Bitcoin Trading Strategy

Melody Mao, Jason Yu

Nov 25, 2024

Table of Content

Literature Review

Literature: Gerritsen, D. F., Elie Bouri, Ehsan Ramezanifar, & Roubaud, D. (2019). The profitability of technical trading rules in the Bitcoin market. Finance Research Letters, 34, 101263–101263. https://doi.org/10.1016/j.frl.2019.08.011

Sharpe ratios for TA rules given various strategies, full sample period.

Trading rule	Strategy 1: Long, out, and short			Strategy 2: Long or out of Bitcoin			Strategy 3: Double-long, long, or out of Bitcoin		
	Sharpe ratio	Difference from B&H in basis points	*p*-value	Sharpe ratio	Difference from B&H in basis points	*p*-value	Sharpe ratio	Difference from B&H in basis points	*p*-value
Moving average									
MA1-200	0.047	−0.83	0.65	0.066	1.04	0.31	0.039	−1.66	0.13
MA1-50	0.047	−0.89	0.69	0.079	2.37*	0.08	0.055	0.10	0.95
MA1-150	0.045	−1.09	0.55	0.066	1.06	0.34	0.040	−1.61	0.15
MA2-200	0.051	−0.51	0.79	0.068	1.22	0.22	0.041	−1.48	0.17
MA5-150	0.053	−0.28	0.89	0.070	1.40	0.16	0.043	−1.29	0.24
Trading range breakout									
SUP/RES50	0.081	2.59	0.21	0.081	2.59	0.20	0.076	2.04***	0.01
SUP/RES150	0.093	3.77*	0.06	0.093	3.77*	0.06	0.074	1.88***	0.01
SUP/RES200	0.089	3.32*	0.07	0.089	3.32*	0.07	0.071	1.55***	0.01
MACD									
MACD	0.060	0.39	0.85	0.085	2.96**	0.02	0.060	0.47	0.75
MACD_SIGNAL	0.062	0.63	0.78	0.084	2.80**	0.02	0.059	0.30	0.81
MACD_HIST	0.058	0.22	0.93	0.091	3.57***	0.01	0.067	1.19	0.44
Rate of change	0.056	0.06	0.98	0.092	3.67***	0.01	0.069	1.32	0.43
On balance volume									
OBV_MA1-200	0.036	−1.96	0.36	0.036	−2.00	0.32	0.051	−0.45	0.59
OBV_MA1-50	0.008	−4.81*	0.06	0.028	−2.81	0.18	0.049	−0.68	0.47
OBV_MA1-150	0.028	−2.74	0.26	0.032	−2.31	0.24	0.049	−0.70	0.41
OBV_MA2-200	0.035	−2.02	0.41	0.035	−2.03	0.32	0.051	−0.48	0.57
OBV_MA5-150	0.023	−3.22	0.16	0.029	−2.63	0.21	0.046	−0.98	0.26
Rel. strength index	−0.110	−16.61***	0.00	−0.008	−6.33***	0.00	−0.022	−7.78***	0.00
Bollinger bands	−0.060	−11.55***	0.00	0.002	−5.34***	0.02	0.021	−3.43***	0.00
Buy and hold	0.056								

Literature Review

1. Trading Range Breakout

- Identifies support and resistance levels based on historical prices over 150 days.
- A buy signal is generated when Bitcoin's price surpasses the resistance level.
- A sell signal is triggered when the price falls below the support level.

2. Moving Average Convergence Divergence (MACD) Histogram

- Enhances the MACD indicator by showing the difference between the MACD line (the difference between 12-day and 26-day EMAs) and its signal line (a 9-day EMA of the MACD).
- It provides insights into momentum changes.
- A buy signal is triggered when the histogram turns positive.
- A sell signal is generated when it turns negative.

