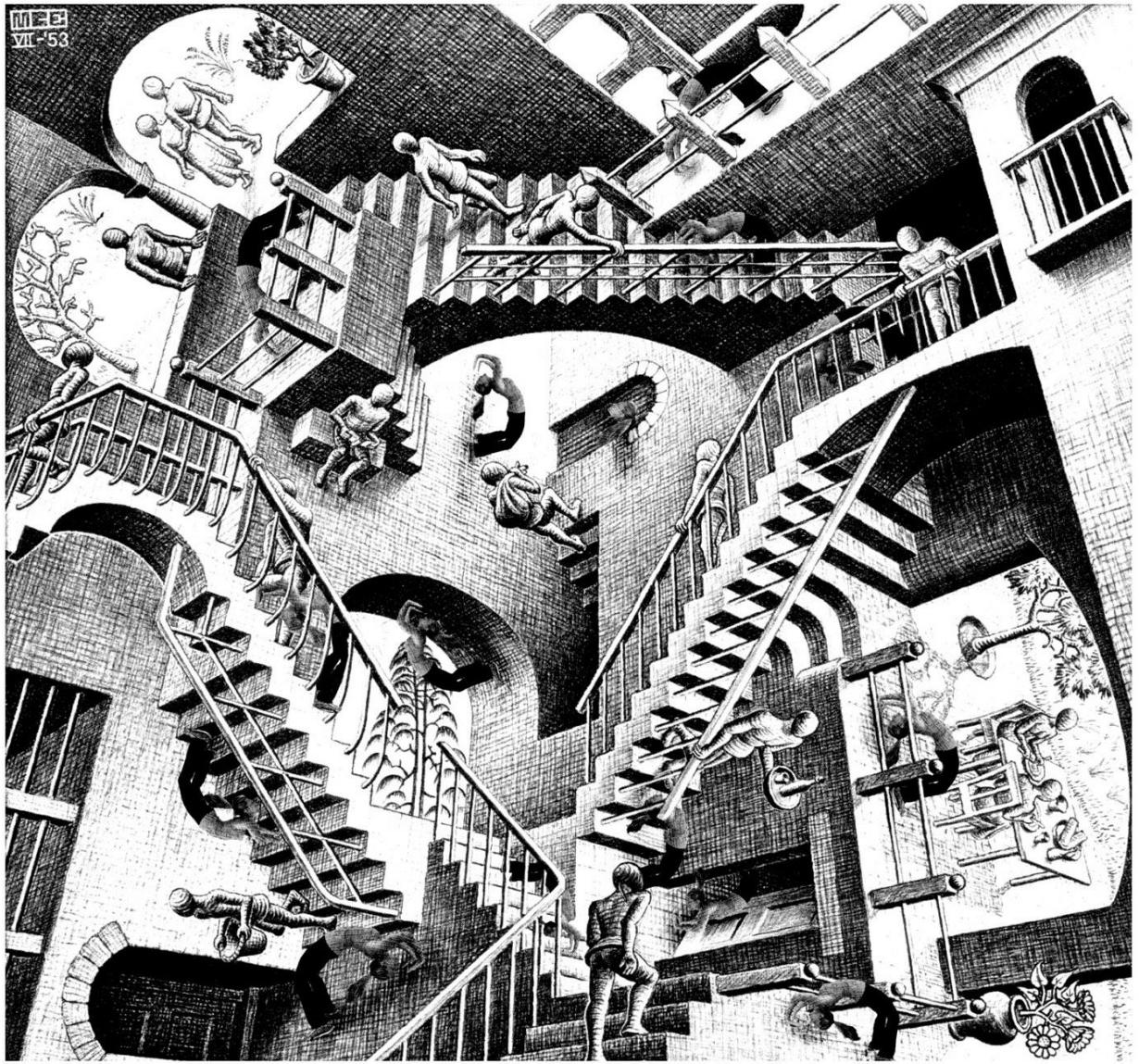
Bitcoin price

Volatility and the Unknown

Volatility is impossible object.

- There are known knowns
- There are things we know that we know
- There are known unknowns
- There are unknown unknowns



Volatility

Volatility is the degree of variation of a trading price series over time

Volatility refers to the amount of uncertainty or risk related to the size of changes in a security's value

MEASURING HISTORICAL VOLATILITY

Close-to-Close, Exponentially Weighted, Parkinson, Garman-Klass, Rogers-Satchell and Yang-Zhang Volatility

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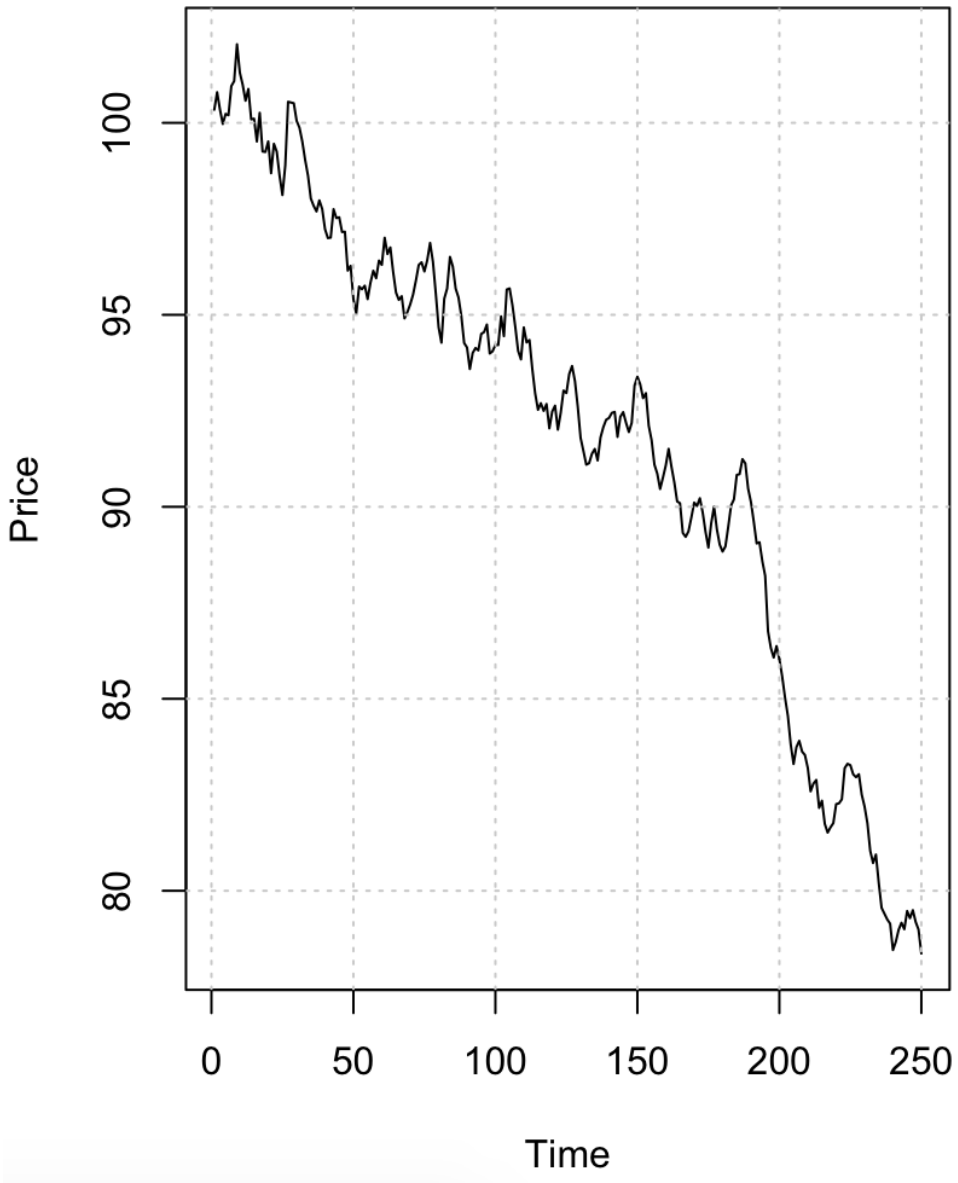
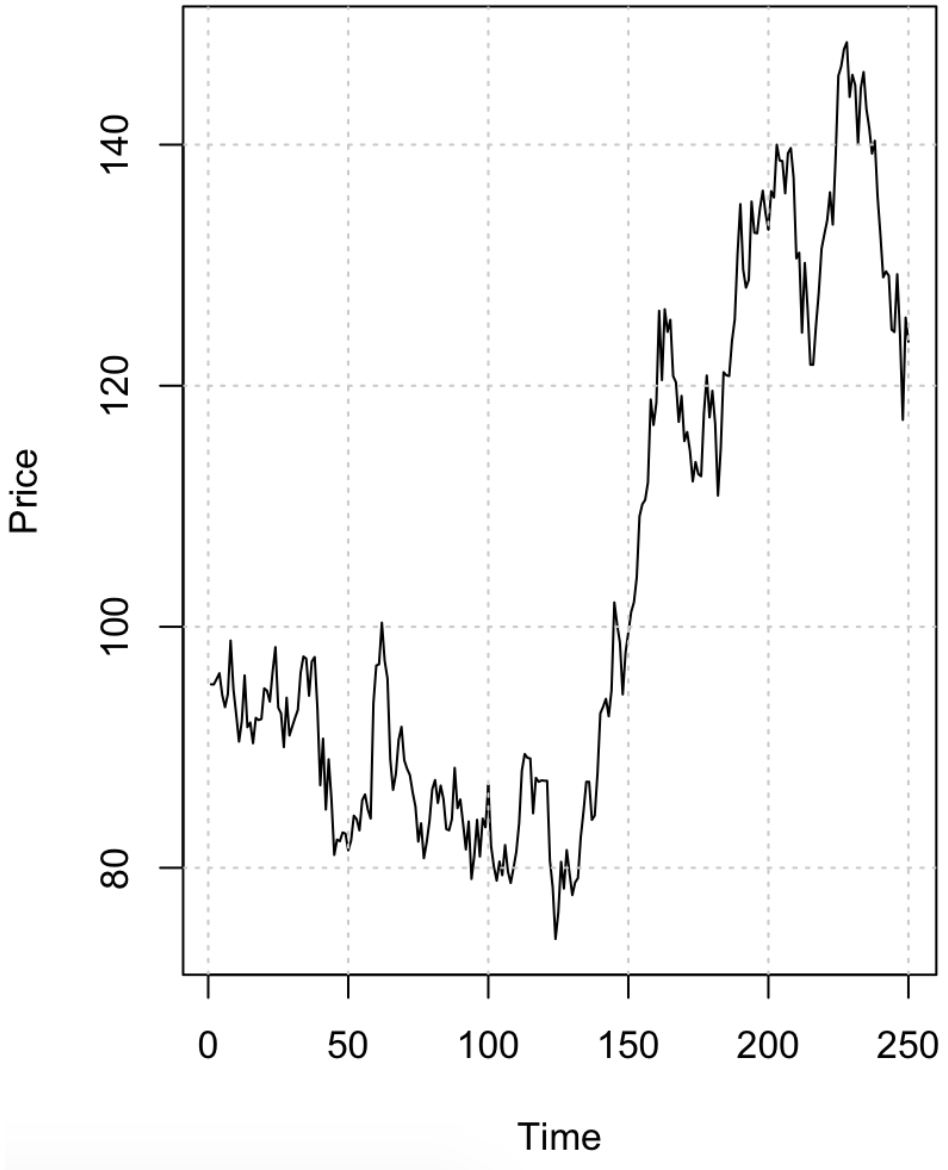
The implied volatility of an option is usually compared against historical volatility to see if it is cheap or not. However, while there is only one implied volatility there are many different measures of historical volatility which can use some or all of the open (O), high (H), low (L) and close (C). Generally, for small sample sizes the Yang-Zhang measure is best overall, and for large sample sizes the standard close to close measure is best.

