Empirical Evidence on 24/7 Trading and Perpetual Contracts in Commodity Futures Markets

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This paper examines empirically the principal concerns in the CFTC's request for comment (RIN 3038-AF75) on whether 24/7 trading and perpetual contracts create materially different market-quality and market-integrity risks from existing futures-market arrangements. On 24/7 trading, weekend sessions exhibit lower trading volume, realized volatility, and forced liquidations than weekday sessions. Furthermore, market closure concentrates weekend price risk rather than eliminating it: the CME Sunday reopening produces one-minute absolute returns of 51 to 191 basis points while venues that never closed show jumps only a third to three-fifths as large. On perpetuals, funding-based convergence anchors more tightly than dated futures expiration, with CME dated Bitcoin futures running a mean absolute basis of 41 basis points against 2.6 to 4.9 for offshore perpetuals and 3.2 for a CFTC-regulated one, and funding rates transmit financing costs and convenience yield exactly as the basis does in a dated future. For energy, where no continuously traded spot tape exists, a perpetual must reference the dated futures contract, and this turns out to be a feature rather than a defect. The referenced market's cash-and-carry arbitrageurs already price storage cost, convenience yield, and seasonality, all of which flow into the perpetual without any change to the funding formula, and the arbitrage tether pushes price discovery occurring in the perpetual back into the dated contract, so a migration of directional flow does not fragment information. The cost is a calendar-predictable reference roll that traders rolling dated futures already bear. Three implications follow: evaluate off-hours liquidity against other markets the Commission already accepts rather than daytime parity; treat the absence of a continuous spot market as a question of reference design; and require disclosure of funding-rate sampling methodology, with continuous accrual in place of snapshot application.

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Notes and Disclosure: This paper is submitted as supporting evidence to the comment letter of Coinbase, Inc. regarding the Request for Comment on the Extension of Standard Futures Contracts to 24/7 Trading and on Perpetual Contracts Referencing Physically Delivered or Storable Energy Commodities (RIN 3038-AF75 · Docket No. CFTC-2026-1388. 91 FR 38334 (June 25, 2026), comment period extended at 91 FR 47158 (July 28, 2026)). The author is a paid consultant to Coinbase, Inc. This document was prepared at Coinbase's request and is submitted as an attachment to Coinbase's comment letter. The views expressed are the author's own and do not represent the views of Coinbase, Inc., the University of Texas at Austin, or any other institution. Portions of the empirical analysis rely on data from Coinbase Derivatives Exchange and Coinbase International Exchange, alongside data from CME Group, Binance, and Hyperliquid. Data sources are identified in the notes to each figure and table. The underlying data and code supporting any analysis described herein can be found at `https://github.com/cesare-fracassi/cftc-247-perps`. Send correspondence to Cesare Fracassi, cesare.fracassi@mccombs.utexas.edu.

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1 Executive Summary

The Commodity Futures Trading Commission ("CFTC" or "Commission") requests comments on the extension of standard futures contracts to 24/7 trading and on perpetual contracts referencing physically delivered or storable energy commodities to provide "data, empirical analysis, transaction- or market-level statistics, and supporting documents rather than with conclusory assertions."

The issue underpinning this question is whether 24/7 trading and perpetual contracts create materially different market-quality and market-integrity risks from existing futures-markets arrangements, and it is possible to directly address this issue with empirical evidence because continuous trading and perpetual-style contracts are already offered on CFTC-regulated designated contract markets ("DCMs") and on offshore venues whose full order and liquidation records are publicly observable.

For 24/7 trading, we examine whether weekend liquidity, volatility, and liquidations differ materially from the overnight conditions the Commission already permits. For perpetuals, we examine whether funding-based convergence works and whether the reference-price design is suitable for each underlying commodity.

The data in our analysis are drawn using data sources from Coinbase Derivatives Exchange ("CDE"), a DCM that has listed 24/7 crypto futures for over a year and extended 24/7 trading to gold and silver futures in June 2026; CME Group; Binance; Coinbase International Exchange ("Coinbase INTX"); and Hyperliquid, an offshore venue listing continuously traded commodity perpetuals since the beginning of 2026 that publishes complete trade and liquidation records.

Summary of findings on 24/7 Trading

- **Weekend liquidity is not too thin to provide reliable prices.** Weekend activity in Bitcoin regulated futures contracts is roughly 14% of weekday overnight activity. Applying that ratio to CME overnight volumes implies weekend notional volume of roughly $8 billion per day in gold, $2 billion in silver, $1 billion in WTI, and $120 million in natural gas — each inside the weekday daily range of other commodity futures contracts the Commission already treats as reliable venues for price discovery and hedging.

- **Weekend trading does not produce unusually volatile price movements.** To the contrary, weekend volatility is lower than weekday volatility, not higher. Across gold, silver, WTI, and natural gas perpetuals that trade continuously, realized weekend volatility runs between 16% and 70% of weekday volatility. Thinner weekend books do not coincide with more disorderly price movement in these contracts.

- **Continuous trading mitigates sharp price adjustments that occur in markets that close over the weekend.** The CME Sunday reopening produces peak one-minute absolute returns of 51 to 191 basis points across the four commodities studied. Venues that traded competing contracts through the weekend show an attenuation of this volatility, with peak absolute returns at the same instant (CME open) only 32% to 58% as large. That is, weekend trading lessens the concentration of weekend price risk at opening due to market closure.

- **Weekend trading does not elevate forced-liquidation risk.** Instead, forced liquidations cluster on weekdays when banking rails are open. Median 30-minute liquidation volume on weekends runs at 32% to 60% of weekday levels, with the largest clusters at Monday open and around scheduled macroeconomic releases, all inside existing CME hours.

Summary of findings on perpetual futures

- **Perpetual contracts remain closely aligned with their reference price without relying on expiration.** The funding-rate mechanism anchors a perpetual to its reference more tightly than convergence anchors a dated future. For example, CME dated Bitcoin futures ran a mean absolute basis of about 41 basis points compared to perpetuals offered offshore by Coinbase INTX (2.6 bp) and Binance (4.9 bp). CDE's CFTC-regulated Bitcoin long-dated future (which utilizes a funding-rate mechanism) ran about 3.2 basis points, in line with true perpetuals on offshore venues.

- **Funding rates are capable of reflecting broader carry economics, including convenience yield.** Funding rates track financing conditions: funding rates decline as Treasury bill rates decline. Convenience yield is also embedded in the funding rate: Ether's funding rate ran below Bitcoin's in every year from 2023 through 2026, and the gap narrowed as staking yields (Ether's convenience-yield analogue) compressed. The claim that a funding mechanism "designed for assets without significant cost of carry" cannot reflect carry is testable and fails.

- **A market structure that links dated and perpetual futures would not fragment liquidity, and possibly increases price efficiency.** Gold and silver perpetuals referencing a continuous spot market track to 2–3 basis points. Crude oil and natural gas have no continuously traded spot tape, so a perpetual there must reference the dated futures contract, importing a recurring monthly roll cost of carry of roughly −27 to −30 basis points (WTI, Brent) and +34 to +37 basis points (natural gas). However, a commodity perpetual referencing a dated futures contract is not a disconnected market — it is structurally tied to the dated contract through arbitrage. Price discovery occurring in the perpetual is therefore pushed back into the dated futures price. So, the perpetual contract referencing the dated contract is an advantage in this case.

2 24/7 Trading of Standard Futures

The Commission's Part 1 questions cluster around the concern that a session with fewer participants is a session whose prices cannot be trusted. Questions 1 and 2 ask whether continuous trading changes the reliability of prices formed overnight and on weekends, and what volume and participant-composition data characterize those sessions. Question 22 asks what recalibration of safeguards would keep weekend price formation "representative of genuine supply and demand." The five subsections below take those questions in turn.

2.1 Concern 1: Weekend and overnight sessions will be too thin to form reliable prices

> "Does extending the trading hours of a standard futures contract to a 24/7 basis, without otherwise altering its fixed expiration or settlement, materially change the availability or reliability of the prices it forms during overnight, weekend, and holiday periods? What data supports the response?" (Question 1) ... "Is liquidity in those sessions sufficient that a price derived from them is reliable and not readily susceptible to manipulation? What data or empirical evidence is there that sufficient natural liquidity exists during weekend trading periods to support orderly markets and efficient price formation?" (Question 2)

Extending the standard futures contract to 24/7 can be answered empirically by looking at Bitcoin futures contracts. Coinbase Derivatives Exchange ("CDE") has listed nano Bitcoin futures

("BIT") on a 24/7 basis for over a year. Because BIT never closes, it reveals how trading distributes across a full week once the weekend constraint is removed, providing evidence no US-listed physical commodity contract can supply.

