Trading Insights

A Primer on Perpetual Futures

June 10, 2024

- **Perpetual futures are the most actively traded product in crypto. Bitcoin perpetual futures had three times the average daily volume of spot products in 1Q24.**
- **The calculation methodology for funding rates varies across exchanges, but skews positive by design.**
- **Funding rates are often seen as a measure of sentiment and leverage. We believe they are trailing indicators for price, but may be an indicator for continued volatility.**

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Perpetual futures, commonly referred to as "perps", are the most actively traded product in crypto. Perps are an attractive tool because they often provide easy access to leverage while removing the rollover costs associated with fixed-term futures. At the same time, we find that the funding rate mechanism enables perps prices to track spot prices with a similar precision as fixed-term futures. This makes perps popular not only for directional speculation, but also for hedging or arbitrage strategies.

In our view, certain characteristics of perpetual futures, such as their funding rate mechanism, are a core part of crypto's market indicators. Funding rates are often seen as a signal for market sentiment and can give some indication of the directionality of market positioning. However, funding rates skew positive (i.e. longs pay shorts) not only because of long-biased markets (markets in contango), but also because of the base interest rate mechanisms and clamping functions used in their calculations that we think are generally not well understood.

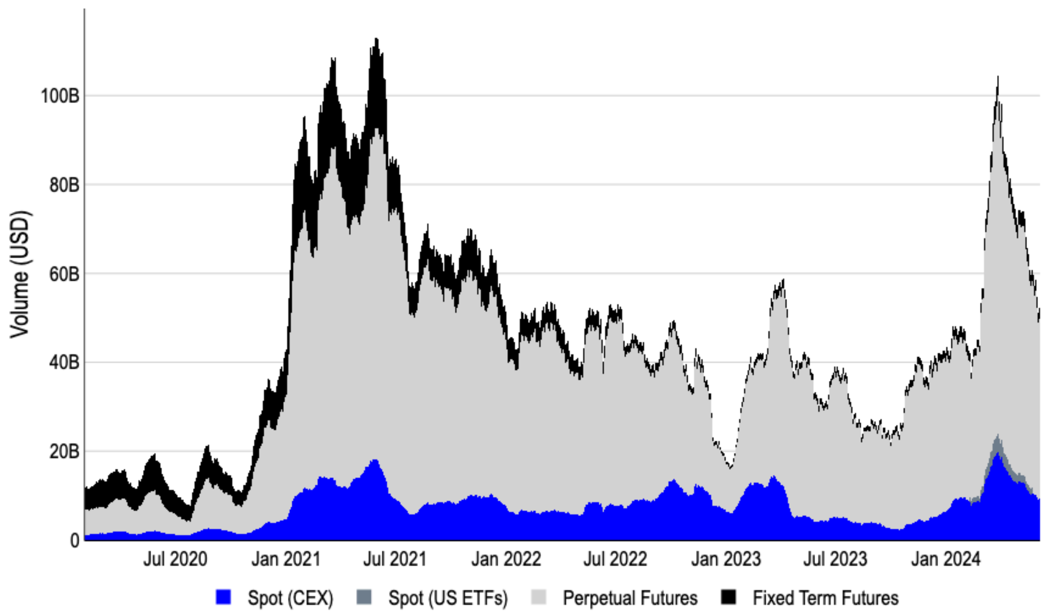
We find that funding rates are linked to long-term price movements, but that the magnitude of positive (or negative) rate changes may actually be trailing byproducts of market momentum rather than leading indicators. That said, our findings do highlight that prolonged periods of high funding rates have been followed by periods of higher volatility, though not all periods of elevated volatility are preceded by high funding rates. We believe that perps and their indicators will continue to remain at the forefront of crypto activity, even as the industry continues to mature.

Perps Market Overview

Perpetual futures constitute the majority of crypto trading volumes, though the exact proportion varies by asset. Bitcoin perps had a daily average volume of US$57.7B on weekdays in 1Q24, three times larger than the $18.8B average weekday spot volume. That said, perpetual futures are currently not available to US-entities, though we have observed that their global volumes peak during US trading hours alongside spot and fixed-term futures activity. Furthermore, the usage of perps is fairly sequestered to cryptocurrencies, unlike traditional fixed-term futures.

