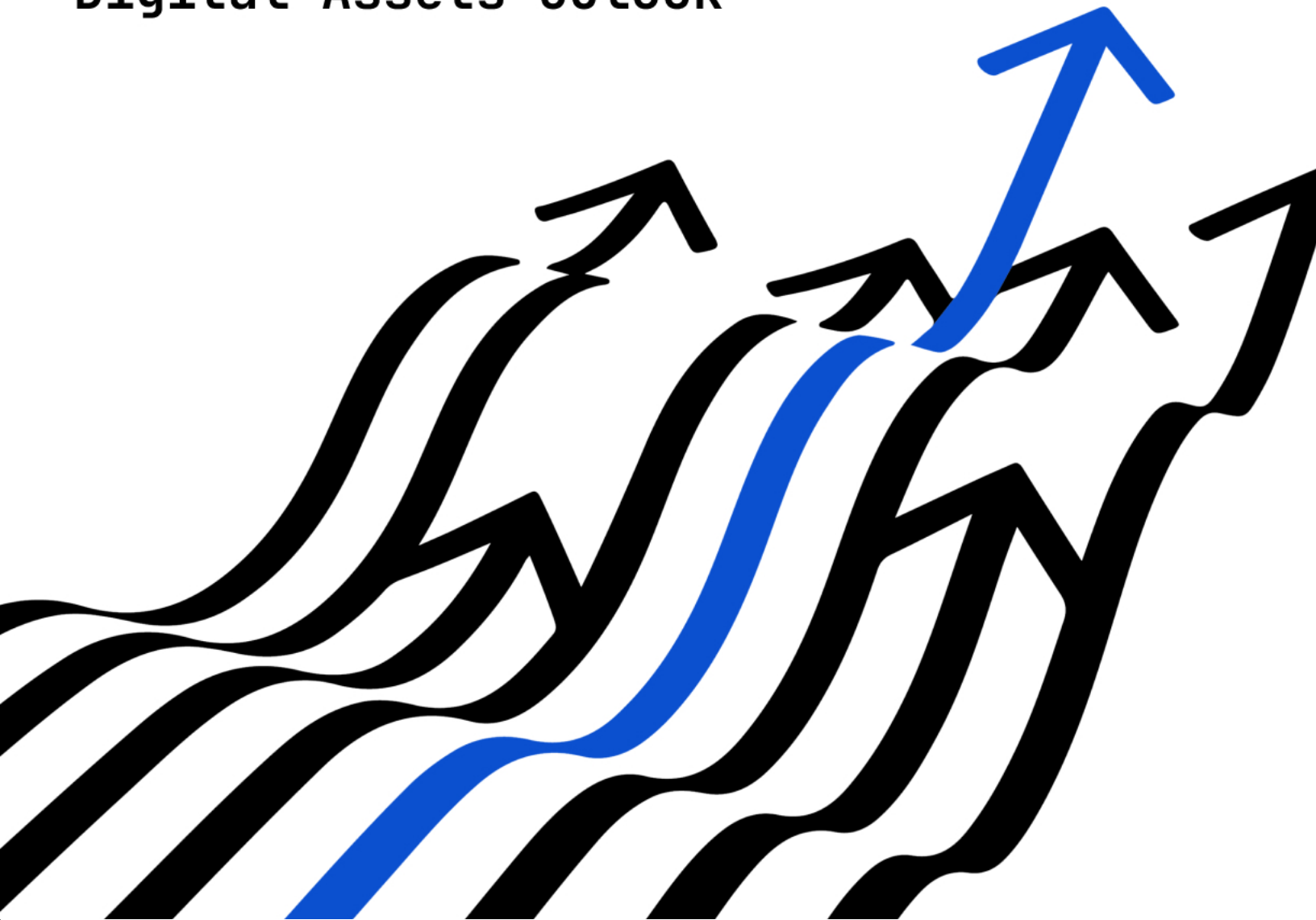


# 2024

## Digital Assets Outlook



RESEARCHED BY  **THE BLOCK PRO** · RESEARCH

The Block Pro is The Block's premium product portfolio designed to help institutions evaluate opportunities in digital assets. Pro's research, news, and data products are powered by teams of subject matter experts deeply entrenched in the digital asset ecosystem who deliver actionable intelligence so businesses can make informed decisions.

The Block Research produces research content covering the digital assets, fintech, and financial services industries.

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EXECUTIVE SUMMARY

Following the immediate aftermath of the crypto market's year-long deleveraging, 2023 ushered in substantial evolution and growth across various corners of the blockchain industry and cryptocurrency asset class.

The report provides an in-depth analysis of key developments shaping the year, focusing specifically on (1) general market and price activity, (2) the role played by infrastructure providers, institutions and regulators, (3) evolution across the blockchain platforms underpinning the on-chain economy, and (4) the applications that drove adoption.

**1. Market Performance & Activity:** The year 2023 was marked by a notable recovery in cryptocurrency prices, with total market capitalization doubling. This resurgence was influenced by macroeconomic factors and a low price floor set by the FTX bankruptcy, which marked the end of a broader market deleveraging that spanned most of 2022. Conversely, except for the tail end of Q4, venues across which investors allocate to the sector saw less activity than recent years.

**2. Market Infrastructure & Regulation:** Endogenous factors altered the landscape of centralized exchanges and stablecoins, highlighted by the relative decline of Binance's dominance, growth of Coinbase's offerings, and rise in USDT dominance. Crypto's relationship with traditional banking experienced setbacks, particularly due to regulatory and banking crisis related headwinds in the U.S. However, positive developments like filings for spot Bitcoin ETFs indicated growing institutional adoption.

**3. Blockchain Platforms and Scaling:** Ethereum continued to lead among Layer 1 blockchains, focusing on a rollup-centric roadmap for scalability. Competing blockchains like Solana, Avalanche, and Cosmos pursued various scalability strategies, slowly gaining market share – Solana's integrated approach seeing the most success towards the end of the year. The growth in rollups and the development of blockchain bridges marked significant progress towards interoperability and enhanced scalability for modular chains like Ethereum.

**4. On-chain Applications:** While blue-chip lending and exchange protocols remained relatively flat, liquid staking providers like Lido grew dominance, and DeFi meaningfully expanded into areas like real-world asset tokenization. The non-fungible token (NFT) sector experienced intense competition, reducing the market share of platforms like OpenSea, and the introduction of Ordinals on Bitcoin spurred the growth of NFTs on its network. Additionally, the rise of decentralized social protocols marked a new era of blockchain application development.

Often, 2023 felt like a year simultaneously playing out across opposite universes. Prices broadly doubled despite relatively tepid investor activity, reflected by multi-year lows in volume and venture deals. Many institutions shied away from servicing crypto market participants, yet recent ETF filings mark the most prominent progress towards institutional adoption. Regulatory bodies warned the market about the risks of the sector and levied enforcement actions, but the judicial branch pushed back on regulatory overreach. And an Ethereum upgrade allowing for stake to be withdrawn led to the rapid growth in total ETH staked and aided the rise of a new dominant DeFi player. The following sections examine some of these nuances.

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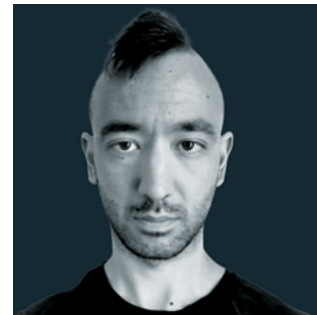
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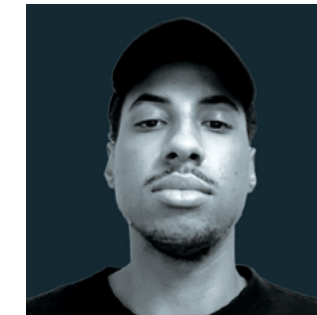
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# SECTION 1 MARKET PERFORMANCE & ACTIVITY

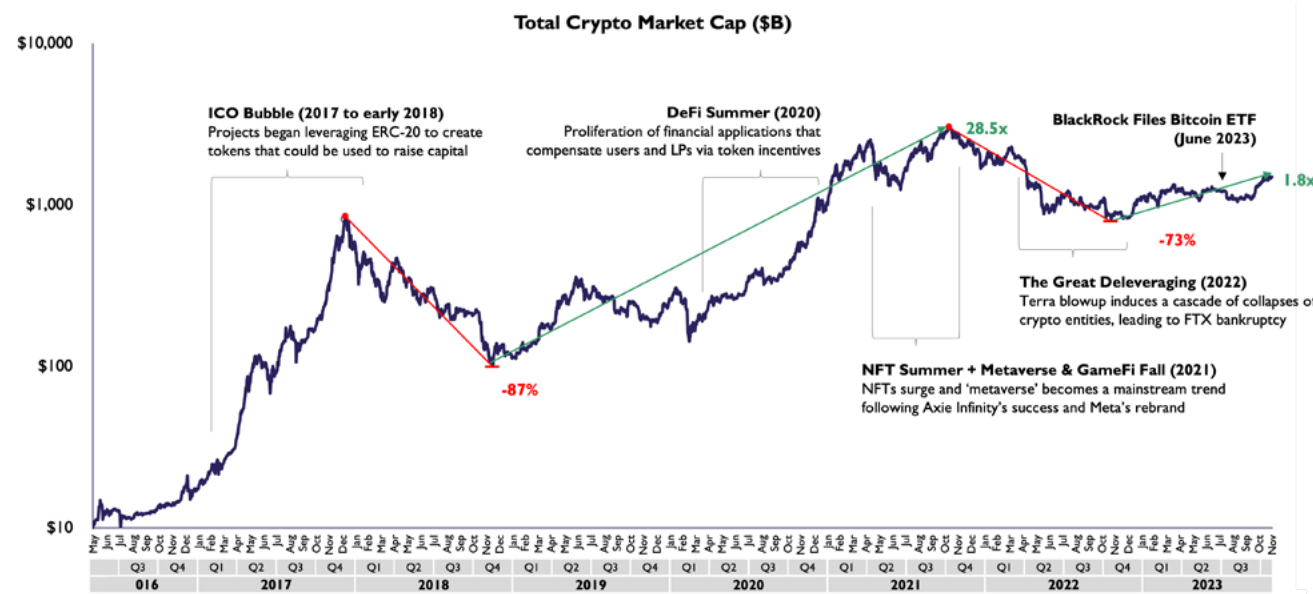
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This section assesses the crypto sector through the lens of the markets assets trade on. First, this section highlights the performance of 2023 asset prices in the context of broader crypto market cycles and macroeconomic conditions. Then, we analyze the activity across the centralized, decentralized and private markets that investors use to gain exposure to crypto as an asset class. Throughout, we contrast the current market environment to prior years and cycles to contextualize the state of the industry.

In 2023, cryptocurrency prices showed strong performance with total crypto market capitalization doubling over the course of the year. This year, prices were uniquely impacted by macroeconomics and the broader institutionalization of the asset class. Additionally, the broader '4-yr crypto market cycle' pattern remains intact as cryptocurrencies have seemingly moved into a new market cycle following the spectacular final throws of the Covid bubble bursting last year.

Dynamics within the venues on which investors seek exposure have also evolved over the past year. Across centralized crypto exchanges (CEX), emerging decentralized exchanges (DEX), derivatives venues, and private markets such as venture capital, private equity and M&A, markets generally see much less activity than the past two years and allocators have slightly altered tendencies.

# PRICE PERFORMANCE

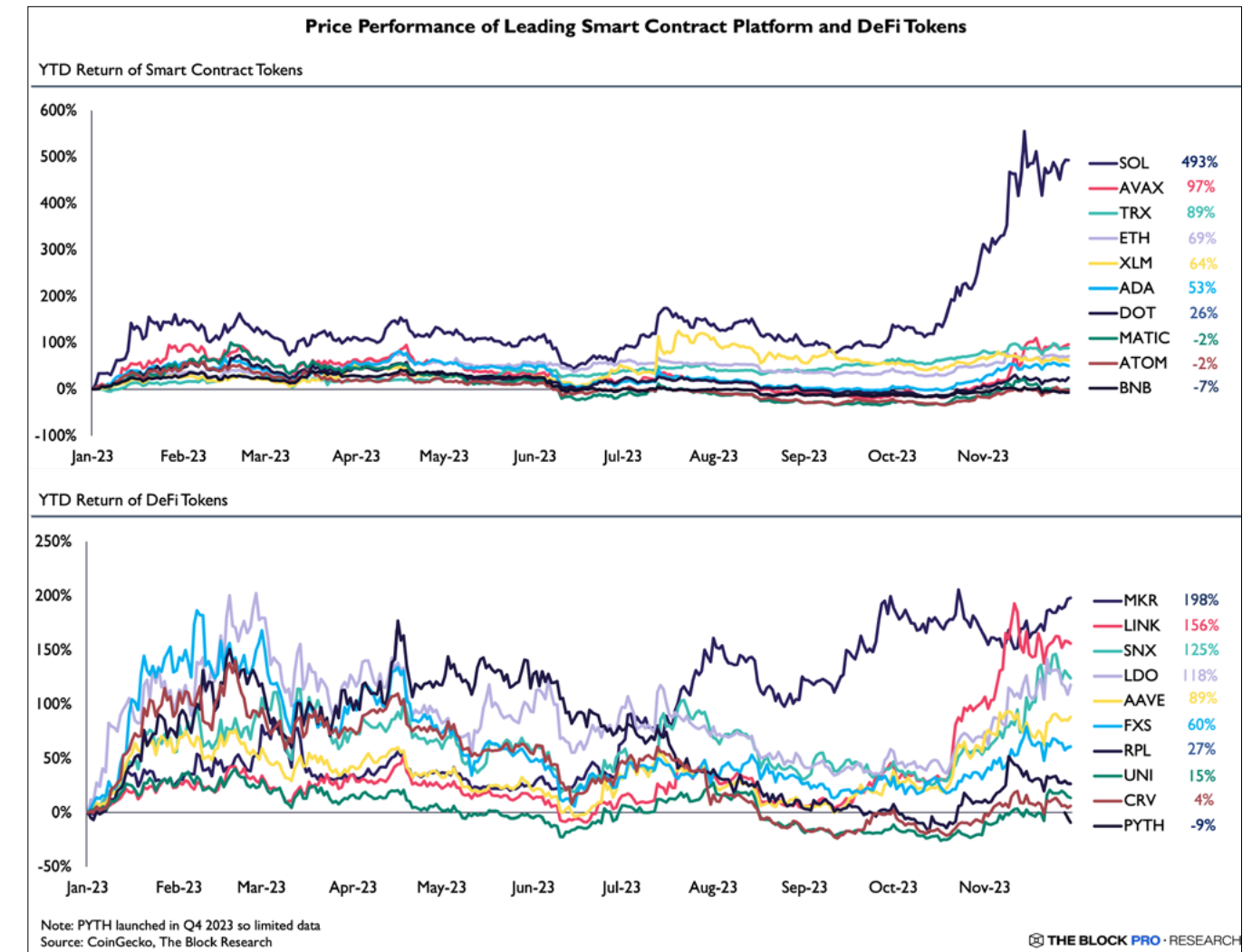


Sources: CoinGecko, The Block Research

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The cryptocurrency market is no stranger to periods of intense speculative fervor, followed by 70-90% drawdowns, then followed by rebirths of interest and activity. Despite suppressed trading volumes and venture capital dollars in 2023, broader cryptocurrency prices have appreciated significantly. Specifically, the total cryptocurrency market has increased from \$840 billion to \$1.6 trillion from January to December of 2023.

Much of those gains came in the first and last quarters of the year. In January, the cryptocurrency market lifted off of cycle-lows set in November 2022 following the bankruptcy of FTX, the final act in the great deleveraging of centralized crypto lenders and trading firms that characterized 2022. March featured the banking crisis, which briefly impacted crypto markets before BTC hit \$30,000 in April for the first time since just after Terra's collapse a year prior. During the middle of the year, BTC moved somewhat sideways around the \$25,000 - \$30,000 mark while new memecoins saw a summer rally. Then in late October, the market gained more serious momentum, and has so far sustained itself with BTC crossing \$40,000 at time of writing in early December.

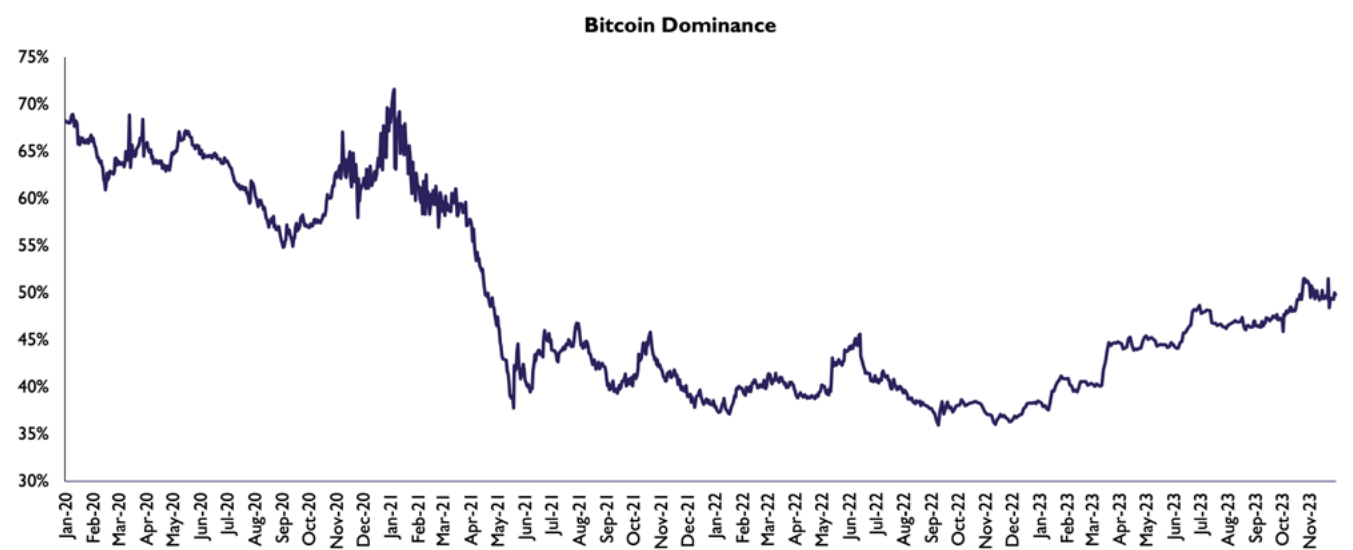


Asset	Price	Price Performance YTD	Price Performance 6mo	Price Performance Q4	YTD Spot Volume
BTC	\$37,711.82	127.99%	38.42%	39.83%	\$2.6 tr
ETH	\$2,051.76	71.46%	9.45%	22.79%	\$837.4 bn
SOL	\$59.18	494.18%	184.25%	176.67%	\$141.9 bn
XRP	\$0.61	78.14%	16.65%	17.54%	\$233.1 bn
UNI	\$5.95	15.31%	18.53%	33.41%	\$10.9 bn
AAVE	\$98.23	89.16%	53.75%	45.53%	\$13.2 bn
MATIC	\$0.76	0.37%	-14.87%	42.98%	\$60.9 bn
OP	\$1.67	82.06%	20.14%	24.63%	\$30.1 bn
ARB	\$1.01		-13.68%	11.30%	\$53.8 bn
LDO	\$2.35	146.90%	11.90%	38.24%	\$19.1 bn
BNB	\$227.60	-7.73%	-25.87%	6.01%	\$71.6 bn
OKB	\$56.33	116.32%	22.59%	31.18%	\$3.8 bn

Source: CoinGecko, The Block Research

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For the most part, crypto asset prices fared well this year across the board. Bitcoin is up over 125% year-to-date and most other crypto assets are higher than where they were on January 1st. While this is partly due to a low floor set by a poorly performing 2022 and changing macro conditions in 2023, this also featured its own unique positive tailwinds. Notably, October marked the kickoff to a big resurgence in the crypto market, which seemed to be triggered by optimism for a spot bitcoin ETF and bullish sentiment spurred by speculation that The Federal Reserve was done raising rates. Tokens of all facets performed well through the resultant rally. Solana, in particular, is up over almost 500% year-to-date after running up from under \$10 at the start of January to \$65 in November. SOL was one of the tokens hardest hit in the FTX fallout due to its ties to Sam Bankman-Fried, but enthusiasm coming out of the Solana Breakpoint Conference seemed to help turn things around. Tokens for DeFi protocols, exchange tokens, layer 1 and layer 2 tokens also posted large gains for the year, most of which were concentrated in Q4 after October kicked off the recent price action.



