

7550140-perpetual-futures-and-their-arbitrage-on-decentralized-and-centralized-venues

SUMMARY: This article examines the arbitrage opportunities in perpetual futures contracts traded on both centralized (CeFi) and decentralized (DeFi) venues. The authors argue that the venue label (CeFi vs. DeFi) is not the most appropriate taxonomy for evaluating these instruments, as the construction of the venues significantly impacts the entry-time arbitrage opportunities and the risks borne by institutional investors. The authors classify funding designs into two layers based on what is known about the next payment at entry. They also highlight the importance of market architecture, including reference price construction, order matching, and position custody, which shape the non-price risks a trader bears.

METHOD: The study reviews seven audited offshore, U.S.-regulated, and decentralized venue architectures. The authors analyze how these venues construct the reference price, calculate funding, and match and settle trades. They examine the differences in funding designs and how they affect the entry-time arbitrage opportunities and the risks borne by arbitrageurs and institutional investors.

KEY FINDINGS:

- The next payment at entry is not always known, and this uncertainty affects the arbitrage opportunities.
- Different venues have different ways of constructing the reference price and calculating funding, which impacts the entry-time arbitrage.
- The entry-time classification of funding designs is crucial for understanding the arbitrage opportunities and risks.
- The market architecture, including reference price construction, order matching, and position custody, significantly impacts the non-price risks a trader bears.

IMPLICATION FOR TRADING: The findings suggest that traders should consider the construction of the reference price and the funding mechanism when trading perpetual futures on different venues. Understanding the differences in market architecture can help traders identify arbitrage opportunities and manage the risks associated with different venues. This knowledge can be used to develop more effective trading strategies and risk management techniques.

Perpetual Futures and Their Arbitrage on Decentralized and Centralized Venues

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Abstract

Perpetual futures on centralized (CeFi) and decentralized (DeFi) venues give leveraged exposure linked to a spot or index price through recurring funding rather than maturity convergence. Venues differ in how they construct the reference price, calculate and time funding, cap or clamp funding exposure, custody collateral, and match and settle trades. These things are not visible in a quoted funding rate or basis level. Funding size alone does not determine the entry-time arbitrage. We organize funding designs into a two-layer entry-time classification. First, by what is known about the next payment at entry. When the payment remains uncertain, by whether a rule imposes an outer bound on payment magnitude but not sign. Across seven audited offshore, U.S.-regulated, and decentralized venue architectures, what is known about the next payment at entry differs materially. Thus, a long-spot/short-perpetual basis trade with an identical basis and funding differs across venues. That gives arbitrageurs and investors ways to compare perpetuals.

1 Introduction

A perpetual future is, on paper, one of the simplest instruments in derivatives markets: a contract with no expiry that tracks a spot or index price indefinitely, whether it trades on a centralized exchange (CeFi) or a decentralized, blockchain-based protocol (DeFi). Both venue types offer continuous leveraged exposure without the roll costs and maturity mismatches of dated futures, and both anchor the contract to its reference price the same way: through a recurring funding payment between long and short positions rather than convergence at a fixed maturity date (He et al., 2022). A CeFi perpetual and a DeFi perpetual on the same underlying can therefore look like close substitutes, and it is tempting to treat perpetual futures as a single, venue-agnostic asset class (Chen, Ma, and Nie, 2024).

The resemblance is real but partial, and this paper argues that CeFi versus DeFi is the wrong taxonomy for judging it. The venue label sorts contracts by *where* they trade, whereas how they are built is a key determinant of entry-time arbitrage discipline. Two design features matter. Neither shows up in a quoted funding rate or a headline basis, yet each changes what an arbitrageur can actually lock in and what risks an institutional investor actually bears.

The first is funding *timing*: what an arbitrageur knows about the next cash flow at the moment a position is opened. A design that fixed the next payment from state observed at entry would let a basis trade be built around a known cash flow, but none of the seven venues we audit does so. One carries state accumulated before entry into the next funding calculation; the others construct their path-dependent premium input from observations realized after entry. Either way, the trade

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can rely only on a forecast or, at best, on a mechanically enforced outer cap that limits how far the realized rate can move without fixing its sign or guaranteeing either side a positive payment. What is known at entry – the payment itself, part of the state that determines it, or nothing beyond the rule – and whether a mechanical bound limits the payment form the paper’s central thread. Section 4 develops it as a two-layer entry-time classification, summarized in Figure 2.

The second is market architecture. How a venue constructs its reference price, whether it relies on an external oracle (a price feed pulled in from outside the protocol’s own trading), how orders are matched, and how positions are custodied and settled shape the non-price risks a trader bears, independent of the funding rule. Counterparty and custody exposure on a centralized venue differs from oracle and smart-contract exposure on a decentralized protocol, even when the reported funding rate and basis are numerically identical. Both features cut across the CeFi/DeFi line rather than along it: two protocols under the same “DeFi” label can differ from each other as much as either differs from a centralized benchmark.

The question has become more pressing. Perpetual futures developed largely in offshore cryptocurrency markets, but in May 2026 the CFTC approved KalshiEX, LLC’s BTCPERP contract for listing on its designated contract market (CFTC, 2026), widely reported as making Kalshi the first CFTC-regulated U.S. venue to offer a perpetual futures contract. Sitting inside a U.S. clearing, surveillance, and customer-compliance framework, the contract reinforces rather than undermines the taxonomy point: “CeFi” is itself not one thing, so a single CeFi category set against DeFi is too coarse.

Section 2 is a primer on funding and arbitrage. Section 3 compares centralized and decentralized market architecture across seven venues and works through two numerical basis-trade examples. Section 4 develops the entry-time funding classification, Section 5 the resulting risks for arbitrageurs and institutional investors, and Section 6 a five-question due-diligence checklist. Section 7 concludes.

2 How Perpetual Futures Maintain Price Alignment

A perpetual future has no expiration date, so unlike a dated future, whose gap to spot is forced closed at expiry, it cannot rely on maturity convergence to stay tied to its spot or index reference. It relies instead on a recurring funding payment between long and short holders: when the perpetual trades above its reference, longs pay shorts, and when it trades below, shorts pay longs, pushing the price back toward the reference.

The basis, the gap between the perpetual price and its reference, is the signal funding responds to. When the perpetual trades rich, buying spot and shorting the perpetual collects funding while hedged against the underlying’s price moves; the mirror trade profits when it trades cheap. This two-sided incentive should keep the basis near zero, since a wider basis attracts more arbitrage capital and larger expected funding.