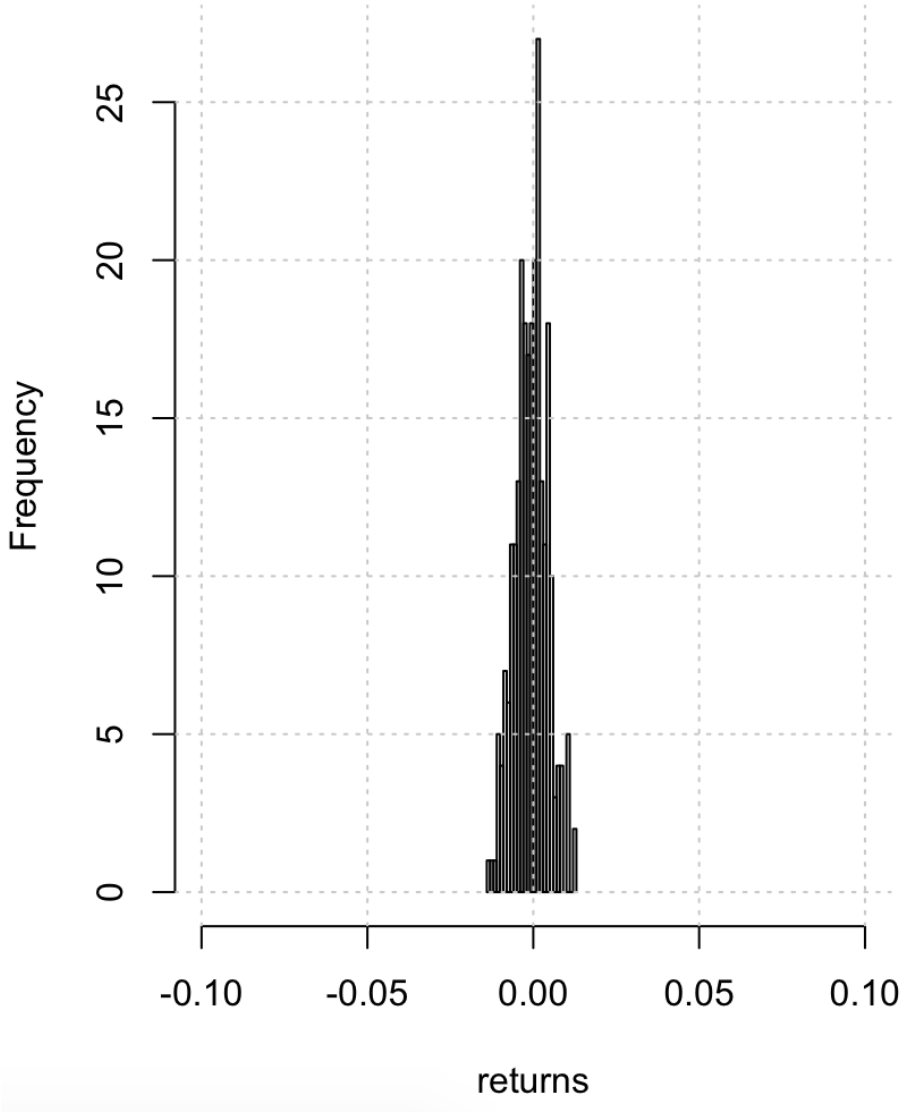
- **CLOSE-TO-CLOSE (C):** The simplest and most common type of calculation that benefits from only using reliable prices from closing auctions. We note that the volatility should be the standard deviation multiplied by $\sqrt{N/(N-1)}$ to take into account the fact we are sampling the population.
- **EXPONENTIALLY WEIGHTED (C):** Exponentially weighted volatilities are rarely used, partly due to the fact they do not handle regular volatility driving events such as earnings very well. Previous earnings jumps will have the least weight just before an earnings date, and the most weight just after earnings. It could, however, be of some use for indices.
- **PARKINSON (HL):** The first advanced volatility estimator was created by Parkinson in 1980, and instead of using closing prices it uses the high and low price. One drawback of this estimator is that it assumes continuous trading, hence it underestimates the volatility as potential movements when the market is shut are ignored. While other measures are more efficient based on simulated data, some studies have shown this to be the best measure for actual empirical data.
- **GARMAN-KLASS (OHLC):** Later in 1980 the Garman-Klass volatility estimator was created. It is an extension of Parkinson which includes opening and closing prices. As overnight jumps are ignored, the measure underestimates volatility. Yang-Zhang modified the Garman-Klass volatility measure in order to enable it to handle jumps.
- **ROGERS-SATCHELL (OHLC):** The Rogers-Satchell volatility created in the early 1990s is able to properly measure the volatility for securities with non-zero mean. It does not, however, handle jumps (hence it underestimates the volatility).
- **YANG-ZHANG (OHLC):** In 2000 Yang-Zhang created the most powerful volatility