Source: Coingecko THE BLOCK PRO RESEARCH

Bitcoin was a big winner this year, with its dominance (defined as bitcoin market cap divided total crypto market cap) growing from 38.43% at the start of the year to 51.13% at its yearly peak at the end of October, which was the highest it's been in over two years. There are several factors that contributed to bitcoin's rise. For one, the most bullish crypto narrative of 2023 centered around a likely approval for a spot ETF for the asset, a saga that has lasted through the second half of the year. Some of this dominance can also be attributed to stablecoins, which experienced an overall decline in market cap, falling from \$138 billion on

January 1st to around \$126 billion at the start of December. While some of this decline is due to challenges faced by USDC and BUSD, we will also later discuss additional potential macroeconomic explanations for the puzzling drop in stablecoin supply amid a market wide rally.

CRYPTOCURRENCY AND THE MACRO ENVIRONMENT

This year more than most, macroeconomic factors and resulting monetary policy had clear impact on the cryptocurrency sector. While multiple cases of fraud exacerbated market turmoil, the initial sharp decline in cryptocurrency prices starting in late 2021 and ensuing 'great deleveraging' spanning Terra's May 2022 collapse and FTX's November 2022 bankruptcy were triggered by rising rates. Similarly, the degree to which cryptocurrency prices lifted off their 2022 lows throughout the past year maps to the improving macroeconomic landscape and appetite for risk assets.

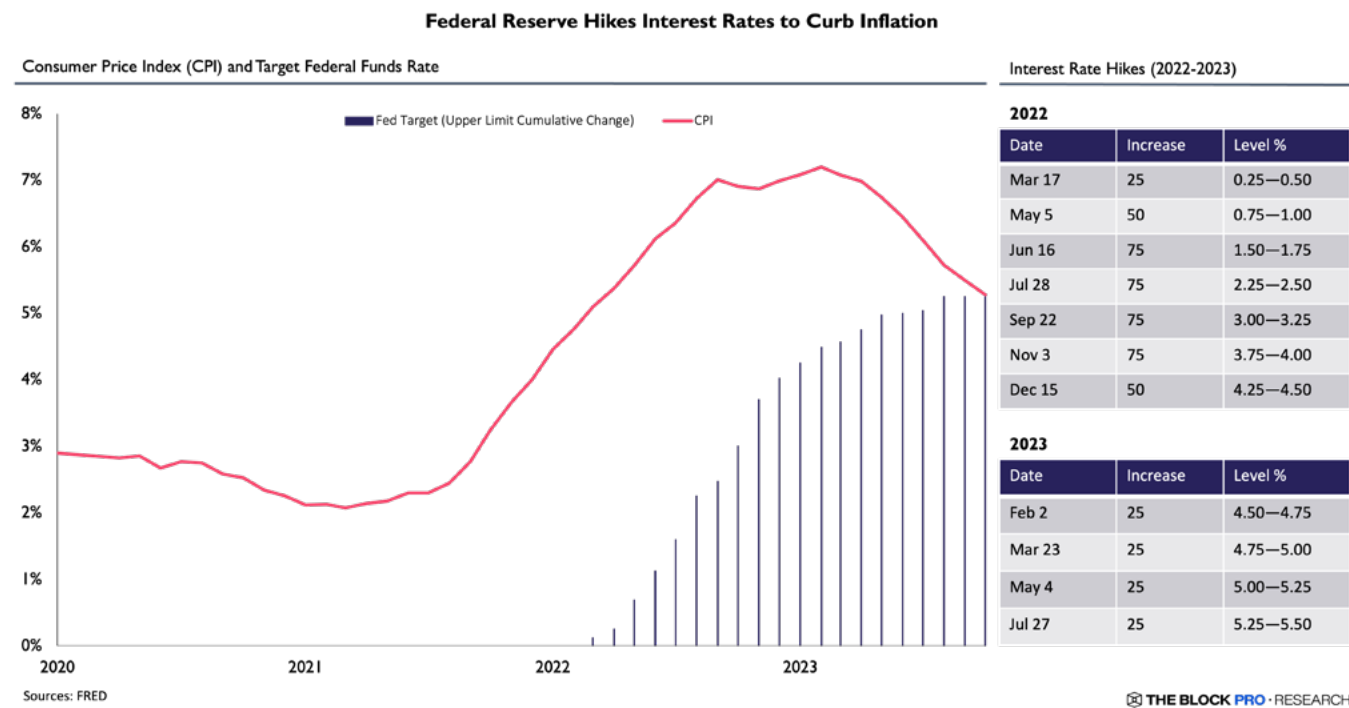
2023 was a year of positive surprises from a macro perspective following headwinds throughout 2022 that depressed not just cryptocurrency prices, but also the broader economy. In 2022, although the US did not fall into a recession, markets responded negatively to slowing global growth, fiscal and monetary tightening in response to persistent inflation, and an energy supply shock resulting from the Russia-Ukraine war. As described in more detail below, the overall liquidity situation set by monetary policy appears to be among the key drivers of 'risk-on' assets like cryptoassets. In 2023, the macro picture was much stronger. Global GDP growth beat consensus forecasts amid positive factors including strong real household income growth, a recovery in manufacturing activity, a smaller drag from monetary and fiscal tightening, and slowing inflation.

IMPACT OF MONETARY POLICY ON CRYPTO MARKETS

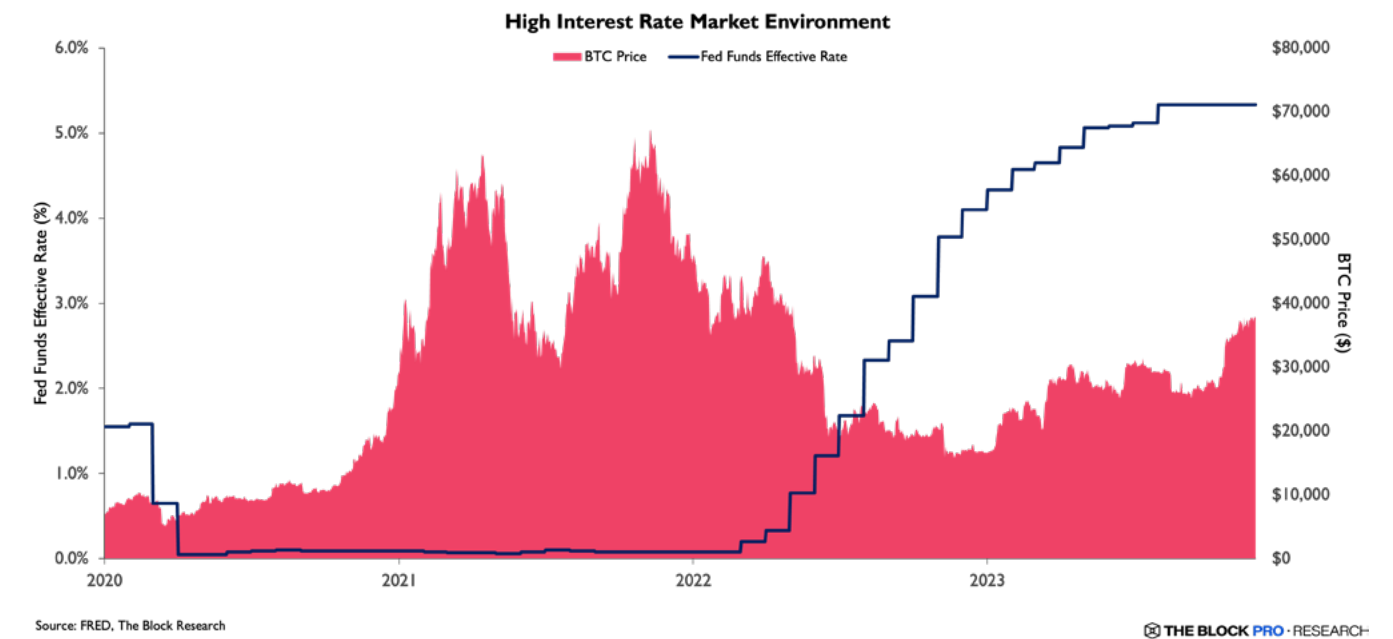
In response to the Covid-19 pandemic, the Fed lowered their target federal funds rate throughout 2020 and into 2021 to a range between 0 and 25 basis points. Its aim was to help the slowing economy by reducing the cost of borrowing, which helped to boost consumer spending and maintain liquidity and stability in the financial markets. Notably, cryptocurrencies surged throughout 2020 and 2021 to record highs during the resulting speculative mania.

Although these low interest rates helped buoy the economy, it also caused inflation to rise far beyond the Fed's target inflation rate of roughly 2%, reaching over 7% towards the end of 2022 and into 2023. The surging inflation can also be attributed to a combination of additional factors including supply chain disruptions, higher energy prices, higher consumer spending, and the continued effects of monetary and

fiscal stimulus. Given the recovery of the global economy in 2022, the Fed started raising the federal funds rate target range to move inflation back towards the Fed’s target level of 2%.



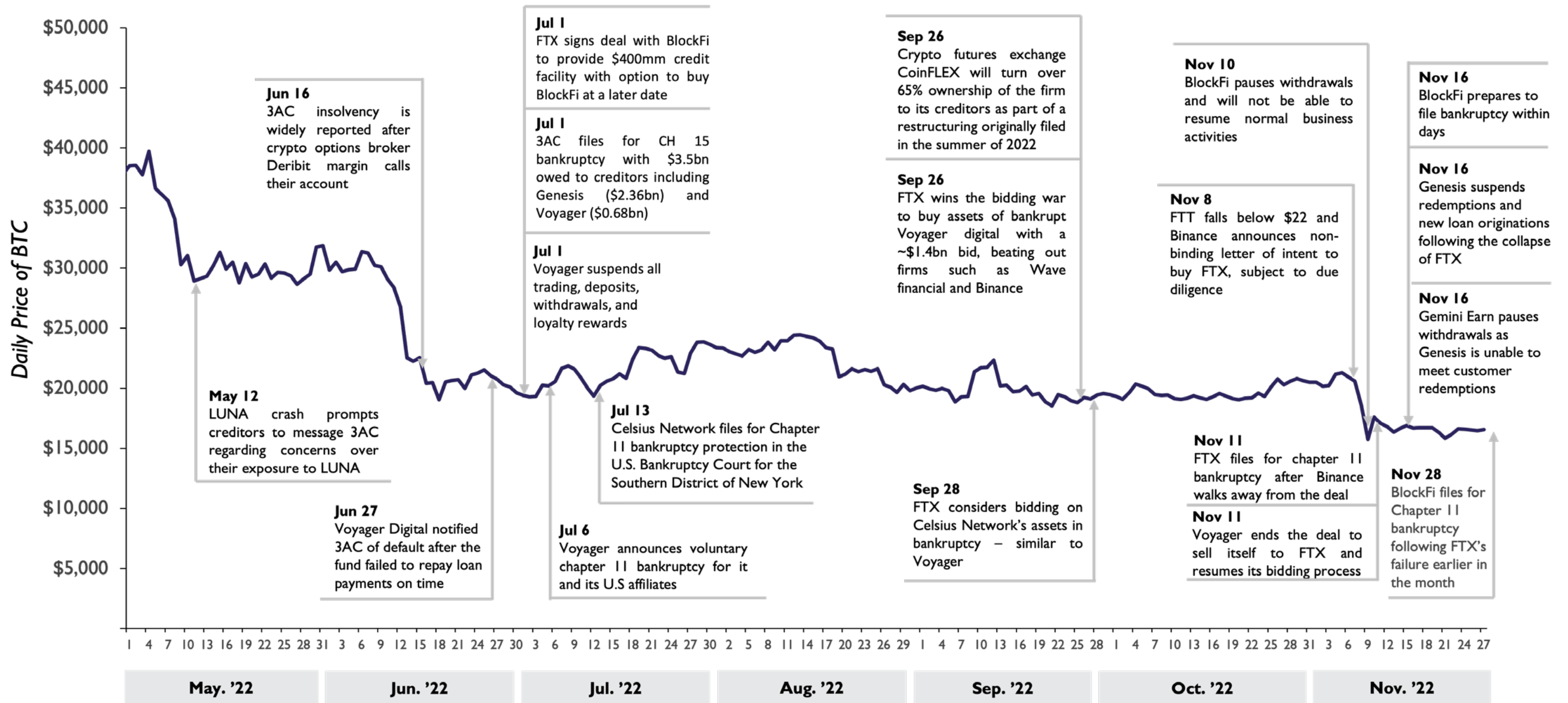
The increase in the effective federal funds rate largely ended the speculative frenzy of 2021 and early 2022. The Fed made 11 rate hikes starting in the first quarter of 2022 to bring the target range from 0-.25% up to 5.25-5.5%. These rate hikes contributed to lower asset prices as the cost of capital increased, economic growth slowed, and eventually, overleveraged companies were exposed. Specifically, a higher interest rate environment was a catalyst for the eventual collapse of centralized crypto lenders and exchanges in the latter half of 2022 and multiple high-profile U.S regional banks in the spring of 2023.



Several crypto protocols and companies weren’t prepared for the depressed asset prices and reduction of speculative activity that would begin at the beginning of 2022. In particular, many funds took on excessive leverage to participate in the Terra trade and other seemingly ‘free money’ strategies such as the GBTC arbitrage, leading to mass insolvencies across these funds and the lending desks financing their trades. The Fed started raising rates on March 17th 2022, preceding the collapse of stablecoin protocol, Terra, in May. The bankruptcy of FTX marked the culmination of this deleveraging in November 2022, with cryptocurrency prices seeing lows in the following weeks. Total crypto market capitalization dropped by over 65% in 2022 to settle at roughly \$828B, setting a lower base moving into 2023.



### The Great Deleveraging



Sources: Company Filings, The Block Research

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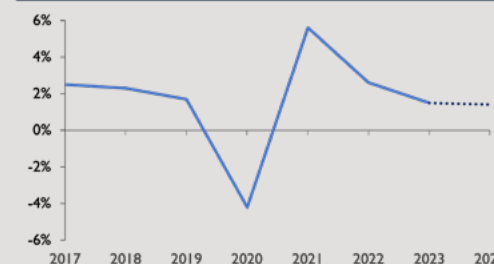
# CASE STUDY: GLOBAL MACRO OUTLOOK

Despite various financial market dislocations resulting from a higher interest rate environment and rising geopolitical tensions, 2023 generally presented a stronger macroeconomic environment than in 2022.

These positive economic developments all came despite several unanticipated challenges, further highlighting the market's resilience in 2023.

- First, both short and long-term interest rates rose significantly further than the market's expectations. This was partially due to better-than-expected growth data but also partly due to more hawkish central bank policy earlier in the year.
- Second, geopolitical tensions, evidenced by ongoing conflicts in Eastern Europe and new escalations in the Middle East, presented additional uncertainties. While these events have not significantly rattled financial markets to date, they serve as a crucial reminder of the underlying geopolitical risks that persist in the global economic landscape.
- Third, there was a brief but concerning phase of U.S banking sector instability in the spring of 2023 that highlighted underlying vulnerabilities within the financial system and prompted increased regulatory focus.

Annual GDP Growth – Advanced Economies



Global GDP growth beat consensus forecasts amid positive tailwinds including strong real household income growth, a recovery in manufacturing activity, a smaller drag from monetary and fiscal tightening, and slowing inflation. Specifically, global real GDP growth is on track to grow 3% in 2023, 1.3% higher than the Bloomberg consensus forecast of a year ago. Additionally, US growth is expected to reach 2.4%, a full two percentage points above the consensus forecast of the previous year. The outperformance in GDP growth has buoyed investor optimism through higher corporate earnings expectations and lower recession risk.

Unemployment Rate – Advanced Economies



Strong GDP growth has translated into normalized labor market performance. The unemployment rate across advanced economies continued to decrease throughout 2022 and 2023 from the peak in 2020. The unemployment rate has dropped below pre-pandemic levels signaling a healthy economy with strong drivers for higher consumer spending and corporate profitability.

Weekly Real Earnings – United States



The supply-demand balance in the labor market continues to improve with the number of job openings falling to align more closely with the number of unemployed workers. Job openings have declined from 2022 without a rise in unemployment which has contributed to nominal wage growth starting to slow back towards target-consistent levels. Along with lower inflation expectations, this slower wage growth suggests that it's unlikely we'll experience any lasting second-order effects from the earlier surge of inflation.

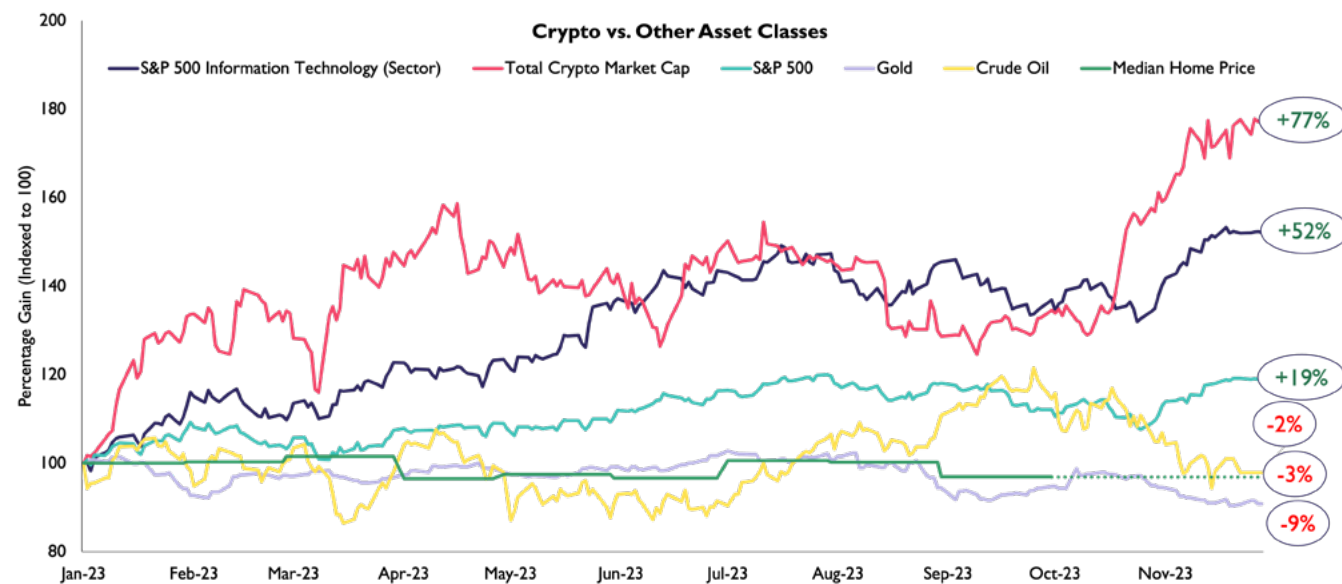
Inflation Rate – Advanced Economies



The global economy has not only seen unexpected gains in growth and employment throughout 2023 but has also experienced a significant reduction in inflation, which spiked due to post-pandemic price surges. Since 2022, the inflation rate among advanced economies has more than halved, falling from 7.2% to 3.3%. Central banks are more than three quarters of the way towards bringing inflation back to target levels. Investors expect that the reduced inflation in 2023, enabled through rate hikes and easing of pandemic-related supply chain pressures, will likely continue through most of 2024 to bring inflation back to target levels.

Sources: IMF, FRED, The Block Research

Aside from the resulting periods of instability across markets including mass carnage within the crypto sector, the higher interest rates set by the fed have relatively successfully curbed inflation, with disinflation projected for 2024. In light of current projections, it is anticipated that interest rates will maintain in a relatively elevated position, with prevailing market consensus suggesting a potential decrease in the federal funds rate of no more than 100 basis points by the end of 2024. In spite of the likely continued high interest rate environment, the crypto market has performed remarkably well in 2023 and has several positive tailwinds moving into 2024. These include a robust economic landscape, a tempering of inflationary expectations, and the prospective catalyst of a spot Bitcoin Exchange-Traded Fund (ETF) potentially drawing significant institutional investment.