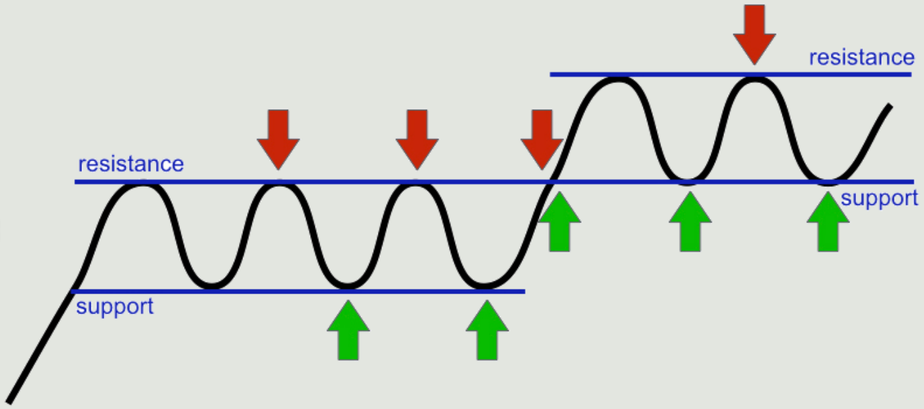
Trading Range Breakout

This paper argues that the trading range breakout rule consistently delivers higher Sharpe ratios than a buy-and-hold strategy.

This rule distinguishes both a support and a resistance level of the Bitcoin price, namely minimum and maximum prices.

$$Support(B)_t = MIN(B_{t-1}, B_{t-2}, \dots, B_{t-n})$$

$$Resistance(B)_t = MAX(B_{t-1}, B_{t-2}, \dots, B_{t-n})$$



The trading rule is defined as “Buy” if $B_t > Resistance(B)_t$ and “Sell” if $B_t < Support(B)_t$.

MACD Histogram

This paper argues that the visual representation of momentum strength highlights when the MACD is diverging from or converging with the signal line, providing an earlier warning of potential trend changes compared to using the MACD line alone.

The EMA is a variant of the simple MA but gives a higher weighting to the most recent closing price, making it useful for identifying trends or momentum shifts in time-series data.

MACD Histogram

$$EMA(B)_{t,n} = B_t \times \frac{2}{n+1} + (1 - \frac{2}{n+1}) EMA(B)_{t-1,n}$$

$$MACD(B)_t = EMA(B)_{t,12} - EMA(B)_{t,26}$$

$$EMACDSIGNAL(B)_{t,n} = MACD(B)_t \times \frac{2}{n+1} + (1 - \frac{2}{n+1}) EMA(MACD(B))_{t-1,9}$$

$$MACDHISTOGRAM(B)_t = MACD(B)_t - EMACDSIGNAL(B)_t$$

MACD: Indicates the momentum of BTC by measuring the difference between its short-term (e.g., 12-day) and long-term (e.g., 26-day) exponential moving averages.

MACD Signal Line: A 9-period EMA of the MACD that smooths out short-term fluctuations, serving as a trigger line for buy or sell signals based on crossovers with the MACD.

MACD Histogram: Visualizes the difference between the MACD and its signal line, highlighting changes in momentum and potential trend reversals.

MACD Histogram

Data

Data Source and Overview

Daily trading data from 2019-11-01 to 2024-10-31, sourced from Yahoo Finance

- Bitcoin (BTC)
- CBOR Interest Rate 10 Year T No (^TNX): Risk free rate

Backtesting – Trading Strategy Overview

Trading Algorithm (Trading rule: Long or Out)

BUY if Buy signal & no holding position

SELL if Sell signal & holding a long position

BUY/SELL Transaction Fee is 10bps

Trading Range Breakout Signal

BUY if close price > Resistance level.

SELL if close price drops < Support level.