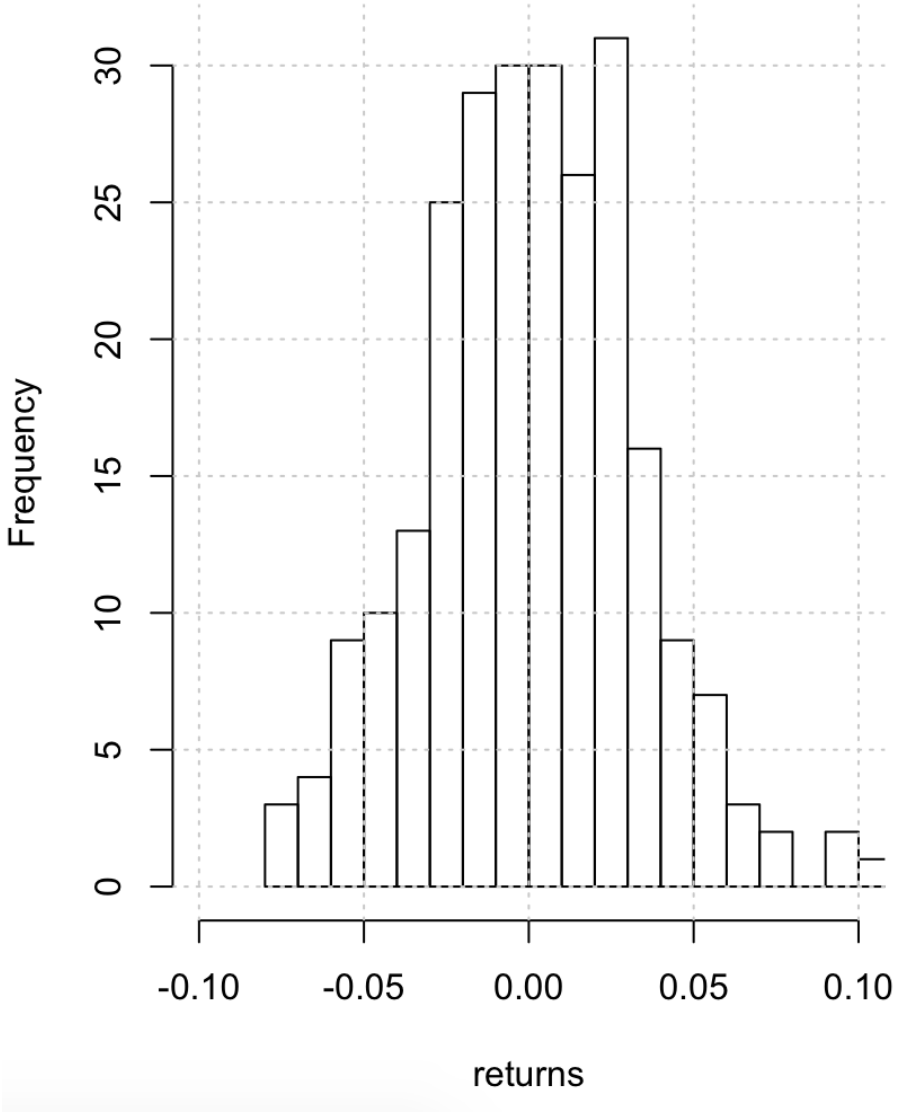
Volatility and price





Volatility and returns





Two worlds

Historical volatility

is the volatility experienced by the asset, stated in terms of annualized standard deviation as a percentage of the asset price.

Implied volatility

is the expected future volatility of the stock that is implied by the price of the asset’s options

Implied volatility

Black–Scholes formula [edit]

The Black–Scholes formula calculates the price of European put and call options. This price is consistent with the Black–Scholes equation as above; this follows since the formula can be obtained by solving the equation for the corresponding terminal and boundary conditions.

The value of a call option for a non-dividend-paying underlying stock in terms of the Black–Scholes parameters is:

$$\begin{aligned} C(S_t, t) &= N(d_1)S_t - N(d_2)PV(K) \\ d_1 &= \frac{1}{\sigma\sqrt{T-t}}\left[\ln\left(\frac{S_t}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)\right] \\ d_2 &= d_1 - \sigma\sqrt{T-t} \\ PV(K) &= Ke^{-r(T-t)} \end{aligned}$$

The price of a corresponding put option based on put–call parity is:

$$\begin{aligned} P(S_t, t) &= Ke^{-r(T-t)} - S_t + C(S_t, t) \\ &= N(-d_2)Ke^{-r(T-t)} - N(-d_1)S_t \end{aligned}$$

For both, as above:

- $N(\cdot)$ is the cumulative distribution function of the standard normal distribution
- $T - t$ is the time to maturity (expressed in years)
- S_t is the spot price of the underlying asset
- K is the strike price
- r is the risk free rate (annual rate, expressed in terms of continuous compounding)
- σ is the volatility of returns of the underlying asset

Robert C. Merton
Prize share: 1/2

Myron S. Scholes
Prize share: 1/2

Robert Merton, Myron Scholes

Derivative cryptoexchange

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Options

- An option is a contract that gives the holder a right, without any obligation, to buy or sell an asset at an agreed price on or before a specified period of time.
- The option to buy an asset is known as a **CALL** option.
- The option to sell an asset is called a **PUT** option.
- The price at which option can be exercised is called an exercise price or a **strike** price.

Option board (Deribit)

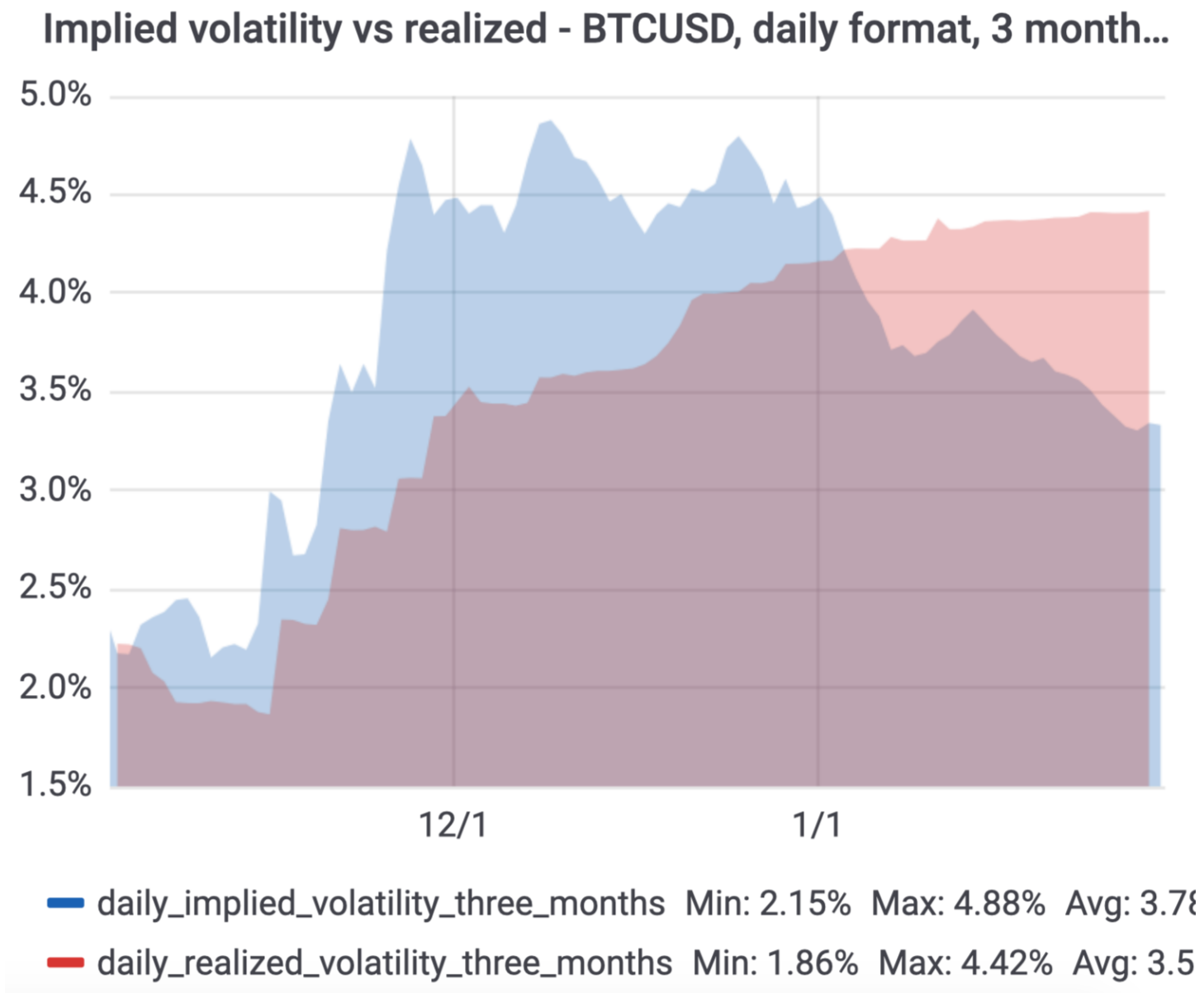
BTC Options click on any price to open order form