Sources: The Block Pro, S&P Global, Bullion Vault, Macro Trends, FRED

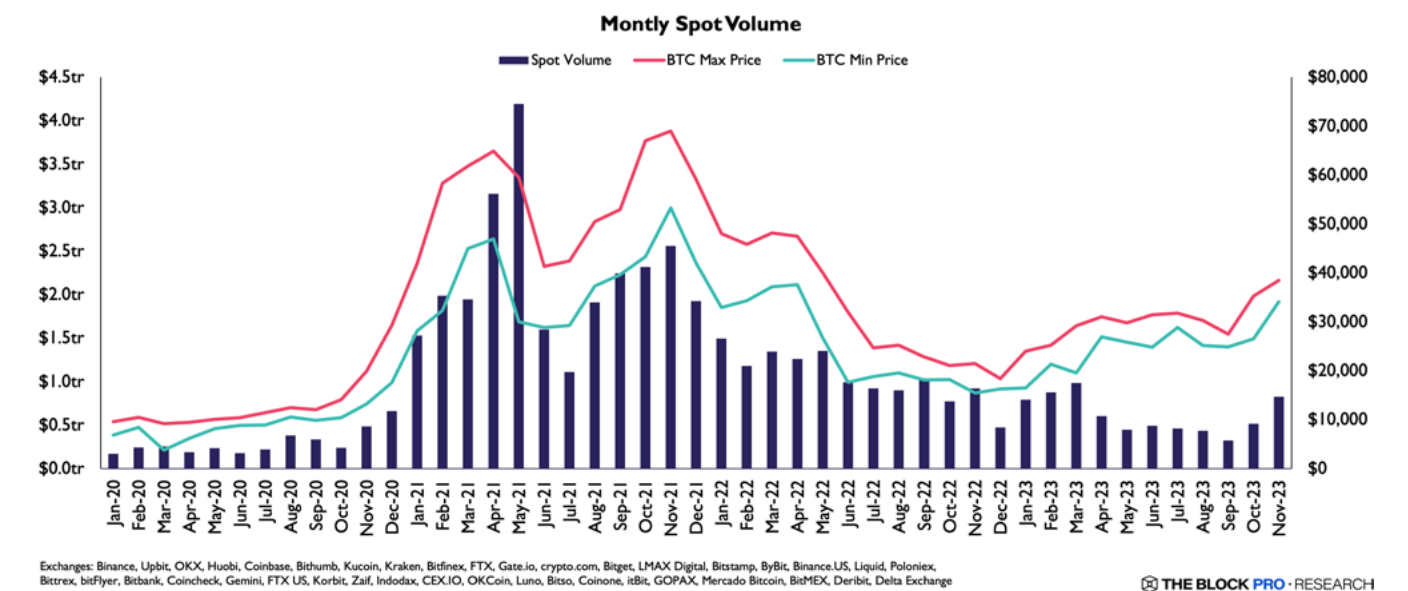
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Specifically, crypto has outperformed other asset classes throughout 2023 registering a 57% gain year to date. The S&P 500 Information Technology index notched the second highest percentage gain at 35% with other asset classes gaining 10% or less. For most of the year, crypto and the tech sector index have tracked fairly closely, with much of crypto's recent separation stemming from Bitcoin gains in October following institutional enthusiasm for spot Bitcoin ETFs. These periods of correlation suggest that crypto often acts as a growth tech stock with higher beta. However, it has been interesting that both crypto and the broader technology sector grew increasingly uncorrelated with broader equities markets. While this

year's data tells a different story from that of 2022, the relevance of macroeconomic and growth trends signal that crypto continues to mature as a more diverse set of market participants gain exposure to the asset class.

## MARKET ACTIVITY

### SPOT MARKET TRADING DYNAMICS



Exchanges: Binance, Upbit, OKX, Huobi, Coinbase, Bithumb, Kucoin, Kraken, Bitfinex, FTX, Gate.io, crypto.com, Bitget, LMAX Digital, Bitstamp, Bybit, Binance.US, Liquid, Poloniex, Bittrex, bitFlyer, Bitbank, Coincheck, Gemini, FTX US, Korbit, Zaiif, Indodax, CEX.IO, OKCoin, Luno, Bitso, Coinone, itBit, GOPAX, Mercado Bitcoin, BitMEX, Deribit, Delta Exchange

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By the end of 2022, the insolvencies of multiple lenders had contracted credit within the crypto ecosystem while FTX's fraud shattered outsiders' confidence of crypto as an asset class. It's unsurprising that market activity continued to dwindle for most of the year relative to the exuberance of 2021, with volumes now starting to build again following rising prices and investor confidence.

Looking first to spot volumes, Q1 of 2023 actually marked a slight reprieve. After FTX's collapse shrank crypto enthusiasm and caused asset prices to falter, volumes dropped to around \$473 billion in December 2022, the lowest they had been in over two years. But January, February, and March all showed month-over-month rises in spot volume. Monthly volumes for 2023 (excluding December) peaked in March at just under \$983.8 billion, meaning that the \$1 trillion threshold was never regained in 2023. For comparison, every month from January 2021 to May 2022 hit the 13 digit level. One cause for heightened volume and

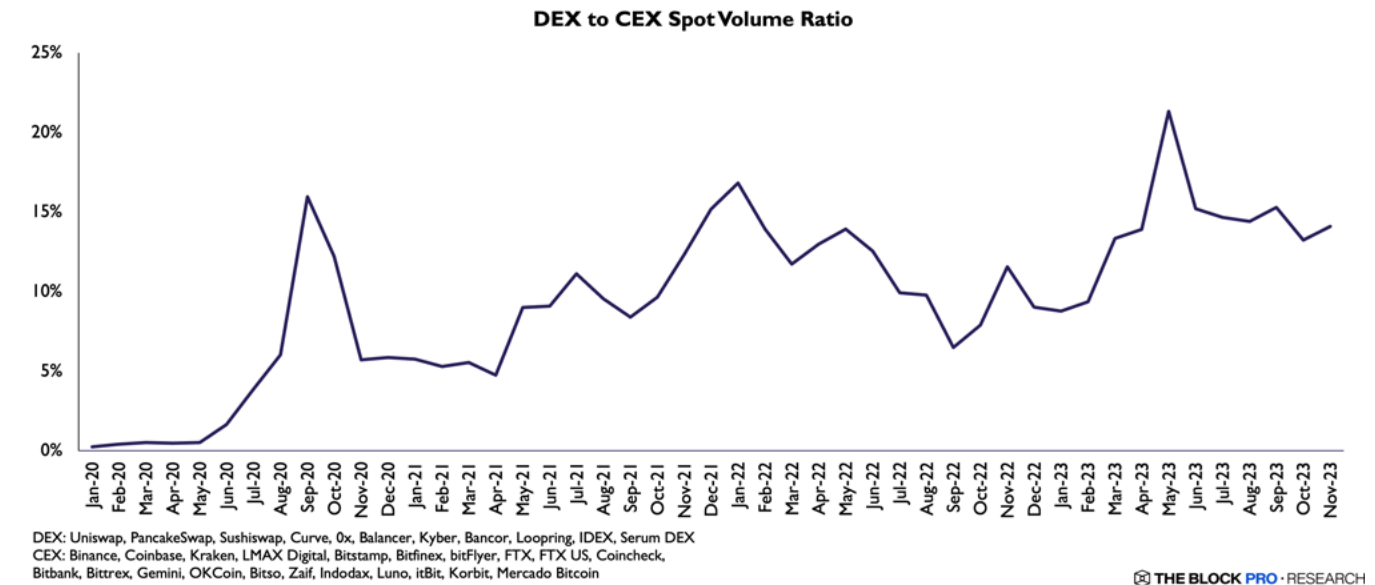
volatility in March was the panic trading that took place throughout the brief depeg of USDC amid the broader US banking crisis. While many crypto assets faced a dip in value when USDC lost its parity, most rebounded and finished March in the green.

From April to September, volumes consistently came in below \$500 billion, with September marking the low point for the year at \$323.76 billion, the lowest volumes had been since October 2020. Crypto's total market cap moved from \$1.13 trillion on March 1st to \$1.24 trillion on March 31st (despite dropping to \$973 billion in between), so it was interesting to see Q2 and Q3 volumes fall off so significantly since the depeg did not leave a lasting scar. But one thing that also dropped after March was volatility. The 30-day annualized volatility fell from over 70% at the end of March to 15.5% in August, the lowest its been since at least 2017. Conversely, volatility climbed from 25% in January to that March peak. The major catalyst for bitcoin and broader crypto prices between March and August were the June bitcoin ETF filings of BlackRock and a group of other reputable firms, which pushed BTC from under \$26,000 to around \$30,000 at the end of Q3. It does make sense that a period of low volumes would be met by a period of low volatility since less trading activity leaves less room for prices to fluctuate. Besides the first three months of the year, the only other months to show an increase in spot volumes compared to the year prior were June, October, and November, which were also both months where volatility increased, and months where you can see increased disparity between the high and low prices of bitcoin.

While Q4 is still playing out, volumes have been on a sustained rise, reaching a 6 month high in November and bitcoin prices hitting \$40,000 as of writing in December. This marks the highest bitcoin price since the collapse of the Terra stablecoin in May 2022, which was a primary catalyst of the credit crunch that plagued the market in 2022.

While an overall less active market was certainly the primary cause of depressed volumes in 2023, a large contributor was also a shakeup in the fee mechanism at the world's largest crypto exchange, Binance. Specifically, in March, Binance ended a zero-fee promotion that drove massive volumes on the platform throughout 2022 and helped cement the exchange's dominance. Between March and April, overall spot volumes dropped 38%, while Binance saw spot volumes diminish by 47% over the same period.

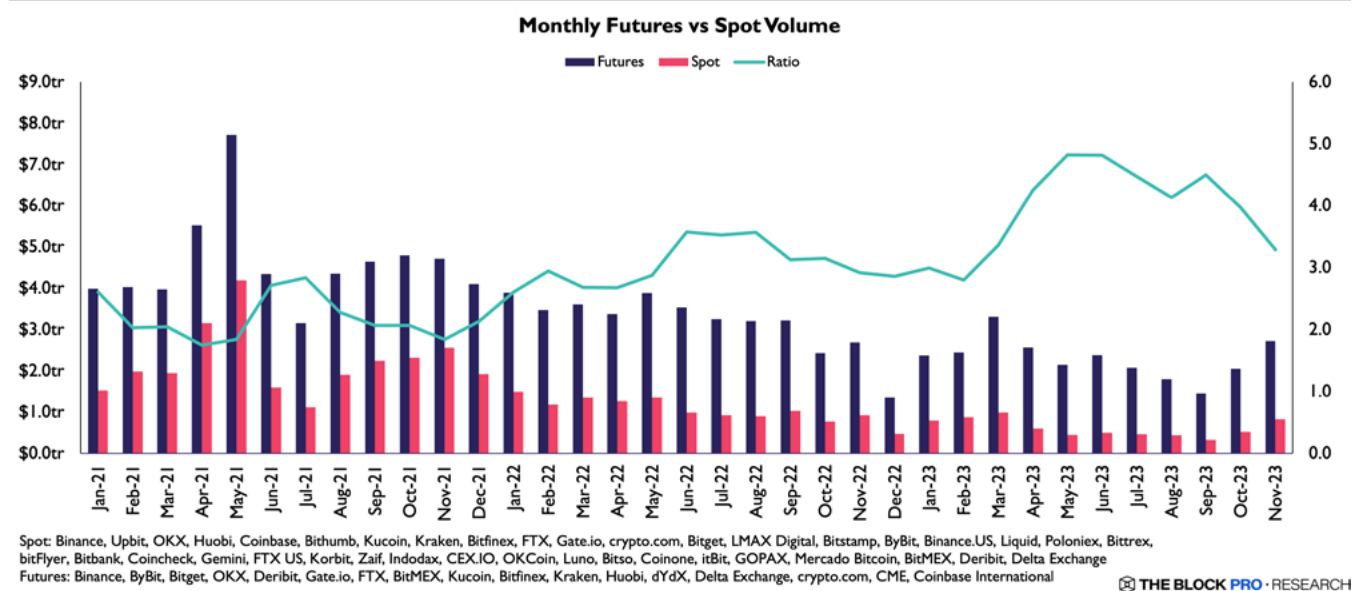
## DECENTRALIZED EXCHANGES



One area of the crypto space that was expected to break out in 2023 was decentralized exchanges. After the collapse of FTX many people became more distrustful of centralized institutions and realized the value of self-custodying their assets. To many this signaled that DEXs were going to be extremely successful this year as people came to appreciate the transparency associated with them. And the ratio of DEX volume to CEX volume did hit a peak of over 21% in May this year, but that was primarily driven by the memecoin mania seen during that month. Given interest was primarily on new coins that would naturally be first traded on DEXs and more slowly added to CEXs, traders satisfied their speculative highs on these decentralized venues. The ratio did stay elevated after the frenzy, coming in over 13% in June through November after sitting below 10% for months earlier this year. One factor to consider, though, is the pronounced drop off in CEX volumes caused by Binance's fee shift. After March, it would make sense for the ratio to pop up.

March was the highest month of volume for DEXs, much like CEXs, also because of panic trading caused by the USDC drama. Since a lot of USDC was held natively on-chain and traders could also use USDC to mint DAI, a lot of the fallout happened outside of CEXs. So March also marked a strong month for the ratio at 13.34%, marking a big turnaround from the 9.35% in February. DEX share also likely plateaued in Q4 as large caps traded on CEX dominated price movements following the bitcoin-ETF hype driven rally.

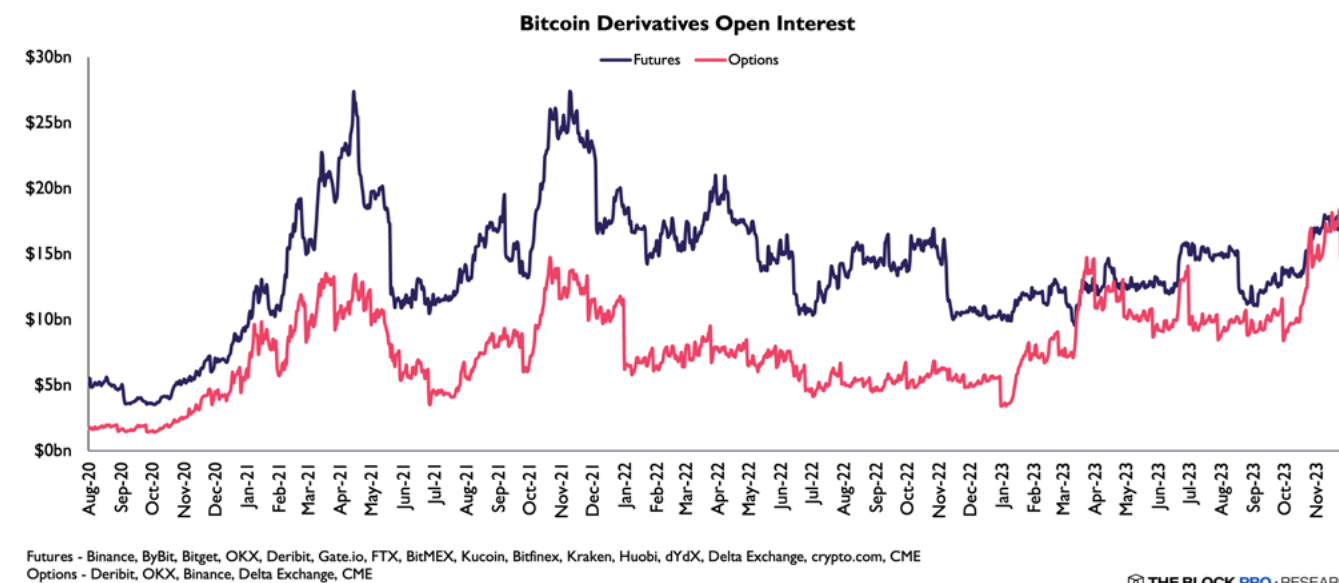
DERIVATIVES



Looking now at the derivatives space, the trends are largely similar to spot. Total volumes across futures contracts for this year peaked in March and hit a low in September, although volumes on the futures front consistently managed to stay higher than the lows of December 2022. The magnitude of the decline coming out of March was also much less pronounced since there was no impact from the fee controversy.

This, in turn, pushed up the ratio of futures volume to spot volume during the year, with futures reaching 4.7x spot in terms of volume in both May and June. The ratio began to decline a bit in the later part of the year but still remains quite elevated compared to the two years prior.

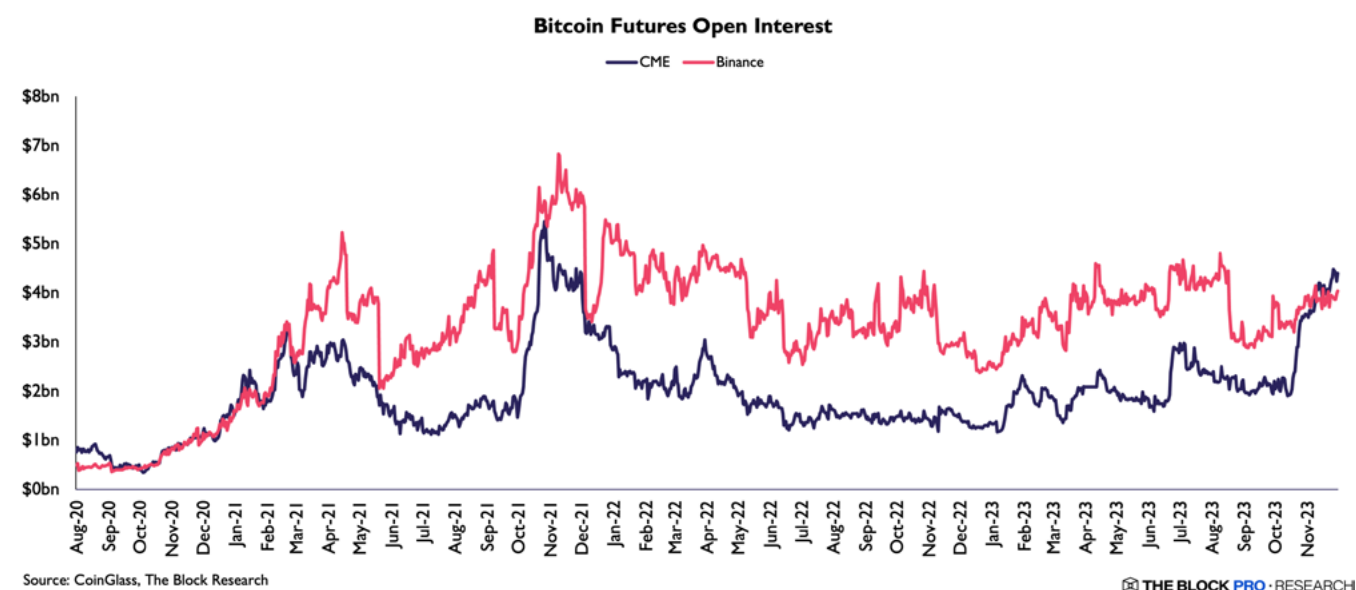
On the open interest front, there is some contrast between futures and options. Looking specifically at bitcoin contracts, since a total aggregate isn't a fair comparison between the two due to the limited number of assets and venues to trade options on, there has been a bit of a recent surge in options activity. On January 1st of this year, bitcoin options open interest across exchanges was only \$3.63 billion, and it climbed to a new all time high of \$17.5 billion in November of this year. Options seemed to get a real jolt in October, as OI more than doubled between the day after September contracts expired to when October contracts expired.



Bitcoin futures open interest for the year also grew but not by quite as large a margin. On the first of the year open interest was \$10.15 billion and climbed to a peak of around \$18.5 billion in November. Futures open interest on bitcoin contracts was, for the most part, trending upwards for the year until a massive sell off in August hit both the crypto market and the broader investment ecosystem as a whole as concerns about taming inflation mounted. Over \$3 billion in open interest was wiped out in one day. That being said, futures open interest recovered from the drawdown and reached the highest it had been since April 2022.

The recent run up in options open interest could be tied to more volatility being expected in the market. Implied volatility (which is a measure of the market's predicted volatility for an underlying asset) for bitcoin options expiring at all expirations has been rising since October, around when the recent crypto rally began. Implied volatility is used to help price options, with higher implied volatility leading to higher priced options since it means a contract has a higher chance of expiring in-the-money. And it does make sense that a rise in IV broke out in the later part of the year as a decision or delay for spot bitcoin ETF approval all have the power to move bitcoin's price. The broader bullish sentiment also plays into the increased IV after it seemed like the U.S. Federal Reserve was done raising interest rates following a no change decision in November and a cool October CPI number, which sparked a surge in all types of investments.