Whether that discipline is strong depends on what is known about the next payment at entry, meaning a position opened immediately after the preceding funding settlement, before any price in the upcoming interval is observed. Three cases can be distinguished. A **known payment** is fixed at entry: the rule reads no post-entry input, so both amount and sign are determined before capital is committed. A **mechanical range restriction** is weaker: the payment remains path-dependent,¹ but a rule published and enforced in advance imposes a finite outer bound on the realized rate, so

¹Many venues compute funding from a time-weighted average price (TWAP), which aggregates premium observations over the funding interval. If those observations are collected after the position is opened, the next funding payment is necessarily path-dependent at entry.

its *magnitude* is restricted at entry while its *sign* is not. Whether a finite bound exists is a separate question from whether its numerical value is fixed at entry, and the class requires only the first: a bound is in force at every moment, which makes the restriction mechanical, even where the venue can revise its value at short notice (Section 4). **No entry-time restriction** means the payment is path-dependent with no mechanically enforced bound, leaving an arbitrageur nothing at entry beyond a forecast. Cutting across the last two cases, a rule may compute funding from moving averages that already reflect prices observed before entry; part of the next calculation’s input is then *inherited* at entry, although the payment itself is not fixed.

Neither a known payment nor a range restriction, as such, guarantees either side a positive payment, and three mechanical devices, all loosely called “clamps,” should be kept apart. An **inner deadband** clamps a term inside the funding formula. Dai, Li, and Yang (2025) study this device on centralized perpetuals: it dampens the rate’s response to small premium deviations, pinning funding at a fixed interest-rate leg inside a narrow band, and it is this insensitivity, not a directional floor, that generates their model-free no-arbitrage price bounds. Because it constrains only the gap between funding and the premium, the realized rate itself stays unbounded. An **outer cap** clamps the realized rate itself; the caps in use are two-sided, bounding each side’s worst-case payment and best-case receipt. A **signed payment floor**, a strictly positive lower bound on what one named side receives, would require an entry-known component of the rate to dominate the worst adverse move of the path-dependent component. No venue in our seven-venue sample supplies one, so the paper reserves “guarantee” for that case alone.

Even a known payment does not translate one-for-one into arbitrage profit: executing the hedge costs money (fees, spreads, and price impact on both legs), and holding it exposes the arbitrageur to basis risk if the legs do not move together. Without invoking a formal model, the tradeoff can be summarized as

Entry-time arbitrage discipline = f (funding-rule information at entry, execution costs, basis risk).

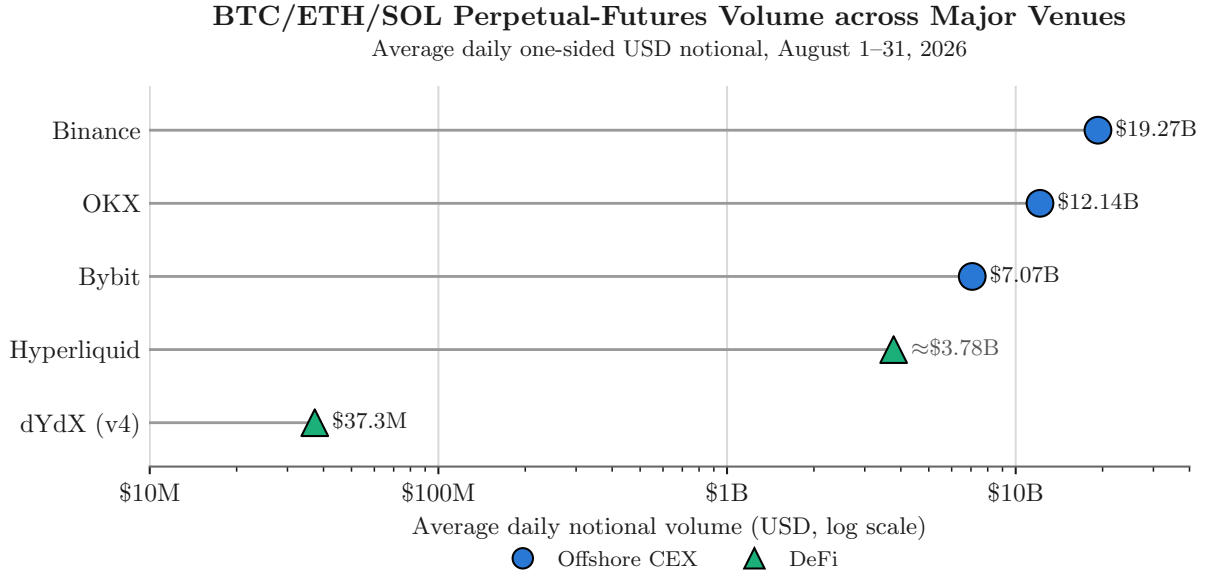
It is written as a function rather than a subtraction because only a known payment yields a signed amount to net against costs and basis risk. Discipline is strongest when the funding rule leaves little in doubt and costs and basis risk are small; when they are large, the basis can persist even though funding nominally exists to correct it.

3 Centralized versus Decentralized Market Architecture

Centralized and decentralized perpetual futures advertise the same payoff, but the plumbing differs: how the reference price is built, how funding is calculated, and who bears the risk. The centralized benchmark is the exchange-style venue formalized by Dai, Li, and Yang (2025); the decentralized cases examined most closely are legacy Drift and dYdX.² Unlike the other venues, legacy Drift computes funding from exponentially weighted TWAPs (EMA-TWAPs, which weight recent observations more heavily) that carry state from before a position opens into its next funding calculation (Drift Protocol, 2026a,b).

Scale matters too: an arbitrage-discipline argument carries different weight for a venue trading tens of billions a day than for one trading tens of millions. Figure 1 reports average daily BTC, ETH, and SOL notional volume in August 2026 for the five venues with comparable full-month data. Two members of the seven-venue taxonomy are omitted from the figure (Data Appendix): Drift, whose legacy protocol was suspended after an April 2026 incident and whose relaunch reached only

²Drift Protocol rebranded to Velocity in July 2026. Velocity’s documentation does not confirm the same funding mechanism, so this paper labels the audited design “legacy Drift” and makes no claim about the relaunched protocol.



† Hyperliquid (≈) is reconstructed: base-asset volume × OHLC-4 typical price (no native USD field).
Kalshi and Drift are omitted (window-exactness and data-availability issues, respectively); see the Data Appendix.

Figure 1: Sources: exchange/protocol APIs and archival market data; authors’ calculations. See the Data Appendix for venue-level definitions and source details.

private beta on August 25, 2026, and Kalshi, whose daily windows do not align with the calendar-day boundary the other venues use. Offshore exchanges dominate, but decentralized activity is economically material: Binance averaged \$19.27 billion a day versus approximately \$3.78 billion for Hyperliquid.

Table 1 compares funding design across the seven venues, grouped by architecture: three offshore exchanges (Binance, Bybit, OKX), one U.S.-regulated exchange (Kalshi), and three decentralized protocols (Hyperliquid, legacy Drift, dYdX).

