



## Trading Focus

# Technical Analysis in Statistical Arbitrage I: Fibonacci Retracement

Aug 29, 2024

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## Summary

- Fibonacci retracements are frequently used as a technical analysis tool in trading.
- Alphas based on a Fibonacci retracement level are tested across different universes in Binance USD $\mathbb{S}$ -M perpetual futures market.
- Simulation results indicate that broader asset universes lead to reduced volatility and enhanced returns.
- The alpha targeting the top 50 most liquid assets outperforms the others, achieving an annualized return of 77.83% and a Sharpe ratio of 3.2.

## Introduction

Fibonacci retracements are widely used in technical analysis to predict potential levels of support and resistance in financial markets. Derived from the Fibonacci sequence, these tools help traders identify points where price reversals might occur, offering a strategic advantage in timing market entries and exits. This article explores the application of Fibonacci retracements in creating trading signals across various cryptocurrency universes, ranging from single assets like BTC/USDT to broader portfolios like the top 50 most liquid assets. The study evaluates the effectiveness of these signals through detailed simulations, providing insights into their performance across different setups.

## Fibonacci Retracements and Ratios

Fibonacci retracements are a technical analysis tool used to identify potential support and resistance levels in the price movement of financial assets. They are based on the Fibonacci sequence, a series of numbers where each number is the sum of the two preceding ones, starting from 0 and 1. The most commonly used Fibonacci retracement levels are 23.6%, 38.2%, 50%, 61.8%, and 78.6%. These key ratios are calculated as follows:

- **61.8%:** Known as the reciprocal of the golden ratio, which is asymptotically approached by dividing a Fibonacci number by the number immediately following it as the sequence progresses.
- **38.2%:** Obtained by dividing a Fibonacci number by the number two places to its right in the sequence.

- **23.6%:** Calculated by dividing a Fibonacci number by the number three places to its right.
- **78.6%:** The square root of 61.8%.
- **50%:** While not derived from Fibonacci numbers, this ratio is commonly included by traders in their analysis.

These ratios are applied to price charts to identify possible levels where the price may retrace before continuing its previous trend. Traders use them to identify optimal entry and exit points by analyzing where an asset's price might experience a bounce or reversal. For more detailed information, refer to [1].

## Constructing Alphas

The same trading signal is applied across different universes: BTC/USDT only, the pair of BTC/USDT and ETH/USDT, and the top 50 most liquid assets, all within the Binance USDⓈ-M market. The alpha formulas are defined as follows:

First, the Fibonacci retracement level is calculated over 144 intervals using the following formula:

```
fibo := 0.618 * (ts_max(high, 144) - ts_min(low, 144)) + ts_min(low, 144)
```

Next, the same core formula is applied to the different universes with the addition of functions that are relevant to each specific universe.

- For BTC/USDT only with variable GMV (Gross Market Value):

```
alpha := 4e8 * ((ts_mean(close, 72) - fibo) / fibo)
```

- For BTC/USDT only with fixed GMV:

```
alpha := scale((ts_mean(close, 72) - fibo) / fibo, 2e6)
```

The scale function is applied here to fix the GMV at 2 million USDT.

- For the pair of BTC/USDT and ETH/USDT:

```
alpha := scale(indneutralize((ts_mean(close, 72) - fibo) / fibo,
                             IndClass.universe), 2e6)
```

In this case, `indneutralize` is added to ensure that the signal is dollar neutral and bets on the relative price movements.

- For the top 50 most liquid assets:

```
alpha := scale(indneutralize(cs_winsorize_percentile(ts_mean(close, 72)
                                                    - fibo) / fibo, 0.1), IndClass.universe), 2e6)
```

To handle extreme values, the `cs_winsorize_percentile` function is applied. This function, with 0.1 as its parameter, adjusts values by replacing those below the 10th percentile with the 10th percentile value, and those above the 90th percentile with the 90th percentile value.

These formulas are applied to 5-minute interval data. Essentially, the signal is designed to bet on momentum from the 61.8% retracement level. Specifically, the greater the deviation of an asset's average price over 72 intervals from the retracement level, the larger the bet placed.