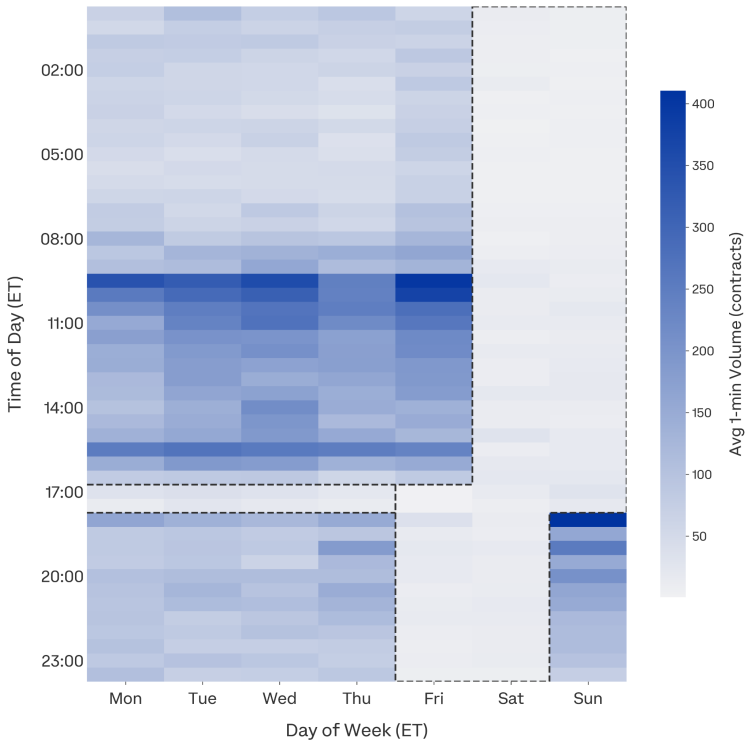

Figure 1. CDE nano Bitcoin futures (BIT): average one-minute trading volume by day and time of day.

Note: CDE. Continuous front-month BIT, Aug 12 2025 – Aug 12, 2026. Dashed lines mark CME/COMEX non-trading hours (CME open: Sun 6:00pm – Fri 5:00pm ET, excluding the daily break and U.S. holidays).

Three features of this data are responsive to the Commission's question. First, activity concentrates during conventional business hours, from roughly 8:00am to 4:00pm ET on weekdays, even though markets are open 24/7. Second, trading volume drops outside these core hours: weeknight volume runs at roughly half of daytime volume, and weekend volume runs at roughly 14% of weeknight volume. Third, there is a visible drop during the workday 5pm–6pm maintenance periods when traditional dated futures are closed, and a pickup at 6:00pm ET Sunday when traditional dated futures reopen, even though BIT and underlying spot market never stopped trading. We return to that third point under Concern 3.

The trading of BIT on CDE outside of core hours and on weekends provides a calibration that can help predict weekend trading behavior of other commodity futures. Standard energy and metals futures otherwise already trade overnight on CME, and the Commission already accepts prices formed in those sessions. If weekend activity runs at roughly 14% of overnight activity as it does with BIT, weekend volume in a 24/7 gold or WTI contract can be estimated from observed CME overnight volume. Table 1 performs that calculation.

Notably, these estimated volumes fall inside the range of contracts the Commission already regards as sufficiently liquid. Figure 2 places them against actual average daily notional volume across U.S. futures markets over the same period.

All four estimates land well inside the range of contracts trading actively today, and none is a thin-market outlier. Estimated weekend gold volume ($8.0 billion per day) exceeds full weekday

Table 1. Estimated weekend trading volume for four benchmark CME contracts.

	Gold (GC)	Silver (SI)	WTI (CL)	Nat Gas (NG)
Avg. CME night volume (contracts/min)	101.49	33.48	66.67	17.64
× 0.14 (observed weekend haircut)	0.14	0.14	0.14	0.14
× average price	$4,001.49/oz	$54.80/oz	$67.59/bbl	$3.45/MMBtu
× contract size	100 oz	5,000 oz	1,000 bbl	10,000 MMBtu
× 1,440 minutes/day	1,440	1,440	1,440	1,440
= estimated weekend $/day	$7,953M	$1,797M	$882M	$119M

Note: CME night session defined as 6:00pm–6:00am ET, Monday–Friday; average prices and contract sizes over April 2025 – April 2026. The 0.14× weekend haircut is the ratio observed in CDE BIT futures (Figure 1), estimated over August 2025–August 2026 and applied to the twelve-month CME night sample. Daily figures are the product of the rows above and are subject to rounding in the displayed inputs.

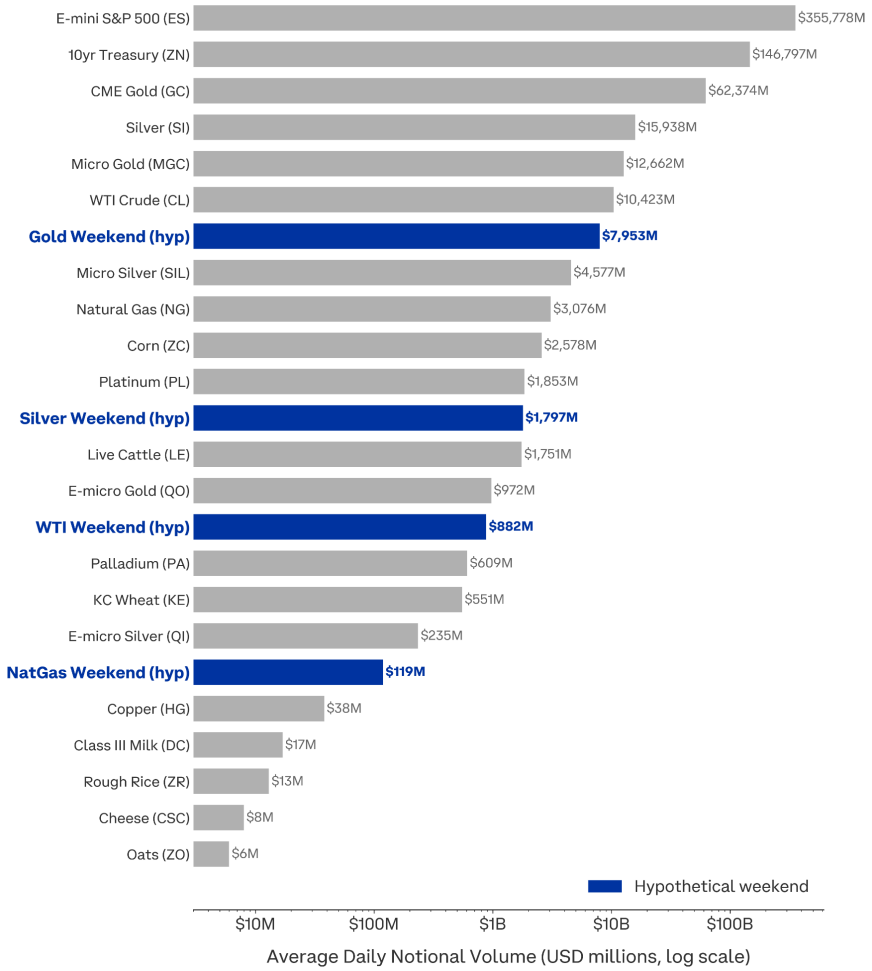

Figure 2. Estimated weekend notional volume vs with actual weekday notional volume across U.S. futures contracts.

Note: Market estimates: CME night average (18:00–06:00 ET) × 0.14 × price × contract size × 1,440 min/day; April 2025 – April 2026. Log scale.

volume in Micro Silver ($4.5 billion), Natural Gas ($3.1 billion), and Corn ($2.6 billion). Estimated weekend silver volume ($1.8 billion) sits between full-size Platinum and Live Cattle ($1.8 billion), and estimated weekend WTI volume ($0.8 billion) just below full weekday E-micro Gold volume ($1 billion). Even natural gas, being the smallest at $119 million, sits between E-micro Silver ($235 million) and Copper ($38 million), contracts that trade every weekday without being treated as illiquid or manipulation-prone.

This evidence helps inform Question 31, which asks whether the manipulation-susceptibility analysis should depend on actual liquidity present during 24/7 trading rather than on the nominal availability of a continuous price. When the analysis is performed on expected liquidity, the four benchmark contracts demonstrate sufficient expected off-hours liquidity. However, it is important that the standard not require that off-hours liquidity will equal daytime liquidity, a standard no session other than the U.S. daytime session meets, including the overnight sessions the Commission already accepts.

2.2 Concern 2: Thin weekend markets will be more volatile and more readily susceptible to manipulation

> "Have there been any stress tests conducted to evaluate whether concentrated one-sided retail or broader investor interest and participation during weekend trading, particularly driven by new geopolitical or significant news, could distort price formation, amplify volatility, or create artificial price levels that influence broader financial markets when traditional markets open?" (Question 19) ... "What recalibration of market safeguards, risk controls, and liquidity protections should a DCM implement during weekend trading to ensure that price formation remains representative of genuine supply and demand, and to prevent thin liquidity conditions from resulting in disproportionate or runaway price movements that could subsequently influence benchmark markets when traditional hours resume?" (Question 22)

Concern 2 is an empirical claim about the relationship between session depth and realized volatility, which is testable directly on commodities that already trade continuously. Figure 3 computes realized 1-minute return volatility over each 30-minute interval in the Hyperliquid gold, silver, WTI, and natural gas perpetuals and averages it by slot across the week.

The pattern of volatility is consistent across all four commodities and runs opposite to the concern. Volatility is highest during conventional U.S. business hours — when the corresponding U.S. dated futures markets are open — even though the Hyperliquid contracts never close. The rhythm of daytime order flow and information arrival, not the presence of a continuous session, drives the bulk of price movement.

The daily maintenance window is a particularly illustrative test. CFTC-regulated venues observe a break from 5:00pm to 6:00pm ET. Hyperliquid trades straight through that hour, yet volatility in all four commodities drops noticeably during that window. A venue that is unconstrained by the CME calendar reduces price movement when the regulated market goes quiet. This does not reflect a thesis that continuous trading itself generates instability, and instead demonstrates that volatility follows information arrival and belief aggregation, which largely take place during traditional US business hours.

