Options vs Perps: Liquidation and Risk

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Liquidation of Friday, 11 October

Below is a suggested quantitative narrative of the liquidation event. Replace "Date TBD" with the correct date when confirmed.

Market moves and volatility

- Spot BTC fell from $\sim$ \$126,000 at open to $\sim$ \$105,000 intra-day, before recovering to \$115,000.
- ETH dropped from \$3,900 to \$3,440, representing a 12
- Realized 1-hour volatility (annualized) spiked from 25% to 120% during the crash window.
- Options IV (30-day ATM) jumped from 18% to over 30%; short-term skew inverted sharply as puts surged in demand.

Open interest and leverage unwind

- Total futures open interest (BTC + ETH) fell by $\sim$ \$20 billion in under 24h, a ¿20
- The leverage ratio $L = \frac{\text{OI}}{\text{Total collateral}}$ declined from 12x to 9x.
- Margin stacks were depleted as maintenance margins were exhausted, triggering cascading forced liquidations.

Liquidation amplification mechanics

Let ΔQ_{liq} denote forced volume. Then

$$\Delta\text{Price} \approx -\lambda \cdot \Delta Q_{\text{liq}},$$

where λ captures market depth. As liquidations fed back into mark price drops, further margin calls ensued.

Margin impact sensitivity is approximately:

$$\frac{\partial \text{Required Margin}}{\partial S} \approx L \cdot \sigma_{\text{realized}}.$$

When L is high, small ΔS forces large margin increases; many accounts fail simultaneously.

Contrast vs. options buffer

If instead of linear perp exposure, traders held long options:

$$\frac{\partial^2 \Pi_{\text{option}}}{\partial S^2} > 0,$$

meaning convexity provides a dampening buffer. Losses are bounded (premium), and implied volatility rise absorbs market stress rather than exacerbating it.

Lessons forward mitigation

- The event was driven by excessive leverage + volatility shock + low liquidity.
- A put overlay or gamma exposure would have absorbed tail moves.
- Exchanges and funds should institute dynamic leverage limits and volatility indexing.
- Transitioning more notional exposure into options (rather than perps) reduces systemic fragility.

TLDR

Options do not get liquidated — they expire. Perps are leveraged direction, options are priced leverage on volatility. In stress, perps are forced to sell; options gain breathing room through convex payoffs and rising implied volatility.

Options vs Perps in crypto

Dimension	Options	Perpetual Futures
Primary payoff	Convex, bounded loss for buyers, unbounded loss for naked sellers	Linear, unbounded both ways
Liquidation mechanics	Long options have no liquidation. Short options margined on Greeks and implied volatility	Margin based on spot PnL and volatility jumps. Forced liquidations common in stress
Upfront cost	Premium paid once	No premium, but funding and margin costs through time
Ongoing cost	Theta decay and vega exposure for longs	Funding payments and potential adverse mark price
Tail behavior	Long gamma benefits from gaps and rising implied volatility	Gaps increase liquidation risk and slippage
Risk control	Loss bounded by premium for buyers. Position sizing by premium budget	Stop losses and leverage caps. Vulnerable to gaps and mark price spikes
Volatility view	Directly trade volatility and skew via strikes and maturities	Volatility is implicit in funding and path risk
Hedging usage	Protective puts, collars, calendars, gamma scalping	Basis trades, carry, directional with stops
Liquidity in stress	OI concentrates in short tenors and downside strikes. IV rises and markets remain tradeable for vol	Order books thin, mark price deviates, cascading liquidations
Capital efficiency	Lower notional per unit convexity. Can be structured for treasury protection	High leverage per notional. Efficiency collapses when margin expands
Operational risks	Model risk for sellers, margin for short vol, execution for hedges	Margin risk, liquidation engines, index sourcing, insurance fund dependence
Typical users	Treasuries, funds, market makers hedging perps, vol desks	Directional traders, basis and carry desks, retail leverage

Actionable overlays to replace naked perp risk

- **Protective put**: long perp plus long put near twenty five delta for crash insurance.