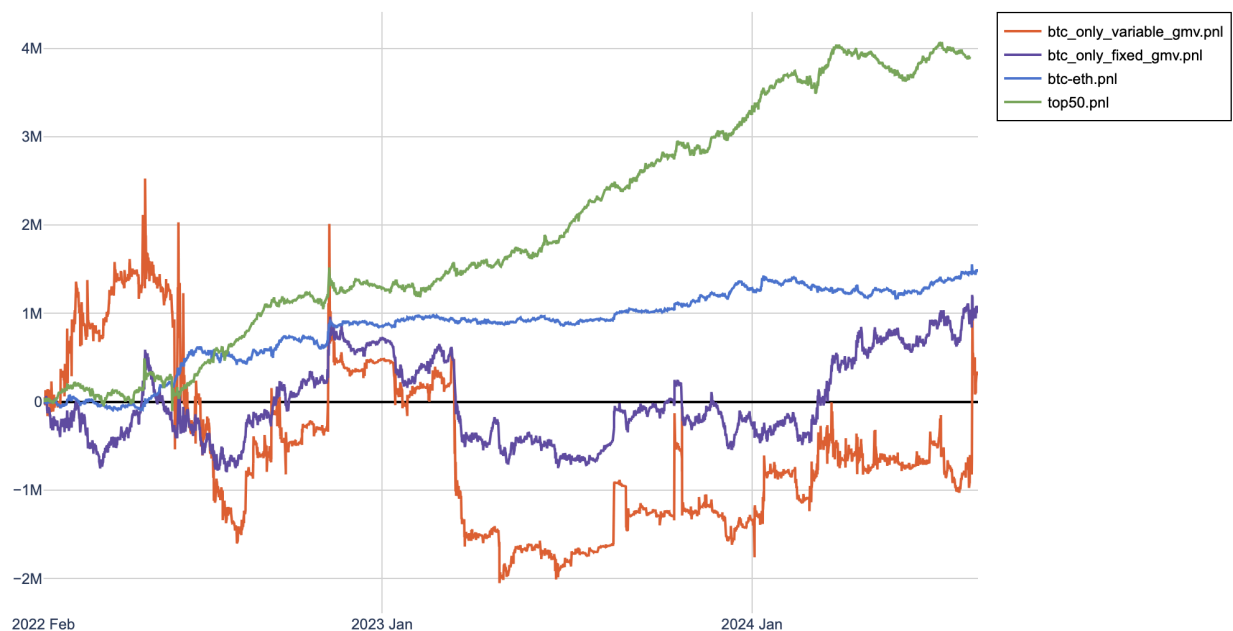
## Simulation Results

Simulation results on different universes, without considering transaction costs, are illustrated in Figure 1. As shown in Tables 1 through 4, increasing the number of assets in the universe leads to reduced volatility and improved returns, yielding higher Sharpe ratios.

In summary:

- BTC/USDT only with variable GMV: This alpha exhibits high volatility and significant drawdowns, resulting in a total annualized return of 6.49% and a Sharpe ratio of 0.04, indicating a poor risk-adjusted return.
- BTC/USDT only with fixed GMV: Although this alpha demonstrates lower volatility than the variable GMV alpha, its overall performance remains subpar, with a total annualized return of 20.03% and a Sharpe ratio of 0.36.
- BTC/USDT and ETH/USDT pair: This alpha offers more stability and better performance, delivering a total annualized return of 29.26% and a Sharpe ratio of 1.68. This suggests a more effective alpha with enhanced risk-adjusted returns compared to the single asset alphas, implying that predicting relative price movements between assets is easier than forecasting absolute changes.
- Top 50 most liquid assets: This approach significantly outperforms the other alphas, achieving a total annualized return of 77.83% and a Sharpe ratio of 3.2, suggesting that it offers the best balance between return and risk.

**Figure 1 : Simulation Results on Different Universes**



Source: Presto Research

**Table 1 : Stats of the Alpha for BTC/USDT only with Variable GMV**

btc_only_variable_gmv.pnl							
	GMV	Return (%)	Sharpe	MDD (%)	Daily Win Ratio (%)	Daily Turnover (%)	Return/Trade (bp)
20220201-20220701	2.78E+06	-19.12	-0.11	110.26	44.67	1138.76	-0.46
20220701-20230101	1.95E+06	66.83	0.48	94.60	54.35	1188.63	1.54
20230101-20230701	1.59E+06	-290.08	-2.56	163.53	53.59	1340.31	-5.93
20230701-20240101	1.24E+06	73.37	0.49	125.92	52.72	1309.16	1.54
20240101-20240701	1.74E+06	99.47	0.81	47.02	54.95	1302.31	2.09
20240701-20240810	2.23E+06	313.18	1.65	43.80	58.54	1253.25	6.85
<b>Total</b>	1.84E+06	6.49	0.04	248.61	52.82	1242.54	0.14