Every commodity's weekend volatility falls well below its weekday level. The precious metals show the sharpest reduction — gold roughly a quarter of its weekday level, silver under a fifth — while the energy contracts have 62% (WTI) and 70% (natural gas) of their respective weekday trading volatility. The result for energy contracts indicates that energy markets during the observed period of the first half of 2026 carry relatively more weekend-relevant information than metals, which is an argument for keeping a regulated venue open to absorb weekend information, as we will

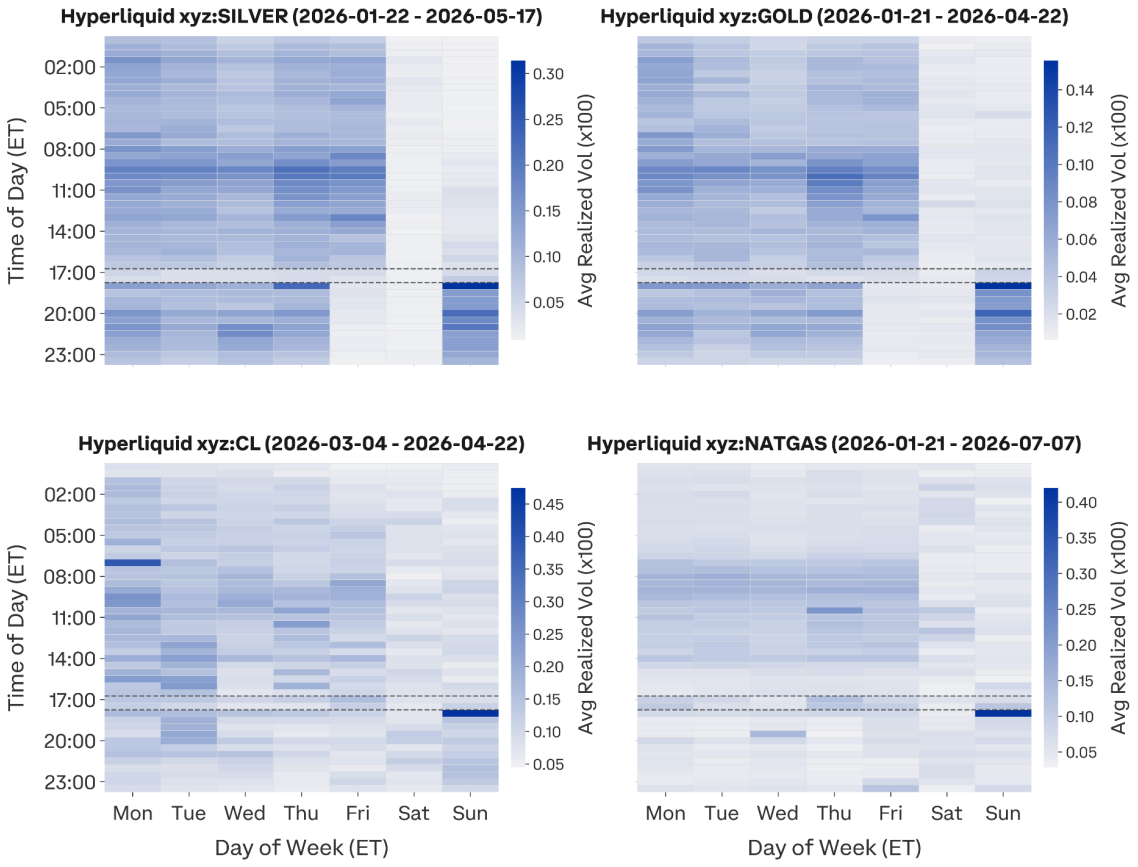

Figure 3. Average realized volatility by day and time of day, Hyperliquid commodity perpetual futures.

Note: One-minute candles; realized volatility computed over 30-minute intervals and averaged by weekly slot. Dashed lines mark the 5:00–6:00pm ET daily CME maintenance break.

Table 2. Weekend and weekday realized volatility, Hyperliquid commodity perpetuals.

Asset	Weekday volatility	Weekend volatility	Ratio (wknd / wkdy)
Gold	0.051	0.013	0.26×
Silver	0.113	0.018	0.16×
WTI	0.131	0.081	0.62×
Natural Gas	0.081	0.057	0.70×

Note: Weekend defined as Friday 5:00pm – Sunday 6:00pm ET.

investigate further in Concern 3.

2.3 Concern 3: Weekend prices do not represent the physical underlying and will contaminate benchmarks

> "The cash market for crude oil and other energy commodities is generally assessed during defined windows, rather than traded 24/7. Where a standard futures contract trades 24/7, but the underlying physical market does not, what are the reliability and manipulation implications of a futures price observed during periods in which no contemporaneous physical trading occurs, and to what extent could such off-hours prices be characterized as not fully or accurately representing dynamics in the physical underlying?" (Question 3) ... "Are there any impact assessments, evaluations, studies, or tests that have been conducted to evaluate the extent to which prices formed during weekend trading could be transmitted to physical contracts, OTC derivatives, financing agreements, index calculations, valuation processes, and other commercial arrangements that rely upon the benchmark prices?" (Question 23)

The concern is premised on weekends being informationally quiet, so a weekend price is one formed in the absence of relevant information. If that were true, weekend trading would be at best a convenience and at worst a source of noise.

The cleanest test is the CME Sunday reopening itself. If nothing price-relevant occurred over the weekend, futures would reopen at 6:00pm ET Sunday approximately where they closed on Friday. That view is not supported in Figure 4, which shows an event study of one-minute absolute returns centered on the exact moment of the market reopening.

There is an average return spike in CME commodity futures of between 50 and 190 basis points in the single minute of the Sunday reopening, which is far larger than the typical one-minute move at any other point in the week. That jump is the market pricing everything that occurred between Friday's close and Sunday's reopen, including geopolitical developments, macroeconomic releases, shifts in related global markets, and anything else impacting price, all while the regulated market was shut. If weekends were informationally quiet, there would be nothing to catch up on and no jump to observe.

A related concern is whether a continuously traded market can actually incorporate that information, or whether price discovery must regardless wait until Sunday evening. Figure 4 overlays the same study on venues that never closed. In all four commodities, the continuous contract also shows a response at the CME reopen — some information aggregation genuinely does occur through the traditional futures market, and we do not claim otherwise — but the response is uniformly smaller, which indicates the continuously-trading market successfully incorporates some weekend information while CME is closed.

Table 3. Peak one-minute absolute return at the CME Sunday open: continuously traded venue versus CME.

Asset	CME peak (bps)	Continuous venue peak (bps)	Ratio
Gold	51.4	29.3	0.57×
Silver	86.9	50.5	0.58×
WTI	190.8	74.6	0.39×
Natural Gas	161.2	50.8	0.32×

Note: Continuous venue is Hyperliquid; peak taken at the minute of the CME Sunday 6:00pm ET open.

Gold and silver retain a little over half of CME's reopening jump, while WTI and natural gas retain roughly a third to two-fifths. In other words, continuously-trading venues had already

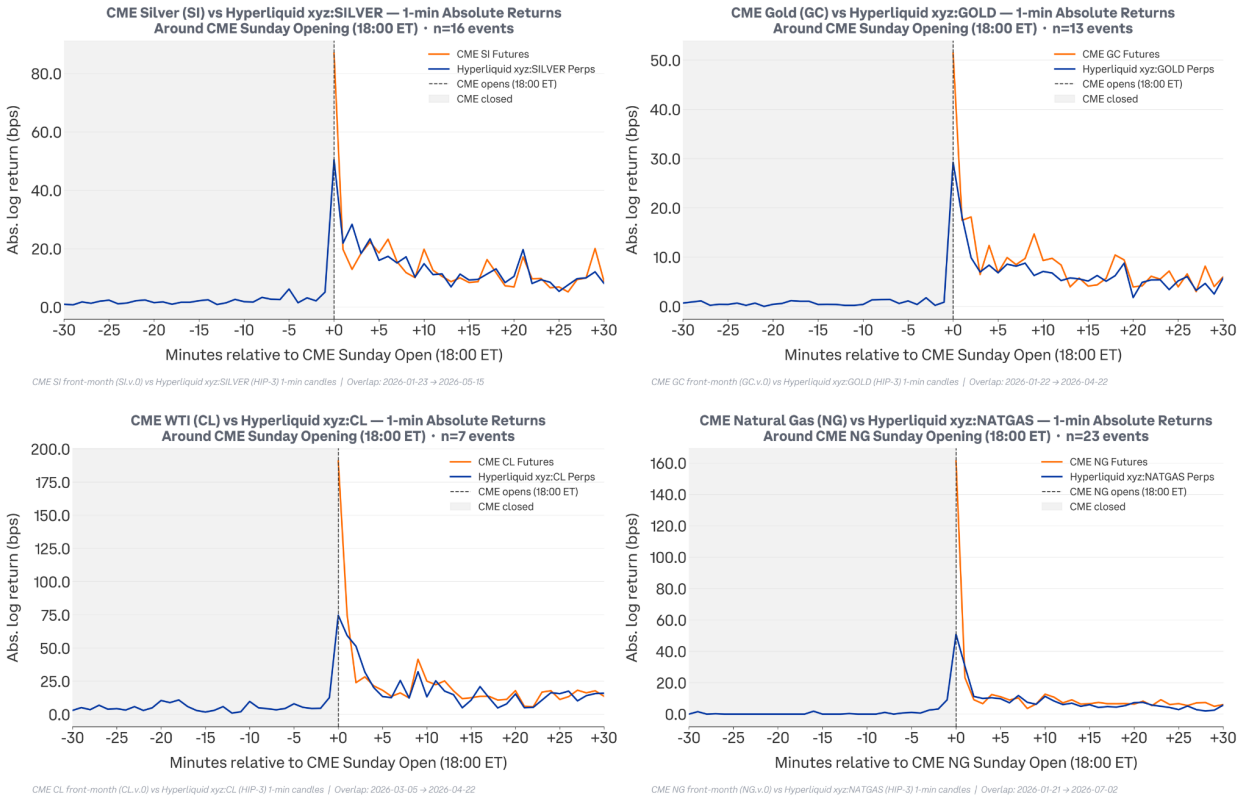

Figure 4. One-minute absolute returns around the CME Sunday open: CME dated futures versus continuously traded perpetuals.