Chart 1 depicts the trading volume of bitcoin products, with perps represented in light gray. Except for the tail end of 2022 (following the FTX fallout), perps have been the dominant means for trading bitcoin exposure since late 2020. Furthermore, perpetual futures have become increasingly utilized over fixed-term futures (represented in black) as measured by notional volume. Today, fixed-term futures across both centralized exchange (CEX) and CME listed products account for less than 5% of bitcoin market volume, down from 40% at the start of 2020.

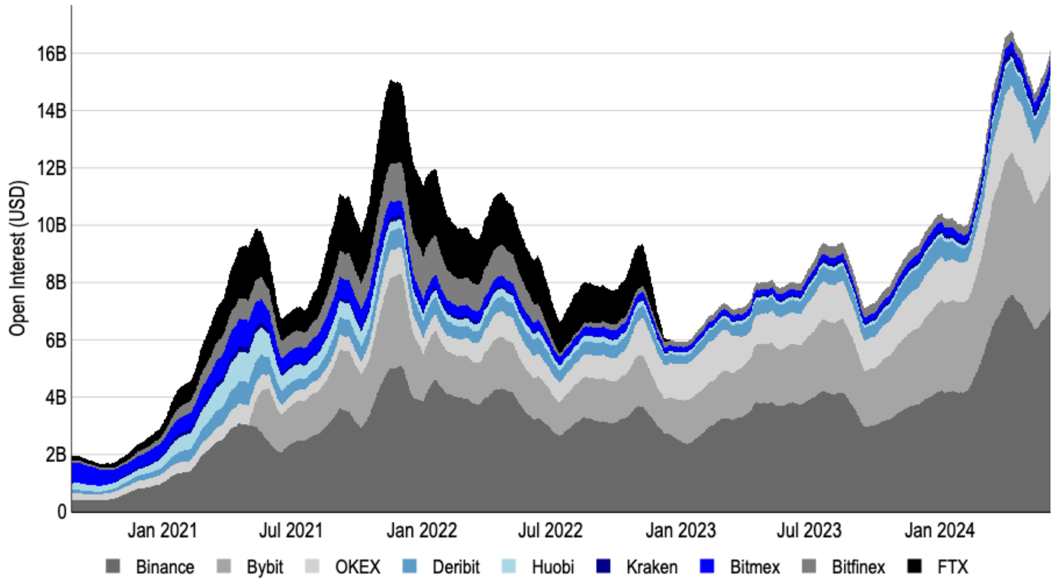
Chart 1. Perpetual futures constitute the majority of bitcoin trading volume



Sources: CoinMetrics and Coinbase. Volumes are taken on a 30 day rolling average.

Although volume can be used as a unified metric across products, we think open interest (OI) is a better comparison within perps as a measure for adoption. OI represents the total number of outstanding futures contracts that have been traded and are "open." OI increases when a new contract is created as a result of a trade (i.e. a new long position is matched with a new short position). Likewise, OI reduces when an existing long position is closed against an existing short position (or vice-versa). Other trades that only transfer existing positions do not impact OI as contracts are neither created nor destroyed. Thus, OI can be seen as a measure of total derivative positioning on an exchange. Currently, Binance, Bybit, and OKEX have the largest perps OI, though the market leaders have continued to shift in this relatively nascent space. In fact, Coinbase launched an International Exchange in 2023, entering the perps market too.

Chart 2. Bitcoin perps open interest is near all time highs



Sources: CoinMetrics and Coinbase. Open interest is taken on a 30 day rolling average.

Correlation Analysis

The easier position management for perps compared to fixed-term futures results from the absence of rollover costs to maintain a position. This stems from their differing incentive mechanisms to align the derivative and underlying prices (fixed settlement dates vs funding fee intervals). Despite their differences in price-pinning mechanisms, we find that the tight correlation between spot and perps mirrors that of fixed-term futures.

Table 1 contains our findings of Coinbase spot and Coinbase International perps correlations utilizing the same methodology used by the SEC in their spot BTC ETF approvals (between CME futures and spot). Although the sample period of our study is shorter due to the relatively recent launch of the Coinbase International Exchange, we find that the correlation between Coinbase spot and perps returns is nearly identical to that between Coinbase spot and CME bitcoin futures. This means that perps can enable similar directional exposure and hedging utility to fixed-term futures, while also having more liquid markets.