Regulatory status separates Kalshi from the other six: the Commission voted to approve BTCPERP (CFTC, 2026), and gold and silver followed on the same designated contract market in September 2026 through Rule 40.2(a) self-certification, which requires no Commission vote on the specific contract (CNBC, 2026; Kalshi, 2026b; crypto.news, 2026). Kalshi nonetheless discloses its funding mechanism in comparable detail: a real-time regulated-exchange index, a period TWAP of the premium, and a symmetric clamp (Kalshi, 2026a).

The funding difference that Section 4 classifies is timing. No venue fixes the next payment at entry, and all seven cap the realized rate (“bounded but uncertain”) (Binance, 2026; Bybit, 2026; OKX, 2026; Hyperliquid, 2026; Kalshi, 2026a; dYdX, 2026a; Drift Protocol, 2026b); they differ in whether the next calculation inherits state from before entry, as legacy Drift’s does, or is built from premium observations realized during the upcoming interval, as at the other six. The split does not track the CeFi/DeFi boundary: legacy Drift and dYdX are both decentralized, yet dYdX’s design places it with every centralized venue.

Table 1 omits institutional risk allocation, which differs even between the two centralized architectures. Offshore venues concentrate exchange, custody, and counterparty functions in one complex. Kalshi separates them: KalshiEX operates the market, collateral sits in a segregated

Table 1: Funding design across seven perpetual-futures venues

Venue	Reference price	Funding input	Pre-entry state inherited?	Cap change prospective?	Funding constraint	Taxonomy
<i>Offshore CEX</i>						
Binance	Internal Index (spot-weighted) + Premium Index	5s premium TWAP over interval	No	No	Inner $\pm 0.05\%$; outer $\pm 0.75 \times \text{MMR}$ (major pairs) or $\pm 2\%$ (other pairs); breach shortens next settlement to 1h	Interval-sampled, bounded
Bybit	Bybit Index (volume-weighted, top 6 spot exch.)	Minute premium TWAP, weight rises near settlement	No	No	Inner $\pm 0.05\%$; outer $\pm \min[(\text{IMR} - \text{MMR}) \times 0.75, \text{MMR}]$	Interval-sampled, bounded
OKX	OKX Index (≥ 3 exch.) + impact-price premium	Premium sampled through period, finalized last minute	No	No	Inner $\pm 0.05\%$; outer per-contract cap ($\pm 0.375 - 1\%$)	Interval-sampled, bounded
<i>Regulated CEX</i>						
Kalshi	CF Benchmarks BRTI (regulated-exch. index)	TWAP of 1-min premium candles over 8h period	No	Unaudited	Deadband zeroes rates below 0.01% in absolute value; outer $\pm 2\%$ clamp	Interval-sampled, bounded
<i>DeFi</i>						
Hyperliquid	Stake-weighted median validator oracle (multi-CEX)	5s premium averaged over settlement hour	No	Unaudited	Inner $\pm 0.05\%/8\text{h}$; outer $\pm 4\%/hour$	Interval-sampled, bounded
Legacy Drift	External oracle; funding uses mark and oracle EMA-TWAPs (markPrice-Twap, oraclePrice-Twap)	EMA-TWAP state from before entry, refreshed with post-entry prices	Yes	Unaudited	Tier cap on realized rate (BTC: about $\pm 0.125\%/hour$)	State-inherited, bounded
dYdX v4	Post-entry impact-price premium samples	Accrued from premium sampled after entry	No	Yes	Outer $\pm 6 \times (\text{IMR} - \text{MMR})$, tier-dependent (BTC-USD: $\pm 4.8\%$); never binds in sample	Interval-sampled, bounded

Notes: IMR = initial margin requirement; MMR = maintenance margin requirement. “State-inherited”: the next funding calculation carries forward state accumulated before entry; “interval-sampled”: its premium input is built from observations realized during the upcoming interval; “bounded”: a mechanically enforced cap limits the realized rate’s magnitude but not its sign. “Pre-entry state inherited?” asks whether the next funding calculation reuses state accumulated before entry; no venue fixes the next payment itself at entry. OKX entries describe its current-period collection method, confirmed via the public API for the instruments checked; a contract still on the legacy cross-period method would have its next rate set before the interval opens. “Cap change prospective?” asks about the venue’s *process* for changing the applicable cap or floor, not about the survival of any particular number. “Yes” means a change can occur only through a prospectively announced, deterministic mechanism whose effective time is set by a published rule and is publicly visible in advance, even if that moment is not provably aligned to a funding-interval boundary; it does not assert that the value in force when an interval opens is guaranteed to survive through that interval’s settlement. “No” means the venue documents no such process and reserves the right to revise the cap or floor in real time, so a change may take effect with no advance notice and no stated effective-time rule. “Unaudited” means the venue has not been examined against this test, and records the absence of a finding rather than a positive or negative one. The column therefore qualifies the cap-setting process; it does not create a separate taxonomy class, because all seven venues retain a mechanically enforced finite bound under every label. All such caps are two-sided, and no venue provides a signed payment floor. See the Data Appendix for venue-level cap-mutability evidence and Figure 1 for volume definitions. *Sources:* first-party venue documentation cited in the text (Binance, 2026; Bybit, 2026; OKX, 2026; Hyperliquid, 2026; Kalshi, 2026a; Drift Protocol, 2026a,b; dYdX, 2026a,b).

account, and Kalshi Klear LLC, a CFTC-regulated clearing organization, becomes the counterparty to every trade through novation (Kalshi Klear, 2025). Legacy Drift and dYdX hold margin on-chain and settle through public blockchain transactions (Qin, Zhou, and Gervais, 2022), shifting the dominant exposure toward smart-contract, oracle, governance, and privileged-control risk, and exposing execution to extraction risk absent from a centralized matching engine (Daian et al., 2020).

Worked examples. Two numerical examples make the timing difference concrete. Both use the same trade: bitcoin’s index price is \$100,000, the perpetual trades at \$100,100 (a 0.10% premium), and immediately after a funding settlement an arbitrageur buys 10 BTC of spot and shorts 10 BTC of the perpetual, a \$1 million position at the index price. Funding payments are reported on this \$1 million reference notional, and execution costs are set aside; the question is what the arbitrageur knows, at entry, about the next funding payment. The examples are stylized: they treat the quoted 0.10% gap as each venue’s premium input and omit legacy Drift’s rule scaling back receipts when the protocol’s own market maker would be the net payer. Table 2 summarizes the answers.