All | 1-02-19 | 22-02-19 | 29-03-19 | 28-06-19 | 27-09-19 | 1500 | 45000

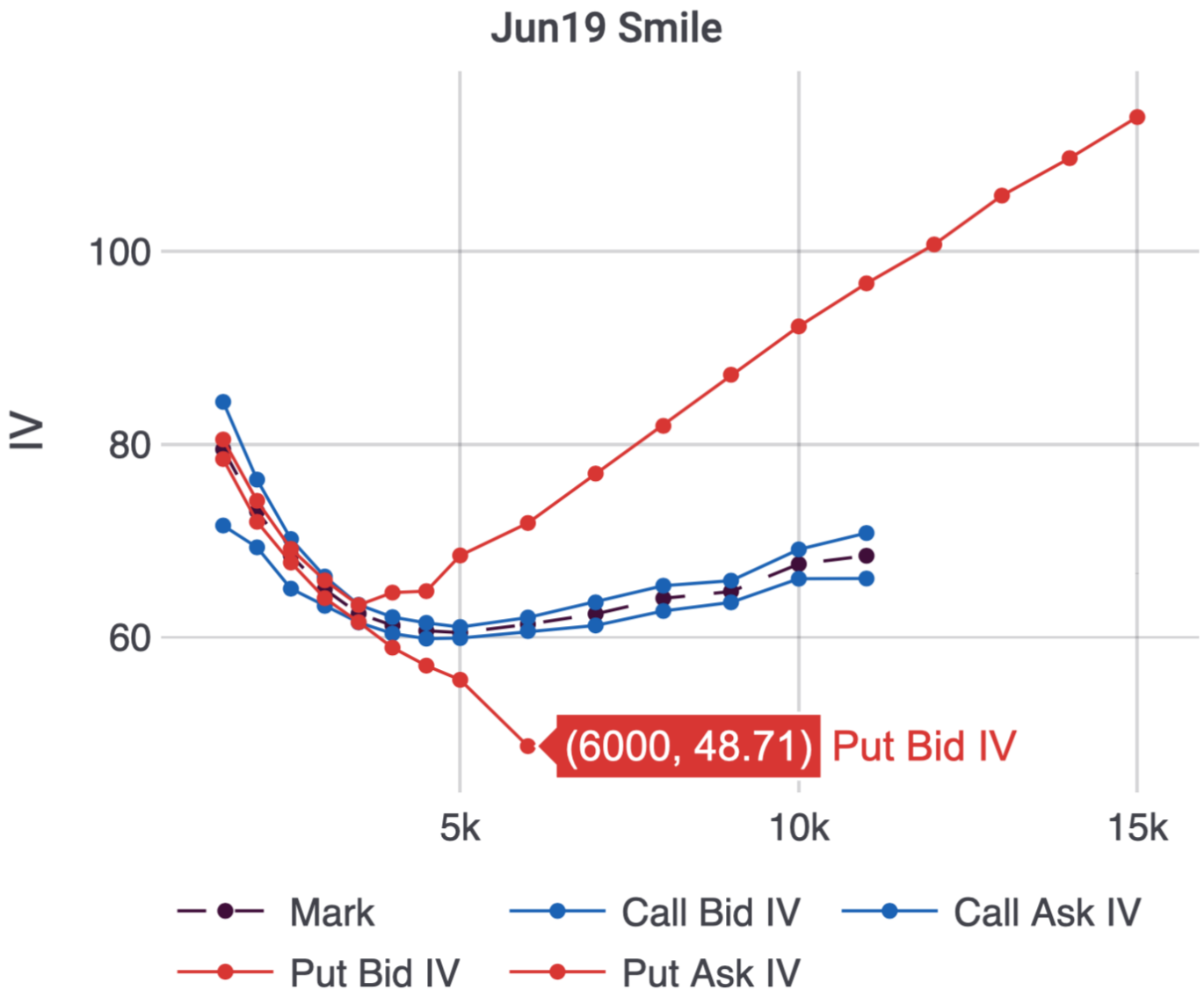
☑ Last ☑ Implied Volatility ☑ Volume ☐ Open Interest ☑ Δ|Delta ☐ Positions

Last	Size	IV	Bid	Ask	IV	Size	Vol	Δ|Delta	Strike	Last	Size	IV	Bid	Ask	IV	Size	Vol	Δ|Delta
Calls				Underlying: BTC-28JUN19($3316)					27-09-19	Expires In **239 days 23 hours 21 minutes**								**Puts**
0.5745	4.3	65.5%	฿0.5580 $1850.33	฿0.5650 $1873.55	74.4%	11.8	-	0.95	**1500**	0.0140	10.0	74.0%	฿0.0170 $56.38	฿0.0190 $63.02	76.3%	8.9	-	-0.05
0.4520	4.0	65.3%	฿0.4335 $1437.73	฿0.4415 $1464.26	70.4%	10.0	-	0.88	**2000**	0.0480	17.8	70.7%	฿0.0450 $149.22	฿0.0480 $159.17	72.5%	13.9	10.0	-0.12
0.3255	5.0	64.1%	฿0.3280 $1087.71	฿0.3355 $1112.58	67.3%	10.1	-	0.79	**2500**	0.0950	7.2	68.0%	฿0.0910 $301.77	฿0.0940 $311.72	69.2%	10.0	0.1	-0.22
0.2450	10.0	62.9%	฿0.2430 $805.79	฿0.2495 $827.34	65.1%	4.1	20.2	0.67	**3000**	0.1600	5.0	65.9%	฿0.1565 $518.97	฿0.1600 $530.57	67.1%	13.7	28.4	-0.32
0.1780	9.2	62.2%	฿0.1780 $590.26	฿0.1820 $603.53	63.4%	10.1	34.6	0.56	**3500**	0.2480	1.8	64.4%	฿0.2405 $797.66	฿0.2440 $809.27	65.5%	6.8	25.3	-0.44
0.1300	10.0	61.1%	฿0.1275 $422.80	฿0.1315 $436.07	62.3%	6.8	15.3	0.45	**4000**	0.3555	2.2	62.4%	฿0.3380 $1121.04	฿0.3540 $1174.10	67.4%	5.0	-	-0.54
0.0915	5.0	60.2%	฿0.0905 $300.10	฿0.0930 $308.39	61.0%	6.0	0.3	0.35	**4500**	0.4415	1.5	62.1%	฿0.4530 $1502.44	฿0.4710 $1562.14	67.9%	6.5	-	-0.62
0.0675	14.4	59.9%	฿0.0650 $215.54	฿0.0685 $227.15	61.2%	6.0	2.0	0.28	**5000**	0.6115	5.0	58.8%	฿0.5695 $1888.85	฿0.5985 $1985.03	69.1%	5.0	-	-0.70
0.0495	0.1	60.2%	฿0.0480 $159.19	฿0.0510 $169.14	61.5%	17.2	0.3	0.22	**5500**	0.7425	5.0	58.8%	฿0.7030 $2331.63	฿0.7315 $2426.15	70.2%	5.0	-	-0.76
0.0405	13.8	59.9%	฿0.0345 $114.40	฿0.0380 $126.01	61.7%	13.8	-	0.17	**6000**	0.8415	1.4	55.5%	฿0.8355 $2770.53	฿0.8745 $2899.86	73.3%	1.5	-	-0.80
0.0215	13.8	60.2%	฿0.0190 $63.02	฿0.0215 $71.31	61.9%	10.0	10.2	0.10	**7000**	-	1.3	50.7%	฿1.1190 $3710.68	฿1.1600 $3846.64	76.8%	1.5	-	-0.87
0.0125	29.4	60.7%	฿0.0110 $36.48	฿0.0125 $41.45	62.2%	24.7	1.3	0.06	**8000**	1.3485	1.4	0.0%	฿1.4100 $4675.59	฿1.4565 $4829.78	82.5%	1.5	-	-0.90
0.0065	13.2	61.8%	฿0.0070 $23.21	฿0.0085 $28.19	63.8%	25.0	-	0.04	**9000**	-	0.9	0.0%	฿1.7050 $5653.81	฿1.7525 $5811.33	86.4%	1.5	-	-0.93
0.0060	25.7	62.6%	฿0.0045 $14.92	฿0.0060 $19.90	65.2%	2.0	5.5	0.03	**10000**	1.8250	0.9	0.0%	฿2.0025 $6640.43	฿2.0520 $6804.58	91.2%	1.5	-	-0.94
0.0045	1.0	64.6%	฿0.0035 $11.61	฿0.0045 $14.92	66.8%	23.8	0.6	0.02	**11000**	2.1010	0.8	0.0%	฿2.3005 $7628.62	฿2.3530 $7802.71	96.0%	1.4	-	-0.95
0.0035	35.4	63.8%	฿0.0020 $6.63	฿0.0035 $11.61	68.3%	29.0	4.6	0.02	**12000**	2.5715	0.6	0.0%	฿2.5990 $8618.47	฿2.6575 $8812.46	102.4%	1.3	-	-0.96