Table 1. Coinbase International Exchange perps and spot correlation compared to CME futures correlation (in parentheses)

	Hourly	5 Minute	1 Minute
Full Sample: 01/01/24 to 05/20/24	98.4 (+0)	89.8 (-4.8)	77.2 (+0.1)
Rolling Three-Month Correlations Over the Full Sample Period:			
Maximum:	99.9 (+0.7)	99.0 (+4.7)	95.4 (+12.2)
Minimum	97.8 (+2.8)	86.3 (-1.3)	71.8 (+2.3)

Source: Coinbase. Correlations are based on log normalized returns and ticks without price data have been forward filled.

Making Sense of Funding Rates

While funding fees are an effective tool for aligning spot and perps prices, the funding rate mechanism and its exact computation are often unclear and vary among exchanges. The mechanism involves periodic payments between long and short position holders, incentivizing price convergence (to spot) by charging position holders of the "overweight" side. In principle, when the futures price trades above the spot price, the funding rate is positive, and long position holders pay shorts. Conversely, when the futures price is below the spot price, the funding rate is negative and short position holders pay longs.

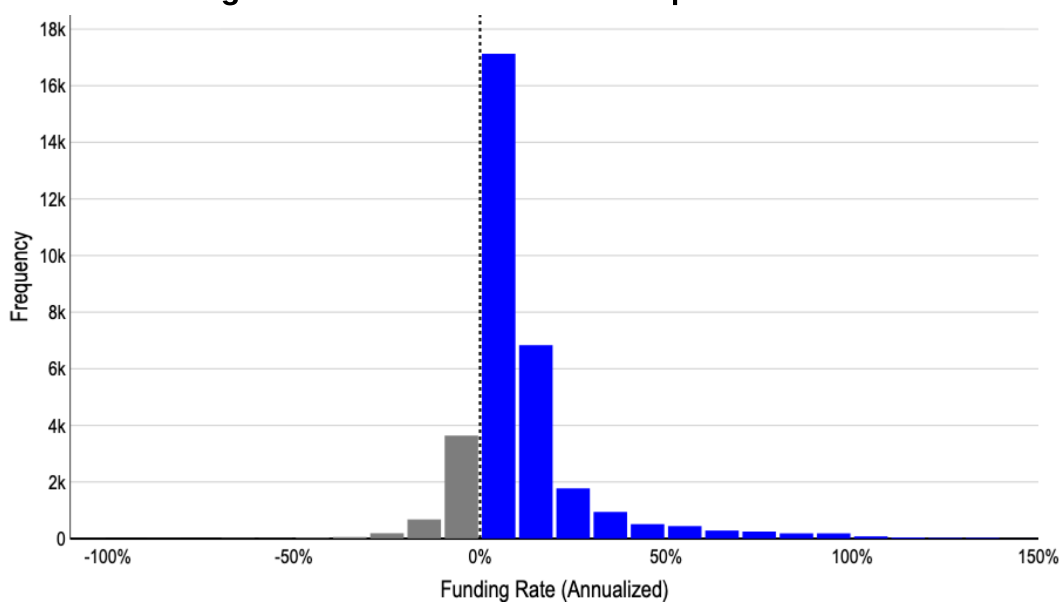
The funding rate is calculated at regular intervals, typically every eight hours on centralized exchanges (CEXs) and every one hour on decentralized exchanges (DEXs), though this varies. For example, Coinbase International Exchange has a funding interval of one hour. The funding rate calculation is based on the time-weighted average price differences between perps and spot (known as the premium index).

Furthermore, the funding rate is often normalized against a base interest rate and a clamping function that eliminates funding rate variability below a certain threshold. For example, if the calculated premium index is within a certain range, the funding rate defaults to the base interest rate (often 10.95% annualized). Separately, funding rate caps are also used to keep the funding rate inside a predefined band. That is, there can be a range function that limits how high or low funding rates can go, thereby eliminating funding rate variability above or below a certain threshold.

That said, the funding rate formula varies across exchanges, and can also be updated in light of new market conditions. Coinbase International Exchange does not utilize a base interest rate or clamping function, for example, and OKX changed their calculation intervals in January 2024. These differences extend to the interfaces, where funding rates are typically displayed on a per interval basis. A 0.01% displayed funding rate on an exchange with eight hour intervals equates to a 10.95% annualized rate (0.01% x 3h x 365d), whereas a 0.01% funding rate on an exchange with one hour intervals results in a 87.6% annualized rate (0.01% x 24h x 365d).

