

Bitwise®

Demystifying the Crypto Derivatives Landscape and Its Opportunities

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Introduction

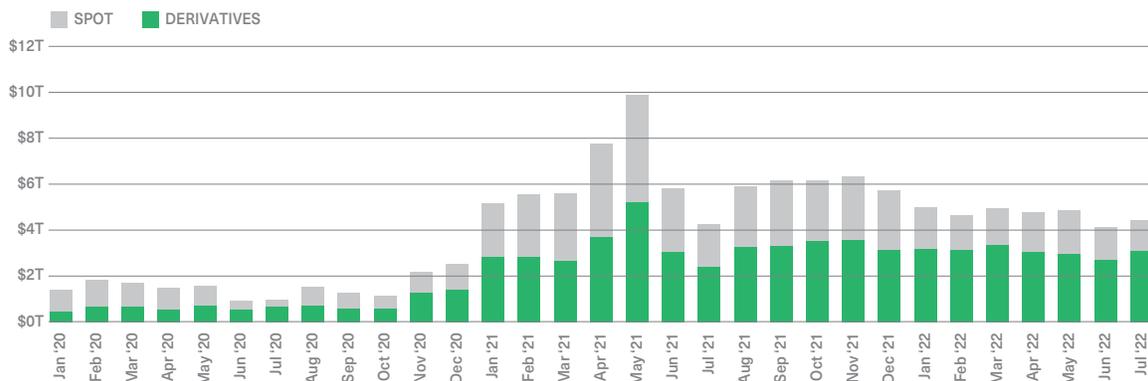
The crypto asset marketplace is maturing rapidly. One can see this along many vectors, including the rapid evolution of custodial solutions, the development of the prime brokerage market, and more. But one of the biggest and most important signposts in this development is the extremely rapid growth of the crypto derivatives market.

In 2021, volumes in the derivatives market overtook the spot market for the first time. The growth didn't stop there: In June 2022, derivatives trading represented 66% of the overall crypto market, with \$2.75 trillion of crypto derivatives trading volume vs. \$1.4 trillion of spot volume.¹

Additional anecdotal signs of this growth include: Genesis' trading activity on the derivatives desk reached up to \$26.6 billion in notional volume in Q2 2022, compared to \$8.5 billion in Q2 2021; the ProShares Bitcoin Strategy ETF (NYSE Arca: BITO), a futures-based ETF, topped the spot-linked Grayscale Bitcoin Trust (OTCQX: GBTC) in terms of trading volume in June 2022; and even Coinbase in their Q2 earnings referred to traders migrating to derivatives platforms as a reason for their declining trading volume.²

Derivatives Volume Has Been Higher Than Spot Volume Since May 2021

Monthly spot and derivatives volume between January 2020 and July 2022 (USD trillions)



Source: Bitwise Asset Management with data from CryptoCompare

Amid this rapid growth, the emerging landscape of the crypto derivatives market is increasingly complex, with both trading and innovation dispersed between multiple markets: traditional derivatives exchanges, centralized crypto exchanges, and most recently, decentralized exchanges (or DEXes). This fragmentation presents novel market structures where the unique intersection of different funding rates, investor types, exchange structure, and instrument specifications is creating potential opportunities for market makers and arbitrageurs to intermediate liquidity provisioning and generate profit.

This paper explores some of these opportunities, examining why they exist, the scale of the potential profit opportunities they offer, and the critical due diligence considerations that must be evaluated prior to engaging in these trades.

To set the stage, we begin with a review of the crypto derivatives exchange landscape.

(1) CryptoCompare, "June 2022 Exchange Review," July 14, 2022, https://www.cryptocompare.com/media/40484726/exchange_review_june_vf-2.pdf

(2) Coinbase, "Q2 2022 Shareholder Letter," August 9, 2022, p.8, https://s27.q4cdn.com/397450999/files/doc_financials/2022/q2/Q2-2022-Shareholder-Letter.pdf

Part 1: Exchanges

Traditional Exchanges: The Waking Giants

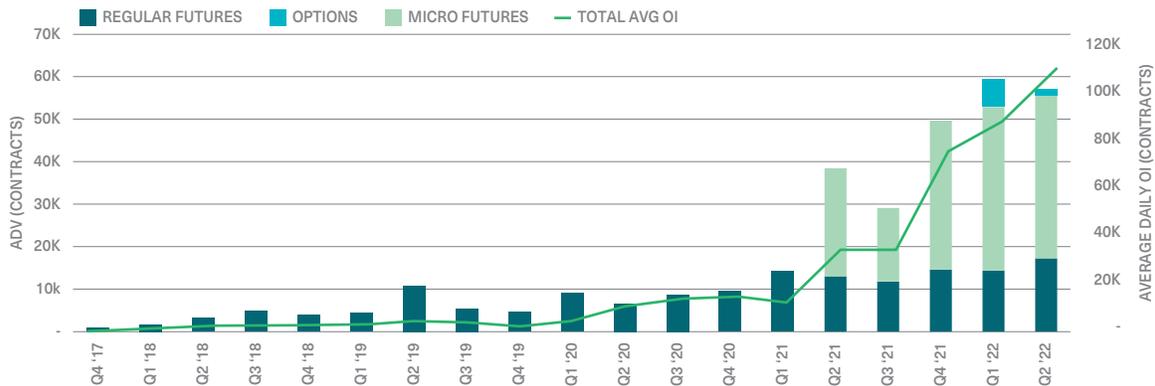
Traditional derivatives exchanges were quick to recognize the opportunity that exists in digital assets. In December 2017, both the CME Group and Cboe Global Markets launched bitcoin futures contracts, creating the first venues for U.S. institutional investors to access the crypto markets in a traditional, regulated setting.