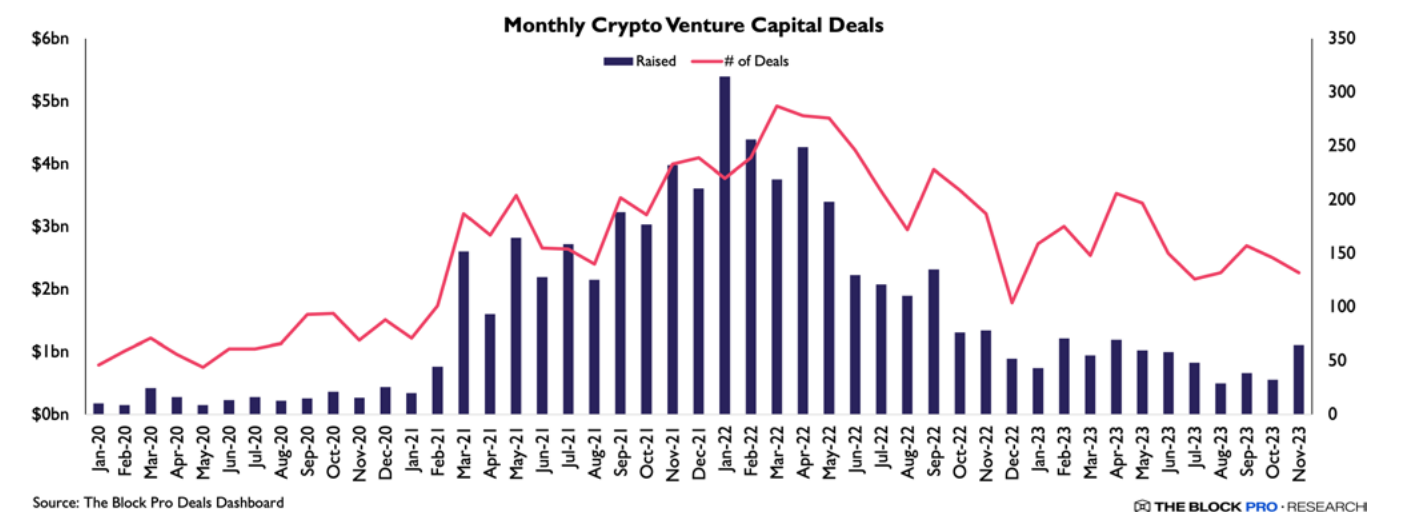
The fact that open interest fell by \$3.6 billion in November actually highlights the recent preference for higher volatility short-term options. Given options have expiry dates unlike perpetual futures (“perps” are far more common in crypto than dated futures), open interest is generally spikier with open interest drop offs at time of expiry. Usually, the most active expiries are year end (December), half year (June) or quarterly (December or June, along with March and September). The November drop-off reflects open interest that expired on Deribit’s November 24th contract (\$4.04B). While less than the ongoing December contract (\$6.15B) or June 2023 (\$4.83B), it is higher than the March 2023 or December 2022 contracts, and higher than any of the other non-quarterly contract all year.



One exchange that fared particularly well this year was the Chicago Mercantile Exchange, or CME. CME, regulated by the U.S. Commodity Futures Trading Commission, offers bitcoin and ether futures contracts. Unlike most crypto-native derivatives platforms, CME does not offer perpetual contracts (ones without an expiration date), which dominate the crypto futures market. CME also attracts more sophisticated, often institutional, traders. For investors looking to gain exposure to crypto in a compliant manner, CME derivatives are an attractive option. And bitcoin futures on the exchange thrived this year, with open interest climbing to over \$4.6 billion in November. Notably, that made CME the largest exchange in terms of bitcoin futures open interest, surpassing the futures giant Binance. This inversion signaled a shift in crypto clientele, indicating that institutions were eager to enter the scene again after many exited in 2022. CME saw open interest really surge in October, when a spot bitcoin ETF seemed on the horizon. The

broader expansion and approval of bitcoin adoption could have helped serve as a catalyst for institutions warming up to crypto again. Of course, bitcoin seems to be the main asset of interest. On the ether futures side, CME recently crossed into the top five exchanges by open interest, but it's \$564 million on December 1st pales in comparison to Binance's \$2.2 billion.

## PRIVATE MARKETS

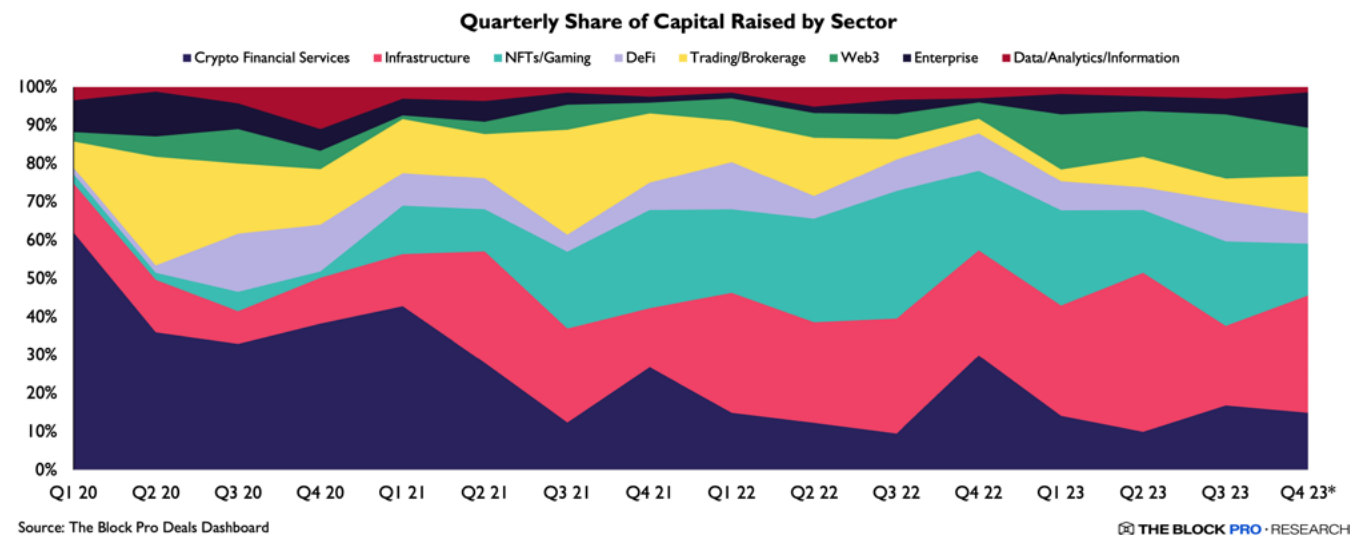


Moving over to the private markets, there was definitely a slowdown in both the number of venture capital deals being done as well as amount of capital being raised. Still, the yearly low of 124 deals announced in November was still higher than the 104 deals announced in December 2022, showing that deal count did manage to stay relatively stable. The number of deals done was consistently higher than monthly deals in 2020 and stayed pretty close to the number of deals done in 2021.

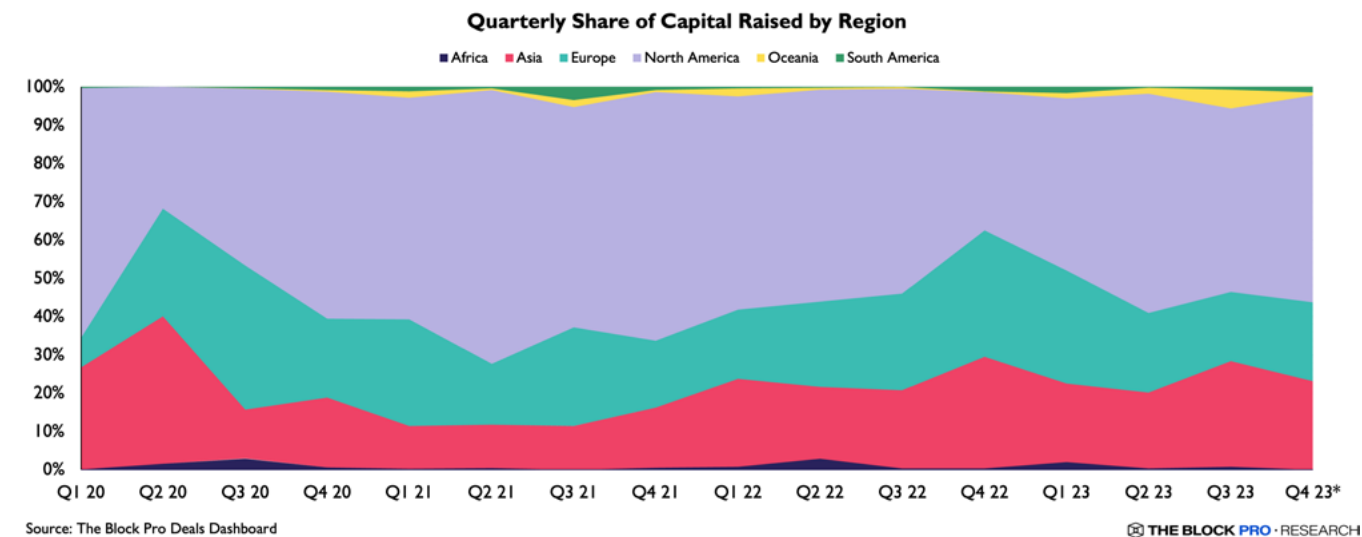
Conversely, in terms of actual amounts being raised by companies, the yearly low of \$498 million in August did mark the lowest aggregate value raised since January 2021, another metric that dropped to levels not seen since pre-bull market. Venture funding has also not rebounded much since hitting that low, unlike most other metrics that began to rise again in the recent rally. Funding is a lagged metric though, as deals take time to develop and close and dealmaking is often recorded from the time the actual deal took place, which is not always immediately announced. For example, much of the recent market activity is only now being reflected through November deal activity, which is up 99% MoM and marks a a six-month high for the sector .

In the broader context of venture funding for the blockchain sector, it's important to note that the total expected investment for the year is projected to reach \$10.6 billion, spanning across 1,749 funding rounds. This represents a substantial 68% reduction in investment compared to the previous year and marks a 35% decrease year-over-year in deal-making activity.

However, it's crucial to view these drawdowns through the lens of perspective. Despite the significant cooling of the VC markets from the historic highs seen in 2022, the investment in the blockchain sector this year has still outpaced other recent bear markets. To put this in perspective, during the previous bear cycle period from 2019 to 2020, a total of \$6.4 billion was raised over those two years. This amount pales in comparison to the funding allocated in the current year, indicating that, even in a less favorable investment climate, the blockchain sector has maintained a relatively robust level of funding.



Sectors that are being invested in are largely unchanged, although there was definitely an increase in the share of capital being allocated to web3 projects. And while investment in NFTs and gaming was still relatively strong in 2023, that market segment lost some dominance compared to 2022. Crypto financial services and infrastructure were two other prominent areas of interest, but the financial services sector is seeing a lot less action compared to 2021. Overall the distribution of the sectors which funds are going to look a bit more diverse compared to previous years.



Investment in crypto projects still tends to be heavily concentrated in North America. Europe and Asia are the other big regions to receive funds but very rarely is money raised in South America, Oceania, or Africa, which is also a side effect of not many crypto companies being based in those areas. North America lost a little of its dominance in 2023 though as more investment poured into Asia and Europe, but it is still the most powerful investment target.

# SECTION 2

## MARKET INFRASTRUCTURE & REGULATION

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This section provides an overview over the evolving landscape of infrastructure and services supporting the crypto industry. Given the scope is both crypto native venues and products, notably centralized exchanges and stablecoins, along with products, services and relationships with traditional financial players, notably banking services and structured products, we end with a review of applicable regulatory activity that impacts these entities' crypto activities.

Following the collapse of one of the largest crypto exchanges, FTX, the landscape of centralized venues was expected to shift considerably. In the beginning of the year, market share shifted towards players who made efforts to provide the type of transparency around reserves and assets that failed exchange, FTX, lacked. However, throughout the remainder of the year, market share diversified, primarily as a consequence of multiple challenges faced by market leader, Binance.

Meanwhile, the stablecoin market also experienced significant shifts in response to higher interest rates and increased regulatory scrutiny. Throughout 2023, several established stablecoins experienced depegging events that eroded their market share, while others were deprecated amid regulatory pressure. Tether has been the primary beneficiary of these shifts, growing its market share in 2023 to levels not seen since 2020, a time when the landscape featured far less competition. Meanwhile, new entrants flooded the market, drawn in by the more profitable business model enabled by higher treasury yields. Many corporates and central banks also marched forward with plans for stablecoins and Central Bank Digital Currencies (CBDCs) respectively.

On the traditional banking side, 2023 experienced several unexpected negative shocks including the brief but serious banking sector instability in the U.S and Europe during the Spring. These events highlighted growing regulatory pressure and institutional reluctance to service the crypto industry. Further, the bankruptcies of two crypto friendly traditional financial institutions, Signature and Silvergate, resulted in the winding



down of Signet and SEN, two pieces of critical payments infrastructure used by crypto exchanges and large market participants. While this report highlights multiple banks continuing - or beginning - to service the industry, broader scrutiny across regulatory bodies has created a form of 'shadow ban' of the industry that some have dubbed "Operation Chokepoint 2.0".

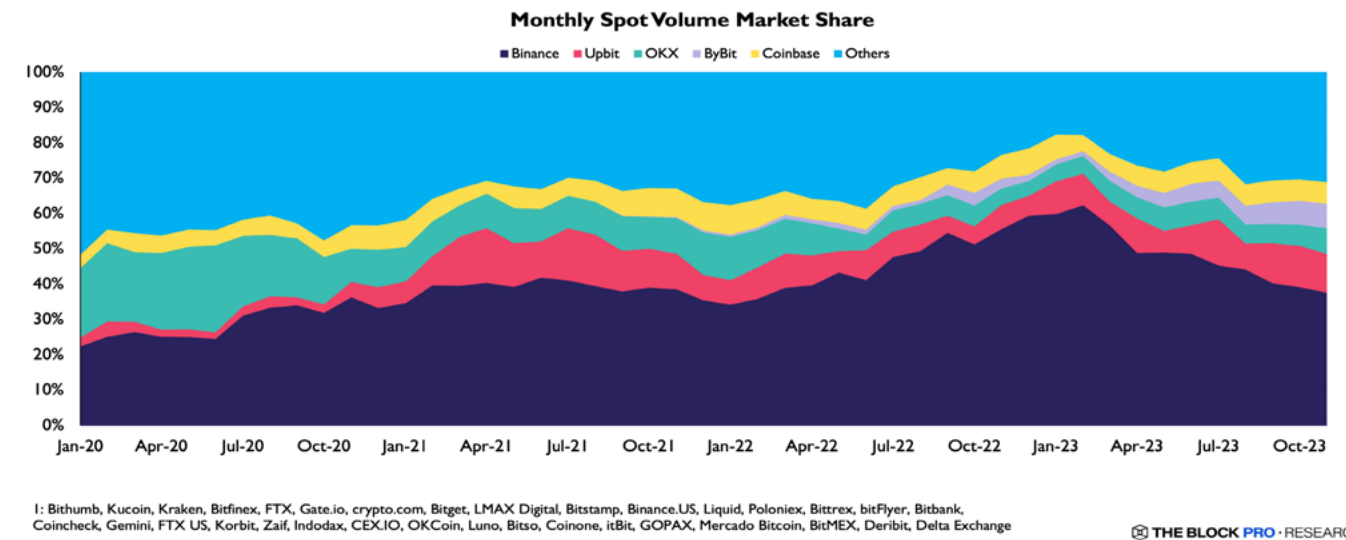
Not all traditional institutions shied away. 2023 had several positive signs of institutional adoption, marked most notably by a series of filings for spot Bitcoin ETFs from large asset managers. This wave of filings was kicked off by BlackRock's surprise application in June, signaling a shift towards mainstream acceptance.

Regulatory pressure intensified in 2023 following the collapse of several centralized firms in 2022. The US appeared to take a firmer stance against the industry than other jurisdictions with some, particularly in Asia, seeing the US pullback as an opportunity. However, the spurn of US regulators was mainly limited to enforcements and decrees; no meaningful regulation was passed, and judicial review of past SEC actions were interpreted as mildly favorable towards arguments made by the industry.

## EVOLUTION OF THE CRYPTO EXCHANGE LANDSCAPE

Crypto exchanges are an integral piece of the crypto ecosystem, with the top 10 centralized exchanges total trading volume reaching over \$40 trillion in 2022, an impressive figure, but still more than a 50% drop from the volumes reached in 2021. Although volumes have continued to drop in 2023, centralized exchanges provide enduring, if not a growing, number of functions to the crypto markets. Some of these include establishing and maintaining market liquidity, providing an on and off ramp for retail and institutional investors and providing a simple user interface for users who want to avoid the complexity of non-custodial wallets on-chain.

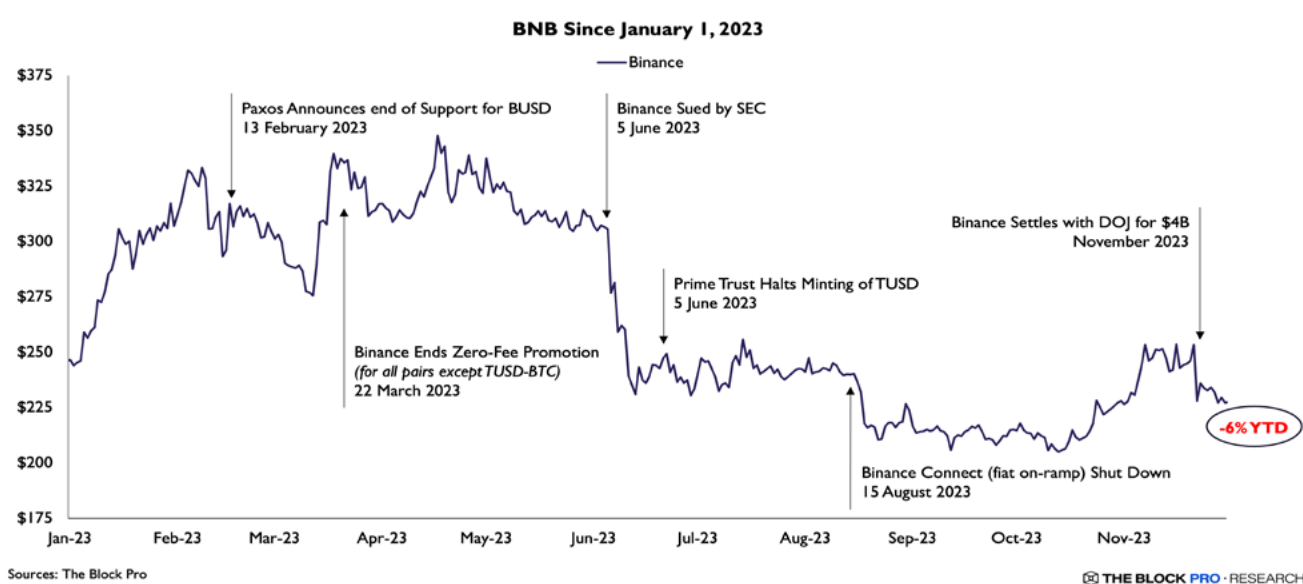
### STATE OF CRYPTO EXCHANGES POST-FTX



Following the collapse of FTX in November of 2022, market share started to concentrate towards large players and exchanges that were viewed as more secure and transparent. Initially Binance and Coinbase benefited, gaining a collective 8% market share between both exchanges in the months after FTX's collapse, while less transparent exchanges without proof-of-reserves such as Huobi lost market share over the same period. This led to a growing number of centralized exchanges issuing proof-of-reserves in an effort to increase transparency and gain market share.

Although transparency has remained important in the wake of the FTX collapse, the U.S banking crisis in

the spring of 2023 contributed to another important shift in the crypto exchange market. Amid the imminent bankruptcies of several U.S regional banks that heavily serviced the crypto industry, not to mention the recent memory of multiple crypto lenders and exchanges collapsing in 2022, regulators in the US ramped up scrutiny. Although the increased regulatory pressure led to charges for multiple crypto exchanges, Binance was clearly the focus of regulators' attention.



### BINANCE FUMBLES ITS LEAD, THEN BEARS THE BRUNT OF REGULATION

Binance faced multiple challenges this year in the form of regulatory hurdles and executive departures, which likely contribute to its shrinking market share. However, the most overlooked catalyst for Binance's loss of dominance was Binance's decision to end zero fee bitcoin trading.

A zero-fee bitcoin trading promotion began in July 2022 as part of a fifth anniversary celebration for the exchange. It initially covered 13 of the most popular pairs, all of which were bitcoin into fiat or stablecoins, and the promotion helped Binance gain significant market share. While other exchanges were struggling with lower volumes in the wake of the May 2022 collapse of Terra, Binance actually saw volumes grow slightly from June to September of 2022. As a result, Binance's spot dominance grew over 20% between June 2022 (last month before the promotion began) and February 2023 (last full month of the promotion).