MACD Signal

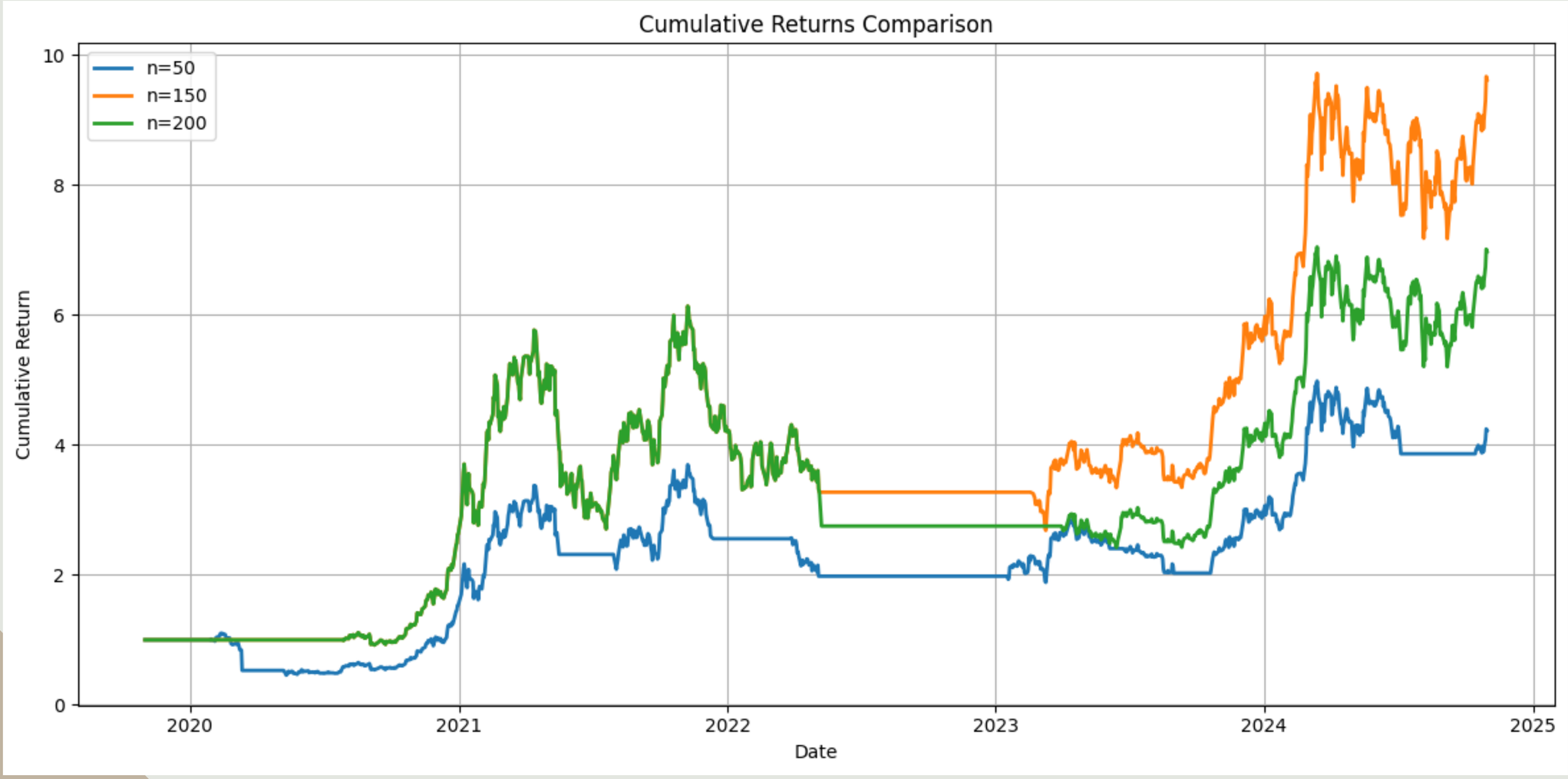
BUY if MACD Histogram exceeds 15 locally for the first time.

SELL if MACD Histogram falls below –15 locally for the first time.

(As we trade daily at high frequency trading, we adjusted the baseline threshold to +/-15, rather than typical 0, to account for transaction costs)