Following the competitive and nearly synchronous launch, CME Group attracted the lion's share of trading volume, and Cboe Global Markets temporarily ceded the market.³ CME then built on its leading position by launching ether futures in early 2021 and adding "micro options" on bitcoin and ether in March 2022, creating a lower price point for investors looking to access the space.

As the chart below shows, investor interest in these regulated futures has grown sharply since their debut.

CME Group's Explosive Growth in Crypto Derivatives

Average daily volume and average daily open interest of CME Group cryptocurrency products between Q4 2017 and Q2 2022



Source: Bitwise Asset Management with data from CME Group

Impressively, CME Group has achieved this result despite the sharp sell-off in digital assets in H1 2022. In fact, even after the sell-off in the digital assets market intensified in the second quarter, CME futures posted record open interest (106.2k contracts) and higher-than-average daily volumes for the month of July.⁴ Most interestingly, the total number of Large Open Interest Holders (any entity that holds at least 25 contracts of the respective futures) in CME's cryptocurrency futures family reached a high of 404 in June, up from an average of just 80 in 2021, signaling growing interest from large, sophisticated institutional investors.⁵ This growth was driven in large part by impressive interest in micro futures and options, which enable traders to express market views in highly customizable ways that were previously unavailable.

- (3) CBOE terminated its bitcoin futures contracts in June 2019. In October 2021, however, it acquired ErisX, a crypto derivatives exchange, hinting at an eventual and potentially significant return to the fast-growing market.
- (4) CME Group, "July 2022 Crypto Insights," August 8, 2022, <https://www.cmegroup.com/newsletters/quarterly-cryptocurrencies-report/2022-q2-cryptocurrency-recap.html>
- (5) Figures for 2021 from CME Group, "Q2 2021 Equity Insights," July 15, 2021, <https://www.cmegroup.com/newsletters/quarterly-equity-index-recap/2021-q2-equity-index-recap.html>

The CME Group is not standing still. In April, in partnership with CF Benchmarks, they also launched reference rates and real-time indices on 11 more crypto assets, including Solana and Cardano. While there are no tradeable contracts on these assets (yet), the new rates and indices offer price discovery with transparent oversight following a robust public calculation methodology.

In addition, CME has extended the listing cycles for all of their cryptocurrency derivatives, which will now have six consecutive monthly contracts, four additional quarterly contracts, and a second December contract.

Of note, CME is not the only regulated entity offering crypto derivatives contracts in the U.S. Bakkt, a subsidiary of the traditional derivatives giant ICE, offers physically delivered Bitcoin futures and monthly options on the corresponding contract period of the monthly future. Additionally, other firms are set to enter the regulated derivatives market: Coinbase, the largest spot crypto exchange in the U.S., recently acquired FairX, which is regulated by the U.S. Commodity Futures Trading Commission and currently offers regulated oil and equity contracts; and FTX US, the U.S. arm of the crypto trading venue FTX, bought LedgerX, which has received U.S. regulatory approval to launch bitcoin futures contracts, and made a strategic investment into IEX Group, the owner of Investors Exchange.

While traditional exchanges are not at the forefront of product innovation or diversified offerings, they are the premier gateway for traditional asset managers to access the crypto market, and therefore serve as a unique sandbox for trading behaviors, signals and adoption for an important investor-type category. CME's continued commitment to the crypto space through bull and bear markets alike is also a positive signal. While they may not be the largest liquidity provider in crypto today, we believe it is only a matter of time until the convergence of traditional and crypto-native exchanges lead to the wider adoption and winning innovation that are yet to come.

Centralized Crypto-Native Exchanges: Where the Action Is

Despite being newer entrants, centralized crypto-native exchanges currently lead derivatives trading activity by a wide margin. Globally, the combined trading volume of BTC and ETH futures surpassed \$32 trillion in 2021, of which almost \$31 trillion occurred on centralized crypto-native exchanges. Furthermore, in H1 2022, crypto-native exchanges accounted for 94% of the \$12 trillion in futures volume, maintaining their leading position.

This dominance by crypto-native exchanges is driven in part by the key advantages that accrue to digitally native assets and blockchain technology. For one, crypto-native exchanges trade 24/7/365 with globally sourced liquidity, as opposed to traditional exchanges with intermittent breaks and regionally sourced liquidity. In addition, crypto-native exchanges offer immediate settlement through the use of "hot wallet" custody, whereas traditional exchanges require lengthy settlement procedures, along with trading breaks including holidays.

In addition, crypto-native exchanges offer a wide selection of digital assets and their derivatives to trade. By the end of 2021, for example, the total number of tradable futures on Binance was over 140, while spot pair listings exceeded 1,300.⁶ This contrasts sharply with the traditional exchanges, which mainly offer only bitcoin- and ether-based products. Lastly, crypto-native exchanges also offer unique settlement methods, enabling both stablecoin-margined and crypto-asset-margined trading.