IV vs HV

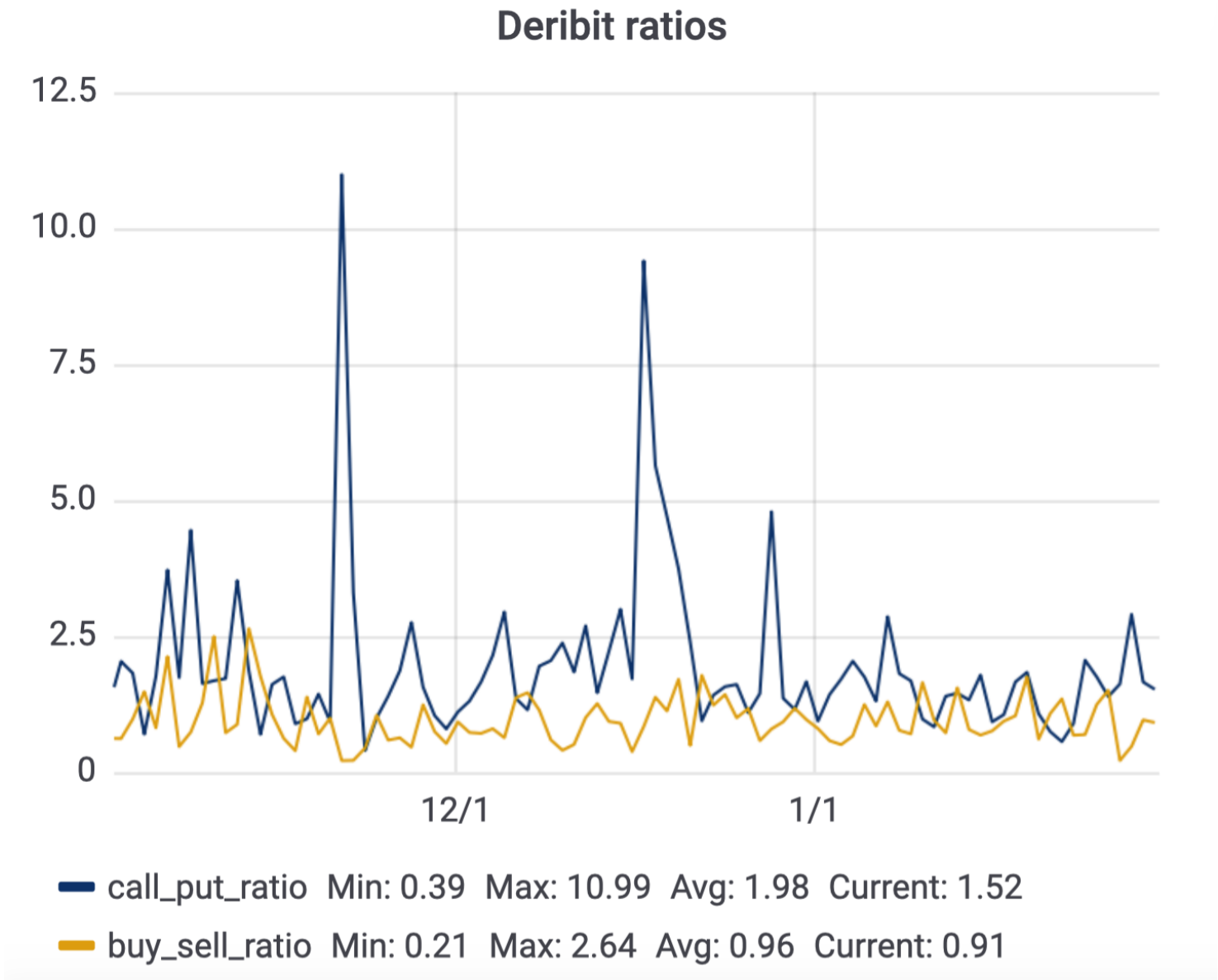

Implied volatility vs realized - BTCUSD, daily format, 3 month...
5.0%
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
12/1
1/1
daily_implied_volatility_three_months Min: 2.15% Max: 4.88% Avg: 3.78
daily_realized_volatility_three_months Min: 1.86% Max: 4.42% Avg: 3.5