Note: CME front-month contracts versus Hyperliquid perpetuals, one-minute candles. Event counts and overlap windows shown in each panel.

incorporated most of the weekend's news by the time CME reopened, so they needed less adjustment to CME's full catch-up.

Closing a market on the weekend does not prevent weekend price formation; it relocates that formation to venues outside the Commission's surveillance and concentrates the entire adjustment into one instant on Sunday evening. Table 3 demonstrates that continuous trading does not add price movement that would not otherwise have occurred — it spreads the same movement over time by allowing new information to be incorporated into price in real time. The result is less volatility, shown by existing CME reopening jumps that are 42% to 68% smaller.

Weekend price formation on continuous venues therefore appears directionally informative, though the residual jump at the CME open indicates it is incomplete.

For Questions 17 and 24 through 29 — how extended-hours prices flow into settlement prices, index calculations, options valuation, and OTC contractual triggers — the practical implication is that the underlying economic risk already exists today as the Sunday gap. Options models, barrier provisions, and margin systems built around a five-day cycle are already exposed to a large discrete Sunday move. What changes is that the same move arrives in smaller increments. This may carry certain costs, including valuation, reporting, and governance frameworks, assuming a Friday-to-Monday hold would require adaptation. But the direction of the change in tail risk is favorable.

2.4 Concern 4: Weekend price formation will trigger margin calls and forced liquidations when payment systems are closed

> "What is the expected impact that weekend price formation will have on leveraged market participants, including the potential for additional variation margin obligations, collateral demands, forced liquidations, and liquidity pressures arising from price movement occurring outside the traditional trading week?" (Question 4) ... "In a case where margin is called during these periods, how could a designated contract market or derivatives clearing organization ensure robust margin call and settlement processes arising during overnight, weekend, and holiday periods when traditional payment systems such as Fedwire and CHIPS do not operate?" (Question 7)

The mismatch between continuous markets and traditional business-hours payment rails is real and structural. However, what the data can establish is whether that mismatch has in fact produced a concentration of forced liquidations during the hours when it would bite hardest. Figure 5 examines when liquidation events actually occur on Hyperliquid in the same four continuously-traded contracts we have assessed earlier in this section.

Table 4. Median 30-minute-slot liquidation value, weekday versus weekend.

Asset	Weekday median (USD)	Weekend median (USD)	Ratio
Silver	$36,440	$16,921	0.46×
Gold	$13,064	$4,180	0.32×
WTI	$62,011	$24,551	0.40×
Natural Gas	$838	$504	0.60×

Weekend liquidations run between 32% and 60% of weekday levels in every commodity. The largest clusters occur on Mondays around the open and close and correspond to scheduled macroeconomic releases, including CPI, PPI, FOMC statements, non-farm payrolls, which are events falling entirely within current CME trading hours when banking rails are open.

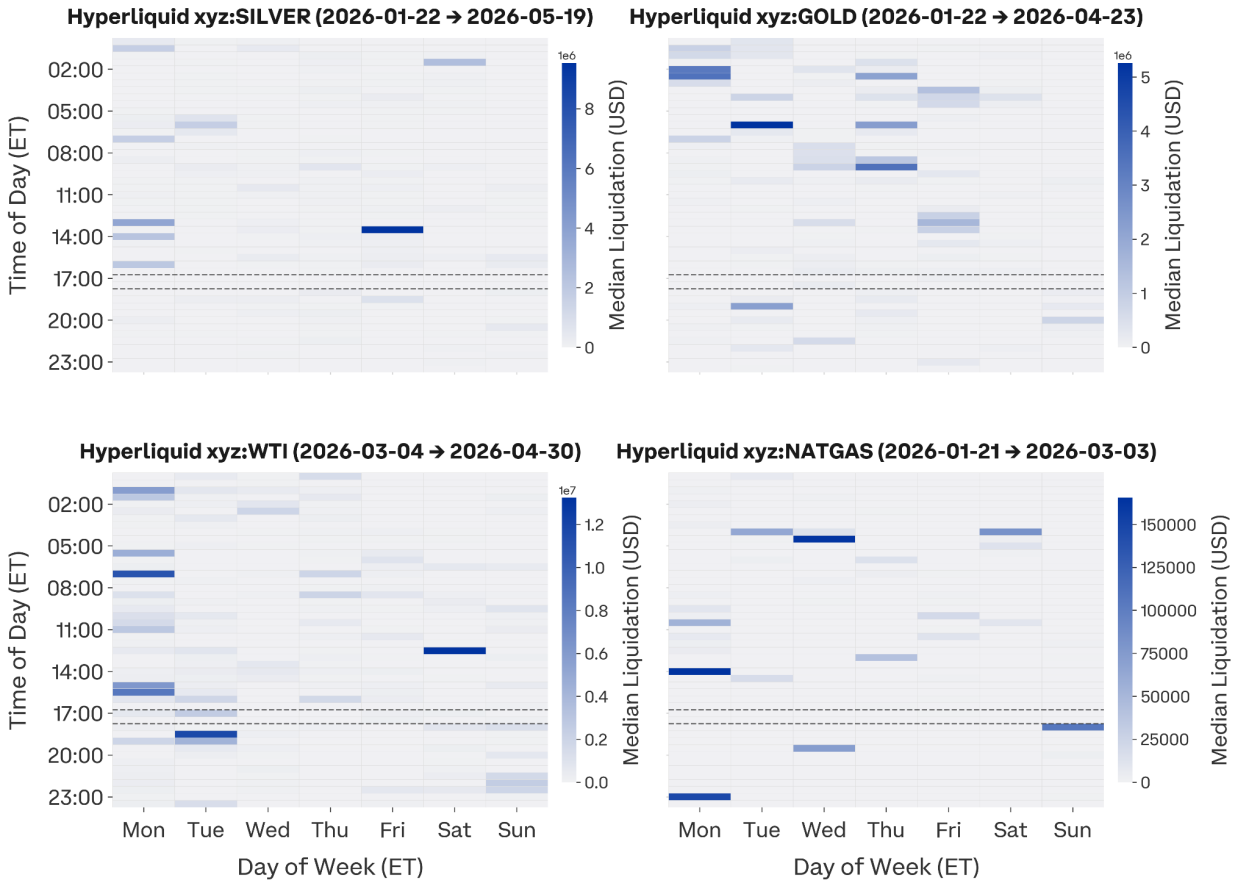

Figure 5. Median liquidation value by day and time of day, Hyperliquid commodity perpetual futures.

Note: Medians across dates; U.S. holidays excluded. Dashed lines mark the 5:00–6:00pm ET daily CME maintenance break.

The implication for Question 4 is that auto-liquidation risk in these contracts peaks on weekdays and is driven by scheduled information events, not by a weekend phenomenon arising from thin markets or closed payment systems. This is consistent with Tables 2 and 3: if continuous trading spreads price adjustment over time rather than concentrating it into a Sunday gap, the instantaneous moves capable of triggering cascading liquidations are smaller.

On the payment-system architecture questions 7 and 10 through 12 — the mechanics of margin calls, collateral eligibility, and temporary liquidity when Fedwire and CHIPS are unavailable — the evidence above supplies no direct answer, and we offer only that these questions will persist regardless of how liquid weekend trading proves to be. We observe only that the size of the problem is bounded by the size of the price moves that generate margin calls; whether prices are observed through continuous trading over the weekend, or not, will not change the ultimate weekend price movement realized at the Sunday open price.

A caveat of this analysis is that the empirical evidence is based on Hyperliquid, an off-shore venue funded by stablecoins, which are 24/7 payment instruments, which does enable collateral and capital movement when Fedwire and CHIPS is unavailable. There may still be weekend frictions in bridging money from fiat to stablecoins in ways that can affect liquidations on Hyperliquid, but as stablecoin use rises, particularly with the implementation of the GENIUS Act in the U.S., and is permitted for use on CFTC-regulated platforms, we should expect collateral management risk over weekends to fall.

2.5 Concern 5: A smaller 24/7 contract will drive price formation in the larger benchmark contract

> "Is it a concern that price formation in a smaller contract that trades 24/7 may influence the larger benchmark contract that trades during traditional hours, especially during those periods when the larger contract is unable to participate in the price-setting process?" (Question 20) ... "Given that many of the contracts being proposed for 24/7 trading seem to be designed to cater to the needs of retail traders, while the benchmark contracts were designed for commercial users, what safeguards should a DCM have in place to protect the interests of commercial users in the benchmark contracts?" (Question 21)

This concern has a well-founded premise: where two contracts are linked by arbitrage and only one is open, price discovery in the open contract propagates to the closed contract at its reopening. That is precisely what the prior analysis in Figure 4 shows, and there is nothing inherently concerning about this – a smaller contract can be a market risk mitigant and not enhancer.