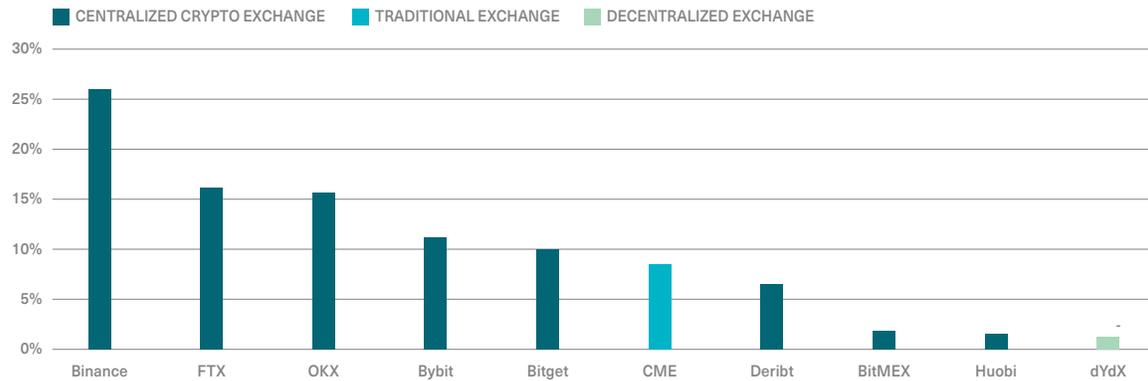
Notably, all of these advantages come with potentially heightened risks, including custodial risk, regulatory risk, and liquidity risk. In addition, crypto-native exchanges handle margin requirements differently from the traditional world: When positions cross certain collateralization levels, traders' positions are automatically liquidated. By comparison, in the traditional futures market, investors have more leeway to supply additional collateral during periods of market stress.

(6) Lucas Jevtic, "The Evolution of Trading Volumes on Binance," *The Block Research*, December 7, 2021, <https://www.theblockresearch.com/the-evolution-of-trading-volumes-on-binance-126479>

There are currently multiple large and successful crypto-native derivatives exchanges operating in the market. The largest is Binance, which was created in 2017 and currently has over 30% of the bitcoin and ether futures market. Other significant exchanges include OKX, FTX, and Bybit.⁷

Centralized Crypto Exchanges Dominate Derivatives Market Share

Eight crypto exchanges account for ~90% of the total open interest in bitcoin and ether futures



Source: Bitwise Asset Management with data from Coinglass (August 2022)

While the crypto market is diversified in the primary futures market, the options venues are particularly distinct. Deribit, founded in 2016, controls over 80% of the bitcoin options market and close to 100% of the ether options market. The market is growing as well: The combined trading volume of bitcoin and ether options was over \$387 billion in 2021, which is approximately a 5.5x increase from 2020. Interestingly, ether made history this month by overtaking bitcoin in open interest on the options market, with \$8 billion and \$4.8 billion in open interest respectively as of mid-August,⁸ signaling the growing base of institutional investors interested in Ethereum’s forthcoming technological upgrade, known as The Merge.⁹

Decentralized Exchanges: A Playground for Innovation

Lastly, on-chain exchanges are by far the most unique frontier of the crypto derivatives landscape. These novel markets are rapidly reimagining how to facilitate liquidity in a completely decentralized market structure. Adoption is still in its earliest stages, due in part to the low throughput and unique risk management challenges that exist at this nascent moment, but the level of innovation and potential growth of these markets are significant.

The largest decentralized derivatives exchange today is dYdX. Like other Decentralized Finance (or “DeFi”) protocols, dYdX is best described as a non-custodial, open-source software program that uses automated smart contracts rather than employees to facilitate transactions. The dYdX platform offers perpetual swaps (more on this below) for more than 35 crypto assets, and has more than 200,000 users (up from fewer than 40,000 in 2020). It has daily trading volume of more than \$1.9 billion,¹⁰ up from \$405 million in December 2020 and just \$37 million in January 2020.¹¹

(7) Coinglass, “Total BTC Futures Open Interest,” <https://www.coinglass.com/BitcoinOpenInterest>

(8) Deribit Metrics, <https://metrics.deribit.com/options/ETH>

(9) For background on The Merge, refer to Bitwise’s recent research brief, “A (Mostly) Jargon-Free Guide to Ethereum’s Quantum Leap,” available at <https://bitwiseinvestments.com/crypto-market-insights/a-mostly-jargon-free-guide-to-ethereums-quantum-leap-part-1-the-merge>

(10) Vicky Ge Huang, “Crypto Exchange dYdX Enters Fee War,” *The Wall Street Journal*, August 1, 2022, <https://www.wsj.com/livecoverage/stock-market-news-today-08-01-2022/card/crypto-exchange-dydx-enters-fee-war-X5FBvy2GCRsLOHAdJ8so>

(11) dYdX, “2020 in Review,” January 21, 2021, <https://dydx.exchange/2020.pdf>

In addition to offering simple derivatives exposure, dYdX also offers more complex transaction types. For example, their cross-margin perpetual trading allows users to repurpose their available on-chain balance in multiple collateral types to provide liquidity to existing trades, helping to mitigate liquidation risks. While dYdX represents a tiny fraction of the overall market (less than 5%), the potential is significant.