Backtesting – Trading Range Breakout

$$Support(B)_t = MIN(B_{t-1}, B_{t-2}, \dots, B_{t-n})$$



Choose to roll over the past 150 days

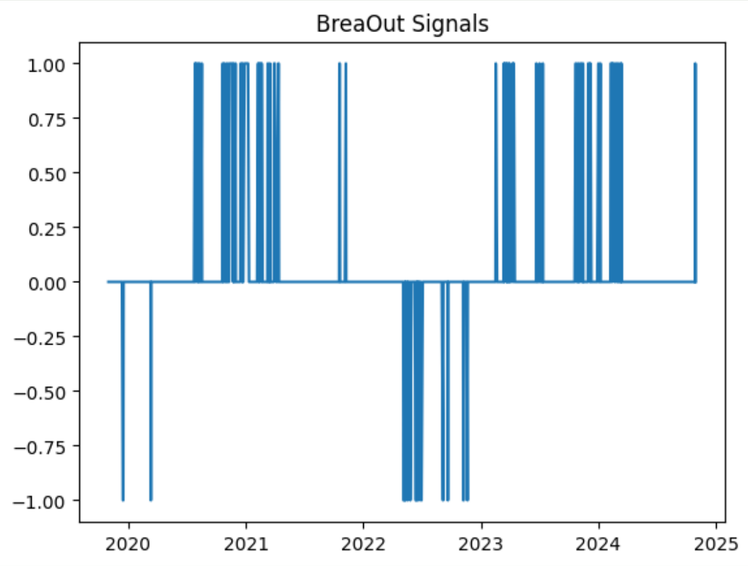
Our Strategy

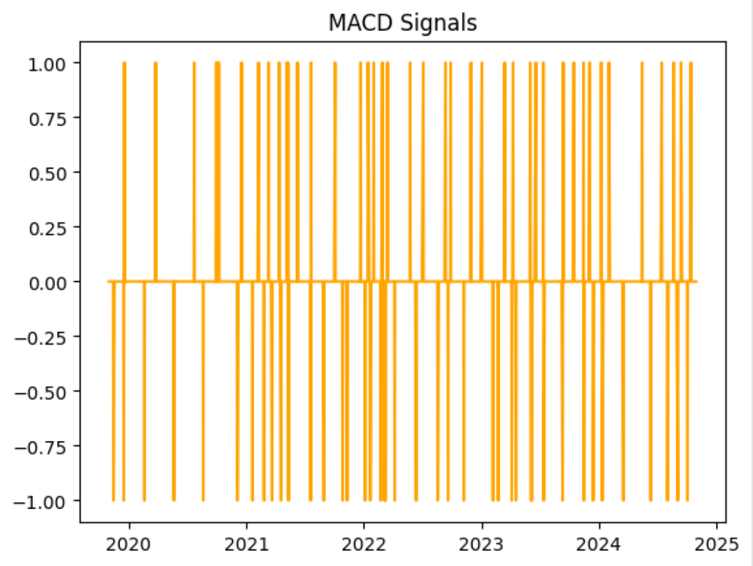
Our Signal

BUY if Buy signal from Trading Range Breakout OR Buy signal from MACD

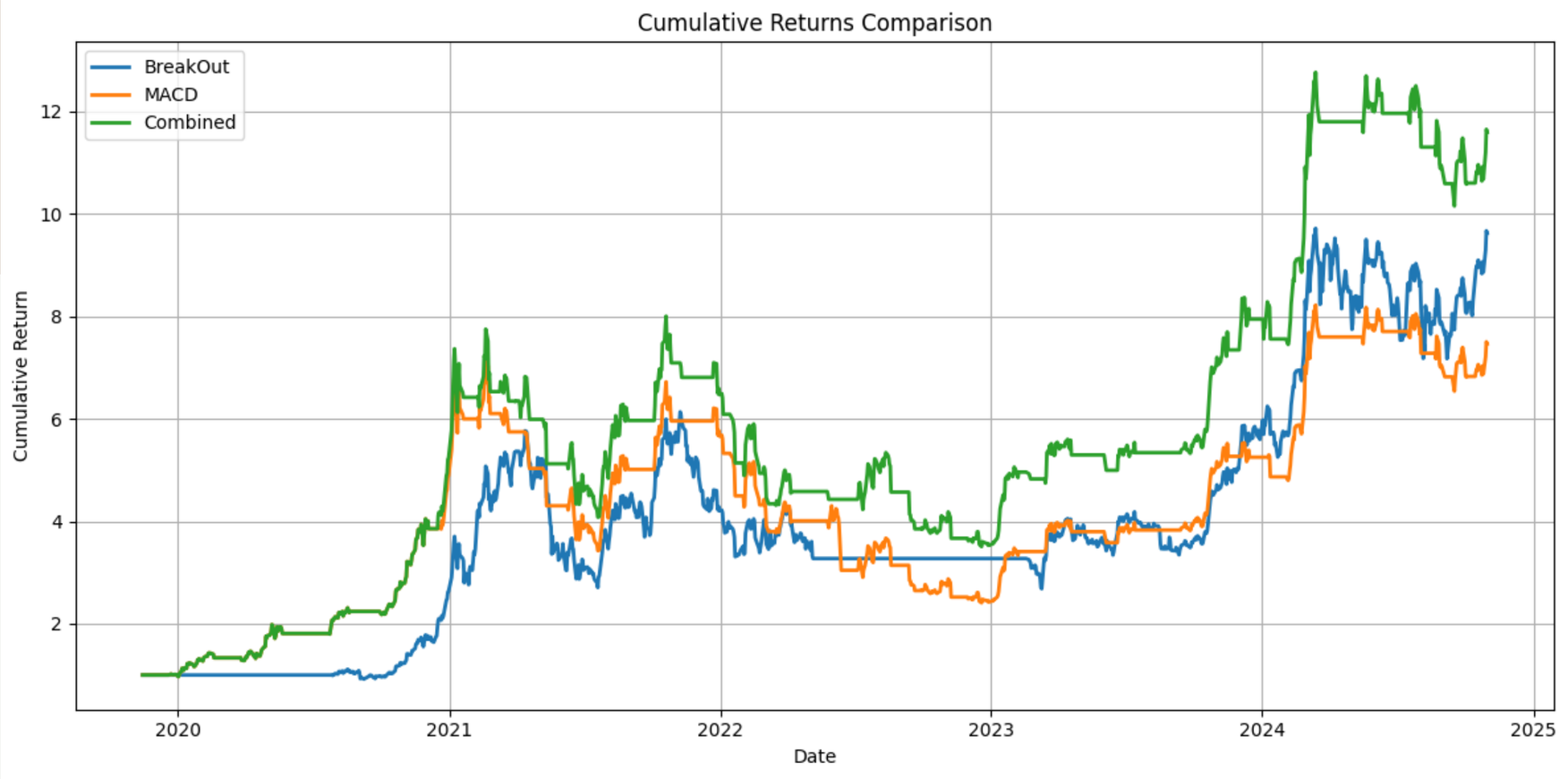
SELL if Sell signal from Trading Range Breakout OR Sell signal from MACD

The MACD Histogram works best in conjunction with the Trading Range Breakout strategy, as its momentum cues supplement signal reliability in stable market conditions. And Trading Range Breakout rule is especially suitable in choppy market conditions.





Performance



SPY:	2.0467
Buy and Hold:	7.8111
Breakout:	9.6178
MACD:	7.4628
Combined:	11.5871

Sharpe Ratio - Breakout:	0.0683
Sharpe Ratio - MACD:	0.0687
Sharpe Ratio - Combined:	0.0828

Recommendation

Literature: Al-Yahyaee, K. H., Rehman, M. U., Mensi, W., & Al-Jarrah, I. M. W. (2019). Can uncertainty indices predict Bitcoin prices? A revisited analysis using partial and multivariate wavelet approaches. The North American Journal of Economics and Finance, 49, 47–56. https://doi.org/10.1016/j.najef.2019.03.019

This paper argues that BTC is lagging behind the VIX index at high frequency (0–4 days) and intermediate frequency (6–8 days). In contrast, BTC is leading the VIX at low frequency (above 16 days). This reveals that the VIX can be used by short-term investors to forecast BTC prices at high frequencies.

BTC and VIX move in-phase movement in the medium frequency, but out-of-phase at both high and low frequencies.