Volatility smile

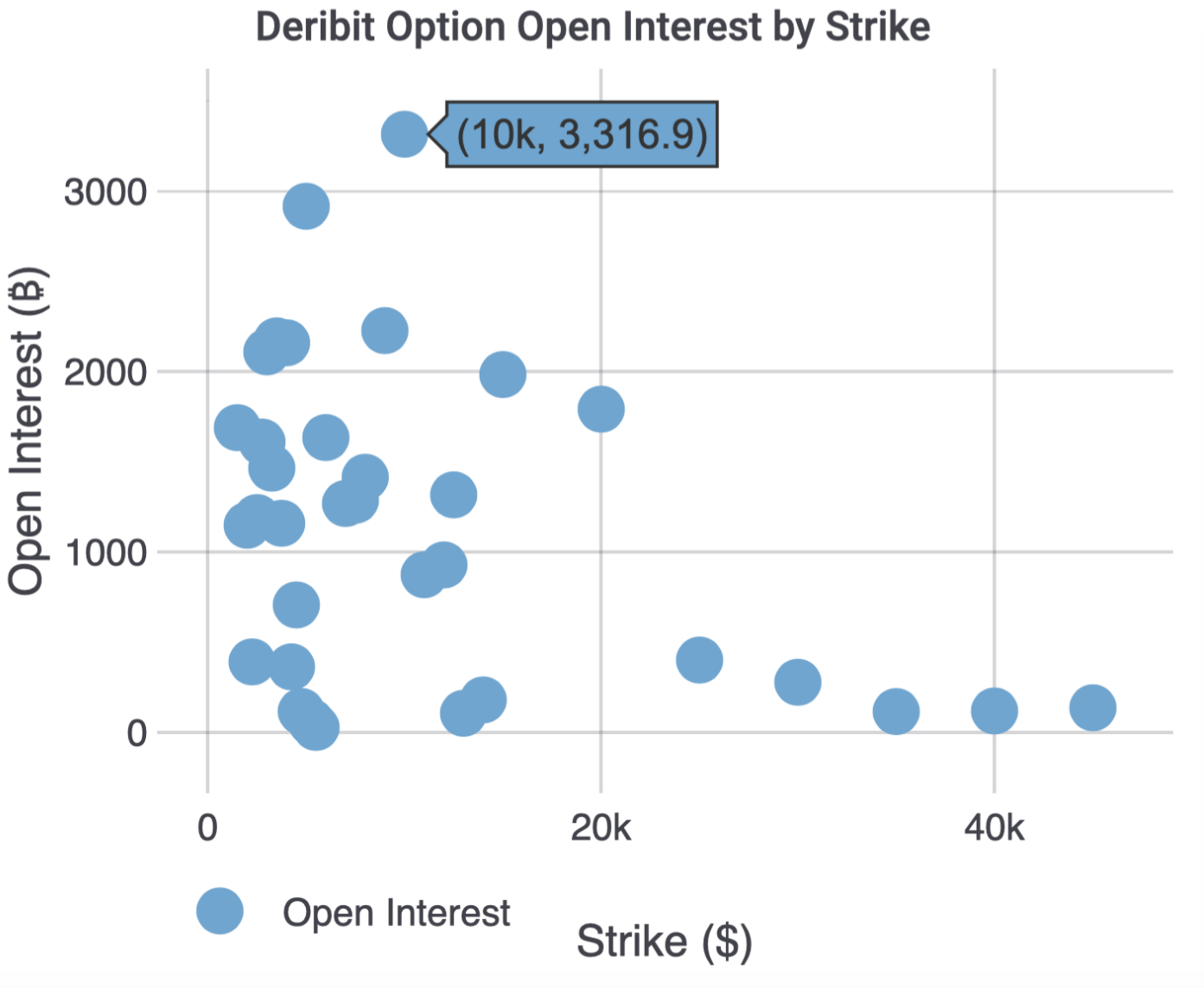


https://www.sk3w.co/options

Call / Put ratio



Open Interest



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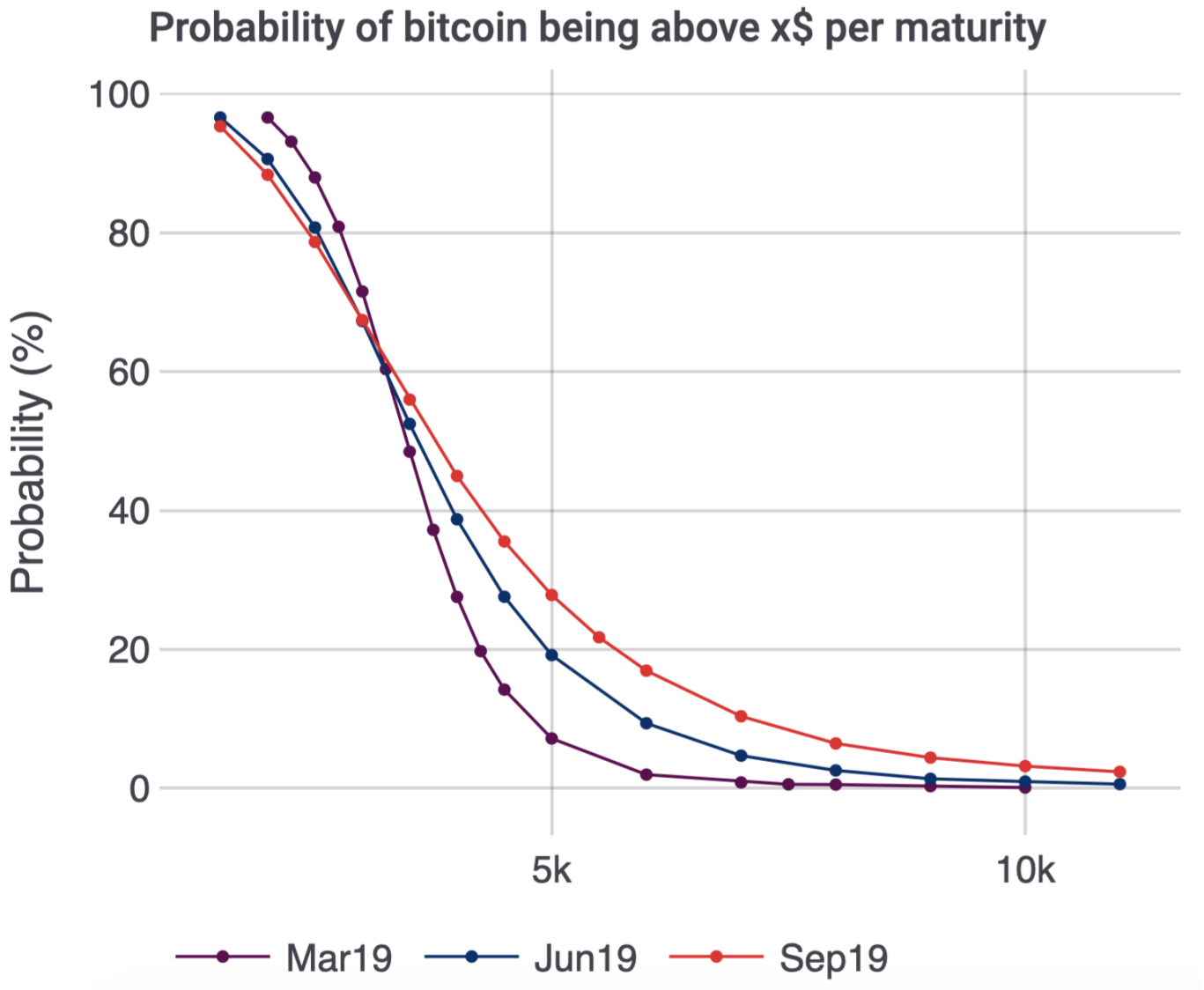
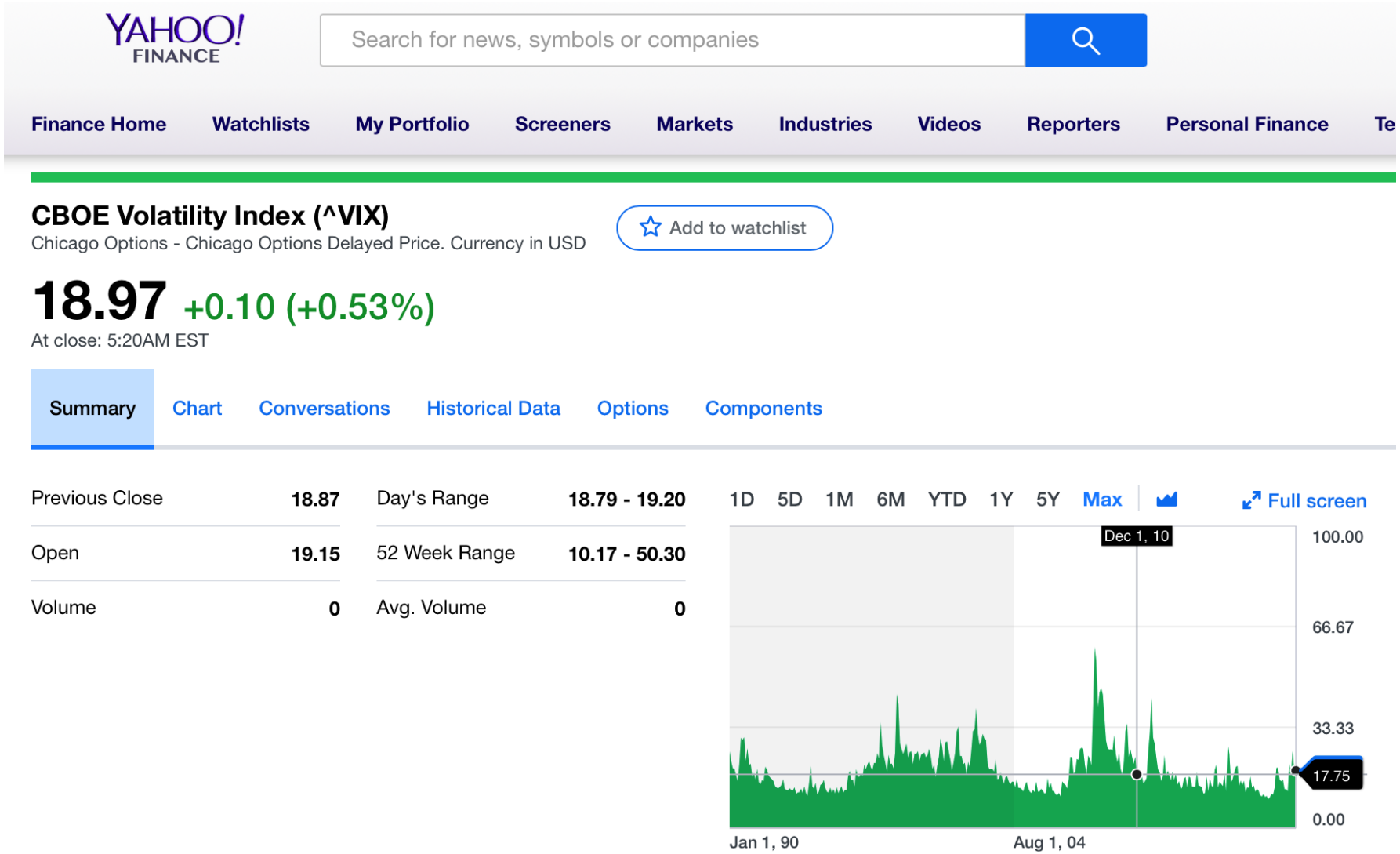
Probability per maturity



https://www.sk3w.co/options

Volatility index on equity - VIX (or fear index)

The VIX is a number derived from the prices of options premium in the S&P 500 index (which is an index comprising 500 large cap stocks).

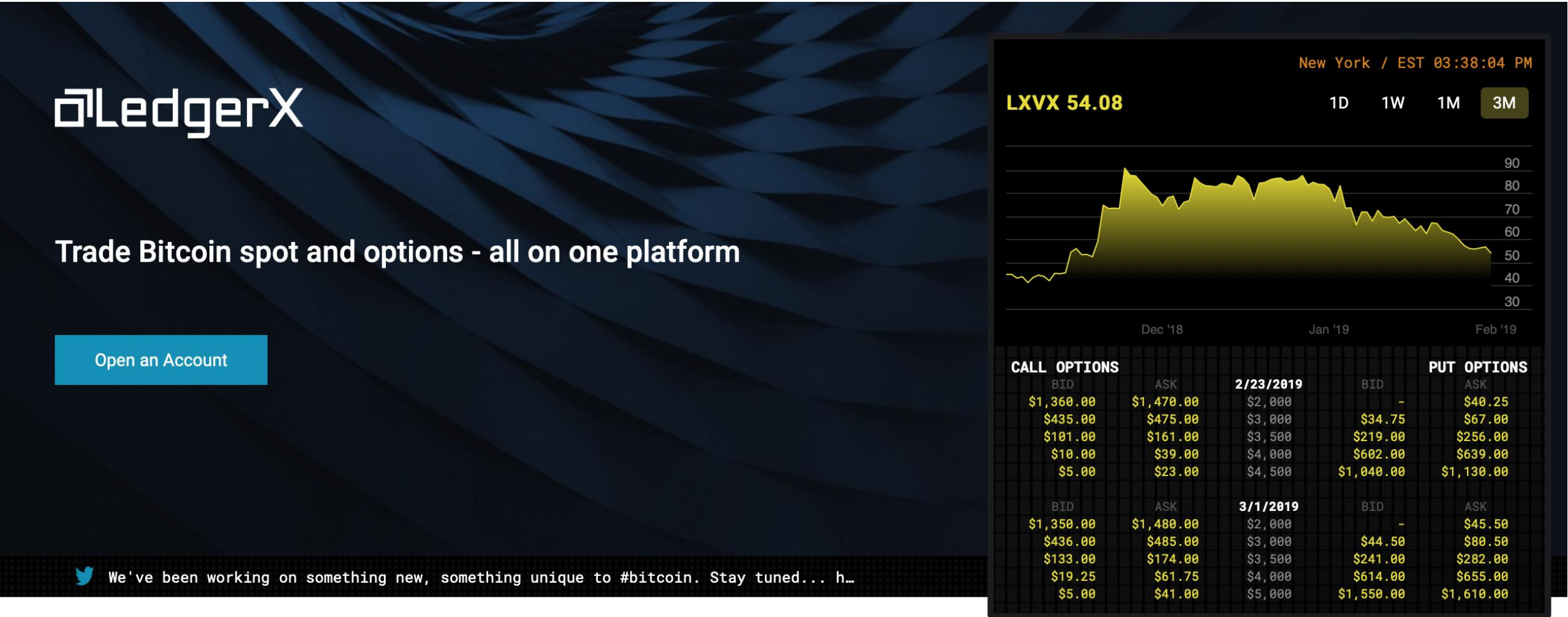


*http://www.cboe.com/micro/vix/vix-index-rules-and-methodology.pdf

Short volatility

Volatility index on Bitcoin (LXVX)

The LXVX is based on implied volatility, for the first time allowing participants insight into what US federally-regulated options are implying for bitcoin's future volatility



Crypto Fear & Greed Index

Each day, we analyze emotions and sentiments from different sources and crunch them into one simple number: The Fear & Greed Index for Bitcoin and other large cryptocurrencies.

*https://alternative.me/crypto/fear-and-greed-index/

Methodology

Data Sources

We are gathering data from the five following sources. Each data point is valued the same as the day before in order to visualize a meaningful progress in sentiment change of the crypto market.

First of all, the current index is for bitcoin only (we offer separate indices for large alt coins soon), because a big part of it is the volatility of the coin price.

But let's list all the different factors we're including in the current index:

Volatility (25 %)

We're measuring the current volatility and max. drawdowns of bitcoin and compare it with the corresponding average values of the last 30 days and 90 days. We argue that an unusual rise in volatility is a sign of a fearful market.

Market Momentum/Volume (25%)

Also, we're measuring the current volume and market momentum (again in comparison with the last 30/90 day average values) and put those two values together. Generally, when we see high buying volumes in a positive market on a daily basis, we conclude that the market acts overly greedy / too bullish.

Trends (10%)

We pull Google Trends data for various Bitcoin related search queries and crunch those numbers, especially the change of search volumes as well as recommended other currently popular searches. For example, if you check Google Trends for "Bitcoin", you can't get much information from the search volume. But currently, you can see that there is currently a **+1,550%** rise of the query **„bitcoin price manipulation"** in the box of related search queries (as of 05/29/2018). This is clearly a sign of fear in the market, and we use that for our index.