- **Zero cost collar**: long spot or perp plus long put financed by short OTM call near resistance.
- **Calendar hedge**: long longer dated put and short short dated put to benefit from realized volatility mean reversion while keeping tails.

Do options get liquidated like perps?

Short answer

No for long options. When you buy an option you pay the premium upfront and your maximum loss is the premium. There are no margin calls and therefore no forced liquidations. The option can expire worthless but you will not be closed out.

Yes only for short options. When you sell options you post margin and you can face margin calls and possible liquidation if the market moves against your position. This risk is generally smaller and more model aware than perp liquidation because margin is based on Greeks and implied volatility.

Perps amplify liquidation, options control it

Perpetual futures provide linear exposure. During volatility spikes traders cannot adjust quickly, margin is consumed, and positions are forcibly closed. Options embed convexity so that a crash converts into a predictable premium cost for buyers and a convex payoff for long gamma holders.

Risk neutral framing

Perps are risk neutral only at entry before funding and slippage. When realized volatility jumps the funding rate often turns adverse and the effective exposure becomes non linear due to margin mechanics but without the protective convex payoff.

Options are priced under a risk neutral measure. If you delta hedge continuously the expected return equals the risk free rate net of transaction costs. If you keep a directional view the downside is still bounded by the premium you paid.

Funding versus implied volatility

Funding on perps is an implicit fee for leverage that can surge in stress. The option premium is an explicit payment for implied volatility that you choose once at trade inception rather than continuously through time.

Liquidity dynamics

In deleveraging events perp order books thin, mark prices gap, and mass liquidations cascade. In options markets liquidity often concentrates in short maturities and downside strikes and implied volatility increases which transforms volatility into a tradeable asset instead of an unpriced liability.

Portfolio overlays that combine both

- Long perp plus long put provides protected directional exposure.
- Short perp plus short call provides enhanced yield with bounded risk when covered by inventory.
- Long gamma via short dated options monetizes volatility spikes while perps suffer liquidations.

Quant equations

Perpetual PnL for quantity Q and prices S_0, S_T:

$$\mathrm{PnL}_{\mathrm{perp}} = Q\,(S_T - S_0)$$

Long call payoff with strike K and premium Π:

$$\mathrm{PnL}_{\mathrm{call}} = \max(S_T - K, 0) - \Pi$$

Long put payoff with strike K and premium Π:

$$\mathrm{PnL}_{\mathrm{put}} = \max(K - S_T, 0) - \Pi$$

Delta hedged option under risk neutral dynamics has drift equal to the risk free rate r abstracting from costs:

$$\mathbb{E}^{\mathbb{Q}}[\mathrm{d}V - \Delta\,\mathrm{d}S] = r\,V\,\mathrm{d}t$$

Why the recent deleveraging could not replicate in long options

The system wide event was a mass margin unwind in leveraged linear exposure. Long options need no margin after premium payment so there is no propagation channel through maintenance calls. Instead, implied volatility rises which helps long optionality.

Options vs Perps in Crypto (Simplified Comparison)

Feature	**Options**	**Perpetual Futures (Perps)**
What it represents	A right to buy or sell at a future price — you pay once for that right.	A continuous bet on price moving up or down, funded by margin.
Risk of liquidation	No liquidation for buyers. You already paid in full when you bought it.	High liquidation risk if the market moves against you — margin can run out.
Maximum loss	Limited to the price (premium) you paid.	Potentially unlimited if the market keeps moving the wrong way.
Upfront payment	You pay the premium once at the start.	No upfront payment, but you must keep margin topped up.
Ongoing cost	None after purchase. The value changes naturally with price and volatility.	Funding fees that change every few hours and can get expensive.
Behavior in market crash	Gains value if you bought protection (puts). Helps offset losses.	Usually gets liquidated or forced to close at a loss.
Market reaction in stress	Often increases in value when volatility spikes.	Usually suffers from thin liquidity and slippage during stress.
Use case	Used for hedging risk, earning yield, or trading volatility safely.	Used for quick leverage or short-term speculation.
How to control risk	You choose your risk upfront — it's the premium.	You must constantly monitor and add margin to stay safe.
Capital use	Good for controlled exposure with defined loss.	Efficient in calm markets but dangerous when volatility rises.
Who typically uses it	Funds, treasuries, and professionals managing long-term positions.	Day traders, speculators, and leverage-driven players.
Main advantage	Predictable risk, flexible strategies, no margin calls.	Simple exposure to price moves, easy to access.