(Return and Sharpe ratio are annualized)

**Table 2 : Stats of the Alpha for BTC/USDT only with Fixed GMV**

btc_only_fixed_gmv.pnl							
	GMV	Return (%)	Sharpe	MDD (%)	Daily Win Ratio (%)	Daily Turnover (%)	Return/Trade (bp)
20220201-20220701	2.00E+06	-32.00	-0.43	50.16	47.33	785.32	-1.12
20220701-20230101	2.00E+06	96.59	1.71	30.98	55.43	756.51	3.50
20230101-20230701	2.00E+06	-135.92	-2.82	74.02	49.17	811.03	-4.59
20230701-20240101	2.00E+06	35.53	0.87	39.73	48.91	870.64	1.12
20240101-20240701	2.00E+06	116.76	2.13	18.65	54.40	838.45	3.82
20240701-20240810	2.00E+06	54.80	0.86	20.66	51.22	990.24	1.52
<b>Total</b>	2.00E+06	20.03	0.36	85.78	50.54	821.26	0.67

**Table 3 : Stats of the Alpha for the Pair of BTC/USDT and ETH/USDT**

btc-eth.pnl							
	GMV	Return (%)	Sharpe	MDD (%)	Daily Win Ratio (%)	Daily Turnover (%)	Return/Trade (bp)
20220201-20220701	2.00E+06	68.39	3.18	8.86	52.67	1137.31	1.65
20220701-20230101	2.00E+06	29.31	1.40	10.55	48.91	1088.02	0.74
20230101-20230701	2.00E+06	3.72	0.29	6.61	49.72	1167.93	0.09
20230701-20240101	2.00E+06	38.42	3.07	5.56	57.61	1192.37	0.88
20240101-20240701	2.00E+06	7.72	0.45	13.49	47.80	1253.82	0.17
20240701-20240810	2.00E+06	53.19	2.53	5.98	53.66	1331.71	1.09
<b>Total</b>	2.00E+06	29.26	1.68	13.49	51.52	1175.92	0.68

**Table 4 : Stats of the Alpha for Top 50 Most Liquid Assets**

top50.pnl							
	GMV	Return (%)	Sharpe	MDD (%)	Daily Win Ratio (%)	Daily Turnover (%)	Return/Trade (bp)
20220201-20220701	2.00E+06	37.47	1.27	29.86	53.33	1776.36	0.58
20220701-20230101	2.00E+06	97.22	4.43	15.44	63.04	1739.32	1.53
20230101-20230701	2.00E+06	62.54	2.82	10.10	57.46	1655.98	1.03
20230701-20240101	2.00E+06	141.16	6.09	8.62	67.39	1607.22	2.41
20240101-20240701	2.00E+06	68.08	2.63	20.95	54.40	1608.82	1.16
20240701-20240802	2.00E+06	-61.67	-3.11	9.87	42.42	1605.14	-1.05
<b>Total</b>	2.00E+06	77.83	3.20	29.86	58.64	1671.42	1.28

Source(Table 1~4): Presto Research

## Conclusion

This analysis demonstrates how Fibonacci retracements can serve in constructing trading signals across different universes. The simulation results reveal that as the number of assets in the universe increases, the alpha's volatility decreases while the return improves, implying that predicting relative returns is easier than forecasting absolute returns.

Overall, expanding the breadth of the universe significantly enhances performance. Machines excel at handling multiple assets simultaneously, whereas humans tend to be more effective when concentrating on a smaller set of assets in greater detail. This is why statistical arbitrage (statarb) strategies are designed to operate across broad universes.

It is generally believed that Fibonacci retracement is a valuable technical analysis tool for counter-trend or reversion trading, especially for trading a single asset. However, as demonstrated in this article, using Fibonacci retracement ratios to bet on momentum yields favorable results in multiple asset setups for statarb alphas.

## References

[1] CME Group, [Fibonacci Retracements and Extensions - CME Group](#)

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