Social Media (15%)

While our reddit sentiment analysis is still not in the live index (we're still experimenting some market-related key words in the text processing algorithm), our twitter analysis is running. There, we gather and count posts on various hashtags for each coin (publicly, we show only those for Bitcoin) and check how fast and how many interactions they receive in certain time frames). A unusual high interaction rate results in a grown public interest in the coin and in our eyes, corresponds to a greedy market behaviour.

Surveys (15%)

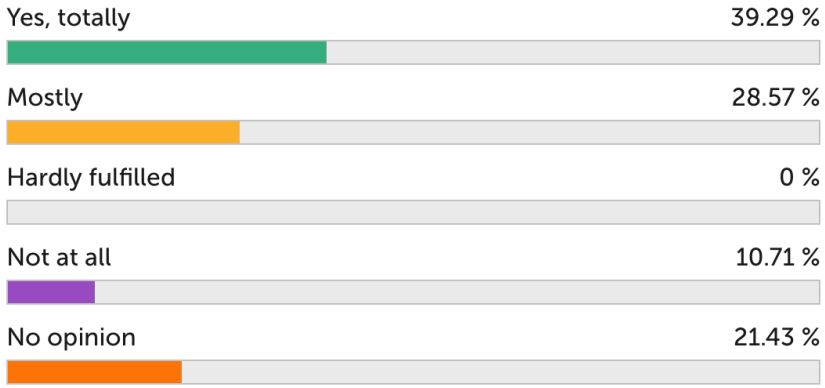
Together with strawpoll.com (disclaimer: we own this site, too), quite a large public polling platform, we're conducting weekly crypto polls and ask people how they see the market. Usually, we're seeing 2,000 - 3,000 votes on each poll, so we do get a picture of the sentiment of a group of crypto investors. We don't give those results too much attention, but it was quite useful in the beginning of our studies. You can see some recent results here.

Dominance (10%)

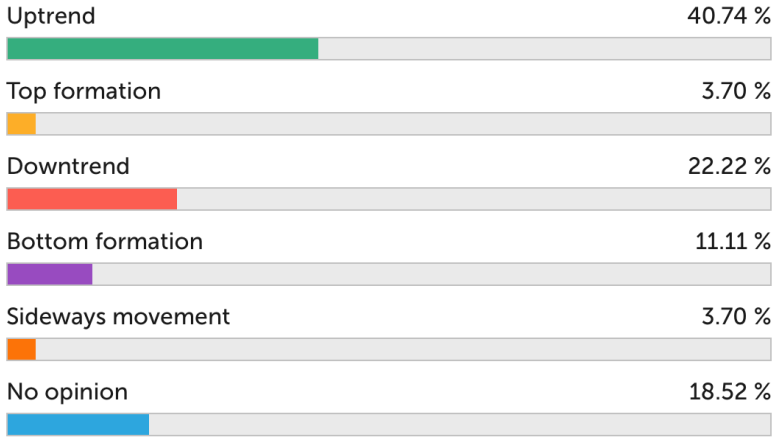
The dominance of a coin resembles the market cap share of the whole crypto market. Especially for Bitcoin, we think that a rise in Bitcoin dominance is caused by a fear of (and thus a reduction of) too speculative alt-coin investments, since Bitcoin is becoming more and more the safe haven of crypto. On the other side, when Bitcoin dominance shrinks, people are getting more greedy by investing in more risky alt-coins, dreaming of their chance in next big bull run. Anyhow, analyzing the dominance for a coin other than Bitcoin, you could argue the other way round, since more interest in an alt-coin may conclude a bullish/greedy behaviour for that specific coin.

Cryptoindex, questions

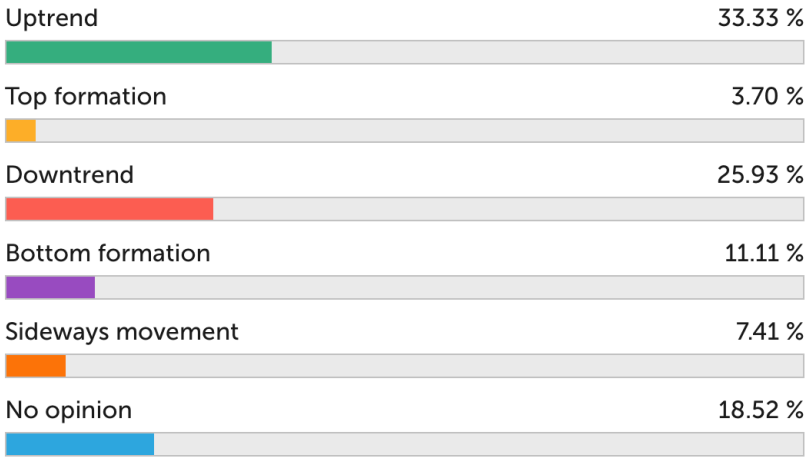
Have your expectations for the Crypto market been fulfilled in the past week?



At what stage of the cycle do you think the market is in three month?

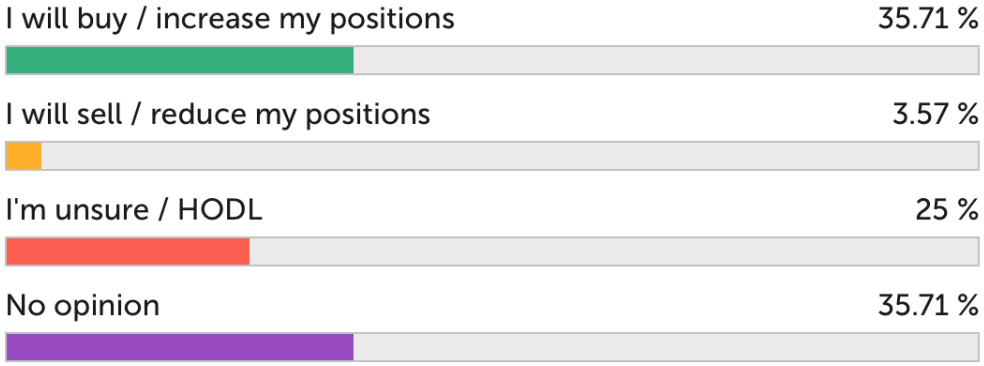


At what stage of the cycle do you think the market is right now?



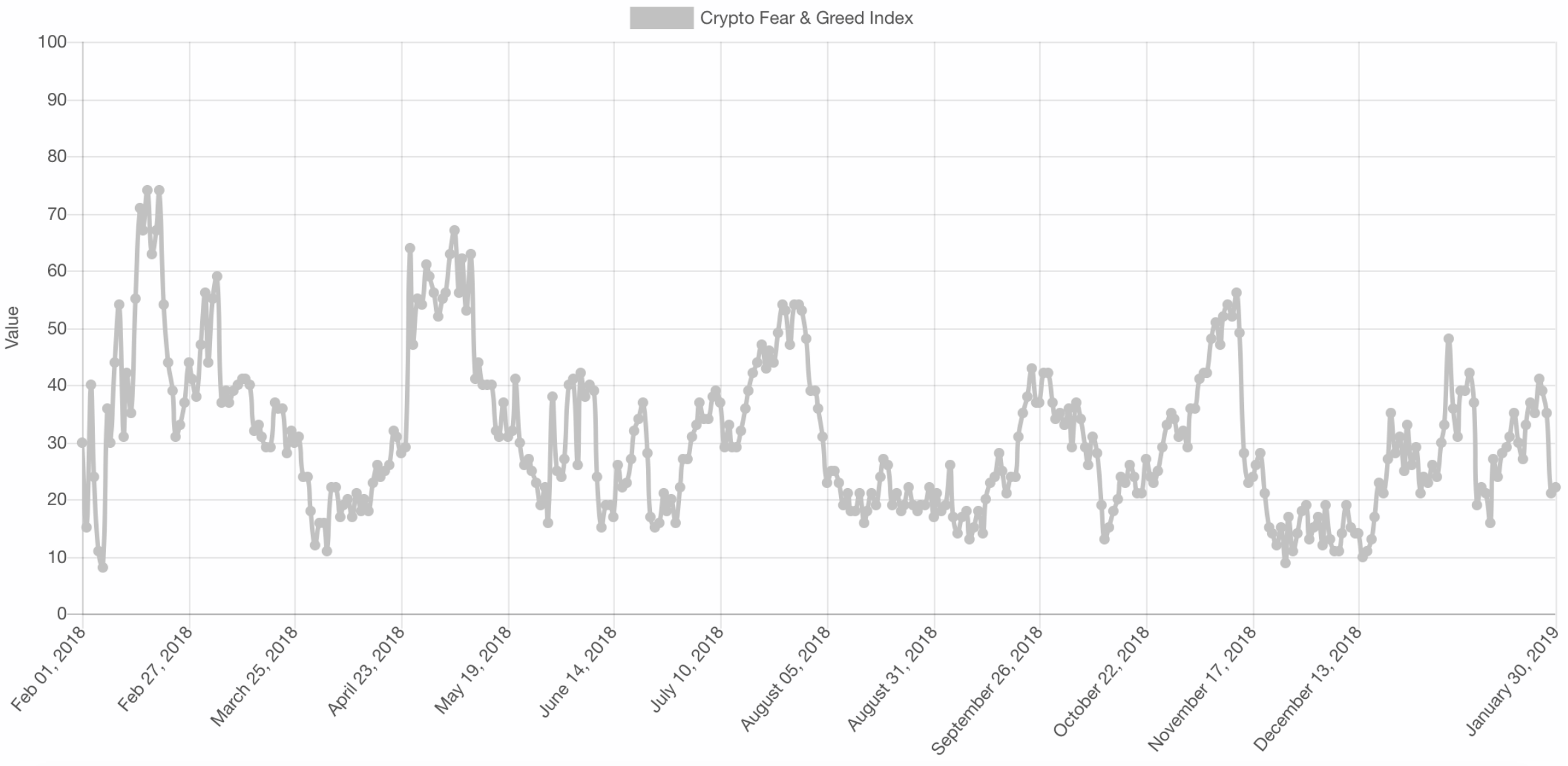
Poll ended on 27.01.2019 at 12:00:01

Are you going to trade in the next two weeks?