As we previously showed, when CME is closed over a weekend, price formation continues via offshore perpetuals, overseas exchanges, related FX and crypto markets, and bilateral OTC arrangements. The movement only can be incorporated into the CME contract's pricing at reopen, and takes the form of a single large move. Under that arrangement, the venues doing weekend price discovery sit outside Core Principle 4 surveillance entirely, and commercial users of the benchmark cannot participate. The solution to any residual concern is to permit the benchmark contract, or any competitor product, to expand trading hours to weekend trading, and thus bring price discovery inside a regulated venue and let commercial users participate.

3 Perpetual Contracts on Energy Commodities

The Commission's Part 2 questions are divided into two groups that are frequently conflated. The first concerns the perpetual structure itself: whether a contract without a fixed expiration can converge, whether a funding rate can carry the economics a delivery date carries, and whether the

mechanism can operate under CFTC supervision. The second concerns what such a contract would reference in an energy commodity with no continuously traded spot market.

The evidence resolves the first group substantially in favor of the perpetual structure. The second contains a design tradeoff that the Commission is right to focus on. We address them in that order.

3.1 Concern 6: Without a fixed expiration there is no mechanism to force convergence

> "A standard futures contract achieves convergence with the underlying through a fixed expiration. For a commodity whose term structure reflects storage costs and convenience yield, how does the absence of a fixed expiration affect convergence (if at all), and what role would the funding mechanism play?" (Question 42) ... "Are there alternative convergence mechanisms, other than a funding rate, that could maintain price parity between a perpetual contract and a physical energy commodity's underlying value?" (Question 44) "How would a perpetual contract behave differently than a standard futures contract during episodic supply shocks characteristic of energy markets, including geopolitical disruptions, supply decisions by major producers, severe weather, and infrastructure outages?" (Question 48)

The premise of these questions is that expiration-based convergence is a stronger form of anchoring than funding-based convergence, where the latter is a weaker substitute. The empirical evidence supports the opposite. Figures 6 and 7 plots the basis (the gap between contract price and its underlying reference) for CME's front-month dated Bitcoin future against two Bitcoin perpetuals over a multi-year window.

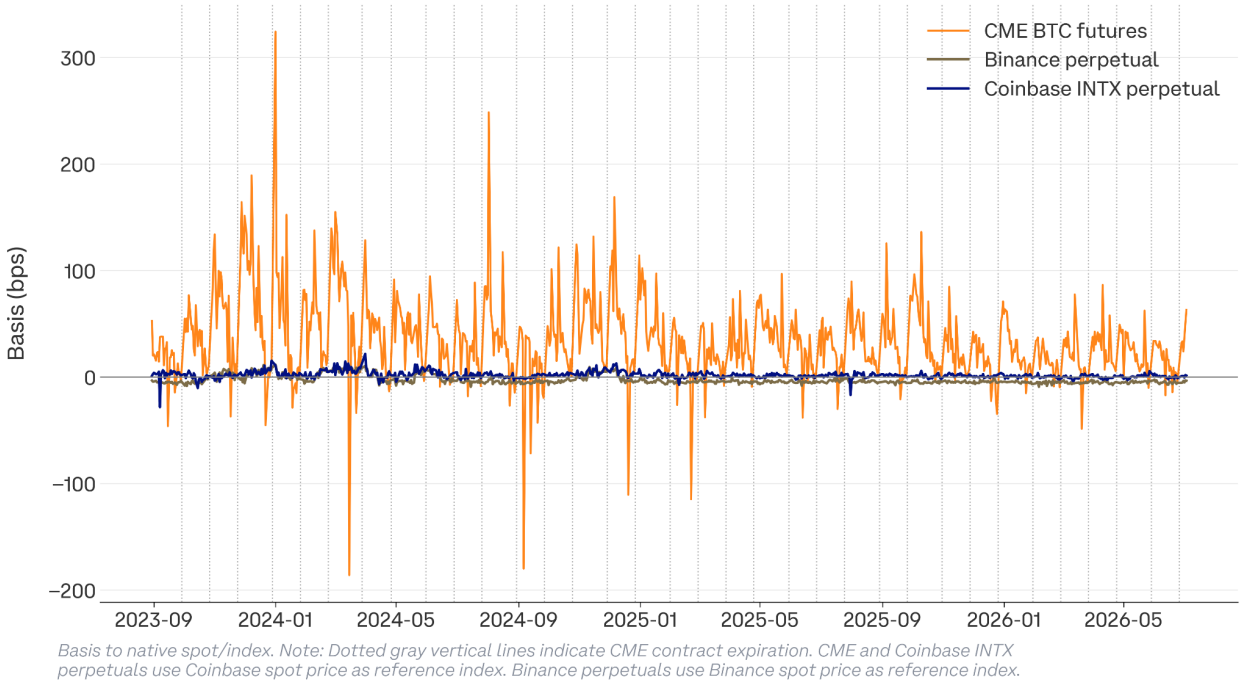

Figure 6. Basis to native spot/index: CME dated Bitcoin futures versus Binance and Coinbase INTX perpetuals.

Note: Dotted vertical lines mark CME contract expirations. CME and Coinbase INTX series use Coinbase spot as reference index; Binance uses Binance spot.

For the dated contract, when the front-month contract switches from the expired contract to the next month expiration contract, the basis opens wide and reduces toward zero as expiration approaches. The pattern repeats every cycle. Convergence is achieved, but only at one point in time, and the path to it is volatile. The perpetuals show no such pattern; they track their reference continuously and are essentially insensitive to where the dated future sits in its own cycle.

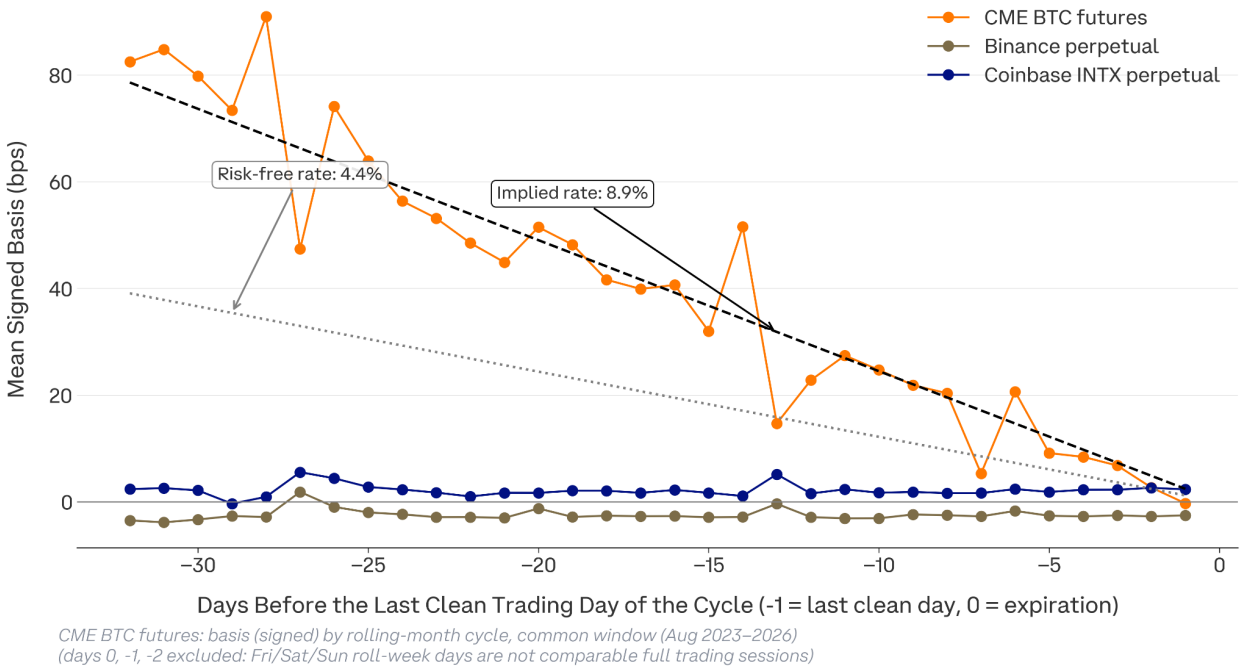

Figure 7. Mean signed basis by day of the contract cycle: CME dated Bitcoin futures versus perpetuals.

Note: Basis by rolling-month cycle, common window August 2023 – 2026. Days 0, −1 and −2 excluded as roll-week days are not comparable full trading sessions.

Table 5. Mean absolute basis to reference index, by venue.

Venue and contract	Panel A: multi-year window	Panel B: since CDE launch (277 trading days)
CME Bitcoin dated futures	41.0 bps	27.0 bps
Binance Bitcoin perpetual	4.9 bps	4.7 bps
Coinbase INTX Bitcoin perpetual	2.6 bps	1.5 bps
CDE Bitcoin perpetual (CFTC-regulated)	n/a (see Panel B)	3.2 bps

Table 5 quantifies the gap. Over the multi-year window the front-month dated contract ran a mean absolute basis of approximately 41 basis points, and the perpetuals ran 4.9 and 2.6 — roughly an order of magnitude tighter. The instrument without an expiration date tracked its underlying an order of magnitude more closely than the instrument with one.

This finding holds through sharp directional moves, where some have voiced concerns about the absence of a terminal event. Between February 3 and March 4, 2024, Bitcoin rose 58.7% ($43,012 to $68,242). The Binance perpetual's mean absolute basis that month was 5.7 basis points, in line with its full-sample average. Between January 6 and February 5, 2026, Bitcoin fell 32.9% ($93,751 to $62,925). The mean absolute basis over that decline was 4.9 basis points, essentially unchanged.