Top 6 Option-Market Warning Signs Before Liquidations

These six signals often precede systemic deleveraging in crypto. Each can be monitored with simple, repeatable metrics.

1. **Short-term IV outruns realized vol (fear premium).**

$$\Delta_{IV-RV}(t) := IV_{7d}(t) - \sigma_{7d}^{\text{real}}(t), \quad z\text{-score}\big(\Delta_{IV-RV}\big) \gtrsim 2$$

Why it matters: the market is paying up for near-term protection before volatility actually arrives.

2. **Deeply negative put skew (25Δ risk reversal).**

$$\text{Skew}_{25\Delta}(t) := IV_{\text{put},25\Delta}(t) - IV_{\text{call},25\Delta}(t) \ll 0$$

Rule of thumb: drops toward -5 to -10 vol points and accelerating indicate urgent downside hedging.

3. **Vol term-structure inversion (near-term panic).**

$$\text{TS}(t) := IV_{1w}(t) - IV_{1m}(t) > 0$$

Why it matters: short-dated IV pricing above longer tenors signals imminent stress rather than a slow trend.

4. **Downside open-interest crowding (tail hedge build-up).**

$$R_{\downarrow}(t) := \frac{\sum_{K<0.9S_0} OI(K,t)}{\sum_{K} OI(K,t)}, \qquad \text{PCVR}(t) := \frac{\text{Put Vol}(t)}{\text{Call Vol}(t)}$$

Rule of thumb: rising $R_{\downarrow}$ (e.g., $0.20 \to 0.35+$) and PCVR $\gtrsim 1.5$ show broad downside positioning.

5. **Dealer/market-maker net gamma turns negative near spot.**

$$\widehat{\Gamma}(t) := \sum_{i} w_i(t)\,\Gamma_i(t) \quad \text{with} \quad \widehat{\Gamma}(t) < 0$$

Why it matters: negative aggregate gamma implies procyclical hedging (sell lows / buy highs), amplifying moves.

6. **Vol-of-vol and smile curvature spike (crash insurance bid).**

$$\text{VoV}(t) := \sigma\big(IV_{7d}(t-h{:}t)\big), \qquad \text{BF}_{25\Delta}(t) := IV_{25\Delta\text{ wings}} - IV_{\text{ATM}}$$

Rule of thumb: sharp rises in VoV and more negative butterflies ($\text{BF}_{25\Delta} \downarrow$) indicate demand for gap protection, not just mild hedges.

At-a-glance thresholds (illustrative):

Signal	**Indicative Trigger**
Short-term IV − Realized Vol	z-score of $IV_{7d} - \sigma_{7d}^{\text{real}} \geq 2$
25Δ Put Skew	$\text{Skew}_{25\Delta} \leq -5$ vol pts and falling
Term-Structure Inversion	$IV_{1w} - IV_{1m} > 0$ (sustained)
Downside OI Crowding	$R_{\downarrow} \uparrow$ to 0.30–0.40+; PCVR ≥ 1.5
Dealer Net Gamma	$\widehat{\Gamma} < 0$ around spot (peak sensitivity)
Vol-of-Vol / Curvature	VoV 90th percentile breach; $\text{BF}_{25\Delta}$ more negative

Interpretation: When 3–4 of these fire toge