Creative financial engineering is flourishing in the DeFi space, especially when it comes to another class of derivatives: options. For example, there are peer-to-peer models, such as Opyn, as well as peer-to-pool models, such as Hegic and Lyra, that allow users to interact with an automated market maker (AMM) liquidity pool. There are unique challenges to these models due to high transaction costs, complex UIs, high collateralization requirements, and low on-chain liquidity. Exploring a few of these protocols in greater detail can help explain their application and limits.

Overview of the Largest Decentralized Options Protocols

Unique differences are emerging between protocols to find product-market fit

	 OPYN V2	 RIBBON	 FRIKTION	 DOPEX	 LYRA	 ZETA
Blockchain	Ethereum, Avalanche, Polygon	Ethereum, Avalanche, Solana	Solana	Arbitrum, BSC, Avalanche, Ethereum	Optimism, Ethereum	Solana
Total Value Locked ("TVL")	\$113.66M	\$85.63M	\$46.25M	\$34.69M	\$24.44M	\$11.57M
Category	Options Exchange	Vaults	Vaults	Options Exchange	Options Exchange	Options Exchange
Features	Order book model	Automated option strategies	Automated option strategies	Automated market makers	Automated market makers	Order book model & automated market makers
Contract Types	V1: American, physically settled V2: European, cash-settled	Covered call, put selling	Covered call, put selling, volatility harvesting, basis harvesting	European, cash-settled	European, cash-settled	European, cash-settled
	Weekly	Weekly	Weekly	Daily, weekly, monthly	Weekly	Weekly
Pricing	Supply/demand-based mechanism through auctions.	Strike selection process is on-chain where the volatility inputs are determined by historical data from Uniswap v3.	Powered by a best-price engine which screens across various on-chain exchanges, and off-chain market makers.	Black-Scholes based on implied volatility from oracles combined with a function to estimate volatility smile based on past data.	Black-Scholes based on internally calculated implied volatility, calculated with a function to estimate volatility smile using a skew and impact parameter.	Black-76 based on internally calculated implied volatility with a function to estimate volatility smile based on past data.
Collateral	Fully or undercollateralized	Fully collateralized	Overcollateralized in certain strategies	Fully collateralized	V2 (Avalon) will allow users to partially collateralize their shorts	Undercollateralized

Source: Bitwise Asset Management

Oryn emerged in 2019 as the first peer-to-peer options platform in the DeFi space. It allows users to leverage a unique off-chain relay and on-chain settlement architecture, where users can trade options in a limit order book market after creating the contract from a decentralized liquidity pool. It is an automated yet familiar solution that allows users to rely on smart contracts instead of a centralized entity. Oryn released an updated version of its protocol, Oryn v2, in December 2020.

Lyra, on the other hand, is a peer-to-pool model, in which option underwriters earn algorithmically determined premiums paid by the option buyers. In other words, unlike Oryn where users directly create options contracts, Lyra leverages two distinct user groups: liquidity providers, who deposit assets into a Market Maker Vault (MMV); and options traders, who can customize the exact option specifications (type, strike, expiration) from that liquidity pool, reflecting the traditional function of OTC market makers.

Peer-to-peer models suffer from the latency caused by on-chain order matching execution, which in turn makes it more difficult to bootstrap initial liquidity. On the other hand, peer-to-pool models suffer from having to rely on external agents like oracles that may create undesirable outcomes depending on the scalability of the AMM relative to the oracle feed's primary market. As a result, hybrid designs, which combine both AMMs and order books, are also actively being designed, most notably by Zeta Markets, the premier derivatives exchange on Solana, which is powered by Serum as the core module.

Conclusion to Part I

The crypto derivatives market is getting more sophisticated and growing rapidly, in both size and user types. It faces an evolving regulatory and technological landscape, and we are likely to see more complexity and innovation in the future. This is natural in an emerging asset class, particularly in one built on a disruptive new technology.

But we are also seeing significant development in crypto-native infrastructures merging with existing traditional frameworks. For instance, in April 2022 FalconX, a leading digital assets trading platform, became the first CFTC-registered cryptocurrency swap dealer and one of the first crypto-focused Primary Members of the ISDA (International Swaps and Derivatives Association).¹² Soon after, Genesis (a full-service crypto derivatives provider and subsidiary of Digital Currency Group) joined ISDA as a Primary Member as well. As a result, both providers permit clients to enter into forwards, options and swap transactions within the financial industry's most conventional framework.

In both cases, digital asset trading platforms and derivatives service providers have committed to collaborating with ISDA in developing contractual and operational standards for digital asset derivatives, creating much-needed guidelines for secure and regulated access to the OTC market. This represents a convergence of traditional and crypto-native standards amid the growing institutional adoption of digital assets.

This evolving landscape creates both risks and opportunities for the savvy investor. In the next section of the paper, we will explore some of both in depth.

⁽¹²⁾ "FalconX Becomes First & Only CFTC Registered Cryptocurrency Swap Dealer," PR Newswire, April 13, 2022, <https://www.prnewswire.com/news-releases/falconx-becomes-first-only-cftc-registered-cryptocurrency-swap-dealer-301524909.html>

Part 2: Implications for Capital Efficiency and Trading Opportunities

The rapidly evolving crypto derivatives landscape has given rise to multiple unique liquid trading opportunities, which offer sophisticated investors the opportunity to generate profits by capitalizing on the need for capital efficiency across what are otherwise globally priced and competitive markets.