On Question 44, the funding rate is not the only conceivable convergence design, but it is the only one with a substantial operating record, and that record is strong. The CFTC should therefore not mandate an alternative absent comparable evidence.

3.2 Concern 7: A funding rate cannot reflect storage cost, convenience yield, and seasonality

> "Funding-rate mechanisms developed in other markets were generally designed for assets without significant cost of carry. Can a funding-rate mechanism accurately reflect physical market dynamics such as storage costs, convenience yield, and seasonality? If so, please describe how the funding calculation would incorporate these factors." (Question 42) ... "What distortions, if any, could arise over extended holding periods due to the interaction of accumulated funding payments with the physical fundamentals of a storable energy commodity, including storage cycles, seasonal demand, and term structure (contango/backwardation)?" (Question 43)

These concerns rest on the incorrect assumption that a funding rate is merely a mechanical peg-maintenance device. However, the data show that the funding rate and resulting payments are instead the continuous-time analog of cost of carry — the price at which the market clears the right to hold leveraged exposure — and that it absorbs the same components a dated future's basis absorbs, including the financing rate, storage cost, convenience yield, and any premium from one-sided leverage demand.

In fact, the funding rate in perpetual futures still represents the cost of hedging a short position like in a dated future, as an arbitrageur would have to borrow funds (financing cost), buy and store the underlying asset (storage cost), and enjoy the convenience of holding the real asset (convenience yield) to offset the perpetual futures contract exposure. The difference is that the cost of carry in perpetual futures partially settles at a much higher frequency (1–8 hours) than in dated futures (monthly). In other words, the continuous funding payments of perpetual contracts and the basis in dated contracts are both expressions of cost of carry.

The economic principle of the funding rate can be verified empirically. The first test is whether funding rates track financing conditions. Table 6 reports the implied financing rate embedded in CME's dated Bitcoin futures alongside annualized funding rates of two perpetuals and the contemporaneous three-month Treasury bill rate.

Table 6. Implied financing rate by venue and year, Bitcoin.

Year	Dated Futures CME implied rate	Perpetual Futures Binance funding rate	Perpetual Futures Coinbase INTX funding rate	3M T-bill
2023 (Aug–Dec)	11.6%	9.4%	9.9%	5.3%
2024	11.0%	11.9%	12.9%	5.0%
2025	7.7%	5.1%	6.0%	4.1%
2026 (through July)	5.3%	1.2%	1.1%	3.6%

All three series decline together as Treasury bill rates decline, the first-order prediction. This correlation demonstrates that financing conditions are factored into funding rates.

The 2026 perpetual funding rates are worth further discussion. Both funding rates (1.2% and 1.1%) fell below the contemporaneous risk-free rate (3.6%). A funding rate below the risk-free rate means the market-clearing price of holding a long position requires paying less than pure financing cost, which occurs when demand to be short exceeds demand to be long. That the gap persisted rather than being arbitraged away reflects limits to arbitrage especially in segmented

offshore markets. This is a well-understood feature of futures pricing generally, not a pathology unique to perpetuals.

The second and more direct test concerns convenience yield, which is the benefit of holding the physical asset rather than a claim on it, pulling the basis down and potentially flipping a futures price below spot (backwardation). If a funding rate genuinely transmits carry economics, an asset with a convenience yield should show a systematically lower funding rate than a comparable asset without one, and the gap should track the size of the yield.

Bitcoin has no meaningful convenience yield. Ether does because of staking, which generates a yield only a holder of the asset itself can capture. The prediction is that Ether's funding rate should sit below Bitcoin's by an amount related to the prevailing staking yield.

Table 7. Bitcoin and Ether perpetual funding rates against Ether staking yield, Coinbase INTX.

Year	BTC funding	ETH funding	Gap (ETH − BTC)	cbETH staking yield
2023	9.90%	2.59%	−7.31 pp	7.97%
2024	12.91%	8.94%	−3.98 pp	2.60%
2025	5.99%	1.91%	−4.08 pp	2.91%
2026 (YTD)	1.11%	0.52%	−0.59 pp	2.81%

Ether's funding rate ran below Bitcoin's in every year from 2023 through 2026, and the gap narrowed over the same period in which Ethereum staking yields compressed industry-wide. A convenience-yield-like factor flows into a funding rate through the same channel that carries it into a dated future's basis. The mechanism prices carry economics.

We do not claim this settles the question for a storable physical commodity. Storage cost in crude oil can be larger and more variable than anything above, and seasonality in natural gas has no analogue. But the burden the concern places on the mechanism — that funding rates are structurally incapable of carrying non-financing components of cost of carry — is refuted by Table 7. What remains is a calibration and reference-selection question, taken up under Concern 10.

On Question 43, where a perpetual references a dated futures contract, storage cost, convenience yield, and seasonality are already embedded in the reference price by that market's own cash-and-carry arbitrageurs. The funding formula inherits physical fundamentals. The cost of that inheritance is the roll distortion discussed under Concern 10.

3.3 Concern 8: Tight tracking is an artifact of offshore, lightly supervised venues

The Commission does not raise this objection in the request. We address it because it is the natural response to an evidence base drawn substantially from venues outside U.S. regulation, and because it determines whether that evidence can satisfy Question 53:

> "What would a DCM be required to demonstrate to establish that a perpetual contract on crude oil or another energy commodity is not readily susceptible to manipulation, consistent with Core Principle 3 and the guidelines in Appendix C to part 38? Based on currently available information and data, can such a demonstration be made, and if so, on what evidentiary basis?"

Any concerns about the evidence drawn from Coinbase INTX and Binance are directly testable. CDE, a U.S. DCM operating under the same core principles as CME, self-certified a Bitcoin perpetual-style contract in July 2025. Figure 8 adds it to the comparison.

Over the eleven months since launch — 277 trading days spanning more than a dozen CME expirations — CME's dated future ran a mean absolute basis of approximately 27.0 basis points

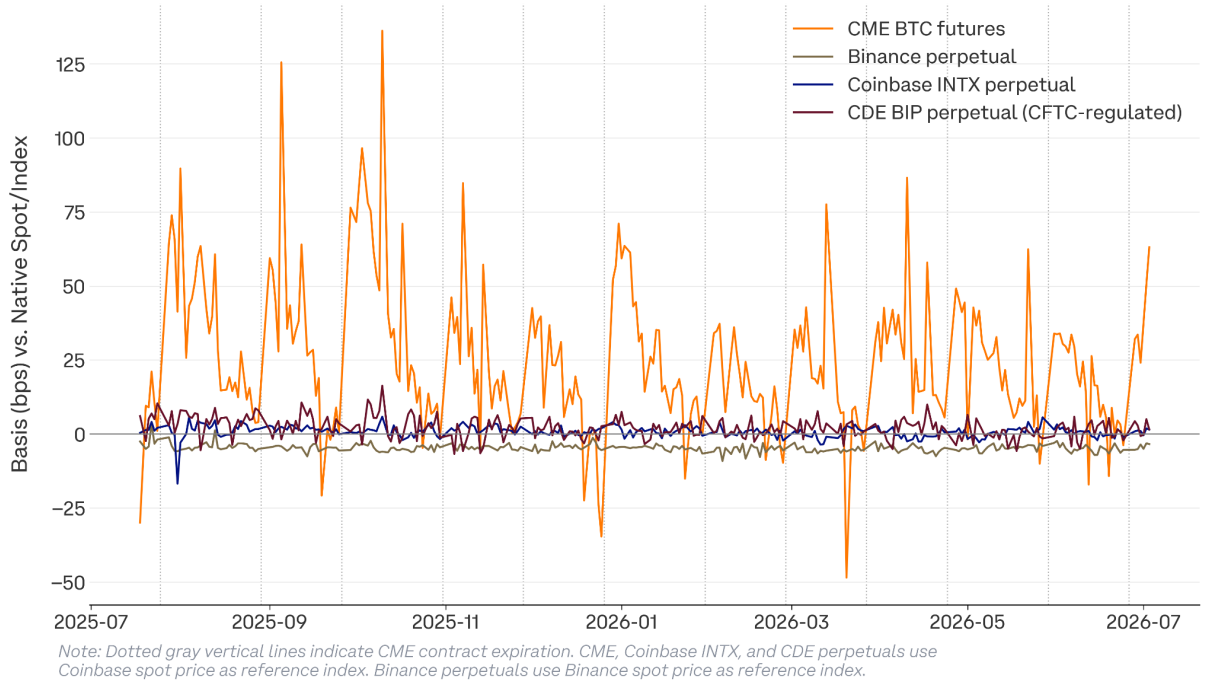

Figure 8. Basis to native spot/index since the launch of the CFTC-regulated CDE perpetual (July 2025 – present).

Note: Dotted vertical lines mark CME contract expirations. CME, Coinbase INTX, and CDE series use Coinbase spot as reference index; Binance uses Binance spot.

while CDE's perpetual ran approximately 3.2. That is in line with the offshore venues over the identical period (Binance 4.7, Coinbase INTX 1.5) and just as insensitive to the CME contract cycle. Panel B of Table 5 reports these figures.

This matters for Question 53, which asks what a DCM must demonstrate to establish that a perpetual is not readily susceptible to manipulation and whether that demonstration can be made on currently available information. It can, at least as to the anchoring mechanism, which is observable, quantifiable as a mean absolute basis, sustained across many contract cycles, and demonstrated on a contract operating under the same regulatory framework as CME. The core convergence mechanism does not depend on regulatory arbitrage to function.