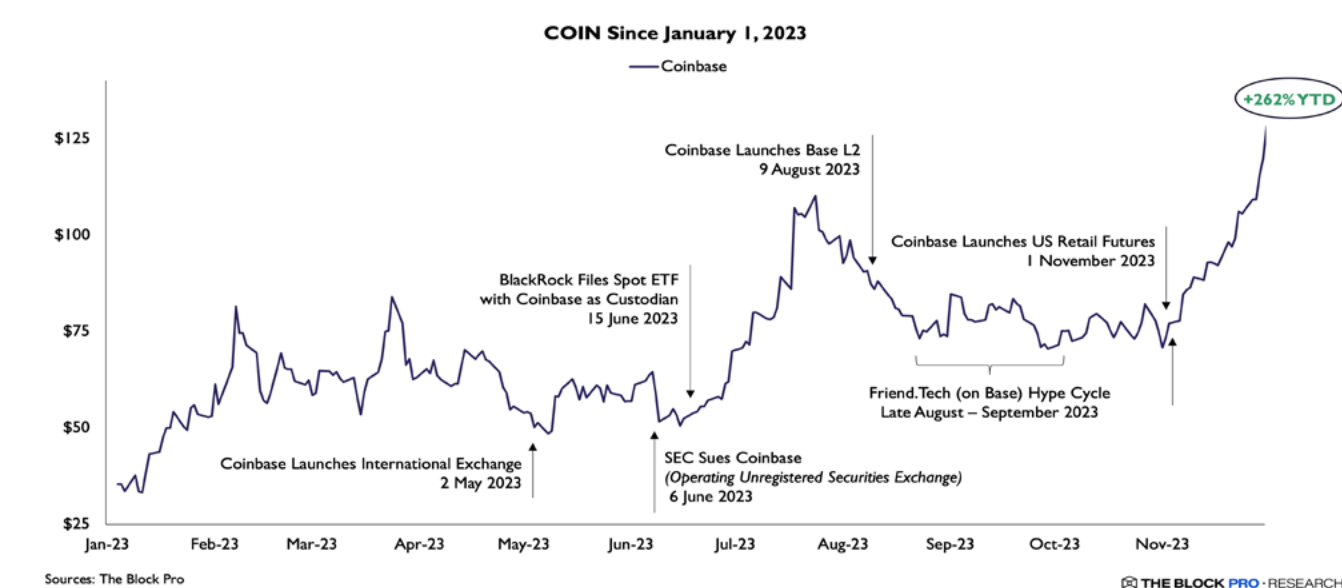
Taken together, despite a strong H2 2022 and beginning to Q1 2023, Binance round tripped its dominance by October, remaining below 40% throughout Q4 2023, putting it in a worse position than at the start of the promotion in 2022.

Around the same time, Binance began facing serious issues from US regulators. In March, Binance and its CEO, Changpeng Zhao "CZ", were both sued by the CFTC on multiple allegations of knowingly evading U.S laws. Just three months later, in early June Coinbase and Binance were both sued by the SEC. While both exchanges were accused of operating as an unlicensed securities exchange, Binance and its senior management were accused of deliberately misleading investors and regulators and improperly mixing and moving customers' money. As a publicly traded company with stronger compliance, Coinbase was much less affected by their SEC case. Coinbase's market share held steady around 6% as they benefited from more positive news including being named the surveillance partner for multiple bitcoin ETF applications and the launch of their optimistic rollup called Base.

While Coinbase was largely left alone after the SEC charges in June, Binance's troubles continued. In addition to the cases brought by the CFTC and SEC, the DOJ conducted a criminal probe on Binance that ended in late November resulting in \$4B settlement in penalties and forfeitures, one of the largest ever obtained from a corporate defendant in a criminal matter. As part of the November settlement, Binance made additional concessions including a complete exit from the U.S market and CZ's resignation. In response to the news of CZ stepping down and pleading guilty, users pulled roughly \$1B from the exchange. While the settlement has eased the market's concerns about a potential Binance collapse, Binance still has to deal with an ongoing SEC civil lawsuit, which is likely to result in additional fines.

The direction of the crypto exchange landscape is largely driven by what happens with Binance. If Binance effectively resolves its regulatory challenges and recaptures its offshore market share, it could solidify its position in the market. This stabilization may lead to a more rigid market landscape, limiting opportunities to grow market share for other exchanges. However, if Binance continues to face regulatory challenges and trust in the exchange continues to erode, the market is likely to become increasingly fragmented. As far as the broader market is concerned, the November events seemed to be perceived as healthy, for while the fines were steep, they addressed some of the biggest looming risks while still potentially reducing the likelihood for one exchange to achieve market dominance.

## COINBASE BECOMES 'THE ONE THAT SURVIVED'



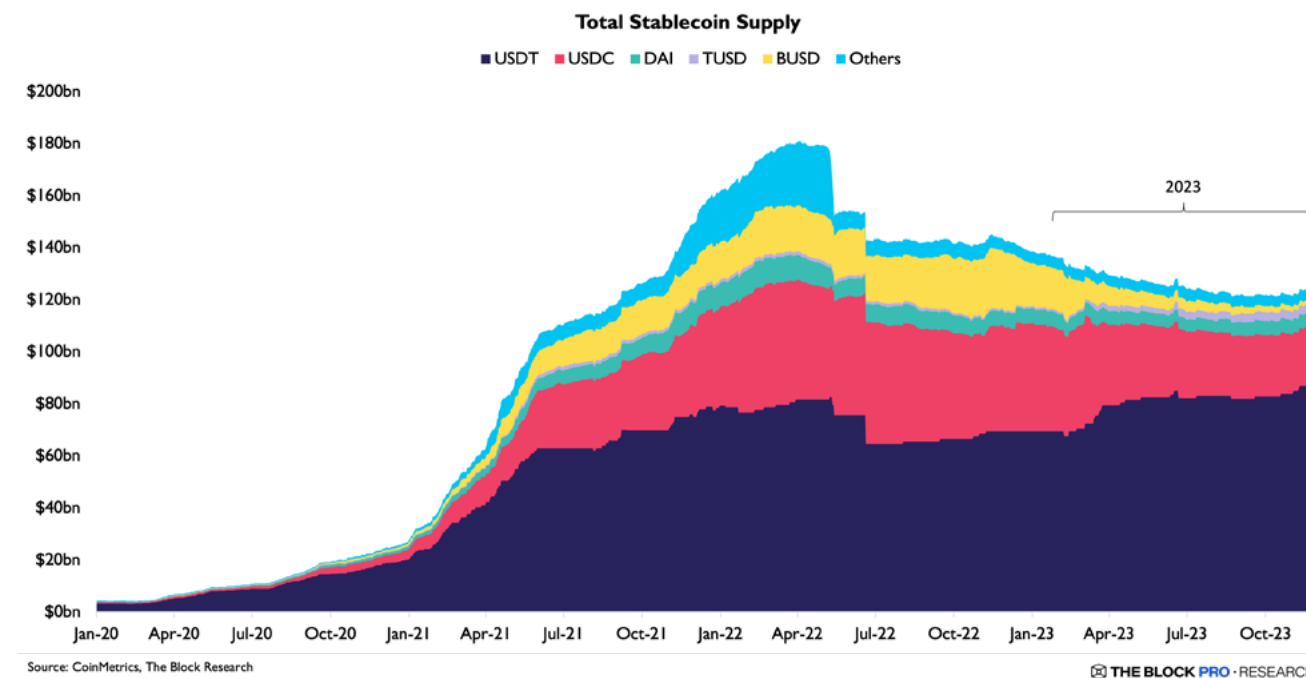
Though Coinbase faced its own legal scares, the leading US exchange had a strong year. Coinbase managed to position itself strongly across arguably the three largest market trends of the year: Layer 2s, Decentralized Social and ETFs. Further, the now reduced set of US competitors and recent crypto rally put Coinbase in a strong position going into 2024, especially given retail mania has still yet to happen, as evidenced by metrics such as app store downloads, which have yet to pick up meaningfully.

In August, Coinbase launched its own Ethereum layer 2 in August, the exchanges most prominent push into the on-chain products market. In addition to a short lived speculative fervor around meme tokens on Base, the new L2 happened to also become home to one of the more popular crypto applications built this year, Friend.Tech, which allows users to monetize their Twitter presence via the selling of 'keys' to their chat on the platform. Taken together, on-chain activity has already generated over \$10M in protocol revenue for Coinbase over the past four months at a ~30% profit margin.

While Coinbase caught headlines for being selected as the custodian for the BlackRock spot bitcoin ETF in June, right now they are also the custodian for 9 of the other 12 proposed spot bitcoin ETFs. Of the remaining three, VanEck has selected Gemini, Fidelity will self-custody, and the remaining provider has not

indicated a custodian. While there are potential decentralization risks with so much of the market relying on one custodian, it puts Coinbase in a strong position as the asset class institutionalizes.

## EVOLUTION OF THE STABLECOIN LANDSCAPE



Now let's turn to another critical piece of blockchain-based financial infrastructure, stablecoins.

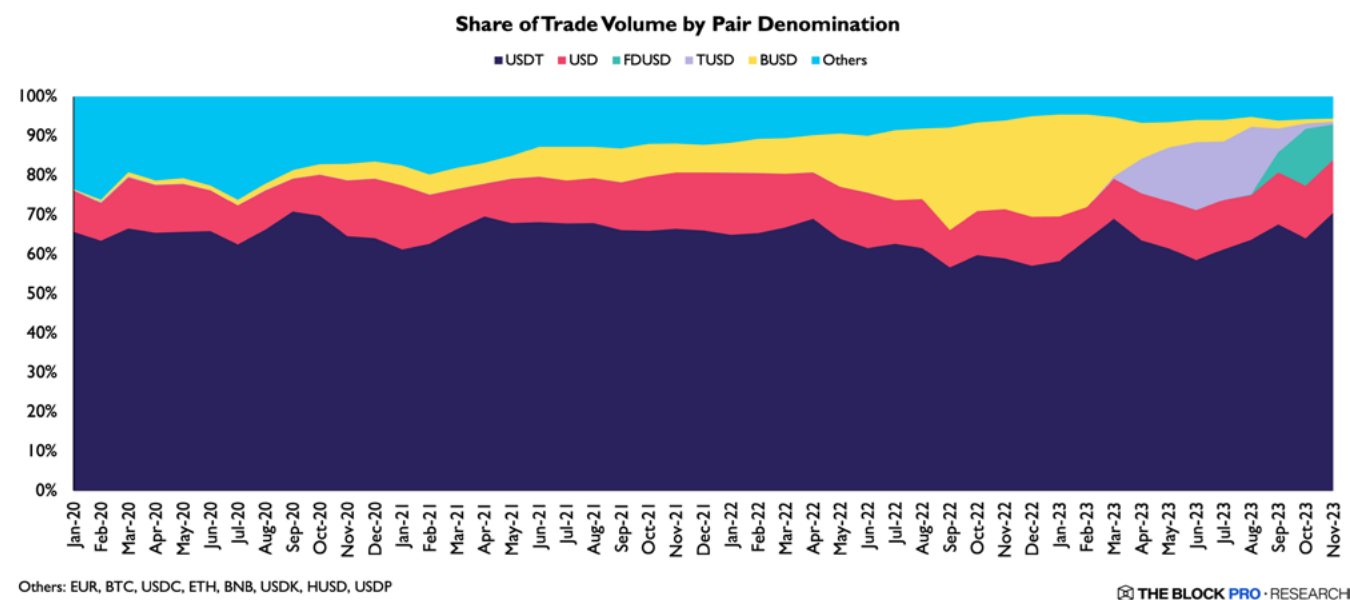
Overall stablecoin supply started dropping after TerraUSD lost its peg in May of 2022 and the decline throughout 2022 is largely explained by the broader selloff in crypto markets given stablecoins' primary role as dollar liquidity for funding cryptocurrency exposure. The continued decline throughout most of 2023, however, is more nuanced. For context, while total crypto market cap grew from roughly \$830B in the beginning of the year to \$1,480B in November, stablecoin supply dropped slightly from roughly \$140B in the beginning of the year to \$125B in November.

This paradox can likely be partially explained by the higher interest rate environment. While the pausing of rate hikes has lifted the floor of asset prices, the sustained high nominal rates still lead to sustained

attractiveness of treasuries, which now offer comparatively higher yields relative to USD denominated DeFi strategies, a large use case for certain stablecoins. Despite the slight decline in supply, stablecoins still remain a critical piece of infrastructure for the crypto ecosystem, providing a stable and liquid option as an alternative to more volatile assets and as a funding currency for accessing crypto on centralized exchanges.

The stablecoin landscape has also experienced notable shifts in market share over the course of 2023 with Tether being the major beneficiary. While USDC was probably the most negatively impacted by high yields given its role in DeFi and presumably more US-centric userbase, the largest shifts in market share came from the deprecation of Binance USD (BUSD), which opened the door for Tether to be more actively traded on the worlds largest exchange.

### BUSD WINDS DOWN



Even now that we have shifted our discussion to stablecoins, we must introduce yet another example of how changes to Binance’s trading incentives can cause ripples across the market.

BUSD was launched in 2019 as part of a collaboration between Paxos and Binance, eventually growing to a peak of roughly \$23B in market share in November of 2022. Binance integrated BUSD heavily into the

exchange and the BSC ecosystem, promoting BUSD and using the stablecoin as the basis for multiple products. Specifically, BUSD usage was heavily incentivized on Binance with a no maker fee promotion on all pairs. In September of 2022, Binance also ended support for USDC, USDP, and TUSD and converted deposits of those stablecoins into BUSD, further fueling the short-lived growth of the stablecoin. Though Binance continued to support USDT trading given its staying power as the dominant stablecoin across other exchanges, Binance was clearly trying to do all it could to increase BUSD activity throughout 2022.

On February 13, the NYDFS issued a notice ordering Paxos to stop minting BUSD citing several unresolved issues relating to Paxos’s oversight of its relationship with Binance. This notice was largely in response to a separate version of BUSD called Binance-peg BUSD, which was issued from Binance instead of Paxos. Since BUSD is an ERC-20 token, Binance created Binance-peg BUSD as a stablecoin that could operate on other blockchains including BSC, Avalanche, and Polygon. Binance-peg BUSD was independently minted by Binance and collateralized 1:1 by the BUSD minted from Paxos. In January, Binance-peg BUSD had a \$1B collateral hole. Although the issue was resolved and Binance claimed that the collateral mismatch was due to operational mistakes that led to timing issues, the NYDFS made it clear that it had not authorized Binance-peg BUSD on any blockchain.

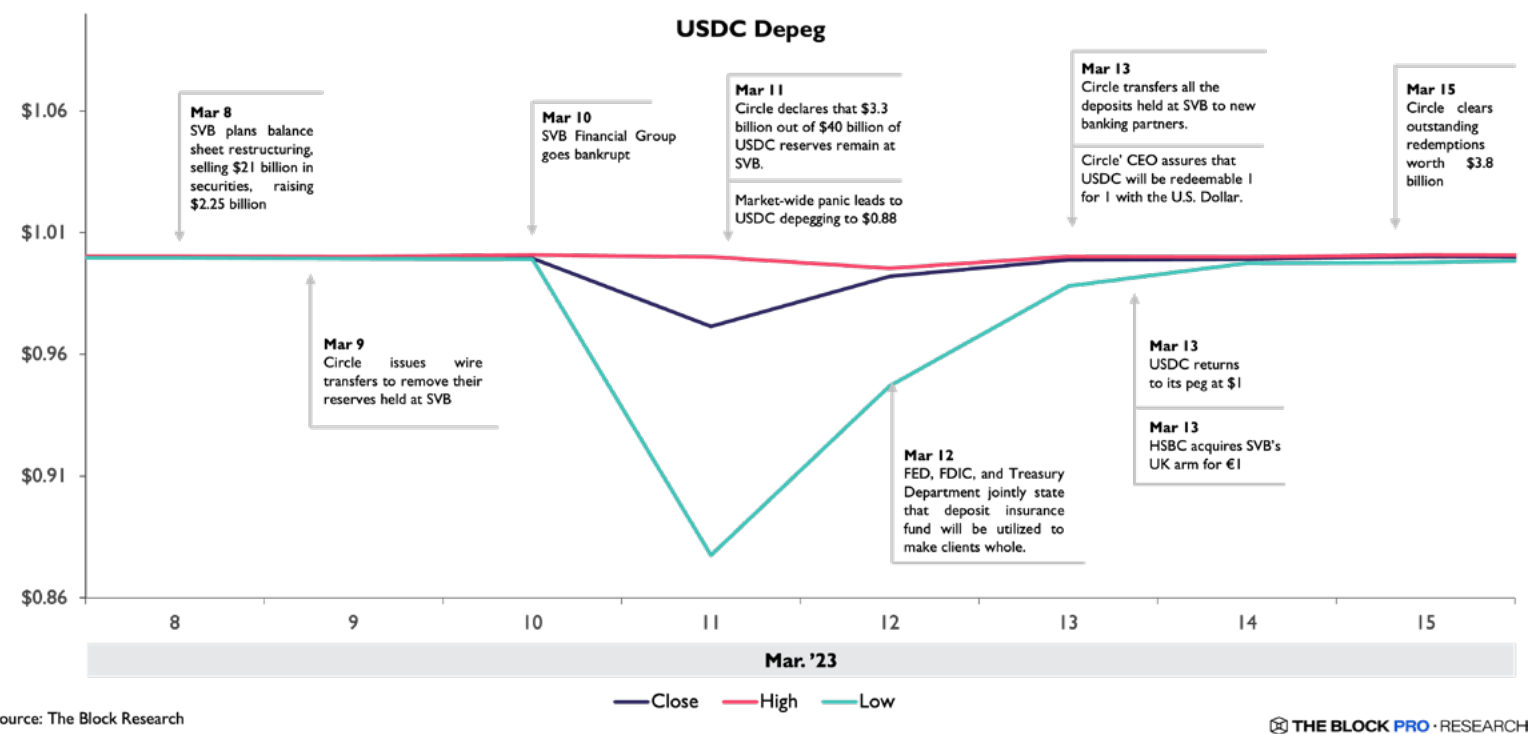
Given the role of BUSD on Binance’s exchange and the BSC ecosystem, along with its sheer size, at one point becoming the fourth largest stablecoin, Binance needed to quickly establish suitable alternatives. This strategy culminated in Binance first encouraging users to transact in True USD (TUSD) and later First Digital USD (FDUSD) with zero-fee trading promotions leading to a sharp increase in market capitalization for both stablecoins.

Binance’s first foray was with TUSD. Upon re-listing TUSD pairs, BTC/TUSD became the lone pair on Binance to hold onto a zero fee status upon the end of the zero-fee bitcoin promotion. Binance also granted all TUSD pairs no maker fees in June. While TUSD was practically unheard of in March, it was the quoted asset for about 17% of trading volume in August. TUSD, though, faced some troubles through the year as one of its banking partners, Prime Trust, went bankrupt and the stablecoin was under constant scrutiny over alleged ties to Justin Sun; claims which Sun denies. Regardless of if these concerns had merit, Binance looked to be weighing other options. Binance first listed their BTC/FDUSD pair at the start of August with no trading fees, but it was not getting much traction as FDUSD was even lesser known than TUSD. To address this imbalance, Binance put a taker fee on the BTC/TUSD pair in September,

which finally helped FDUSD establish some dominance. FDUSD was the quote asset for about 14.5% of volume in October, coming in only behind USDT and USD. Binance's experimentation with a new favored stablecoin had the ability to make some of these smaller stablecoins emerge as prominent spot volume assets. None of them have become as significant as BUSD yet, though, which accounted for 26% of volume at its peak in September 2022. Each stablecoin's issuers were based in Asia which boasts a more accommodative regulatory environment. Additionally, each stablecoin was natively deployed on multiple networks including BSC meaning that Binance didn't have to worry about creating their own stablecoin solution to bridge to other chains.

As a result of Binance's chaotic stablecoin saga, USDT has become much more dominant as a quote asset for spot pairs. USDT accounted for around 70.5% of quote asset volume in November, nearly recouping the 70.8% of volume it made up back in September 2020.