As a result of the growing complexity of the exchanges as discussed above, institutional-caliber communications platforms that automate price negotiation, execution, and settlement and enable better trading services are on the rise. Paradigm is one of the leading block trading RFQ (request-for-quote) platforms that facilitates liquidity, structuring, and price discovery across these fragmented marketplaces. According to CEO Anand Gomes, Paradigm captured 30% of the crypto options market in 2021. Looking ahead, the release of more innovative tools is not slowing down anytime soon. In August 2022, FTX partnered with Paradigm to launch one-click spreads trading between spots, perpetuals, and futures instruments with guaranteed atomic execution and clearing on both legs on FTX. This allows traders to more efficiently access yield-generating opportunities in spreads trading via “cash and carry” strategies or funding rate arbitrages. These are unique alpha-generating vectors for digital asset exposure, with return patterns that are distinct from those of long-only, venture capital, and other institutional approaches to the crypto market. Let’s explore these examples in further detail.

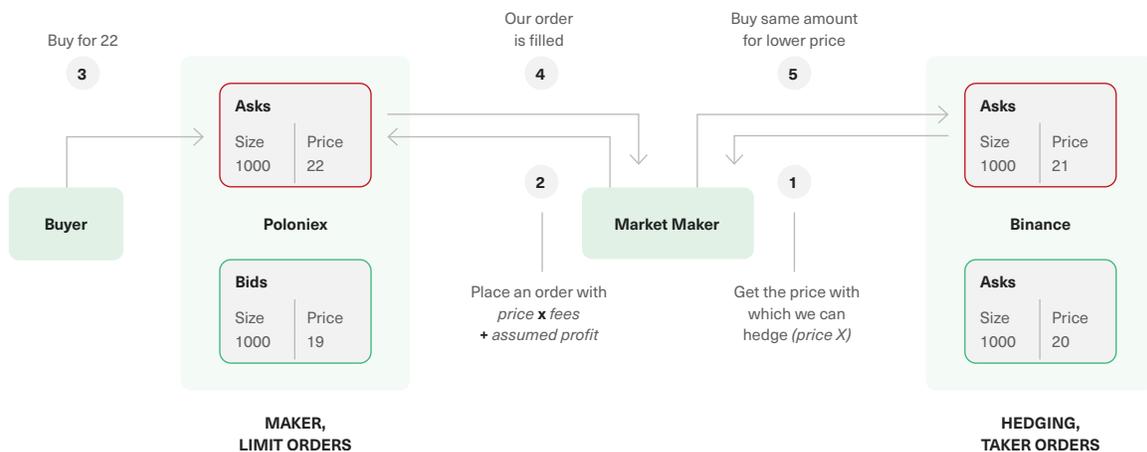
Exchange Arbitrage: Old-School Methods, Limitless Permutations

With approximately 600 cryptocurrency exchanges globally and over 1000 trading pairs available, digital assets are one of the most fragmented markets in the world. In this fractured environment, many exchanges show price discrepancies among different trading instruments for a variety of reasons.

The image below illustrates how traditional arbitrage techniques can be used to profit from these discrepancies, while removing friction for users.

Trade Flow of a Cross-Exchange Arbitrage

By intermediating maker and taker order flows, fast traders can take advantage of price discrepancies



Source: Bitwise Asset Management with data from MultiTrader.io

Beyond this simple arbitrage example, there are opportunities in crypto for triangular arbitrage, involving reference rates among three different crypto assets. This is a strategy borrowed from foreign exchange markets, where traders often arbitrage across three different currency pairs to profit from micro pricing discrepancies. This strategy can be particularly profitable in crypto, given the long tail of digital assets, where liquidity and price discovery may not be as plentiful in select combinations on select exchanges during select periods.

Although the profit-capture technique here is standard arbitrage, the opportunities tend to be larger than in traditional markets, for multiple reasons. For one, many institutional investors are reluctant to enter the crypto markets, due to a lack of understanding, regulatory uncertainty, or other factors. This limits the amount of capital at work solving these inefficiencies, which may help alpha persist.

Beyond that, there are critical due diligence considerations that must be accounted for in order to engage in these opportunities profitably and in a durable fashion—an obstacle that further restricts capital from accessing this market. However, those due diligence hurdles can be cleared by sophisticated investors with expertise in the space.

For example, understanding market depth and different fee models in this market is critical to limiting risk and maximizing profit. In traditional markets, spreads are commonly used as a proxy for liquidity. However, while tighter spreads signal higher liquidity on average in crypto, they need to be contextualized with exchange fees, which increase execution costs. Different exchanges have different maker-taker model pricing, and exchanges that implement a zero-fee maker-taker structure, such as Coinbase and Kraken, can create microstructures where market makers can maintain a tight spread even where there is not actually deep liquidity. Having a thorough understanding of order book depth and individual market microstructures is therefore critical for traders who are looking to take advantage of these opportunities.

Underwriting exchange stability and credit risk is also important. Crypto exchanges are unique in that exchanges serve as the principal counterparty unless the assets are moved to cold storage. The ability to dynamically manage and move cash quickly between various exchanges in anticipation of trading is considered proprietary know-how when deploying into these strategies, and unique strategies exist to maximize speed while minimizing risk. At a minimum, understanding the individualized custodial risk at each venue if using hot wallet storage is a must.