The normalization against the base interest rate and the usage of clamping functions across many perps exchanges means that the base funding rate skews positive (typically 0.01% per eight hour interval or 10.95% annually). This means that traders are often incentivized to short perps (to earn the funding rate), creating room for arbitrageurs to close price gaps between derivatives and spot. For example, in a positive funding rate environment, traders can long spot and short perps in a delta neutral strategy to get paid the funding fee (similar to basis trading for fixed-term futures). This bias toward positive funding rates is depicted in the histogram below (Chart 3), revealing that the OI-weighted funding rates for bitcoin have been positive more than 85% of the time in the past two years across CEXs.

Chart 3. Funding rate distributions are skewed positive



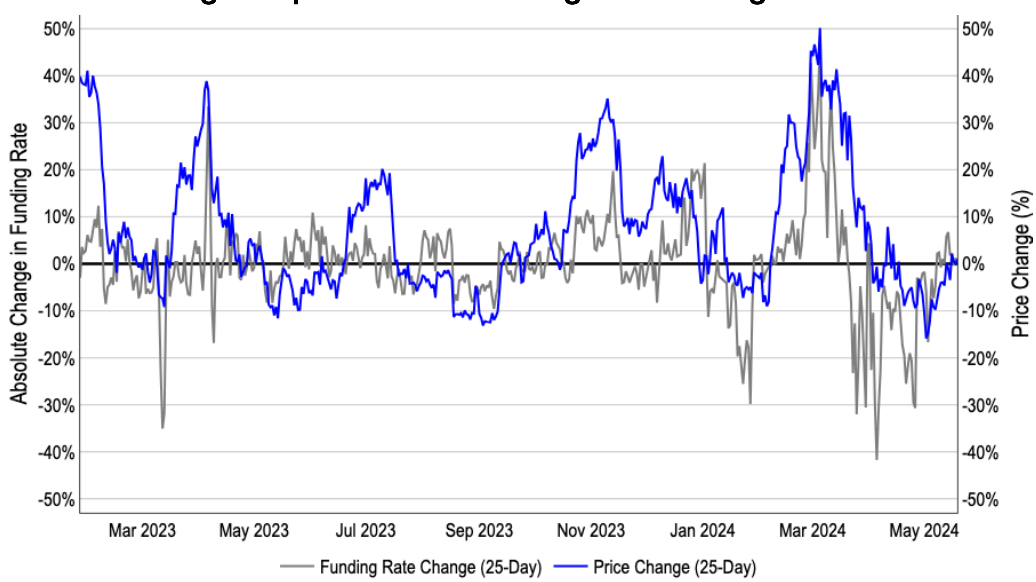
Sources: CoinMetrics and Coinbase. Funding rate instances are taken hourly from 2022-08-01 to 2024-05-20. Funding rates are annualized and weighted based on open interest.

Despite the differences across actual funding rate calculations, the effective fee paid follows a standard formula of *funding rate x notional position size*. This means that – in an efficient market – arbitrageurs would spread out their positions across CEXs to close funding rate differences irrespective of their underlying calculation method. Thus, the variations in both formulas and headline funding rates are often unified into a single annualized funding rate metric that is weighted by OI across multiple exchanges. This metric is often used as an indicator of market bullishness and leverage when interest rates are highly positive, and vice versa when negative.

The Funding Rate Factor

It stands to reason that a large positive funding rate typically arises from increased long positioning in perps relative to spot – at a rate and size larger than arbitrageurs can close (and vice versa). This could arise in a scenario where traders are directionally long via perps due to bullish expectations and are willing to pay a high annualized fee to do so. Indeed, we find that changes to perpetual futures funding rates are associated with price trends over longer periods. Chart 5 depicts the 25-day change in funding rates compared to the 25-day change in BTC price, which reveals a linkage between the two. In fact, it appears that price appreciation actually precedes increases to the funding rate (changes in blue tend to precede spikes in gray). We think this could be caused by the momentum-driven characteristics of crypto markets, where traders may open perp positions in the same direction that the spot market is already trending towards.