### USDC FACES NOVEL CHALLENGES



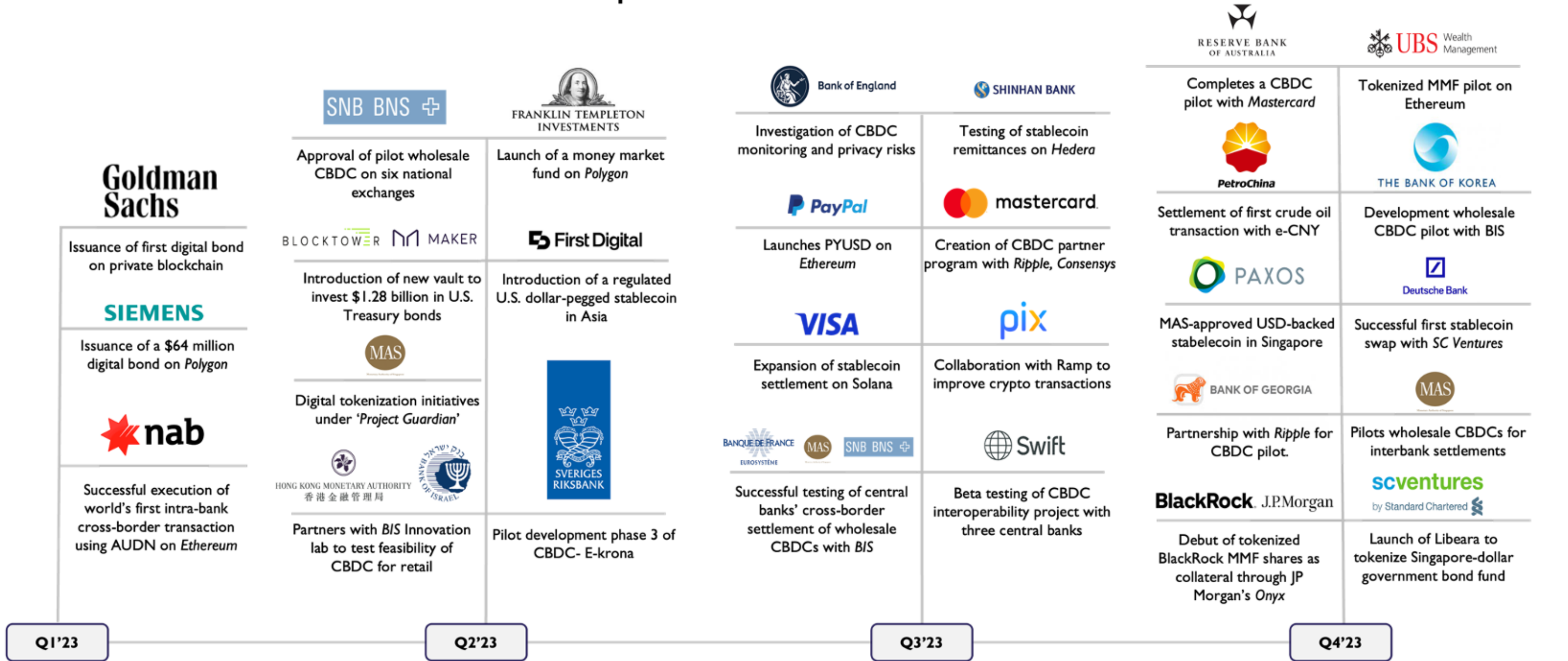
The second major stablecoin story has been the decline of Circle's USDC throughout most of the year, which was in many ways catalyzed by the banking crisis in early 2023. Circle, the issuer of USDC announced on March 10th that \$3.3B of the roughly \$40B of USDC reserves were held at Silicon Valley Bank. Although Circle made the announcement just three days later on March 13th that the \$3.3B reserve deposit would be fully available for transfer to new banking partners when banks open Monday, the damage was largely done. USDC dropped to a low of \$.87 on March 11th as traders speculated that Circle had worse exposure to SVB than the amount they disclosed. USDC lost considerable market share over this period as investors shifted into safer stablecoin options including USDT. USDC dropped from 30% market share on March 10th to around 24% a month later while USDT gained close to 7% moving to roughly 62% market share over the same period.

Further, Maker's DAI, the most popular decentralized stablecoin, reduced its reliance on USDC after it also lost its peg in 2023, reaching \$.88 on March 11th. At the time, USDC represented roughly 52% of DAI's collateral base. Despite DAI dipping under \$.90, the stablecoin's market share has held fairly steady throughout 2023, largely due to Maker's pivot into RWA collateral. Maker lowered its dependence on USDC as collateral and purchased short-term government bonds growing their RWA portfolio to over \$2.7B. The higher yield provided from short-term treasuries helped to fund high interest rates for the Dai savings rate which was crucial in keeping market share. Maker varied the DSR, at times reaching 8%, but ultimately stabilized it around 5% to sustain enhanced profitability.

Still, given USDC's perceived strength before the banking crisis and fact that it actually averted any real issues, many market participants have been puzzled that the stablecoin has continued to steadily lose both overall supply and market share throughout 2023. One potential reason could be that the USDC user base is likely much more US-centric than other stablecoins such as USDT. Given US citizens' access to now higher yielding treasuries, these outflows are likely more concentrated to USDC. Similarly, USDC is highly used in DeFi, and given rates are higher, potentially capital has migrated from USDC denominated stratifies.

Another way of looking at USDC's declining market share is through the lens of the surge in Tether's dominance. Given USDT's primary use case is trading on centralized exchanges, BUSD volumes likely translated directly to USDT following the BUSD halt. Additionally, Tether also benefited from a symbiotic relationship with Tron on payments outside of the US, particularly in LatAm, Africa and Europe. Tron currently boasts higher stablecoin volumes than Ethereum and ~97% of these transactions are carried out in USDT.

### Corporate Stablecoins and CBDC



Source: The Block Research

THE BLOCK PRO · RESEARCH

## CORPORATE STABLECOINS AND CENTRAL BANK DIGITAL CURRENCIES

Another impact of the high interest rate environment in 2023 is high corporate enthusiasm for launching stablecoins. The ability to simply invest non-interest-bearing deposits into highly liquid short-term strategies makes the stablecoin business model extremely profitable. The highest profile corporate stablecoin launched in 2023 was PayPal's PYUSD launched on August 7th with Paxos as the issuer. PYUSD has already broken the top 20 stablecoins by market cap, reaching over \$150M without much effort from PayPal on driving demand. In September, PayPal announced an integration of PYUSD into Venmo, allowing users to purchase and send the stablecoin which will be fully rolled out sometime in late 2023. There are likely additional opportunities for integrating the stablecoin into PayPal's platform such as reducing merchant fees that could boost demand.

CBDC projects have continued to advance in 2023. Project mBridge, a collaborative venture led by the BIS Innovation Hub and central banks including the Hong Kong Monetary Authority, Central Bank of the UAE, People's Bank of China's Digital Currency Institute, and Bank of Thailand, continues to make strides in 2023 in transforming wholesale cross-border payments with its multi-CBDC platform. Building on its 2022 successes in addressing inefficiencies in international payments, the project in 2023 is focusing on evolving the mBridge Ledger, a custom DLT platform, into a minimum viable product. This advancement includes enhancing the technology, refining legal and governance frameworks, and exploring synergies with other innovative projects. The platform remains dedicated to facilitating real-time, direct cross-border transactions and foreign exchange using CBDCs, with a keen adherence to jurisdiction-specific compliance and regulatory standards.

In 2023, China's digital yuan (e-CNY) has seen notable advancements and a surge in adoption. Key developments include enhanced accessibility for foreigners to open e-CNY wallets using international phone numbers, innovative payment solutions allowing transactions without a charged phone or internet, and the integration of e-CNY in the mBridge project for international settlements. Additionally, the e-CNY's integration into regional commerce, especially with Southeast Asian nations, has been emphasized, with banks in Guangxi showcasing its functionality and the Bank of China Hong Kong facilitating cross-border e-yuan transactions. These strides signify China's commitment to elevating the e-CNY's role in the global digital currency landscape, though the project still has a long way to go before it achieves meaningful adoption.

In 2023, the UAE's Digital Dirham strategy has made significant headway, marked by the Central Bank of the UAE's partnerships with G42 Cloud and R3 for infrastructure and technology development. This initiative is part of the broader Financial Infrastructure Transformation program aimed at reinforcing the UAE's position as a global financial center. The strategy has also progressed through international collaborations, notably the mBridge project for cross-border transactions. Additionally, a notable milestone is the agreement with the Reserve Bank of India to develop a bilateral CBDC bridge, focusing on enabling cross-border transactions in remittances and trade, furthering the Digital Dirham's integration into the global financial system.

In 2023, Brazil's Central Bank has been actively progressing with the development of its CBDC, the DREX (Digital Real), targeting a first-phase launch in May 2024. This year's focus has been on addressing privacy and infrastructure challenges, essential for the successful implementation of DREX. The currency, utilizing distributed ledger technology, aims to enhance financial services access and efficiency in Brazil. Although potential delays due to employee strikes have been noted, the development of DREX remains a significant step towards digital innovation in Brazil's financial sector, promising to transform financial services accessibility and inclusivity.

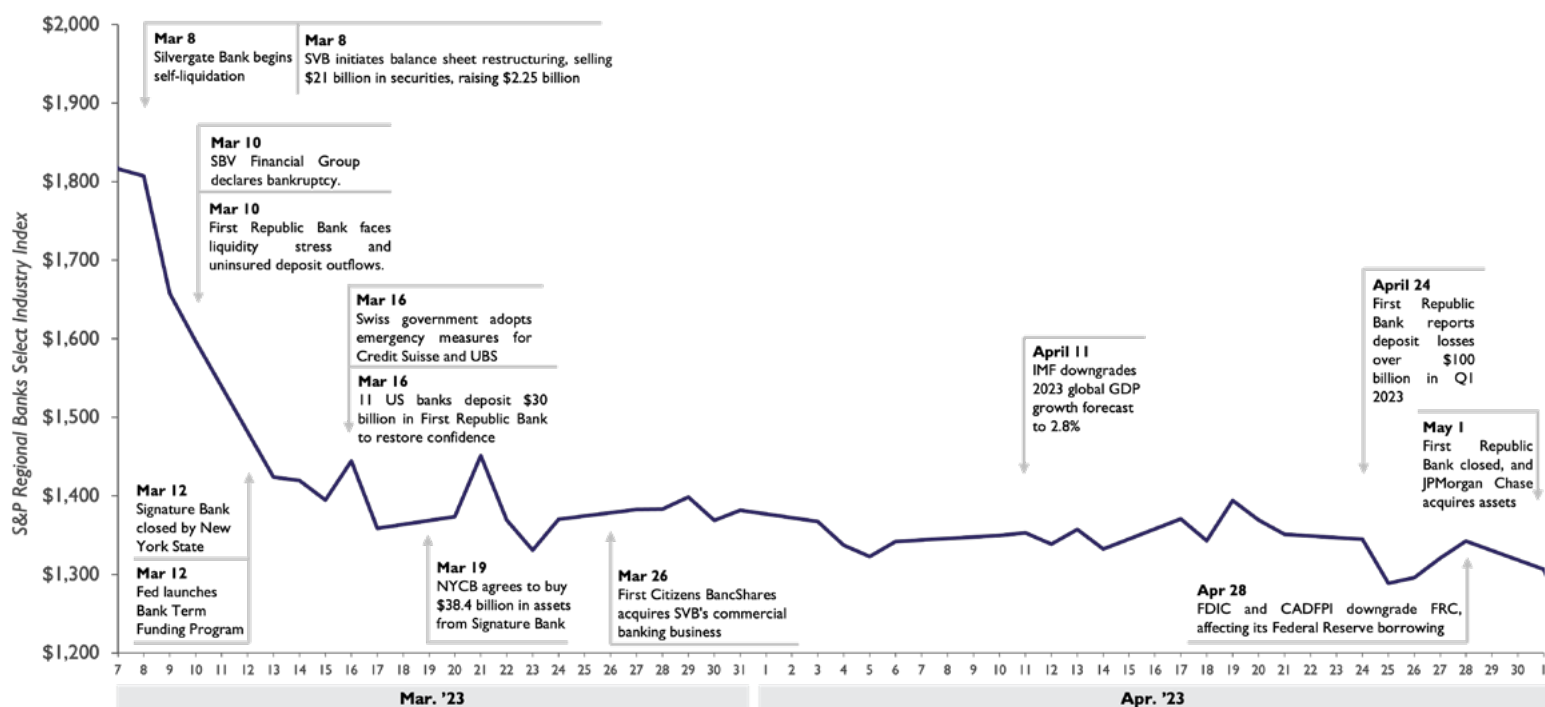
The Digital Euro project advanced into its preparation phase, focusing on finalizing its rulebook, selecting technology providers, and conducting essential testing and experimentation. Designed as a digital form of cash, the Digital Euro emphasizes privacy, accessibility, and utility in various transactions. It aims to enhance the European payments sector by offering a resilient, competitive, and innovative payment solution under European governance. Access to Digital Euro services will be available through various platforms, ensuring inclusivity even for those without bank accounts or digital devices. The final decision on issuing the Digital Euro awaits the completion of the EU's legislative process.

Finally, in 2023, the Monetary Authority of Singapore (MAS) announced its plan to issue a "live" CBDC for wholesale settlement. This initiative is part of a broader effort to expand trials of asset tokenization and establish the infrastructure for a digital Singapore dollar. The MAS' Orchid Blueprint outlines the necessary technology infrastructure for future digital money transfers. In addition, MAS will conduct a set of four trials with industry players to test various components, including tokenized bank liabilities for retail payments. The first wholesale CBDC pilot will focus on settling retail payments between commercial banks, with future tests possibly exploring cross-border settlements.

# THE BATTERED CRYPTO BANKING LANDSCAPE

## BANKING CRISIS

2023 Banking Crisis



Source: The Block Research

THE BLOCK PRO RESEARCH

The 2023 Banking Crisis, a significant financial event, unfolded rapidly over several days in March, leading to the failure of several U.S banks and sparking widespread concern in global financial markets. Central to this crisis were the collapses of Silicon Valley Bank, Silvergate Bank, Signature Bank and First Republic Bank, all of which faced unique challenges exacerbated by the broader economic environment, including rising interest rates, as well as for some, unique exposure to the cryptocurrency market.

Though the March crisis was the major culminating event, the year started off with what seemed like the strongest forewarning possible from the Board of Governors of the Federal Reserve, the Federal Deposit Insurance Corporation and the Office of the Comptroller of the Currency. In their joint assessment, Crypto-asset risks to Banking Organizations, they carried a clear message to U.S Banks considering or actively

engaged in crypto-asset activities: "The agencies believe that issuing or holding as principal crypto-assets that are issued, stored, or transferred on an open, public, and/or decentralized network, or similar system is highly likely to be inconsistent with safe and sound banking practices." Although immediate direct enforcement didn't follow the message, it laid the groundwork for stronger oversight of banks' crypto involvement for the remainder of the year.

Silvergate and Signature were the two banks most closely tied to the crypto sector. As we delve deeper into the specifics of their collapses, a narrative unfolds that highlights the delicate balance between innovation and stability in the intertwining worlds of traditional finance and crypto. This exploration reveals not just individual missteps, but also the broader challenges and lessons that emerge when new asset classes rely on traditional models for critical services such as payment and settlement.

Silvergate and Signature % Returns (June 2020 - June 2023)



Source: FactSet, The Block Research

THE BLOCK PRO RESEARCH



# CASE STUDY: SILVERGATE BANK

Founded in 1988, Silvergate Bank began its journey as a modest community bank in La Jolla, California. With just three branches across southern California, it remained relatively under the radar for much of its early existence. The foundation of Silvergate was as a thrift institution, which later, under the guidance of Chairman Dennis Frank, a former Goldman Sachs banker, transformed into a fully-fledged bank. Frank, who had experience dealing with the savings and loan crisis of the late 1980s, played a crucial role in reorganizing Silvergate into a bank in 1996.

Silvergate demonstrated an impressive ability to adapt and thrive in challenging financial landscapes. Notably, the bank ceased its mortgage operations in 2005, foreseeing the impending subprime mortgage meltdown. This strategic move positioned it advantageously during the 2008 financial crisis, enabling it to lend when many other institutions were crippled by bad mortgages.

Despite successfully navigating earlier financial crises, many years later they would encounter a crisis they couldn't quite navigate. The story of Silvergate's entry into the world of cryptocurrency begins with a visionary move by CEO Alan Lane. In 2013, sparked by the disruptive potential of Bitcoin, Lane foresaw an opportunity for the bank in the rapidly growing digital currency industry. His early investment in Bitcoin and keen interest in its underlying technology signaled a significant shift in the bank's focus.

Lane's engagement with cryptocurrency was not just a personal fascination but a strategic business decision. He recognized that while digital currencies might pose a long-term challenge to traditional banking, there was an immediate need for banking services within the crypto industry. Many crypto businesses were struggling to find banking partners, largely due to the skepticism and risk-averse nature of traditional banks. Silvergate, under Lane's leadership, decided to fill this void. The bank began actively engaging with early stage crypto exchanges, seeking to understand their specific challenges and exploring ways to support them. This marked the beginning of Silvergate's journey into becoming a key banking partner for some of the largest cryptocurrency firms in the industry.

Silvergate's strategic move to embrace the cryptocurrency sector marked the beginning of a period of significant growth and transformation for the bank. As Silvergate delved deeper into the world of cryptocurrency, its foresight and willingness to engage with a then-nascent industry began to bear fruit.

Specifically, the launch of the Silvergate Exchange Network (SEN) was a pivotal moment in the bank's growth trajectory. SEN, a network facilitating real-time transactions, quickly became an essential tool for crypto businesses needing efficient fiat currency transfers. The value of SEN to the crypto market could not be overstated. Its introduction and success led to a staggering year-over-year increase in digital asset deposits from 2020 to 2021, skyrocketing from \$5 billion to \$14.1 billion by EOY 2021. The quarterly transaction volume on SEN also saw

a remarkable 341% year-over-year increase. These figures not only demonstrated SEN's utility at the time but also highlighted how it reshaped Silvergate's deposit structure – 99.3% of the bank's deposits became non-interest-bearing at its apex. Non-interest bearing deposits became synonymous with inflows from crypto clients because, as Matt Levine put it, "crypto firms kept their money at Silvergate for transactional and convenience reasons, not to earn interest".

SEN also served as a foundation for an array of other financial services, opening up new growth avenues for the bank. A notable example was the SEN Leverage product, which allowed institutional traders on SEN to access USD loans collateralized by Bitcoin. Silvergate also famously purchased the intellectual property associated with Diem, the stablecoin product operating under Meta, which faced regulatory headwinds that stalled its abilities to come to market. This was part of a larger plan to further diversify their digital asset offerings, including a repeated attempt at launching their own stablecoin.

The meteoric rise of Silvergate mirrored its precipitous downfall. The rapid decline of Silvergate Bank began unfolding in late 2022 coinciding with increased concerns following the implosion of FTX, a key client of Silvergate. In the aftermath of FTX's collapse in November 2022, Silvergate was quick to clarify its exposure to FTX. CEO Alan Lane made a November statement assuring investors and clients that FTX represented less than 10% of Silvergate's total digital asset customer deposits. He emphasized that Silvergate had no outstanding loans or investments in FTX and that the SEN Leverage loans, collateralized by Bitcoin, were performing as expected with zero losses. Despite these assurances, the bank's association with FTX and the broader uncertainty in the crypto market began to affect its operations profoundly.

Silvergate's principal issue, however, was that the bank had developed a strong maturity mismatch, with very long maturities on the asset side (loaded while interest rates were low, to generate yield), and very short maturities on the liability side (daily callable deposits). When interest rates increase, assets with longer maturities fall stronger in value than those with shorter maturities. Hence Silvergate's economic capital came under pressure. Deposit holders knew this, withdrew, forcing Silvergate to sell the assets at their lower value (losses crystallized) to honor redemptions/debt. In short, Silvergate had not properly managed its interest rate risk, and the lender of last resort did not step in (as it did later).

Specifically, by December 2022, Silvergate's deposits had plummeted to \$6.3 billion, a stark decline from earlier in the year. This massive withdrawal of deposits forced Silvergate to sell securities and related derivatives at a loss of \$718 million. In January 2023, in a move indicative of its worsening financial health, Silvergate laid off 40% of its workforce. The final blow came on March 8, 2023, when Silvergate announced its decision to wind down operations and liquidate the bank. This decision marked the conclusion of Silvergate's saga, an institution that once flourished at the forefront of financial services for digital assets. However, Silvergate's downfall was not solely a repercussion of the FTX collapse.

# CASE STUDY: SIGNATURE BANK

Signature Bank was a New York-based commercial bank, and an institution significantly larger than Silvergate. Signature had ~\$88 billion in deposits at the end of 2022, compared to \$6.3 billion for Silvergate. However, Signature, like Silvergate, found itself at the heart of the 2023 banking crisis due to its significant role in the U.S. cryptocurrency ecosystem.

This entanglement with crypto wasn't always the case for Signature, which many have since associated as solely a "crypto bank". Following the acquisition of Republic National Bank of New York by HSBC, Joseph J. DePaolo, Scott A. Shay, and John Tamberlane launched Signature Bank in 2001 with an initial focus on catering to affluent clients and middle-market businesses. This business model, drawing from their previous experience, targeted successful entrepreneurs who had grown their business significantly over the years. Over time though, Signature decided to set its sights on clients from the cryptocurrency industry.