Example 1: a centralized exchange. On OKX’s BTC-USDT-SWAP, the rate paid at the next eight-hour settlement is

$$F = \text{clamp} \left[\bar{P} + \text{clamp}(0.01\% - \bar{P}, -0.05\%, +0.05\%), -0.375\%, +0.375\% \right],$$

where $\bar{P}$ is the average premium over the coming eight hours, sampled after entry, and $\text{clamp}(x, a, b)$ limits x to the interval $[a, b]$ (OKX, 2026). Two paths for $\bar{P}$ show how far apart the outcomes for the short can be:

- If the premium persists at 0.10%, the inner clamp binds and $F = 0.10\% - 0.05\% = 0.05\%$: the short receives \$500.
- If a sell-off pushes the perpetual to an average 0.50% discount, $F = -0.45\%$ before the outer cap and -0.375% after it: the short pays \$3,750.

In between, any average premium from -0.04% to $+0.06\%$ leaves F at the 0.01% interest leg, a \$100 receipt: the insensitivity that Dai, Li, and Yang (2025) model. At entry, the arbitrageur knows only that the payment will lie between $-\$3,750$ and $+\$3,750$, and OKX may adjust even that bound in real time (Section 4). A running estimate of 0.05% per eight hours, about 55% on a simple annualized basis, describes the first path, not a cash flow that can be locked in. In the sell-off path, even if the premium closes by settlement, delivering the \$1,000 the trade was built to capture, the hedged trade is \$2,750 down before costs.

Example 2: two decentralized protocols. On legacy Drift, the hourly rate is computed from the mark-price and oracle-price TWAPs,

$$f = \frac{1}{24} \cdot \frac{M - \bar{I} + \bar{I}/5000}{\bar{I}},$$

where M is the mark-price TWAP, $\bar{I}$ the oracle-price TWAP, and $\bar{I}/5000$ a fixed 0.02% offset (Drift Protocol, 2026b; Erez and Smirnov, 2026). With entry-state values $M = \$100,100$ and $\bar{I} = \$100,000$, the formula evaluated at entry gives $f = \frac{1}{24} \times (\$100 + \$20)/\$100,000 = 0.005\%$, a \$50 receipt for the short. This is not a locked-in payment: the protocol refreshes both TWAPs with post-entry prices before the next funding update, so prices realized during the coming hour

can change its size and sign, within BTC’s tier cap of about $\pm 0.125\%$ an hour, or $\pm \$1,250$ (Drift Protocol, 2026b; Erez and Smirnov, 2026). What distinguishes legacy Drift is that part of the state entering that calculation has already accumulated when the trade is opened. The \$50 is simply the rate the protocol has just settled, computed from that same state; OKX and dYdX publish their just-settled rates too, but their next calculations do not reuse the state behind them. On dYdX, the same short receives one-eighth of the average premium sampled over the coming hour, with that premium, read as an eight-hour rate, clamped at $\pm 4.8\%$ for BTC-USD: six times the gap between its 2% initial and 1.2% maintenance margin fractions (dYdX, 2026a; Erez and Smirnov, 2026).³ If the 0.10% premium persists, the short receives \$125, more than on Drift. At entry, however, dYdX offers no counterpart to Drift’s inherited state, only its cap: anywhere between $-\$6,000$ and $+\$6,000$ for the hour, nearly five times Drift’s bound and, per eight hours, almost 13 times OKX’s. In practice the bound has had no bite: Erez and Smirnov (2026) find that dYdX’s caps never bind in their sample, even under a tenfold tightening. Both protocols are “DeFi” and neither fixes the payment, but only one carries pre-entry state into it; Section 4 turns this contrast into a classification.

Table 2: The next funding payment on a 10 BTC long-spot, short-perpetual position (\$1 million reference notional) opened at a 0.10% premium

Venue	Architecture	Interval	At entry	If premium persists
OKX	Offshore CEX	8 hours	Range $-\$3,750$ to $+\$3,750$	$+\$500$
Legacy Drift	DeFi	1 hour	Range about $-\$1,250$ to $+\$1,250$; formula at entry state gives $+\$50$	$+\$50$
dYdX	DeFi	1 hour	Range $-\$6,000$ to $+\$6,000$	$+\$125$

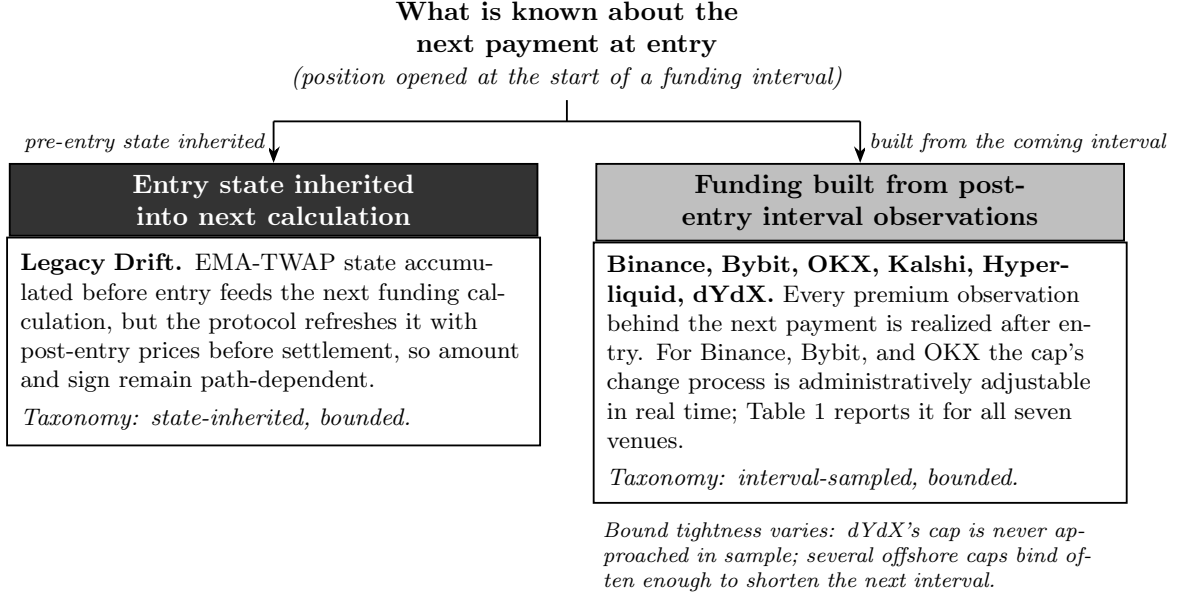
Notes: Stylized illustration using each venue’s published funding formula (Examples 1 and 2); payments are to the short, on \$1 million of reference notional, before execution costs. Each payment covers that venue’s own next settlement interval (eight hours at OKX, one hour at legacy Drift and dYdX), so the amounts are not same-horizon yield comparisons. Over eight hours of a persisting premium, the three would pay about \$500, \$400, and \$1,000, and the ranges would widen to $\pm \$3,750$, about $\pm \$10,000$, and $\pm \$48,000$. *Sources:* OKX (2026); Drift Protocol (2026b); dYdX (2026a); Erez and Smirnov (2026).