In addition, technical developments like hard forks bring another level of consideration, particularly during specific periods in the market. As one example, consider The Merge: the high-profile technological upgrade of the Ethereum blockchain, scheduled for mid-September 2022, which could see the blockchain move from a Proof-of-Work (PoW) consensus mechanism to a Proof-of-Stake (PoS) consensus mechanism. Some market experts predict that this could result in a fork, where certain miners elect to continue to maintain a residual PoW network and therefore a PoW token. Understanding the potential value of this asset and the unique risks of claiming forked assets may create unique crypto-native elements with respect to such trading arbitrages.

Exchanges are already adapting to this: As an example, Poloniex and MEXC have listed tokens tied to the possible miner-led fork, while BitMEX has now added a futures product related to the tokens. (This is an amazing concept: These listings allow the trading of an asset that is yet to come into existence!) A sophisticated crypto arbitrage trader must take multiple factors into account when considering the opportunities and risks this creates, including which exchanges to establish positions at, given that each exchange could treat the event differently.

Funding Rate Arbitrage With a Crypto-Native Flavor

Not all arb strategies in crypto are borrowed from the traditional arbitrage playbook. One of the key differences in the traditional and crypto derivatives market is the innovation in perpetual swaps, often called perps.

Perpetual futures were first proposed by finance professor Robert Shiller in 1992 as a means to offer ongoing (or perpetual) exposure to an asset price in a derivatives contract, but they have not gained significant traction in traditional assets. In crypto, however, they have come to dominate: In May 2022, such contracts accounted for 66% of open interest and over 90% of trading volume.¹³ This is driven by multiple factors, including the industry's lack of standardized fixing procedures. Of note: Centralized crypto derivatives exchanges, which dominate the perps market, are lightly regulated, and may face a changing regulatory landscape in the future.

Perps are closely related to traditional cash-settled futures contracts, but feature some notable differences, which create opportunities.

For one, they do not have expiration dates, which eliminates the need to constantly re-establish a long or short position. In traditional futures trading, traders roll over existing positions that are about to expire to a longer-dated contract in order to maintain the same position following expiry. With perps, futures price is tied to spot via a funding fee mechanism, in which either side can pay or receive depending on the basis spread. These funding rates are periodically charged and reset multiple times a day by each venue that offers them, based on the unique balance of supply and demand on that venue. This provides traders with strategies like the cash-and-carry trade which can be profitable during momentum-driven markets.

The table below illustrates a representative opportunity in the current environment. While the hypothetical yield may not seem interesting today, remember that crypto is a very volatile asset; in momentum-driven markets such as in 2020-21, the annualized funding rate spreads can be multiples higher. These opportunities can persist for various reasons, such as event-driven delta-hedging activities on options exchanges.

Example of a Perp-to-Perp Funding Rate Arbitrage Trade

Funding spreads due to idiosyncratic supply/demand dynamics can be monetized

TRADING VENUE	8-HR FUNDING RATE	ANNUALIZED FUNDING RATE	FUNDING RATE ARBITRAGE TRADE	
 Binance	0.0003%	0.33%	Lowest Funding Rate → Buy Future	Net Trade = Long Binance lowest funding rate + Short Bybit Highest funding rate
 Okex	0.004%	4.48%	—	
 FTX	0.0056%	6.32%	—	Annualized Yield = (11.57% - 0.33%) = 11.24%
 Bybit	0.01%	11.57%	Highest Funding Rate → Short Future	

Source: Bitwise Asset Management with data from Coinglass (August 2022)

Note: When the funding rate is positive, long position holders pay the short position holders the funding rate. The opposite occurs if the funding rate is negative.

(13) Vildana Hajric and Muyao Shen, "Bitcoin Traders Move to Perpetual Contracts as Risk-Free Return Ends," *Bloomberg*, May 25, 2022, <https://www.bloomberg.com/news/articles/2022-05-25/end-of-risk-free-returns-leads-to-bitcoin-perpetuals-dominance?sref=pG7uGQV9>

Another source of difference is that, in the traditional world, dealer desks typically profit on the roll yield on the back of short-term event-driven technicals, and often do so behind closed doors. Perps, by contrast, provide a uniquely democratized opportunity for any trader to participate in arbitraging the differences in funding rates across multiple durations and venues. This creates a more transparent environment to openly witness and apply technical analyses, which has implications for what a quantitative model-driven strategy might be able to accomplish.

As with the traditional price arbitrage model mentioned earlier, there are critical due diligence considerations that make funding rate arbitrage complex to execute. First, the recurring themes around counterparty risk in arbitrage strategies cannot be overstated. A recent survey by VALK found that 54% of institutional allocators are “very concerned” about custodial services in crypto, and that the market architecture’s reliance on hot wallets is central to such concerns.¹⁴

Second, the contract specifications of perp contracts vary based on the exchange, so understanding in great detail how the funding rates are quoted, calculated, paid, and reset is critical to success. For example, “fair basis” is a decaying measure of the most recent funding rate that is used to normalize the “premium index price,” which measures the difference between the swap’s price and the underlying asset’s price. Many exchanges apply this computation with slight differences, ranging from measurement intervals to whether it applies to the current or the forward interval. Third, Binance and BitMEX quote eight-hour rates, even though the funding rate is updated every hour, whereas FTX quotes every hour; more specifically, FTX measures the one-hour TWAP (time-weighted average price) of the perpetual future and the one-hour TWAP of the underlying spot to determine the exact payment. Knowing how to meticulously standardize across these idiosyncratic changes, but more importantly, keeping up to date with minute changes, is an integral component of risk management.