"If you're not involved in blockchain, in five years you won't be around as a bank", said Joseph DePaolo in December of 2018, shortly before the launch of their blockchain payments platform Signet. Although in hindsight this statement feels like an ironic foreshadowing of what went wrong with Signature, it did also mark the beginning of a highly productive multi-year strategic pivot to the digital asset space that aided in its meteoric rise.

On December 4, 2018, the New York Department of Financial Services granted Signature Bank approval to offer a new blockchain-powered digital payment platform, the first of its kind to receive such authorization. Signet, the name of the blockchain payments platform, was subsequently launched in January of the following year and provided a new avenue for clients, primarily within the cryptocurrency sector, to facilitate real-time transactions and settlements between other Signature Bank clients. The service operated 24/7 without any direct involvement from the bank. This feature addressed an acute pain point for crypto exchanges and large market participants, which often conducted large trades overnight or on weekends across various time zones. Signet was powered by Tassat, a company that offers a white-labeled version comparable to Silvergate Exchange Network. The end-product is called TassatPay, which is a permissioned blockchain-based payment network.

Two years and nearly thirty billion in dollar deposits generated from their digital asset business later, Signature was flying high as one of the top performing banks by the end of 2021. This all soon changed though, with 2022 marking an extremely volatile time for the cryptocurrency industry at large and further serving as a warning to Signature that after its tremendous rise, it would soon come crashing down.

In the wake of the FTX collapse and other significant events impacting the crypto world, Signature Bank began to reposition itself, shifting its focus away from being predominantly recognized as a crypto-oriented bank to highlighting its wider range of banking services. By December 2022, in response to growing uncertainties in the crypto space, Signature Bank announced plans to reduce its exposure to the sector. The bank aimed to decrease its crypto-

related deposits significantly, intending to bring down the proportion of these deposits from 23.5% to below 20%, and potentially even lower in the future.

On a now notorious April 2022 earnings call, mounting concerns from banking analysts about the bank's stability during the crypto market downturn led CEO DePaolo to assure the public that the bank regularly conducted risk assessments assuming a complete withdrawal of all crypto deposits. DePaolo specifically stated "Every month we model with an assumption that every single last crypto deposit is withdrawn". This model, however, did not anticipate the unease of their equity investors that would grow amid troubles at other banks.

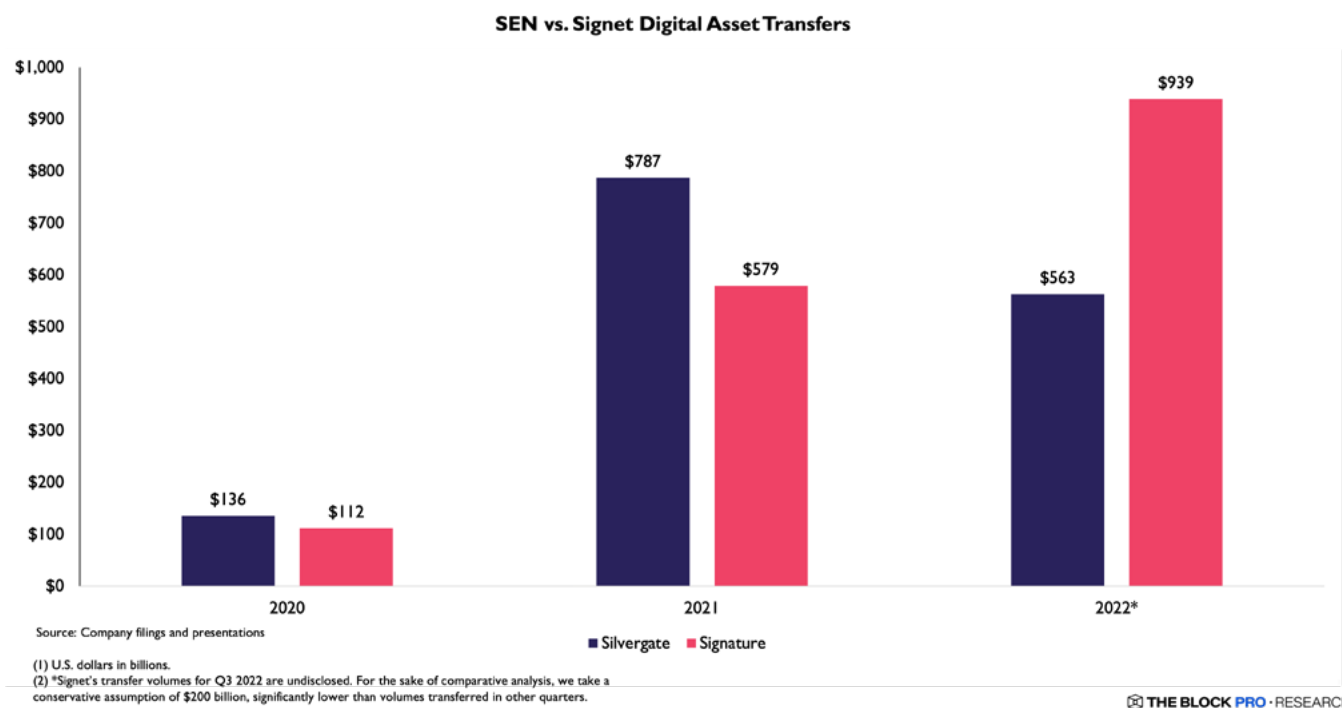
In fact, Signature Bank's 2022 year-end report projected an image of resilience and compliance, with the institution claiming to be well above the FDIC's 'well capitalized' standards. Despite acknowledging the challenges of the previous year as the toughest in terms of deposit environment, the bank's leadership remained optimistic about its future. Endorsements from credit agencies like Fitch, Kroll, and Moody's in late January 2023 further bolstered this perception, affirming the bank's credit ratings based on its financial stability and risk management practices.

By March 9, 2023, Signature Bank issued a press release underscoring its strong financial position, liquidity, capital levels, and diversified deposit mix, aiming to reassure investors and regulators amidst the evolving industry landscape. Signature Bank's assurance of stability on March 9th quickly unraveled as customers, spooked by Silicon Valley Bank's demise on the 10th, withdrew over \$10 billion in deposits in a matter of hours over a general concern of further contagion risk. Despite efforts by Signature's management to secure the bank's position, including seeking new capital and potential buyers, the NYFDS closed the bank on March 12th and appointed the FDIC as receiver.

Board member and co-author of key banking legislature Barney Frank, as well as crypto industry voices like Nic Carter, suggested that the closure was a deliberate move by regulators to send an anti-crypto message, effectively an Operation Chokepoint 2.0, that aimed to isolate the industry from its banking relationships. The NYFDS refuted claims that the bank's crypto involvement was the closure's cause, citing a failure to provide consistent data during the critical period of withdrawal surges. The controversy surrounding Signature's closure left the industry in a state of uncertainty, questioning whether the regulatory actions were fair safeguards or part of a larger targeted strategy.

## WHO IS LEFT BANKING CRYPTO?

The integral role of Silvergate's SEN and Signature Bank's Signet in the cryptocurrency ecosystem was underscored by their abrupt closures, which left exchanges, stablecoin providers, and various institutional investors scrambling for alternatives. These platforms had provided a seamless and rapid means to move significant volumes in real-time, which was essential for maintaining the liquidity and stability required in the fast, always-on crypto markets. During its apex in 2021, SEN did \$787 billion in transfer volume while Signet hit an apex of roughly \$939 billion in 2022. Both numbers demonstrate just how pivotal their role in the industry was.



Key players like Coinbase, Circle, and Kraken, among others, relied heavily on these networks for their operational efficiency. SEN and Signet's near instantaneous transfer services had been a cornerstone for institutional adoption, allowing firms to engage with the crypto market in a more agile and risk-averse way.

The sudden absence of these networks has disrupted operational flows and caused greater challenges around access to liquidity, exerting further pressure on an industry already reeling. While BCB Group's Blinc and other emerging networks offer some hope, they currently lack the extensive client base that

Signature and Silvergate boasted, potentially leaving smaller exchanges and trading desks at a competitive disadvantage.

While the approach to finding new providers hasn't been exactly straightforward, there has been a greater diversification of approaches across the industry, with firms now exploring a range of banking partnerships both domestically and abroad.

In the dynamic landscape of US crypto banking in 2023, a few different types of institutions have stepped into pivotal roles catering to the needs of cryptocurrency firms. Their emergence as key players is marked not only by the services they offer but also by the increasingly larger list of crypto clients they serve.

First, let's look at other regional banks, which have both increased relevant service offerings and grown crypto client bases. Customers Bancorp, based in Pennsylvania, has actively embraced the crypto market. By launching a real-time payments platform, similar to the now defunct networks of SEN and Signet, they have attracted significant clients from the crypto world with notables including Circle, primary issuer of USDC, Coinbase and Bitstamp US. Additionally, Cross River Bank, headquartered in New Jersey, has also ramped up its efforts in attracting clients in the crypto space, also serving Circle and Coinbase as clients. Finally, Western Alliance Bancorp and Axos Financial are also notable for their focus in catering to the crypto industry's banking needs. Western Alliance's strategy of offering real-time payments capability, also akin to the SEN and Signet networks, signals their commitment to filling the operational gap left by larger banks. While Axos Financial has demonstrated some level of comfort with the industry given they are listed as a banking partner for Binance.US, the latter's recent withdrawal from the US market puts the Axos' continued involvement in question.

Meanwhile, large systemically important banks have also shown a cautious willingness to engage with cryptocurrency firms, albeit with a notably lengthy onboarding process. Bobby Zagotta, CEO of Bitstamp USA Inc., points out that "the on-boarding process with large global banks is quite long", sometimes extending up to six months. While some firms experience a long delay before being accepted, others receive an impersonal rejection. Archblock's COO and CFO Alex de Lorraine shared, "They don't tell you directly why — we got a generic email saying, 'Sorry, we can't open an account for you at this time.'" Despite this, the bank has opened accounts for specific types of crypto firms, such as VC funds and web3 infrastructure startups. Chris Burniske, a partner at Placeholder, observes, "Systemically important banks are picking up more crypto business as they see the growth trajectory of the industry." A representative

from a large crypto venture-capital fund echoes this sentiment: “We did call down to a lot of banks that are big-name brands from that ‘too big to fail’ category. I can’t say anyone said no to us.”

To take JPMorgan Chase & Co. and BNY Mellon as examples, both have engaged with the broader crypto space in unique and multifaceted ways. While the former is a banking partner to Coinbase and the latter is one to Circle, each has pursued robust internal strategies for engaging with the sector. JPMorgan has focused primarily on internal and cross-bank use cases, such as payments and tokenization via its Onyx division, while BNY Mellon (along with others like State Street) have looked to expand their foothold in the global custody market by building support for the custody of cryptocurrencies.

**Stable Banking Partners: Which Banks are Still Active?**

GSIB Large Banks Working With Crypto Companies			Non-U.S. Banks Working With Crypto Companies		
Bank	Ticker	Crypto Company Partner Type	Bank	Location	Crypto Company Partner Type
JP Morgan Chase	JPM	Crypto exchange: Coinbase	Bank Frick	Liechtenstein	Crypto exchange: Kraken
Bank of New York Mellon	BK	Stablecoin: Circle (USDC)	SEBA	Switzerland	Crypto Exchange: ZondaCrypto
Goldman Sachs	GS	Crypto Exchange: Coinbase	Deltec Bank	Bahamas	Exchange (Bitfinex), Stablecoin (Tether)
State Street	STT	Stablecoin: Paxos (USDP)	Capital Union	Bahamas	Stablecoin (Tether & TrueUSD)

Source: Morgan Stanley Research & The Block Research



American crypto firms are also exploring offshore banking options. Swiss banks like Sygnum and Bank Frick in Liechtenstein have reported a surge in account requests from U.S. firms. Sygnum has seen a marked increase in interest across various segments, from venture capital firms to trading entities. Bank Frick continues to engage with new crypto clients while remaining a longstanding funding provider of the exchange Kraken. SEBA Bank in Switzerland has noted a rise in inquiries, driven by its stable regulatory environment and comprehensive digital asset services. Other banks in the APAC region such as DBS in Singapore, and ZA Bank in Hong Kong are also becoming popular choices.

Other offshore banking options gaining attention include FV Bank in Puerto Rico, Jewel Bank in Bermuda, and Deltec in the Bahamas. These banks offer U.S. dollar-based services, an obvious benefit for US firms looking for stability and ease of transaction in a familiar currency.

Meanwhile, given the backdrop of the recent failures of banks servicing the crypto industry, the OCC has been hesitant to grant regulatory approvals to banks focusing on the sector, which has led to the expiration of banking charters. Specifically, both Paxos and Protegos Trust Bank saw their charter applications expire

in Q1 after receiving conditional approval in 2021. As it stands, Anchorage Digital remains the sole crypto institution with a national trust charter.

**Stalled Crypto Bank Approvals**

<b>Custodia Bank</b>	In January 2023, the U.S Federal Reserve Board rejected a Wyoming-chartered special purposes depository institution's application to join the Federal Reserve System. The Federal Reserve Board stated that the firm's proposed focus on crypto-assets posed significant safety and soundness risks. In February 2023, the Federal Reserve Board denied the institution's request for Fed supervision.
<b>Protego Trust Bank</b>	Protego Trust Bank, which received conditional approval from the OCC in February 2021, has seen its national banking charter application expire in February 2023. The bank now has the option to reapply to the OCC or seek a state authority to operate as a state bank.
<b>Paxos National Trust</b>	Paxos National Trust, a New York-chartered trust company which was granted conditional approval in April 2021, saw its national banking charter application expire in March 2023. However, the institutions existing business remains unaffected due to its regional charter.

Source: The Block Research



**LEARNINGS FROM THE BANKING CRISIS**

When looking back at the March banking crisis, it's essential to recognize the multifaceted nature of the event. The turmoil that ended banks like Silvergate and Signature was not solely a consequence of their crypto involvement. This crisis was the result of a complex interplay of factors, including the challenging macroeconomic environment marked by rising interest rates, the intricacies of regulatory frameworks, and critical shortcomings in the banks' operational and risk management strategies. To attribute the crisis exclusively to the crypto sector would be oversimplifying the matter.

Banks with less significant crypto client bases, such as Silicon Valley Bank, also played a pivotal role in the recent banking turmoil. A key example is the de-pegging of USDC, the second-largest stablecoin by volume and market capitalization. This incident was sparked by Circle, the issuer of USDC, revealing that it had over \$3 billion in cash reserves backing USDC at Silicon Valley Bank. The bank's inability to process withdrawals before its collapse raised serious concerns over the 1:1 reserve backing of USDC, leading to its de-pegging. This event underlines how disruptions in the traditional banking sector, even those not heavily focused on crypto, can have substantial impacts on the crypto ecosystem.

The recent banking turmoil has highlighted an inherent contradiction in the current state of the crypto industry: in its rush to gain institutional credibility, it leaned heavily on the very traditional financial systems it once sought to disrupt. This reliance exposed crypto businesses to the very risks—like financial censorship and the entanglement of banking services—that the industry aimed to eliminate. While access to financial institutions is useful for specific services like providing dollar liquidity to exchanges or financing business

ventures within a bank's risk profile, crypto's foundational promise is to offer a self-sufficient system where asset ownership and transfer aren't contingent on the stability of intermediary institutions. Moving forward, the community must reaffirm commitment to autonomy and resilience of critical infrastructure, steering clear of the vulnerabilities that come with more centralized dependencies.

## NEW INSTITUTIONS FILING ETFS

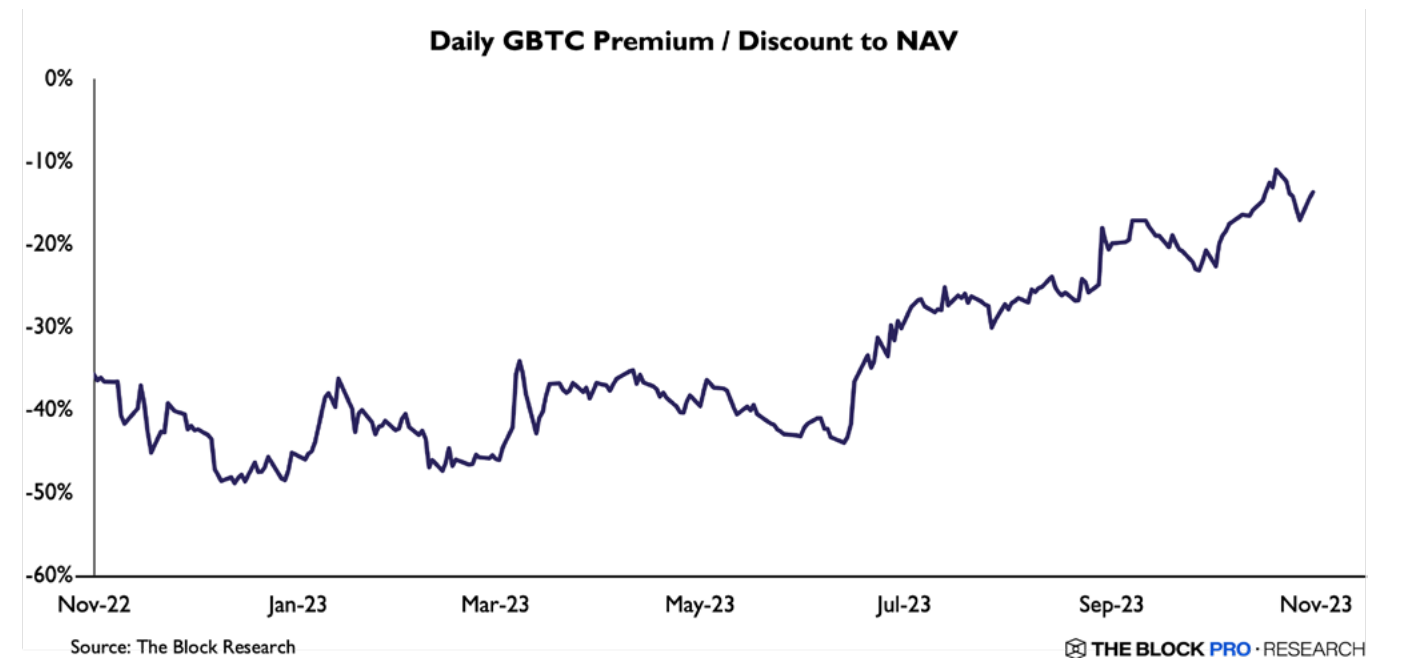
The competition for the first spot-traded Bitcoin exchange-traded fund (ETF) in the US has heightened in the latter part of 2023, with prominent traditional finance entities such as BlackRock and Fidelity joining the fray. Despite the SEC's approval of a Bitcoin-linked Futures ETF in October 2021 (ProShares Bitcoin Strategy ETF - BITO), decisions on spot Bitcoin ETF filings have consistently faced rejection and delays. Conversely, Bitcoin ETFs are actively traded in Canada, Germany, Brazil among other regions. Still, some tangible progress was made this year in the US. Specifically, in 2023, the SEC greenlit "ether" futures ETFs and the first leveraged bitcoin futures ETFs. Regarding the spot ETF question, the fact that it was BlackRock that filed an application inspired confidence given their nearly perfect track record of 575 ETF approvals with just 1 denial. Presently, more than 10 applicants await outcomes, with over half approaching their crucial third and final deadlines in the first half of 2024.