4 When Does Arbitrage Discipline Prices?

The examples in Section 3 show that what is known about the next payment at entry varies across venues in ways the CeFi/DeFi line does not track. Two questions sort the seven venues: what is known about the next payment at entry, and, because it remains uncertain everywhere, is its magnitude mechanically bounded? Figure 2 shows the result: all seven are bounded, and they split on the first question into a *state-inherited* class (legacy Drift) and an *interval-sampled* class (the other six). Both are *bounded but uncertain*, where “bounded” describes the payment’s per-interval magnitude; its sign and realized value remain unknown until settlement.

Layer 1: what is known about the next payment at entry? Three answers are logically available: the payment itself, part of the state that determines it, or nothing beyond the rule. No venue gives the first. Legacy Drift gives the second: its rate is computed from mark-price and oracle-price EMA-TWAPs whose accumulated state is observable when the position opens, but

³BTC-USD margin fractions from the dYdX v4 Indexer API ([/v4/perpetualMarkets](https://v4.perpetualMarkets)), retrieved September 30, 2026.



Both classes are path-dependent but mechanically bounded: every venue caps the realized rate with a two-sided bound, so magnitude is bounded while sign is not. No audited venue fixes the next payment at entry or leaves it unbounded, and none provides a strictly positive signed payment floor at interval start.

Figure 2: What is known about the next funding payment at entry, for the seven audited venue architectures (Drift Protocol, 2026a,b; Dai, Li, and Yang, 2025; Binance, 2026; Bybit, 2026; OKX, 2026; Kalshi, 2026a; Hyperliquid, 2026; dYdX, 2026a). Layer 1 asks what the next payment takes from before entry: legacy Drift's calculation inherits EMA-TWAP state, while the other six build their premium input from observations realized during the upcoming interval; none fixes the payment itself. Layer 2 asks whether a mechanically enforced rule bounds the realized rate: all seven do, without guaranteeing either side a positive payment. Shading marks the two classes, not a position on a scale; bound tightness (Section 4, Layer 3) does not move a venue between them.

the protocol refreshes both TWAPs with post-entry prices before computing the next payment, so amount and sign remain path-dependent (Drift Protocol, 2026a,b).⁴ The other six give the third: beyond fixed terms of the rule, such as an interest-rate leg and caps, they build the next payment from premium observations realized during the upcoming interval. Erez and Smirnov (2026) study the TWAP ratio behind this calculation empirically, with a band calibrated on the 2023 training-window distribution of the basis and tightened by the rate computed at each hourly update. They evaluate funding at the hourly update; under the interval-start convention adopted here (Section 2), that update-time rate is not the next payment of a position newly opened after the preceding settlement. Card 1 of Figure 3 reports the band's non-vacuous out-of-sample exit rates across 8,774 BTC-PERP, 8,773 ETH-PERP, and 8,773 SOL-PERP held-out 2024 observations: evidence that a band built on Drift's TWAP state has empirical bite, not that the next payment is known at entry under this paper's convention.

Layer 2: is the range mechanically restricted? A payment not fixed at entry can still be disciplined if a rule published and enforced in advance imposes a finite outer bound on the realized rate, restricting its *magnitude* without fixing its *sign*. All seven venues enforce such a bound,

⁴On legacy Drift's rebrand to Velocity, see Section 3.

legacy Drift’s being a tier cap written into its funding code (Binance, 2026; Bybit, 2026; OKX, 2026; Kalshi, 2026a; Hyperliquid, 2026; dYdX, 2026a; Drift Protocol, 2026b). They do so with devices that the word “clamp” otherwise collapses into one.

An **inner deadband** clamps a term inside the funding formula, not the realized rate. Binance, Bybit, OKX, and Hyperliquid clamp the gap between the fixed interest-rate leg and the premium index at $\pm 0.05\%$ per 8-hour equivalent (Binance, 2026; Bybit, 2026; OKX, 2026; Hyperliquid, 2026), the insensitivity Dai, Li, and Yang (2025) model for their no-arbitrage price bounds, while leaving the premium term itself unconstrained. Kalshi’s deadband differs structurally: with no interest-rate leg to nest inside, its rule zeroes any rate smaller than 0.01% in absolute value and so applies directly to the realized rate (Kalshi, 2026a).

An **outer cap** applies to the realized per-interval rate itself and is enforced mechanically (Table 1); it is the entire content of Layer 2. The bounded venues differ, however, in the *process* by which the cap’s value may change, which Table 1’s “Cap change prospective?” column records. Call the process *prospective* if any change must run through a prospectively announced, deterministic mechanism whose effective time follows from a published rule and is publicly visible before it binds, and *administratively adjustable* if the venue instead reserves the right to change the cap in real time. dYdX is the prospective case: its clamp factor changes only through on-chain governance and takes effect in the block after a fixed three-day voting period (dYdX, 2026b). One caveat remains: no primary source confirms that this block falls on an hourly funding boundary, so a change knowable three days in advance could still first bind within a funding hour already open. Binance, Bybit, and OKX are adjustable. Bybit’s own announcements show a revised limit applying to an interval already open (SNTUSDT’s bound widened from $\pm 1.5\%$ to $\pm 2\%$ mid-interval, just 19 minutes after the change was announced), and its announced limits have exceeded its default formula by up to $5.3\times$, so the formula in Table 1 is a default, not a meta-cap (Bybit, 2026). Binance reserves the right to adjust its cap in “extreme market volatility” with no effective-time qualifier, and its one dated cap change on record took effect mid-interval (Binance, 2026). OKX says its cap “may be adjusted in real-time” and commits to no boundary alignment for such a change, a weaker basis that rests on an absent safeguard rather than a demonstrated instance (OKX, 2026). Kalshi, Hyperliquid, and legacy Drift have not been audited on this process question (Kalshi, 2026a; Hyperliquid, 2026; Drift Protocol, 2026b); the Data Appendix gives the venue-level evidence. Adjustability does not move a venue out of its class, because all seven enforce some finite bound at every moment. What it removes is protection against a short-notice revision of the number read at entry.

A **signed payment floor**, the only device that would guarantee a cash flow, is absent everywhere. Every outer cap is two-sided and sign-symmetric, so $F \in [-c, +c]$ caps a side’s worst payment and best receipt at once, supplying neither a floor nor any constraint on the premium’s sign. Where an inner deadband applies, the short receives exactly the fixed interest leg only if the premium lands inside it, which is known only once realized. Layer 2’s other branch, path-dependent funding with no mechanical bound, also has no occupant. The empty cells are informative: no contract fixes the next payment at entry, none guarantees either side a positive payment, and none leaves the rate mechanically unbounded.