3.4 Concern 9: Continuous funding intervals multiply the opportunities for manipulation

> "For a perpetual contract, the reference price must be reliable at every funding interval on a continuous basis rather than at a single settlement. What features would such a contract require to satisfy Core Principle 3 on that continuous basis, and what data demonstrates that such reliability is (or is not) achievable for crude oil and other energy commodities?" (Question 50) . . . "How could the timing of a funding-interval calculation be protected against manipulation, particularly during overnight and weekend windows of reduced liquidity?" (Question 51) . . . "[A] large perpetual position may create an economic incentive to influence the referenced contract's price during its spot month without the perpetual itself participating in delivery." (Question 56)

The concern is that more settlement moments means more targets for manipulation. We think the comparison runs the other way, but analyzing it requires separating three funding rate design

parameters that are routinely treated as one: (1) how it is computed, (2) how the resulting payment is applied, and (3) how often the payment is settled. Only the first is relevant to the manipulation question the Commission is asking. The second raises a narrower issue we address below. The third is a counterparty-risk parameter and not a market-integrity parameter at all.

1. **Rate computation:** Consider what a manipulator must accomplish in each structure. In a dated futures contract, the entire economic value of the position crystallizes at one publicly-known moment, by which most traders have already rolled forward, so the market is thin exactly when the stakes are most concentrated, and both the timing and the direction of the roll flow are predictable in advance. The attack surface is a single, scheduled, thin window. In a perpetual futures contract, the published funding rate is a time-weighted average across thousands of samples: one venue samples its premium index every five seconds, producing 5,760 observations per eight-hour interval; another samples every second over a rolling one-hour window. To move a published rate materially, a manipulator cannot use a brief price flash. The distorted price must be sustained against real order flow and real arbitrage across a large share of the sampling window, hours at a time. That cost is orders of magnitude higher than the cost of distorting a single settlement print. This is the property that answers Question 51, and a DCM should be required to disclose its sampling interval and averaging methodology as a condition of listing.

2. **Payment Settlement:** Under the current common design, the funding payment is applied to a snapshot of open positions at the settlement timestamp, so a participant who is flat at that instant pays nothing. That creates a date-certain moment with one-sided order flow. When funding is positive, participants seeking to avoid the payment and participants seeking to collect it both sell into the timestamp and both buy after it. In that narrow respect, snapshot application reproduces a miniature version of the settlement-window dynamic we have just described as a weakness of dated futures. The distinction that matters is the amount exposed. At a dated contract's expiry, the entire economic value of the position is determined. At a funding timestamp, what is at stake is the funding payment alone — for a rate in the range observed in Table 6, roughly one basis point of notional per eight-hour interval. These are the same structure separated by three to four orders of magnitude in what can be gained. They are also self-correcting in a way an expiry is not. Because avoiders and collectors trade in the same direction ahead of the timestamp, the price moves against both, and in a competitive market the anticipated payment is capitalized into the basis around the settlement rather than avoided. A participant executing the round trip also carries directional exposure across it, which for these contracts exceeds one basis point over the relevant horizon. Two implications follow for contract design. First, a DCM should specify whether funding is applied to a position snapshot or accrued continuously against position-time; continuous accrual eliminates the gaming surface entirely. Second, shortening the settlement interval is not a substitute for continuous accrual as it reduces the amount at stake at each timestamp while proportionally increasing the number of timestamps, leaving the total materially unchanged.

3. **Settlement period:** The remaining parameter (hourly versus eight-hourly settlement) governs how much unrealized funding exposure accumulates between payments, and is therefore a counterparty-risk choice rather than a manipulation-resistance one. The exposure it governs is very small: at a typical 11% annualized rate, approximately one basis point per eight-hour interval, well below realized price volatility over the same period. Funding accrual is not itself a plausible driver of liquidation.

3.5 Concern 10: There is no continuously observable reference price for crude oil or natural gas

> "Appendix C to part 38 provides that a cash-settled contract is not readily susceptible to manipulation only where the settlement price is reliable, acceptable, publicly available, and timely, and is computed from a cash market that is sufficiently liquid and not itself readily susceptible to manipulation. Is there a cash price series for crude oil, or for specific grades, that satisfies those factors and that could serve as a reference price observable at every funding interval?" (Question 38) ... "To what extent is price discovery for crude oil and other energy commodities located in the futures market rather than in a continuously traded physical cash market (and how much does this differ across energy products)?" (Question 39)

Where a continuous spot market exists, the mechanism performs as it does in crypto

Gold and silver trade spot on the OTC bullion market, which is a continuous, liquid, transaction-based global market, so a perpetual on those metals can reference spot directly, exactly as a Bitcoin perpetual does. Figure 9 shows the resulting basis.

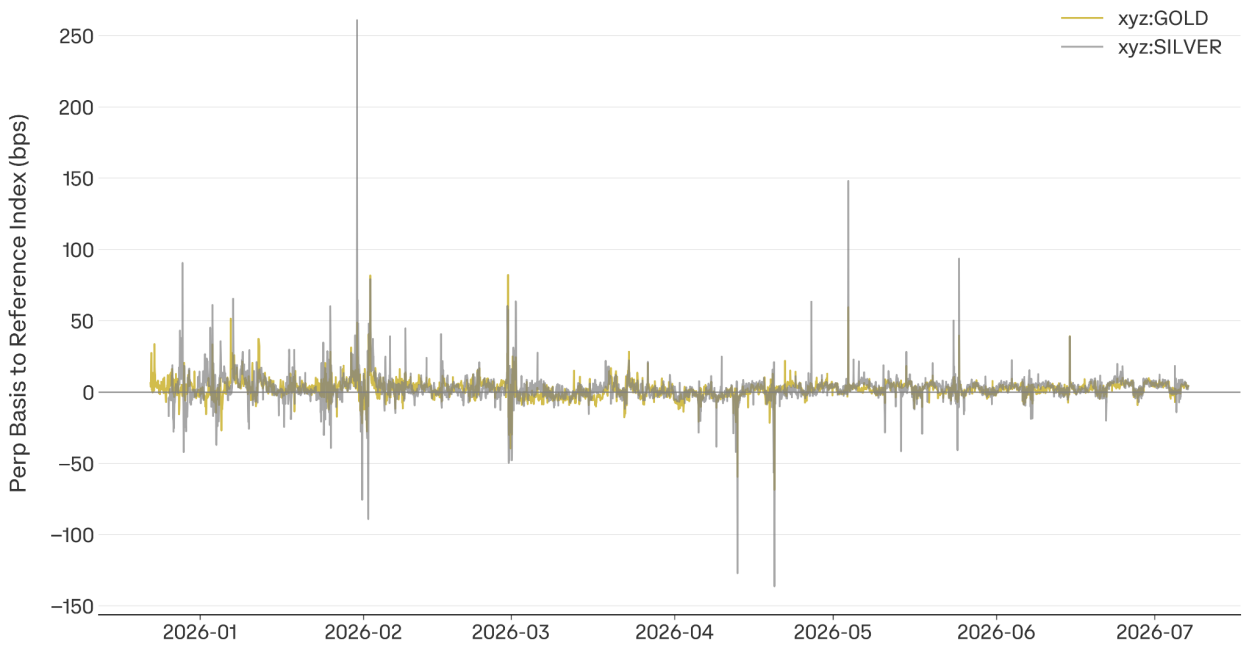

Figure 9. Perpetual basis to reference index, precious metals (spot-referenced).

Note: Hyperliquid gold and silver perpetual contracts, January – July 2026.

As predicted, the mean basis runs near 2 to 3 basis points with a standard deviation of 6 to 10, essentially indistinguishable from the Bitcoin perpetuals in Table 5. For metals, the CFTC's Appendix C reference-price condition is satisfiable on its own terms.

Where no continuous spot market exists, the reference must be a dated future and therefore must roll

Crude oil and natural gas underlyings are different in kind. What is casually called "spot oil" is either the front-month futures contract as it approaches expiration or a periodically assessed benchmark built from surveyed transactions. Neither is a continuously traded tape an exchange can

sample every second. In response to Question 38, to our knowledge there is no crude oil cash price series that satisfies the Appendix C factors and is observable at every funding sampling frequency.

That leaves the dated futures contract as the only continuously available substitute. The approach taken by Hyperliquid, a venue currently listing energy perpetuals, references front-month WTI, Brent, and natural gas and rolls from the expiring front-month contract into the next month over a multi-day window, in the manner of traditional commodity indices such as the S&P GSCI. This has a real advantage and is relevant to Question 43. The referenced futures market already has cash-and-carry arbitrageurs pricing storage cost, convenience yield, and seasonality, and all of that flows into the perpetual's reference without any change to the funding formula.

It also has a recurring cost that is unavoidable for traders currently using dated futures. Every month, during the roll, the reference itself jumps because the perpetual begins tracking a contract that does not share the price of the one it was tracking days before. Figures 10 and 11 quantify the effect.