Chart 4. Changes in prices versus changes in funding rate for bitcoin



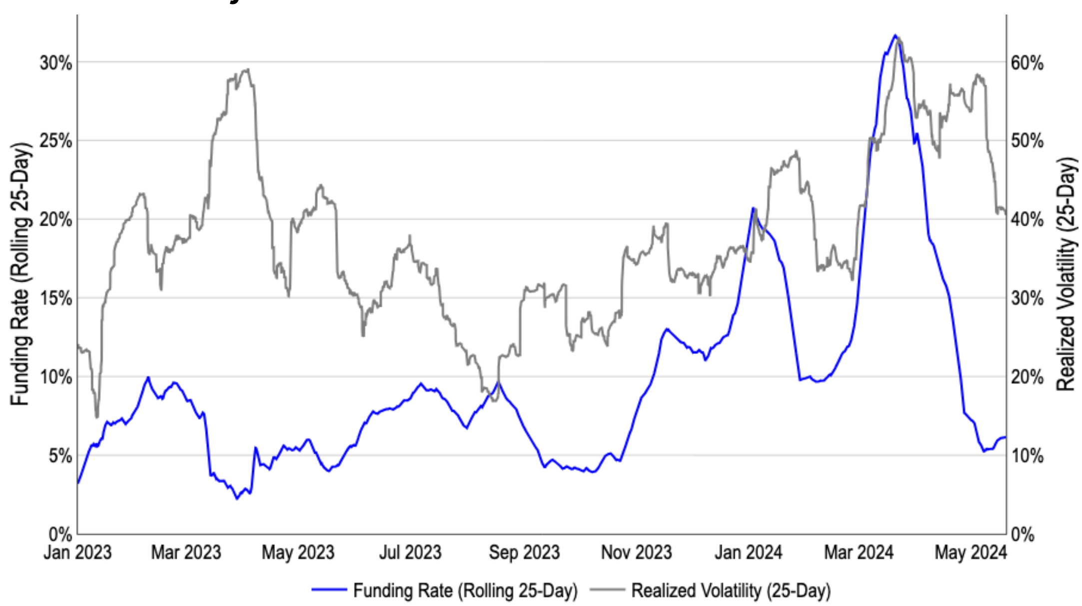
Sources: CoinMetrics and Coinbase. Funding rate instances are taken hourly and averaged for their daily rate. Funding rates are annualized and weighted based on open interest.

It should be no surprise then, that higher funding rates are typically associated with elevated levels of volatility (and volumes by extension). In fact, the rise in funding rates in December 2023 and March 2024 directly preceded the highest levels of bitcoin volatility since 1Q23 (see Chart 6). Thus, while funding rates are not a leading indicator for prices, we do think that persistently elevated funding rates could signal a period of extended volatility.

The converse is not true, however. Periods of volatility are not always driven by higher funding rates. As bitcoin recovered from its cycle lows throughout 1H23, for example, the rolling average funding rate did not exceed 10% annualized despite large price movements and volatility. In part, we think the generally reduced funding rates in 1H23 was due to a difference in trading regimes.

At the start of 2023, sentiment was dampened in the wake of several bankruptcies (both in crypto and traditional banking sectors) and the US debt-ceiling crisis resulting in a risk-off attitude and little appetite for directional longs via perps. In contrast, the tailwinds for crypto over the past several months have paved the way for more directional perps positioning (particularly in the long direction), and thus higher volatility. Barring another large shift in trading environments, we expect that high funding rates will continue to act as an early indicator of inbound volatility in the coming months.

Chart 5. Elevated funding rates tend to have led to periods of higher realized volatility for bitcoin



Sources: CoinMetrics and Coinbase. Funding rate instances are taken hourly and averaged for their daily rate. Funding rates are annualized and weighted based on open interest.

Conclusion

Perps are a key and growing part of crypto markets. Coinbase International launched a perpetual futures exchange (available in select jurisdictions only), and we've previously addressed the growth of decentralized perps too. At its core, the funding rate mechanism drives perps, facilitating opportunities for both basis trading and directional speculation. Meanwhile, the market funding rate can also act as a precursor for volatility and signal price momentum in an asset. We believe that perp mechanics will continue to be an important signal as we continue to progress in this bull cycle.

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