*https://alternative.me/crypto/sentiment/#results

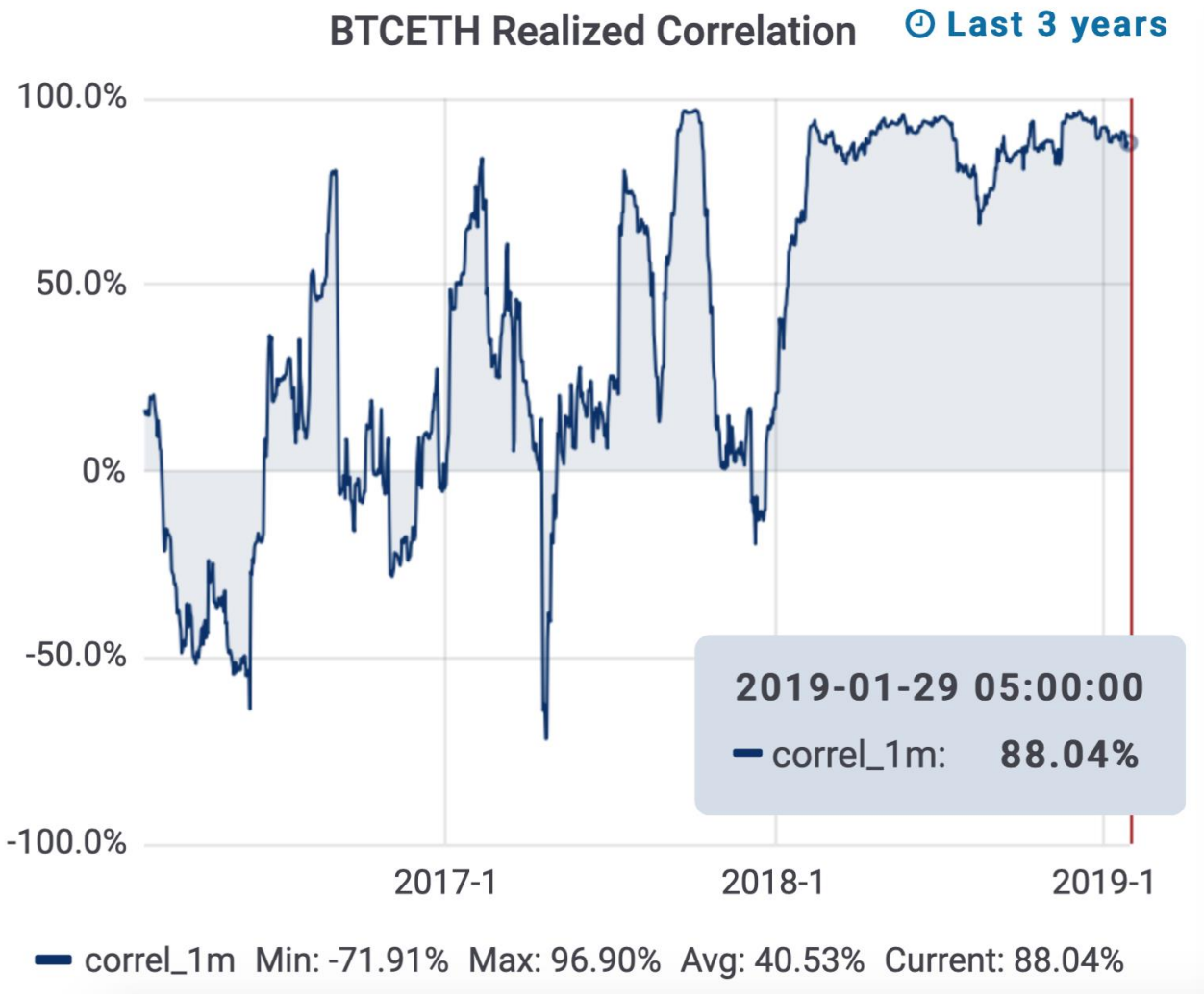
Cryptoindex, dynamics



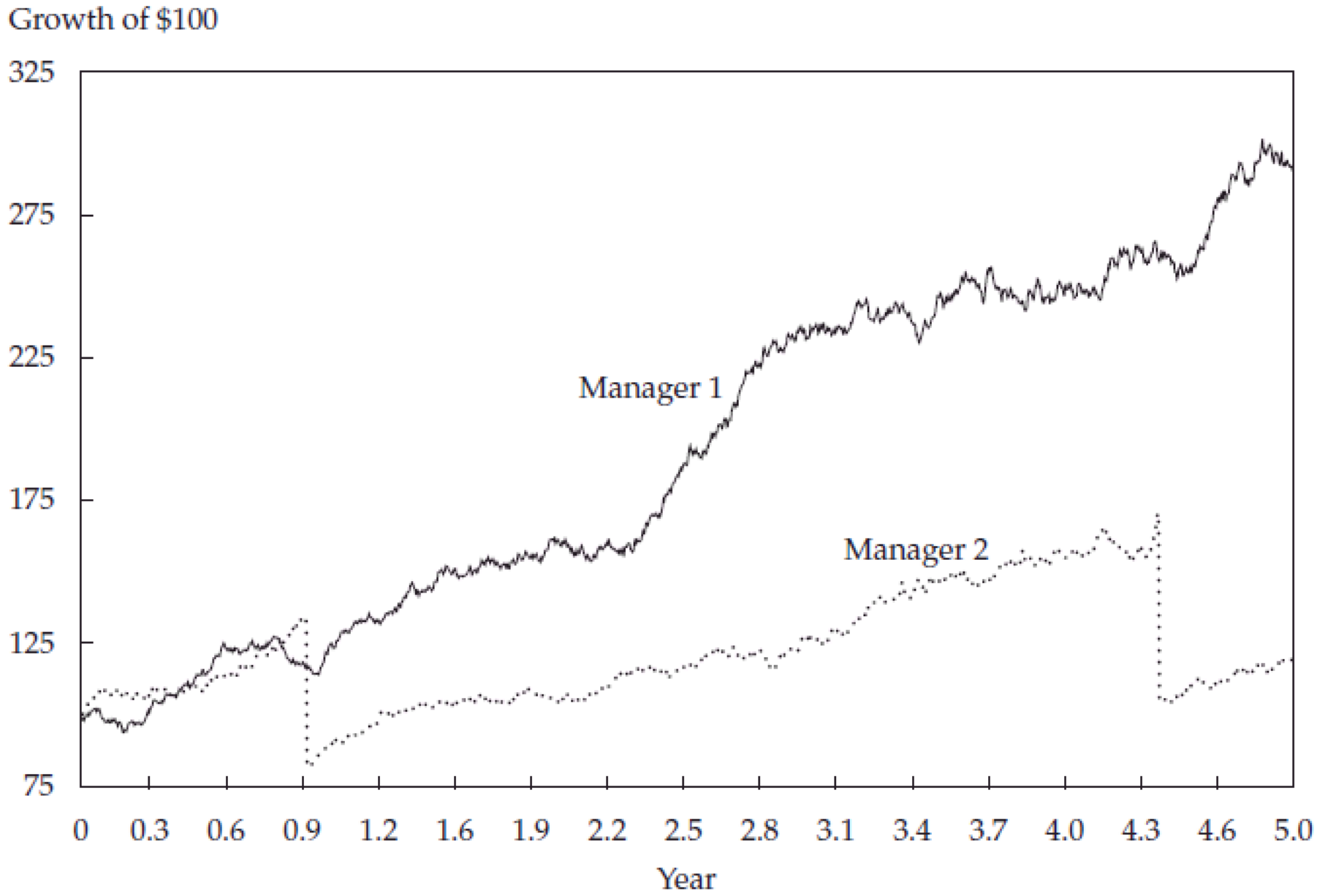
We Are All Volatility Traders

The alpha from active management often comes down to two factors:

1. asset selection
2. short volatility or short correlation exposure



What is the difference?



Bear market in Greed

- Emotional factor (growth 2017)
- Macro risks (Trump, North Korea…)
- Monetary (mining)
- Government regulation and institutional investors

How to bit?

- Sell both tails of the return distribution (with hedge?)
- … ?

Thank you for your attention!