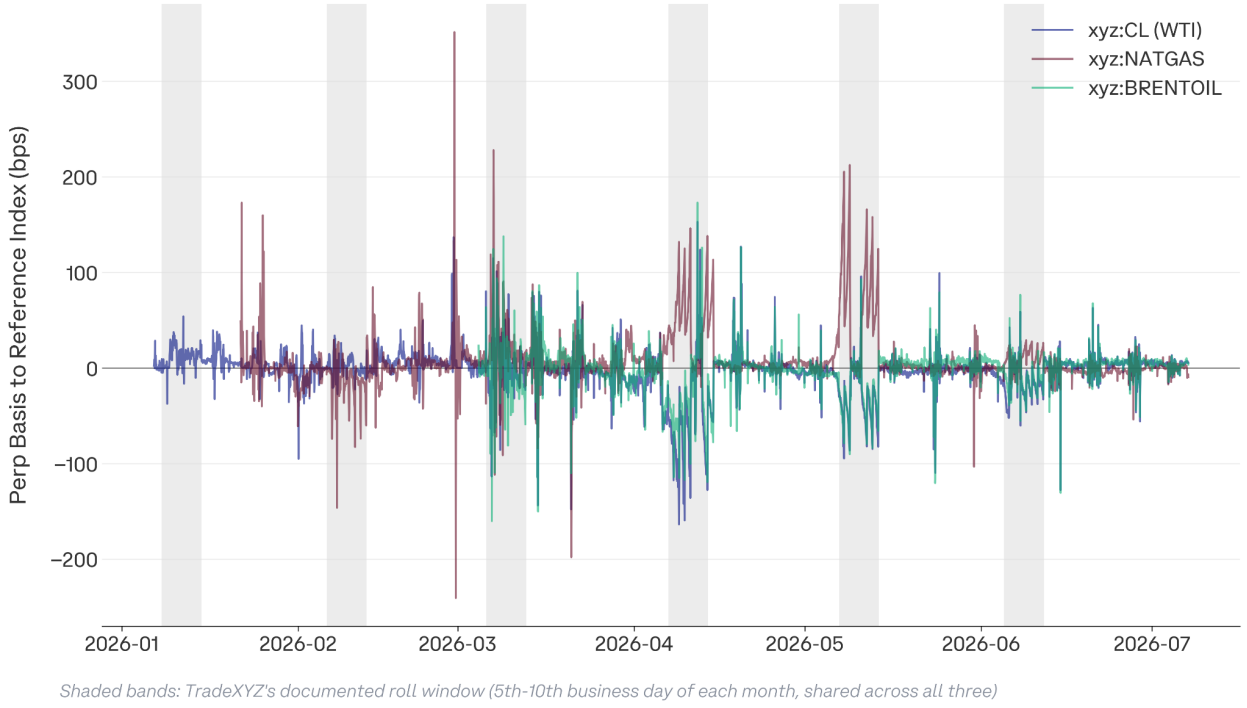

Figure 10. Perpetual basis to reference index, energy (futures-referenced).

Note: Shaded bands mark the venue's documented roll window (5th–10th business day of each month), shared across all three contracts.

Basis in the futures-referenced energy perpetuals runs four to five times more volatile than in the spot-referenced metals or Bitcoin contracts. Aligning every monthly roll cycle on a common calendar demonstrates that WTI and Brent basis falls to roughly −27 to −30 basis points at the start of the roll window and does not fully recover until day eight to twelve, while natural gas moves the opposite way, spiking to roughly +34 to +37 basis points over the same window. This is a real, recurring, and predictable dislocation a spot-referenced perpetual does not carry, but that is already an inherent dislocation for those trading/rolling dated futures.

Thus, the lack of a spot market should not be automatically disqualifying, but it could be taken into account in product design. A smoother roll across a longer window, or the reference built as a constant-maturity composite could be a design question that might address some of the basis

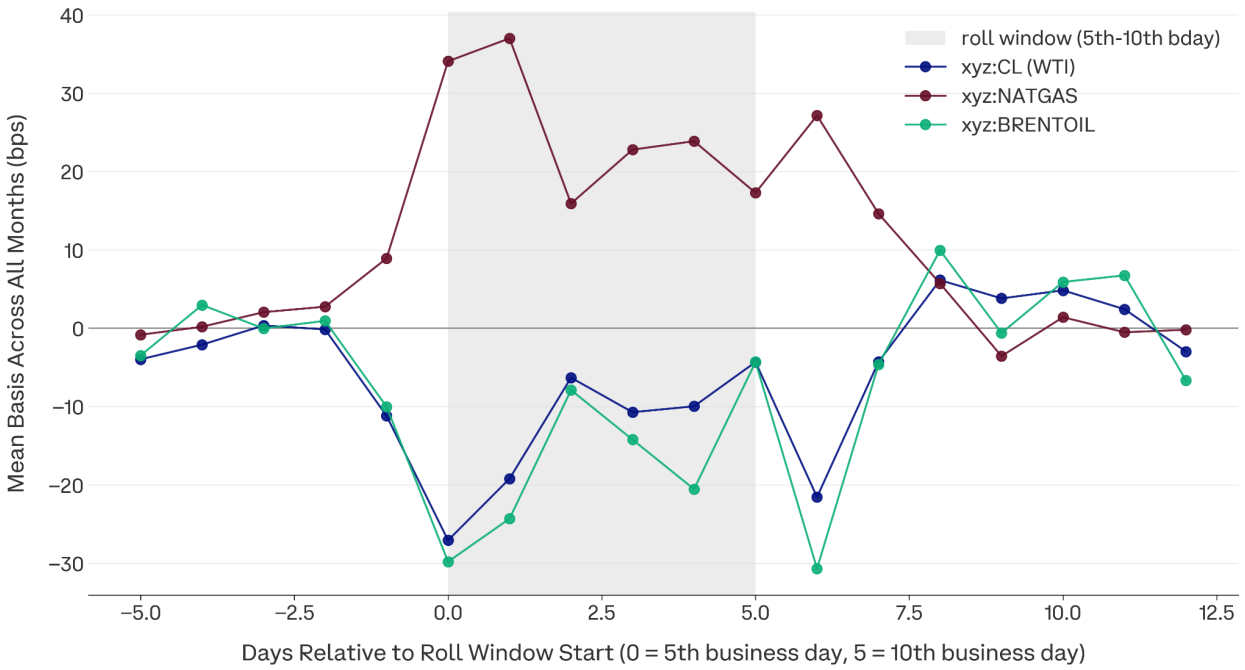

Figure 11. Event study: average basis around the monthly roll window, energy perpetuals.

Note: Basis averaged across all months, aligned on the roll-window start (day 0 = 5th business day; day 5 = 10th business day).

volatility.

3.6 Concern 11: A perpetual will drain liquidity from the dated futures market that commercial hedgers rely on

> "Commercial participants such as producers, refiners, and end-users rely on standard futures contracts to hedge cash-market exposure. To what extent, if at all, could listing a perpetual contract affect the volatility, margin requirements, or reliability of those standard futures contracts for hedging purposes?" (Question 36) ... "To what extent, if at all, could trading volume in a perpetual energy contract—including during overnight and weekend periods—affect price formation in the standard futures contract it references, including front-month price discovery?" (Question 35)

The concern presupposes a substitution dynamic. We instead expect specialization, and the reference architecture described under Concern 10 is what makes the difference.

The two instruments – dated futures and perpetual futures – serve different participants. A producer or consumer needs a fixed date, because that is when the physical transaction occurs; a dated future is the correct instrument and will remain so. A directional trader has no delivery obligation, and for that participant expiration is pure friction because of the need to roll, pay transaction costs twice per cycle, and sit exposed to a thin settlement window. Today, both types of participants share a single order book. If directional flow migrates to a purpose-built instrument, each market ends up reflecting the information of the participants it was designed for.

The liquidity-fragmentation objection is that a thinner dated futures book means wider spreads and higher hedging costs for exactly the participants the market exists to serve. While a valid concern in principle, a commodity perpetual referencing a dated futures contract is not a disconnected market, but is structurally tied to the dated contract through arbitrage. Because the perpetual's

reference price is the dated futures price, any gap between them creates an arbitrage opportunity, and closing it requires trading in both markets. Price discovery occurring in the perpetual is therefore pushed back into the dated futures price. The fact that the perpetual contract would reference a dated contract is in fact an advantage in this case.

The relevant question for Question 35 is accordingly how much information is reflected in the dated futures price. The reference link means a substantial share of that information arrives through arbitrage rather than direct participation. The same feature that creates the roll cost in Figure 11 — referencing the dated future rather than an independent index — prevents a fragmentation of trading volume from becoming a fragmentation of information. In fact, one could argue that a market structure that includes both dated and perpetual futures is more efficient at price discovery, and thus beneficial to all market participants.

4 Conclusion

Our analysis demonstrates that most of the concerns related to market quality can be allayed by observable data.

On 24/7 trading, the data show that weekend sessions are quieter in an orderly way. Activity steps down in a predictable way, with projected weekend volume inside the range of contracts already accepted as liquid. Realized volatility sits below weekday levels in every commodity examined. Liquidations concentrate on weekdays around scheduled information releases. And the CME reopening jump on continuously traded venues runs 42% to 68% smaller than CME's at the same instant. Weekend closure does not eliminate weekend price risk; it relocates price discovery to venues the Commission does not surveil and then delivers the accumulated adjustment to the regulated market in a single jump.

On perpetual contracts, the funding-rate mechanism anchors a contract to its reference an order of magnitude more tightly than expiration-based convergence anchors a dated future; it holds that tracking through 59% rallies and 33% selloffs; it transmits convenience yield as carry theory predicts; and it performs on a CFTC-regulated designated contract market as it does offshore.

The structure performs as its design predicts, but the reference price deserves additional discussion. For gold and silver, a continuous transaction-based spot market exists and the Appendix C requirement is satisfied. For crude oil and natural gas it is not, and a perpetual must reference the dated futures contract by inheriting that market's physical-fundamentals information along with a recurring, calendar-predictable roll dislocation of roughly 27 to 37 basis points. At the same time, the presence of both dated and perpetual futures markets can increase price discovery and thus improve price efficiency.

We would welcome the opportunity to discuss this submission with the Commission or its staff, and to provide the underlying data and code supporting any of the analyses described above.