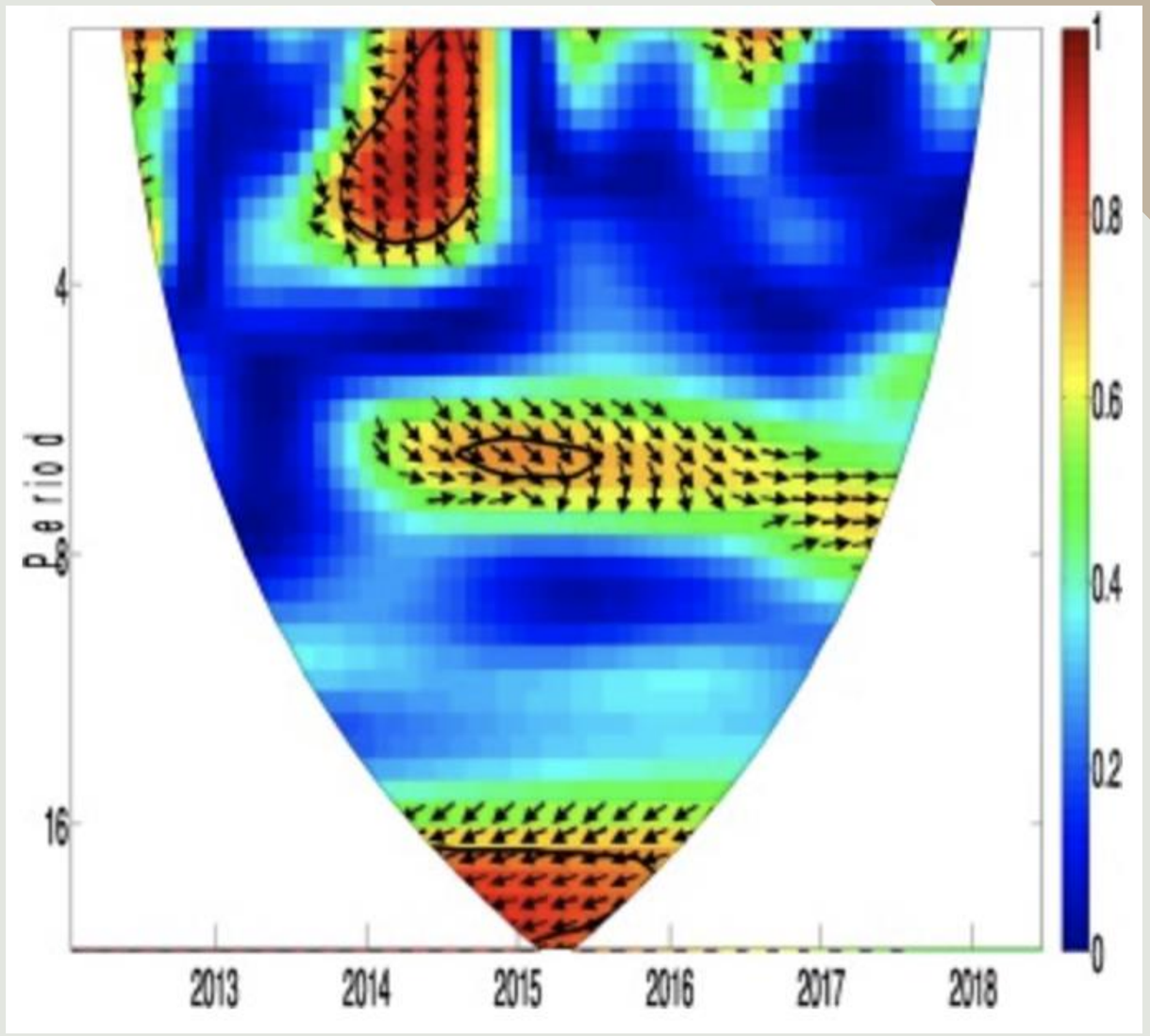
Recommendation

→: BTC and VIX move in the same direction

←: BTC and VIX move in the opposite direction

↗, ↙: BTC is leading

↖, ↘: BTC is lagging



Recommendation

Hedging with S&P 500 ETF (SPY)

- The VIX, or Volatility Index, measures the market's expectation of 30-day future volatility for the S&P 500, based on options prices.
- A higher VIX typically signals increased uncertainty or fear in the market, coinciding with poor S&P 500 performance.
- The VIX demonstrates predictive power for Bitcoin prices through its out-of-phase movement with BTC at high frequencies.
- Shorting (Longing) SPY to hedge the inherent risk exposure of the long (short) positions in BTC.

As we trade daily, we recommend to go with shorting (longing) SPY to hedge the risk of the long (short) positions in Bitcoin

Thank You