Layer 3 (descriptive only): how much economic content does the bound carry? Layers 1 and 2 are the formal classification and depend only on each venue’s rules; all seven venues answer Layer 2 from a transcribed clamp formula. Bound *tightness*, meaning how close realized funding comes to the cap and how often it binds, is reported separately, because a tightness threshold would make a venue’s class depend on price history rather than on its contract. Tightness varies within a class. dYdX’s outer cap on the realized 8-hour rate is $|F| \leq 6 \times (\text{IMR} - \text{MMR})$, e.g.

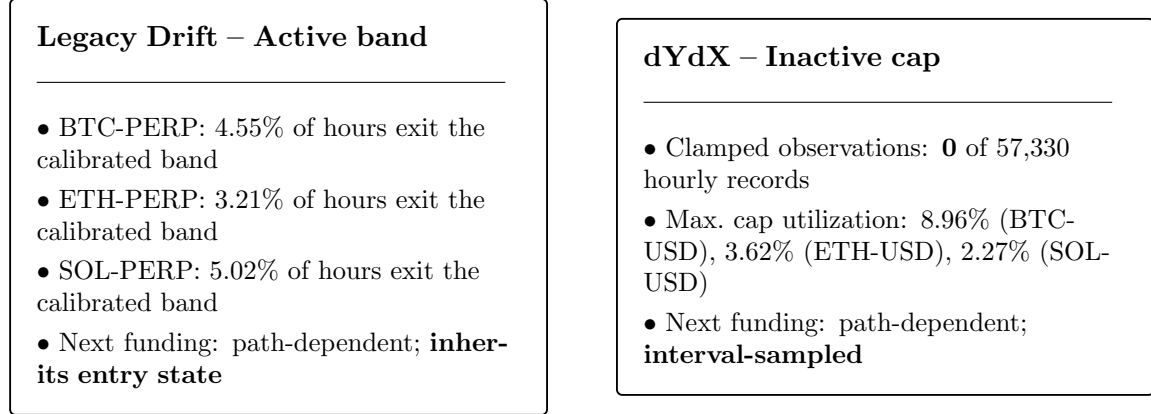


Figure 3: Two findings from Erez and Smirnov (2026) on the two decentralized protocols. Left: the TWAP ratio behind legacy Drift’s funding exits a band calibrated on the training-window basis distribution in 3.2%–5.0% of held-out hourly observations across BTC, ETH, and SOL; the band evaluates funding at the hourly update, which under Section 2’s interval-start convention is not the next payment of a newly opened position. Right: dYdX’s margin-based cap is never clamped in sample, and realized funding stays far from it. The two cards report different quantities and are not meant to be compared on a shared scale.

$\pm 4.8\%$ for BTC-USD, whose initial and maintenance margin fractions are 2% and 1.2% (dYdX, 2026a), and Card 2 of Figure 3 shows it never binding in the held-out sample, even under a ten-fold tightening (Erez and Smirnov, 2026). OKX’s and Binance’s own documentation reports caps sitting closer to realized rates, with a Binance breach automatically shortening the next interval to one hour (OKX, 2026; Binance, 2026). Legacy Drift’s tier cap is tighter than dYdX’s but was not reached in the same study either: realized funding peaked at 21–36% of it (Erez and Smirnov, 2026). Running the same standardized cap-utilization calculation across the remaining five venues is a natural extension that this paper does not undertake.

Two populated classes, not a gradient. The classification sorts venues by whether the next calculation reuses state from before entry, not along a smooth scale or the CeFi/DeFi line: legacy Drift, a decentralized protocol, is the only venue whose calculation does, while dYdX, also decentralized, shares its class with every centralized venue. It describes how the next payment is formed, not how well it can be forecast (the premium observed at entry is informative everywhere) or how tightly any venue’s basis trades.

A design tradeoff, not a simple ranking. Inheriting pre-entry state is not free. Carrying it into next-period funding, as legacy Drift does, ties part of the calculation to prices observed before entry but makes funding slower to reflect information that arrives *during* the period, while dYdX’s post-entry premium sampling keeps funding responsive at the cost of any such carry-over. Persistence and intra-period responsiveness are competing design objectives. Which one a venue should favor depends on what it is trying to discipline, entry-time arbitrage bounds or continuous alignment with a moving market, not on which design is unconditionally better.

Table 3: Risk channels across offshore CeFi, regulated CeFi, and DeFi architectures

Risk channel	Offshore CEX	Regulated CEX	DeFi
Price anchor	Exchange index	Regulated methodology	Oracle/protocol
Asset control	Exchange/custodian	Intermediary + clearing framework	Contract/admin keys
Rule changes	Internal	Rulebook/regulatory process	Governance/admin
Execution	Central matching	Regulated central venue	On-chain ordering
Tail event	Insolvency/freeze	Clearing/member failure	Code/oracle/admin compromise

5 Risks for Arbitrageurs and Institutional Investors

A long-spot/short-perpetual basis trade is often treated as venue-agnostic: lock in the quoted basis, collect funding, and stop there. Sections 3 and 4 show that this view breaks down at the level of funding and arbitrage discipline. It breaks down further once the trade’s other risks are counted, because CeFi and DeFi relocate risk rather than eliminate it. Table 3 gives a stylized, not exhaustive, summary of five institutional risk channels across offshore CeFi, regulated CeFi, and DeFi; the discussion below covers only the differences not obvious from the table. Two further risks sit at the level of the trade and cut across all three architectures: funding-rate risk, which Section 4’s classification addresses directly, and liquidation risk, since a margin call or liquidation-engine trigger can force early closure regardless of the entry-time basis (Ackerer, Hugonnier, and Jermann, 2025; He et al., 2022).

Several rows compound rather than stand independently. On the centralized side, price anchor and rule changes sit inside one institution: an offshore exchange controls its index methodology and internal rulebook within a single vertically integrated structure, with less external oversight than a regulated venue, where both run through CFTC oversight. DeFi’s oracle anchor and governance channel are formally separable but depend on the same privileged-access layer that the case study below examines (Mackinga, Nadahalli, and Wattenhofer, 2022; Angeris and Chitra, 2020). Asset control and tail events pair the same way. Offshore custody concentrates counterparty risk on one balance sheet, so insolvency is the tail event; a regulated venue interposes a clearinghouse through novation, so the tail event becomes a clearing-member and default-management risk rather than direct exchange-counterparty exposure (Chen, Ma, and Nie, 2024; Werapun et al., 2026); and DeFi’s contract and admin-key control replaces both with smart-contract and privileged-access exposure (Ackerer, Hugonnier, and Jermann, 2025; Qin, Zhou, and Gervais, 2022). Execution is the row least captured by a single label: impact, liquidity, and settlement finality vary by venue, and on-chain ordering adds extraction risk, since whoever orders transactions (a validator, or a rollup’s sequencer) can insert trades ahead of a pending one for profit, a failure mode distinct from the latency and queue-priority risks of centralized matching engines (Daian et al., 2020; Qin, Zhou, and Gervais, 2022).