Lastly, there are risks to manual execution: Sudden price movements can create liquidation as the trader may not be able to close out the position in advance, leading to unintended basis risk. Combine this with the fact that the strategy is inherently highly volatile and unpredictable due to the charged combination of leverage and spread trading and it is evident that there is a need for robust risk management and VaR-based scenario analyses. At a thematic level, it is imperative to consider the various roles of automation for this particular strategy. Still, the opportunity is large, and with the right due diligence protocols and crypto expertise in place, can deliver exceptional returns over time.

On-chain Volatility Arbitrage: A New Frontier for Black-Scholes

As a final example, the emergence of the on-chain options markets has created entirely new volatility arbitrage opportunities for sophisticated investors operating in the Decentralized Finance (DeFi) space.

Despite lower overall trading activities in decentralized exchanges, DeFi structured products have demonstrated considerable innovation beyond traditional markets, becoming a leading gateway for broader adoption. For example, “vaults” are options-based products where investors can contribute assets that are then deployed into contracts that systematically employ various options-trading strategies, such as covered calls or put-writes. These can be particularly profitable as long as volatility remains elevated, and present unique arbitrage opportunities for traders who are able to seamlessly move between on-chain and off-chain to monetize deterministic pricing differentials.

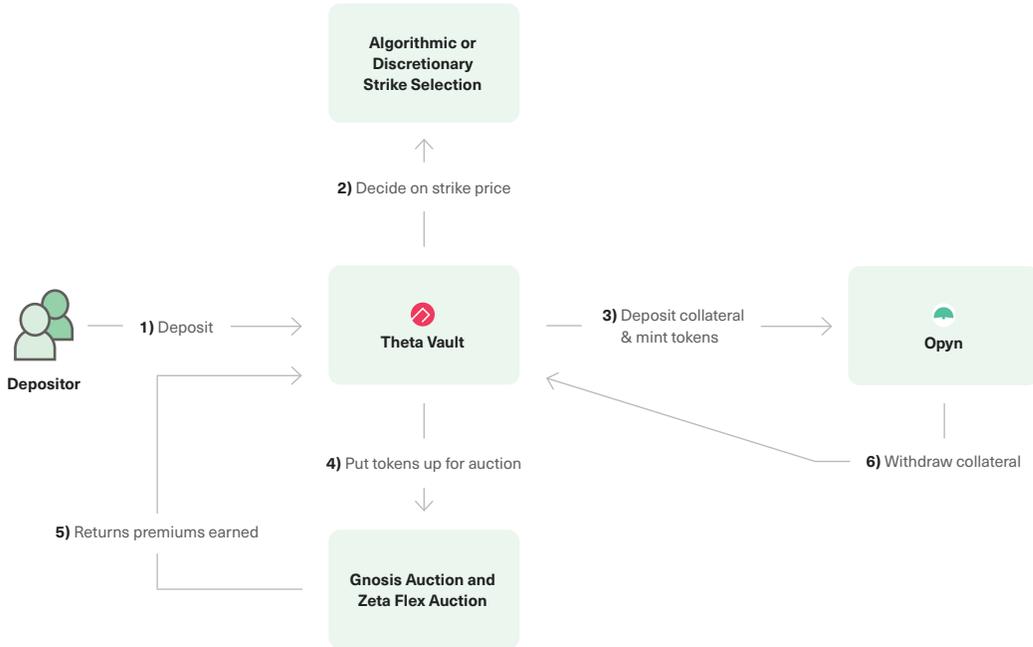
Ribbon Finance, for instance, one of the largest decentralized structured products protocols, hosts regular auctions for various vaults in partnership with Paradigm. One of its many available strategies allows users to deposit AAVE in an automated covered call strategy that is projected to yield 127% APY, inclusive of reinvestments, according to the protocol’s website.¹⁵

⁽¹⁴⁾ Hugh Leask, “Why counterparty risk is the key to crypto market institutionalisation,” *Hedgeweek*, March 25, 2022, <https://www.hedgeweek.com/2022/03/25/313206/why-counterparty-risk-key-crypto-market-institutionalisation>

⁽¹⁵⁾ Projection for the T-AAVE-C vault as of August 26, 2022. The projected vault yield, which is calculated by annualizing the four-week average weekly yield, can be highly variable. Please refer to <https://www.ribbon.finance/> for the current projected yield.

Anatomy of an Options Vault Strategy

On-chain structured products can be created by a chain of smart-contract functions instead of discretionary OTC dealers



Source: Bitwise Asset Management with data from Ribbon Finance

Squeeth, as another example, functions similarly to traditional leveraged ETFs, offering ETH^2 exposure in a perpetual swap format. Most recently, Squeeth also added a “Crab Strategy,” which is an automated perpetual “short strangle” strategy that creates systematic short vega exposure on a weekly basis. Many of these products with unique payoffs are initiated and led by community governance with a low fee structure, upending the traditional Wall Street model.