Case Study: Drift’s 2026 Security Incident. On April 1, 2026, Drift Protocol, one of the DeFi venues examined in this paper, suffered a security incident with total losses of approximately \$296 million across its collateral assets (Drift Protocol, 2026c). Drift’s recovery communications do not identify the precise exploit path, but its remediation program emphasized signer security, multisig governance, timelocks, transaction verification, and independent audits: a new community-governed multisig requiring dedicated signing devices, durable nonces disabled for all signers, timelocks with real-time alerts on critical actions, signer identities restricted to a need-to-know basis, and a full relaunch contingent on independent audits. The episode illustrates that DeFi risk management extends beyond the trading and funding logic of Sections 3–4 to the privileged-control layer surrounding the protocol: the asset-control and tail-event channels of Table 3, concretely realized.

None of these channels appears in the quoted basis or the headline funding rate, yet each changes the realized payoff. Decentralized venues are not uniformly riskier; the channels concentrate differently by venue, as the Drift episode shows. A 15% basis yield on a centralized exchange and a 15% yield on a decentralized protocol are not the same trade.

6 Five Questions Before Putting on a Perpetual Basis Trade

Neither a headline funding rate nor a quoted basis is a sufficient statistic for how a perpetual basis trade will perform. The five questions below turn that finding into a checklist a portfolio manager can put to any venue before sizing a position, each tied to a part of the framework above rather than to a venue’s description of itself.

1. **What funding cash flow is actually known at entry?** Ask for the exact rule that generates the next payment, not just its current level. At every venue in the sample, the next payment is path-dependent and bounded in magnitude but not in sign (Binance, 2026; Bybit, 2026; OKX, 2026; Hyperliquid, 2026; Kalshi, 2026a; dYdX, 2026a; Drift Protocol, 2026b); only legacy Drift’s next calculation reuses state accumulated before entry (Drift Protocol, 2026a,b). The worked examples in Section 3 put this in dollars. Then ask whether the bound itself can move before settlement: at dYdX only through a public three-day governance process (with the boundary-alignment caveat of Section 4), at Binance, Bybit, and OKX administratively in real time, and at Hyperliquid, Kalshi, and legacy Drift the process has not been audited. A manager should know which case applies before treating a quoted bound as fixed.
2. **What price anchors the contract, and who controls that anchor?** The reference price is set by an exchange’s own index methodology, a regulated venue’s contract-defined methodology, or an on-chain oracle, and each anchor fails differently. Time-weighted and oracle-derived reference prices are documented as manipulable under thin liquidity (Mackinga, Nadahalli, and Wattenhofer, 2022; Angeris and Chitra, 2020), while an exchange index depends on that exchange’s own data and process. A manager should identify who publishes and can revise the anchor, and under what conditions, before treating the quoted basis as stable rather than methodology-dependent.
3. **Who controls the collateral and privileged administrative functions?** Custody and privileged access do not disappear when a venue is decentralized; they relocate (Chen, Ma, and Nie, 2024; Werapun et al., 2026). On a centralized venue, this question resolves to exchange or clearing-member solvency and withdrawal control; on a protocol, it resolves to who holds

signing authority over multisig, upgrade, and pause functions, and under what governance and timelock constraints. The Drift incident in Section 5 illustrates this: remediation emphasized signer security and governance controls (Drift Protocol, 2026c).

4. **What can force the position to close before convergence?** Because a perpetual has no expiry, a basis trade’s effective holding period is set by whichever constraint binds first: a margin call, a liquidation-engine trigger, a funding-driven cash drain, or a rule or parameter change imposed by an exchange or a protocol’s governance process (Ackerer, Hugonnier, and Jermann, 2025; Alexander, Deng, and Zou, 2023; He et al., 2022; Kim and Park, 2025). A trade that looks attractive at entry can still be forced closed before it pays out, so a manager should size against the tightest constraint, not the average case.
5. **What execution frictions separate the quoted basis from realized carry?** Market impact, liquidity depth on both legs, latency between order and fill, and on-chain transaction-ordering extraction all widen that gap (Daian et al., 2020; Qin, Zhou, and Gervais, 2022; Werapun et al., 2026). These frictions apply on both entry and exit and scale with position size in ways a single quoted number does not disclose.

No question is answered by the funding rate alone, and none dominates the others: a venue that answers Question 1 well can still fail on custody or execution grounds. Together, they are the practical form of this paper’s central claim: what a basis trade actually is depends on how its funding, price anchor, control, closure risk, and execution are built, not on the CeFi or DeFi label attached to it.

7 Conclusion

Funding timing and market architecture, not the CeFi/DeFi label, are key determinants of entry-time arbitrage discipline in perpetual futures. In the seven-venue sample, no venue fixes the next funding payment at entry, and all seven bound it with a cap on the realized rate (Binance, 2026; Bybit, 2026; OKX, 2026; Hyperliquid, 2026; Kalshi, 2026a; dYdX, 2026a; Drift Protocol, 2026b). What differs is what the next calculation takes from before entry: legacy Drift, a decentralized protocol, is the only venue whose next calculation inherits state accumulated before entry (Drift Protocol, 2026a,b), while the other six, spanning offshore, regulated, and decentralized designs, build their premium input from observations realized during the coming interval. Venue type is therefore an unreliable guide to how a contract’s next funding payment is formed and bounded before capital is committed.

The practical implication is that a quoted funding rate or basis is not a sufficient statistic for comparing perpetual futures across venues, because it says nothing about how the next payment is formed or how tightly it is bounded at entry. In the worked examples, the same trade’s next hourly payment is capped at about $\pm\$1,250$ on one decentralized protocol, which also carries pre-entry state into it, and at $\pm\$6,000$ on another. A trader, portfolio manager, or risk officer should ask how a venue’s funding is constructed and when it becomes known, and weigh that against the venue’s reference-price, custody, and execution architecture.

Perpetual futures began as a crypto-native innovation largely outside the U.S. regulated derivatives system. Their adoption by a CFTC-regulated exchange in 2026 (CFTC, 2026; CNBC, 2026; Kalshi, 2026b) confirms this paper’s opening claim: as centralized perpetuals themselves split into offshore and regulated variants, the relevant question is no longer whether a contract is CeFi or DeFi, but which institutional design, in funding timing and market architecture, governs its price anchoring, clearing, and risk.