Deployment into these strategies is not without substantial risks. Some of the risk factors that are common to DeFi generally, such as liquidity and smart contract risks, are more elevated in derivatives, due to the sophistication brought by contract-linked instruments as well as the embedded leverage.

Beyond that, however, there are some intellectual and technical challenges worth noting as well. The development of Black-Scholes was a landmark in financial engineering, and continues to be used extensively for traditional asset options pricing. However, there are some features unique to both digital assets and decentralized exchanges that do not allow Black-Scholes to work nearly as well.

First, Black-Scholes assumes there are minimal transaction and slippage costs; we know that this is not true on-chain, where there can be meaningful trading frictions due to high gas fees during network congestion, and potential slippage due to low liquidity.

Second, a key input into Black-Scholes is the risk-free rate, which is typically the yield on short-term treasuries. However, the assumption of a risk-free interest rate cannot be taken for granted on-chain, where a native yield curve does not yet exist to replicate the forward contract seamlessly to enforce put-call parity. As a result, embedded in the neutral rate are several other exogenous risk factors that also coexist such as counterparty and contract risk.

Third, Black-Scholes was created with the assumption of a constant volatility input using a normal price distribution curve. In digital assets, this can be problematic as intraday volatility can often be higher than close-to-close business day volatility. For example, an analysis using average hourly high-low difference in digital assets performed by Arcane Research shows that large deviations from the spot market can be regularly observed, especially during volatile market conditions.¹⁶ This is further exacerbated by what is widely accepted as a non-normal price distribution curve that tends to exhibit positive skew and high kurtosis. Excess kurtosis ultimately means that very large changes in price are less predictable, making the assumption of a Gaussian random walk highly problematic.

Even on the technology front, the lack of reliable infrastructure, especially as it relates to oracles, can create existential risks for some of these trading strategies, where the delay in pricing inputs can lead to catastrophic outcomes for slower or manual traders. For example, if the protocol relies on pulling off-chain data like implied volatility to on-chain for execution, there can be meaningful latency issues if the updates are not timely and dynamic. In addition, the scalability of the pool itself is limited to the size of the market that the input data is being pulled from. Yet-to-be-released primitives like Panoptic aim to overcome such technical limitations by relying on Uniswap v3 and an oracle-less Black-Scholes pricing scheme.¹⁷ Despite these unique challenges, this also creates a unique trading environment for those who are capable of navigating the frontier with a deeply rooted risk management framework and solid understanding of traditional quantitative finance.

(16) Best Owie, "By the Numbers: Bitcoin's Most Volatile Day of 2022 Compared," *Bitcoinist.com*, May 2022, <https://bitcoinist.com/bitcoins-most-volatile-day-of-2022/>

(17) Guillaume Lambert and Jesper Kristensen, "Panoptic: a perpetual, oracle-free options protocol" (preprint, submitted April 27, 2022), <https://arxiv.org/abs/2204.14232>

Conclusion

The fragmentation of the crypto derivatives market is significant, and the continued innovation complex. The good news is that there are meaningful steps being taken today to bring these systems together, which over time should lead to combining the best features of each purpose-built institution to create a deeper, more efficient, and more robust financial market. This innovation will flow both ways: from crypto-native platforms to the traditional markets, as well as the reverse.

For example, crypto exchanges in the U.S. today cannot offer leverage with respect to undercollateralized contracts without being a regulated Futures Commission Merchant (FCM). FTX, which operates a CFTC-registered Derivatives Clearing Organization (DCO) through several acquisitions, has submitted an application to CFTC to provide retail investors with direct access to futures on a margined basis. FTX's proposed direct clearing service would see customers post margin directly to the exchange, and disintermediate the need for a FCM with backstop providers. Much of the traditional futures industry objects to this proposal, claiming that such a regime change would inject systemic risk into the U.S. financial system. On a more impartial basis, IDX's derivatives experts believe the FTX proposal might not be workable but could prompt improvements to the current clearing structure.¹⁸ While the CFTC has not yet decided its direction, the engagement itself shows that the commission is taking the proposal seriously, and highlights one of the most significant overhauls in the derivatives market.

At the same time, as FTX's engagement with the CFTC and other regulatory bodies show, crypto-native derivatives exchanges are wrestling with the need to mature as their customer base transitions from primarily retail to increasingly institutional.

Against this background, we also see continued innovation coming from other sides of the market. For example, the CME recently launched EUR-denominated bitcoin and ether futures, offering yet another addition to the multivariate financialization of digital assets and their marketplace. Then two weeks later, they announced the launch of options on ether futures for September ahead of The Merge. Meanwhile, new approaches to undercollateralized leverage and other exotic features are creating new opportunities on the decentralized crypto-native front.

The discussion of the sampled investing strategies is by no means comprehensive nor typical of the amazing depth and breadth of R&D that is being resourced by financial engineers and technologists. As these trends continue, uncorrelated trading opportunities will exist for savvy investors that marry crypto-native expertise with robust due diligence procedures. These investors have the opportunity to generate alpha while inaugurating a new era of capital efficiency across the ecosystem.

⁽¹⁸⁾ Kirsten Hyde, "FTX proposal could prompt clearing structure evolution," *FIA Market Voice*, June 8, 2022, <https://www.fia.org/marketvoice/articles/ftx-proposal-could-prompt-clearing-structure-evolution>

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