Data Appendix: Volume Sources

The market-scale comparison in Figure 1 draws on five venues’ first-party market-data APIs or archives, each queried directly by the authors for BTC, ETH, and SOL perpetual (non-expiring) contracts only, over the identical window August 1–31, 2026 UTC. Table 4 records, per venue, the exact source, field or endpoint, contracts queried, USD-conversion method, and whether the reported figure is a native exchange-reported field or an authors’ reconstruction.

Table 4: Data provenance for the market-scale volume comparison (Figure 1)

Venue	Source	Field/Endpoint	Contracts	USD Conversion	Native/ Reconstructed
Binance	data.binance.vision, official historical-data archive	Daily klines; quote_volume	BTCUSDT, ETHUSDT, SOLUSDT	Native USDT notional field; no conversion	Native
Bybit	public.bybit.com, official raw trade-tape archive	Per-trade foreignNotional , summed per UTC day	BTCUSDT, ETHUSDT, SOLUSDT	Native per-trade USDT notional, summed over the month (exact, not approximated)	Reconstructed
OKX	OKX v5 public market-data API	/market/history-candles ; volCcyQuote	BTC-USDT- SWAP, ETH-USDT- SWAP, SOL-USDT- SWAP	Native USDT notional field; no conversion	Native
Hyperliquid	Hyperliquid public Info API	candleSnapshot ; base volume field v	BTC, ETH, SOL perps	Base volume $\times$ OHLC-4 typical price (approximation)	Reconstructed [†]
dYdX v4	dYdX v4 Indexer API	/v4/candles/perpetualMarkets ; usdVolume	BTC-USD, ETH-USD, SOL-USD	Native USD notional field; no conversion	Native

Notes: all figures are one-sided USD-equivalent notional volume, averaged over the 31 days August 1–31, 2026 UTC.

[†]Hyperliquid’s Info API exposes no native USD field; its volume is a documented approximation (base volume $\times$ OHLC-4 typical price), flagged with $\approx$ in Figure 1. Kalshi (KXBTCPERP/KXETHPERP/KXSOLPERP) is omitted from this table and from Figure 1: an independent re-verification pass found its daily candles anchored to 04:00 UTC rather than the UTC calendar-day boundary used by the other five venues, so its reported figure could not be certified as an exact August 1–31 UTC window and is marked not established rather than published. Drift is omitted for a different reason: its legacy protocol was suspended after an April 2026 incident, and its relaunch (as Velocity) reached only private beta on August 25, 2026, leaving no comparable full-month figure to report.

Cap/floor effective-time evidence (Table 1’s “Cap change prospective?” column). The column classifies the *process* by which a venue may change its cap or floor, not whether a particular published number is guaranteed to survive a given interval. A “Yes” means any change must run through a prospectively announced, deterministic mechanism: the change is publicly visible before it binds, and its effective time follows from a published rule rather than from administrative discretion. A “Yes” does not claim that the effective moment is provably aligned to a funding-interval boundary, and so does not claim that the value in force when an interval opens must govern that same interval’s settlement; where boundary alignment is unconfirmed, the residual caveat is recorded below. A “No” means the venue documents no such mechanism and expressly reserves

the right to revise the cap or floor in real time, so a change may take effect with no advance notice and under no stated effective-time rule, and the bound that will govern an already-open interval’s settlement therefore cannot be established at entry from published documentation. An “Unaudited” means the venue has not been examined against this test at all, so its cell records the absence of a finding rather than a positive or negative one. All seven venues have some mechanically enforced finite bound whatever their label here, so the column is a qualifier on how the bound is set, not a separate taxonomy class.

Binance (No). The FAQ reserves the right to “adjust the funding rate cap and floor parameters” in “extreme market volatility,” with no effective-time qualifier. The one dated cap change on record took effect at 08:30 UTC on 2023-10-09 – mid-interval under both the 8-hour and 4-hour settlement schedules then in force. Binance’s live API (`GET /fapi/v1/fundingInfo`) exposes only the currently active cap/floor, with no effective-from timestamp or history (Binance, 2026).

Bybit (No). Bybit’s own change announcements publish settlement-level tables in which a revised limit first applies to the settlement that closes an interval already open – e.g. `SNTUSDT`’s bound moved from $\pm 1.5\%$ to $\pm 2\%$ at 06:55 UTC on 2025-04-10, 19 minutes after the announcement, with Bybit’s own table confirming the $\pm 2\%$ bound governed the 08:00 UTC settlement already in progress. Announced limits have exceeded the published $\min[(IMR - MMR) \times 0.75, MMR]$ formula by up to $5.3\times$ (`STXUSDT`: a 0.38% formula value widened to 2%), so that formula is a default rather than a meta-cap; Bybit states future limit changes are “adjusted dynamically without separate announcements” (Bybit, 2026).

OKX (No). Current documentation states the funding rate cap/floor “may be adjusted in real-time according to market conditions.” By contrast, OKX’s *funding-frequency* rule explicitly ties every escalation or reversion to “the next settlement time of the new frequency.” No comparable boundary-alignment or advance-notice commitment is stated anywhere for a cap/floor *value* change itself, and no worked mid-interval example is published for one (OKX, 2026).

dYdX (Yes). A governance-approved clamp-factor change “takes effect in the block after the voting period ends,” following a fixed 259,200-second (three-day) voting period (dYdX, 2026b). That is a prospectively announced, deterministic mechanism – the proposal is publicly visible throughout the three days, and the effective time follows from a published rule rather than from discretion – which is what the “Yes” records. The residual caveat is narrower than the label: no primary source confirms that the block ending the voting period coincides with an hourly funding boundary, so a change knowable three days in advance could still first bind within a funding hour already open (dYdX, 2026a). That is a limit on boundary alignment, not on the prospectiveness of the process.

Kalshi, Hyperliquid, and legacy Drift (Unaudited). These three cells have not been tested against the process question put to Binance, Bybit, OKX, and dYdX above. Kalshi’s and Hyperliquid’s carry over an earlier reading that asked only whether *some* finite bound exists, not whether a change to that bound must run through a prospectively announced, deterministic mechanism; legacy Drift’s cell records only the tier cap in its funding code, which clamps the offset-adjusted mark–oracle spread by contract tier. They are therefore recorded as unaudited on this question – neither a confirmed prospective process nor a demonstrated real-time-adjustable one (Kalshi, 2026a; Hyperliquid, 2026; Drift Protocol, 2026b).

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- rebrand to Velocity; this URL is pinned to commit 13e8e9b8d614f3b62e3a65a8c372c819e6529aeb, the repository’s final **master** HEAD at archival, so the citation remains fixed against any future un-archiving, branch changes, or further org/repository renames).
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