Official Deadlines/ Estimates for Spot ETF Applications

ETF Name	Ticker	Issuer	Asset	First Deadline	Second Deadline	Third Deadline	Final Deadline
ARK 21Shares Bitcoin ETF	ARKB	ARK and 21Shares	Bitcoin	06/29/23	08/13/23	11/11/23	01/10/24
iShares Bitcoin Trust	IBLC	BlackRock	Bitcoin	09/02/23	10/17/23	01/15/24	03/15/24
Bitwise Bitcoin ETP Trust	na	Bitwise	Bitcoin	09/01/23	10/16/23	01/14/24	03/14/24
VanEck Bitcoin Trust	na	VanEck	Bitcoin	09/02/23	10/17/23	01/15/24	03/15/24
WisdomTree Bitcoin Trust	BTCW	WisdomTree	Bitcoin	09/02/23	10/17/23	01/15/24	03/15/24
Invesco Galaxy Bitcoin ETF	na	Invesco and Galaxy	Bitcoin	09/02/23	10/17/23	01/15/24	03/15/24
Wise Origin Bitcoin Trust	na	Fidelity	Bitcoin	09/02/23	10/17/23	01/15/24	03/15/24
Valkyrie Bitcoin Trust	BRRR	Valkyrie	Bitcoin	09/04/23	10/19/23	01/17/24	03/19/24
Global X Bitcoin Trust	na	Global X	Bitcoin	10/07/23	11/21/23	02/19/24	04/19/24
VanEck Ethereum ETF	na	VanEck	Ethereum	11/10/23	12/25/23	03/24/24	05/23/24
ARK 21Shares Ethereum ETF	na	ARK and 21Shares	Ethereum	11/10/23	12/25/23	03/24/24	05/23/24
Hashdex Bitcoin ETF (Strategy Change)	DEFI	Hashdex	Bitcoin	11/17/23	01/01/24	03/31/24	05/30/24
Hashdex Nasdaq Ethereum ETF	na	Hashdex	Ethereum	11/17/23	01/01/24	03/31/24	05/30/24
Franklin Bitcoin ETF	na	Franklin	Bitcoin	11/17/23	01/01/24	03/31/24	05/30/24
Greyscale Ethereum Futures Trust	ETH	Greyscale	Ethereum	11/17/23	01/01/24	03/31/24	05/30/24

Source: Bloomberg Intelligence, SEC.gov  
 (1) Provided dates are estimates or final deadlines, and there is a possibility that events could be completed ahead of schedule.

Grayscale's recent legal victory in August has significantly bolstered optimism for the approval of spot Bitcoin ETFs. Although the ruling doesn't provide immediate approval for Grayscale to convert its Bitcoin Trust (GBTC) into an ETF, it mandates the SEC to reassess Grayscale's previously rejected application. The unanimous ruling criticized the SEC's rejection as "arbitrary and capricious" and highlighted its failure to explain the differing treatment of spot bitcoin ETFs from the bitcoin futures ETFs. The SEC's decision not to appeal the court ruling further fueled anticipation for spot ETFs. This positive sentiment has been reflected in the GBTC discount to NAV trend as well. The GBTC discount to NAV has decreased in the latter half of 2023, rebounding from its lowest point of approximately a 50% discount. Following the August ruling, the discount reduced to around 25%, marking a significant improvement. This positive trend has persisted, and the current discount stands at approximately 15%, indicating a continued narrowing of the gap as the anticipation of a spot ETF approval increases.



In addition to the Grayscale ruling, a pivotal aspect that revitalized optimism for the spot BTC ETF was the surveillance sharing agreement feature within BlackRock's application. On June 15, 2023, BlackRock submitted a filing for a spot Bitcoin ETF, introducing a novel Surveillance-Sharing Agreement (SSA) feature. This move prompted similar filings from other institutions, such as VanEck, Fidelity and Invesco. Despite the SEC's historical trend of rejecting spot Bitcoin ETF proposals, there is a renewed sense of hope for approval.

## REGULATION

### UNITED STATES REGULATIONS

In the United States, cryptocurrency regulation has comprised a combination of a case-by-case approach and the expansion of traditional financial frameworks, which have not comprehensively addressed the distinctive nature of cryptocurrencies. This regulatory landscape is further complicated by the intricate interplay of federal and state regulations, resulting in varying treatment of digital assets by different government agencies.

#### FEDERAL AGENCIES AND THEIR PERSPECTIVES

- **IRS (Internal Revenue Service):** The IRS treats digital assets as property for tax purposes. This classification has implications for capital gains tax when cryptocurrencies are bought, sold, or exchanged.
- **FinCEN (Financial Crimes Enforcement Network):** FinCEN enforces anti-money laundering (AML) and know-your-customer (KYC) protocols, categorizing digital assets as a form of currency. This perspective is focused on combating illicit financial activities in the crypto space.
- **CFTC (Commodity Futures Trading Commission):** The CFTC is actively exploring the classification of digital assets as commodities. This approach seeks to regulate digital assets in a manner similar to traditional commodities like gold or oil.
- **SEC (Securities and Exchange Commission):** The SEC primarily designates certain digital assets as securities, subjecting them to securities laws and regulations. This designation has significant implications for Initial Coin Offerings (ICOs) and token offerings.
- **Biden Administration's Executive Order:** The Biden Administration introduced its own definitions and regulatory approach to the cryptocurrency space, aiming to provide further clarity on the industry's future.

#### STATE-LEVEL REGULATIONS

At the state level, the cryptocurrency regulatory landscape is characterized by diverse regulations, creating a fragmented environment where crypto firms must navigate different sets of rules and requirements for state licensing.

Following the global regulatory trend, especially after the FTX incident, many states have been strengthening their existing regulatory frameworks. Notably, New York, known for its BitLicense regime, proposed updates to its crypto regulations in September as part of the broader 'VOLT' initiative. These updates encompass risk considerations, coin de-listing, and a reduction in the number of approved coins to Bitcoin, Ether, and six stablecoins.

Given the varying pace and directions of individual state regulations, cryptocurrency firms are compelled to stay vigilant and adapt to the rapidly evolving regulatory landscape. Despite their compliance efforts, these firms have found themselves exposed to federal scrutiny and face challenges in obtaining federal-level charters.

For instance, Kraken, despite being registered as a Money Service Business with FinCEN and supervised by the Wyoming Division of Banking under a Special Purpose Depository Institution charter for certain digital asset-related services, faced SEC charges. The SEC accused Kraken of failing to register its crypto-asset staking-as-a-service program, resulting in a \$30 million fine and a permanent injunction against the program.

The Office of the Comptroller of the Currency (OCC) has been reluctant to grant regulatory approvals to crypto banks, leading to the expiration of banking charters for Protego and Paxos, as well as the rejection of Custodia Bank's application to become a part of the Federal Reserve System. Anchorage Digital is the only OCC-approved crypto trust company, posing challenges for the broader U.S. crypto industry in finding reliable banking partners.

As such, the complex interplay of state and federal regulations, combined with varying definitions and approaches, presents significant hurdles for crypto firms operating in the U.S., highlighting the need for greater regulatory clarity and consistency.

#### SEC

The SEC employs a "regulation by enforcement" strategy in the crypto industry, clarifying and imposing standards through enforcement actions rather than issuing specific guidelines. This approach involves leveraging existing regulatory frameworks like the Securities Act of 1933 (issuance of securities) and the

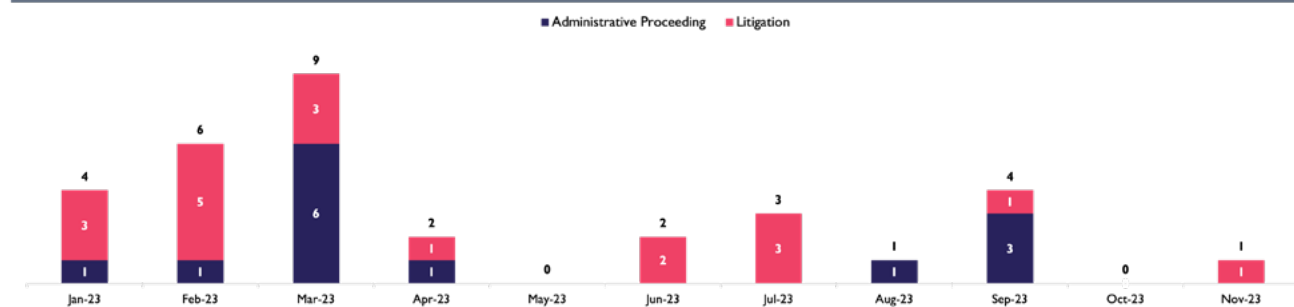
Securities Exchange Act of 1934 (secondary trading of securities) to categorize crypto-assets as securities. Initial investigations during the ICO boom targeted initial coin offerings, prompting crypto projects to adapt strategies. Recent enforcement actions have introduced a new theory that assets are deemed securities during secondary market trading based on the reliance of current investors on the efforts and profit expectations of associated individuals (requirement of the Howey Test). The SEC has expanded its scrutiny to unregistered crypto broker-dealers, exchanges, and intermediaries, urging them to register with the SEC.

**SEC Cryptocurrency Enforcement Actions**

Enforcement Actions Trend (2013 – 2023 YTD)



Monthly Enforcement Actions (2023 YTD)



1: SEC's administrative proceedings refer to internal process conducted before administrative law judges (ALJs) to enforce securities laws. The SEC acts as the prosecutor and the ALJ makes findings and decisions.  
 2: SEC's litigations refer to legal actions brought before federal courts, involving alleged violations of securities laws. The SEC acts as the plaintiff and the case is presented before a judge or jury.  
 Note: March 2023 includes 6 individual administrative filings from the SEC v. Justin Sun et al. case.  
 Source: Cornerstone Research, SEC.gov, The Block Research

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The SEC's "regulation by enforcement" approach has resulted in increased litigation and concerns about the clarity of regulatory guidance. However, the SEC insists that the existing regulatory framework offers adequate clarity and has been ramping up on its enforcement activities. This has resulted in major cryptocurrency exchanges, such as Binance and Coinbase, facing legal charges, sparking apprehensions about the industry's future under the purview of securities laws. One noteworthy trend observed during the Binance, Bittrex, and Coinbase cases was the SEC's departure from its previous practice. In these

filings, the SEC explicitly identified tokens it deemed as securities, listing 6 to 13 tokens (see the figure below). This marked a departure from the SEC's prior approach, which was more vague in identifying specific tokens considered as securities.

**Assets Deemed Securities by the SEC**  
Binance, Bittrex and Coinbase Cases

Binance Case	Bittrex Case	Coinbase Case
<ul style="list-style-type: none"> <li>• ADA</li> <li>• ALGO</li> <li>• ATOM</li> <li>• AXS</li> <li>• COTI</li> <li>• FIL</li> <li>• MANA</li> </ul>	<ul style="list-style-type: none"> <li>• MATIC</li> <li>• SAND</li> <li>• SOL</li> </ul>	<ul style="list-style-type: none"> <li>• ALGO</li> <li>• DASH</li> <li>• IHT</li> <li>• NGC</li> <li>• OMG</li> <li>• TKN</li> </ul>
		<ul style="list-style-type: none"> <li>• ADA</li> <li>• AXS</li> <li>• CHZ</li> <li>• DASH</li> <li>• FIL</li> <li>• FLOW</li> <li>• ICP</li> </ul>
		<ul style="list-style-type: none"> <li>• MATIC</li> <li>• NEXO</li> <li>• NEKO</li> <li>• SAND</li> <li>• SOL</li> <li>• VGX</li> </ul>

Source: The Block Research, Financial Services Committee, Congress.gov, Senate.gov

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**Notable 2023 Cases Highlight SEC's Focus**

<b>Genesis &amp; Gemini</b>	In January 2023, the SEC charged a Genesis Global and Gemini for the unregistered offer and sale of securities through the exchange's lending program. In May 2023, the defendants filed motions to dismiss the complaint or, alternatively, strike the SEC's requests for a permanent injunction and disgorgement.
<b>Paxos</b>	In February 2023, the SEC issued a Wells notice to Paxos, alleging that BUSD, which Paxos issues and lists, is an unregistered security. The New York Department of Financial Services (NYDFS) also commanded the company to cease the issuance.
<b>Kraken</b>	In February 2023, the SEC charged Kraken for failing to register the offer and sale of their crypto-asset staking-as-a-service program. The exchange paid \$30 million in fines and agreed to a permanent injunction against its staking program.
<b>Coinbase</b>	In March 2023, the SEC issued a Wells notice to a major exchange in the U.S., indicating potential violations of securities law. In June 2023, the SEC charged the company for (1) operating as an unregistered securities exchange, broker, and clearing agency and (2) unregistered offer and sale of securities in connection with its staking-as-a-service program.
<b>Bittrex</b>	In April 2023, the SEC charged a crypto-asset trading platform for operating an unregistered national securities exchange, broker, and clearing agency. In this complaint, the SEC named six crypto tokens listed on the platform as securities.
<b>Binance</b>	In June 2023, the SEC filed charges against the world's largest crypto exchange, its U.S. affiliate trading company, and its founder, alleging various violations of securities laws. The SEC seeks permanent restraint and injunction to prevent further violations. In this complaint, the SEC named 12 crypto tokens listed on the platform as securities.
<b>Celsius</b>	In July 2023, the SEC charged a crypto lending company with unregistered sale of securities, false statements, and market manipulation related to its lending program.

Source: The Block Research

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Other noteworthy developments in 2023 were the Ripple case and Grayscale case rulings, which provided partial victories to the crypto firms.

- **Ripple:** The Ripple ruling in July highlighted the dual classification of tokens as both securities and non-securities, representing a partial victory for the Ripple team. In October, the SEC's request for an appeal was denied, and the possibility of an appeal must now await the conclusion of the trial for the remaining issues, scheduled for April 23, 2024.
- **Grayscale:** In August, Grayscale won its legal battle against the SEC regarding its ETF conversion plan. This doesn't grant immediate approval for Grayscale to convert its Bitcoin Trust (GBTC) into an ETF. Instead, the SEC must revisit Grayscale's previously rejected application. The unanimous ruling deemed the SEC's rejection "arbitrary and capricious" and criticized its failure to explain the differing treatment of similar products. This decision is significant for the cryptocurrency and asset management sectors, as it addresses their long-standing efforts to gain SEC approval for a spot bitcoin ETF.

CONGRESS

In terms of congressional advancements, two significant cryptocurrency bills have made headway in Congress this summer, but the prospects of either bill being enacted into law in the near term seem dim.

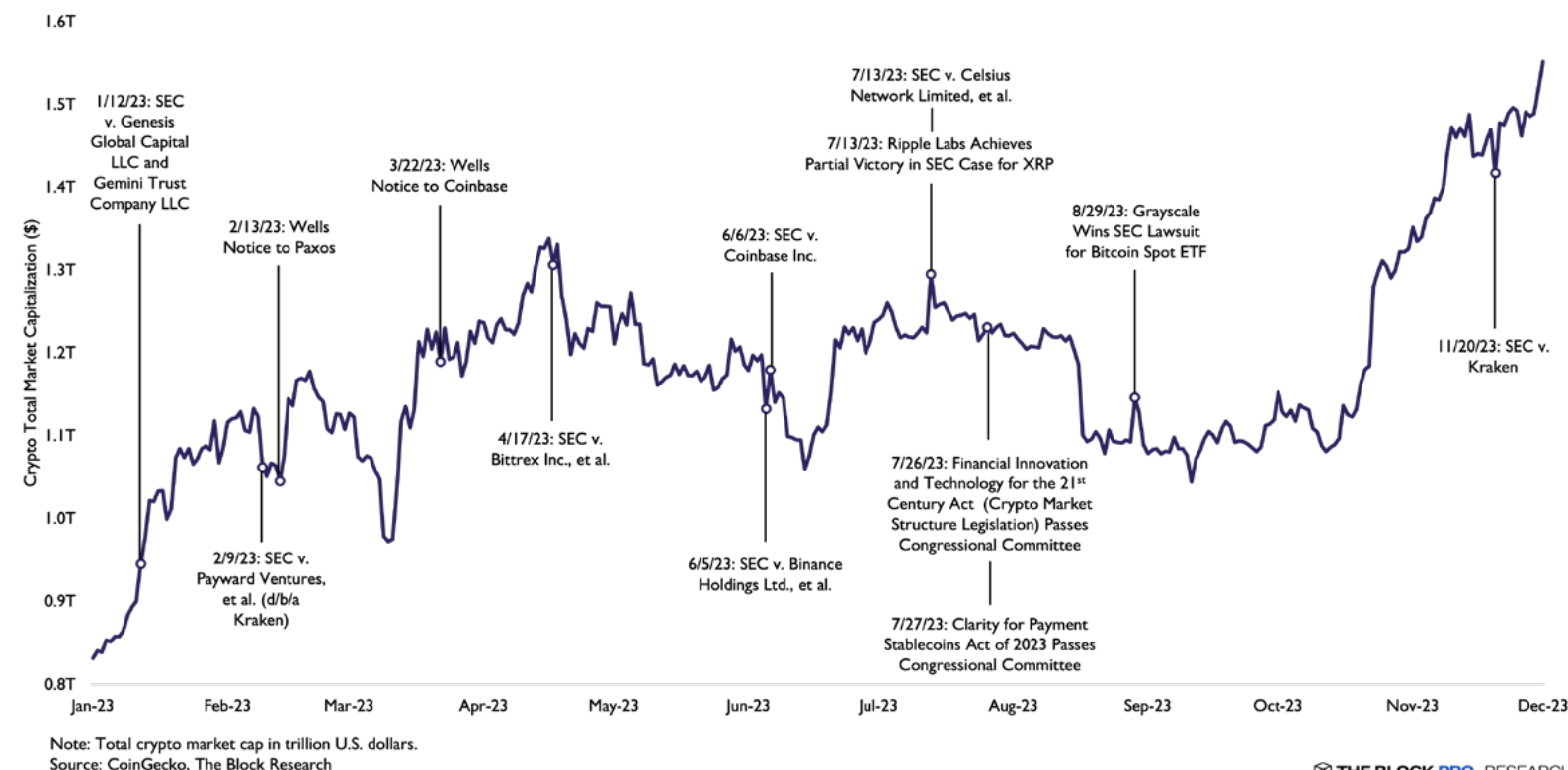
- **Market Structure Bill:** One of these bills focuses on reforming the structure of the cryptocurrency market. It suggests that the CFTC (Commodity Futures Trading Commission) should assume regulatory authority over a wide array of tokens, potentially offering relief from the regulatory pressures currently imposed by the SEC.
- **Stablecoin Regulation Bill:** The second bill outlines regulatory guidelines specifically tailored for stablecoins, a topic that has gained prominence in global regulatory discussions.

While it's encouraging to see lawmakers proposing cryptocurrency-related legislation, many industry experts have noted that developing a comprehensive crypto framework in the U.S. is likely to be a multi-year process. This extended timeline is due to the limited dialogue between Congress and the relevant regulatory agencies, primarily the SEC.

IRS / TREASURY

Besides the SEC and Congress, several other government agencies have ramped up their involvement in cryptocurrency regulation. Notably, in August, the U.S. Department of the Treasury and the IRS introduced regulatory proposals aimed at overseeing digital asset sales and exchanges conducted by brokers, in accordance with the Infrastructure Investment and Jobs Act. According to the proposal, the term "broker" would encompass both centralized and decentralized digital asset trading platforms, crypto payment processors, and specific online wallets used for storing digital assets. This regulation would apply to various cryptocurrencies, including bitcoin and ether, along with non-fungible tokens. These regulations are designed to enhance tax compliance and mandate brokers to report pertinent transactions, bringing them in line with regulations governing other asset categories. The implementation of these reporting requirements is scheduled to commence in 2026 for transactions occurring in 2025.

Notable U.S. Regulations Timeline





## GLOBAL DEVELOPMENTS

Global Crypto Regulations Overview

Jurisdiction	Regulatory Framework	AML / CTF	Travel Rule	Stablecoins Regulation
Argentina	In progress	In progress	In progress	In progress
Bahamas	✓	✓	✓	✓
Brazil	✓	✓	✓	In progress
Canada	✓	✓	✓	✓
Cayman Islands	✓	✓	✓	✓
China	✗	✗	✗	✗
Colombia	In progress	In progress	In progress	In progress
European Union	✓	✓	✓	✓
Hong Kong	In progress	✓	✓	In progress
India	In progress	In progress	In progress	✗
Japan	✓	✓	✓	✓
Nigeria	✓	✓	✗	✗
Singapore	✓	✓	✓	✓
South Korea	✓	✓	✓	In progress
United Arab Emirates	✓	✓	✓	In progress
United Kingdom	In progress	✓	✓	In progress
United States	In progress	✓	✓	In progress
Vietnam	✗	✗	✗	✗

Source: The Block Research, PwC, legal filings.

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In 2023, regulatory authorities across the globe have been actively engaged in the development of updated regulatory frameworks pertaining to crypto-assets. This heightened regulatory activity comes in response to a string of notable crypto-related incidents in the preceding year, with the most prominent being the FTX fallout. Their primary objective has been to refine their regulatory stance on cryptocurrencies, with a keen focus on providing clarity to businesses and market participants. Regulators worldwide are primarily concerned with creating frameworks that address crypto activities that closely resemble traditional markets, such as implementing measures related to anti-money laundering (AML) and counter-terrorism financing (CTF), as well as formulating rules for stablecoins. Regulatory bodies have also been delegating authority to specific agencies and instituting licensing regimes. Although some of these frameworks have

not yet encompassed more crypto-native concepts such as Decentralized Finance (DeFi), there has been discernible progress in the direction of more comprehensive regulation.

### MIDDLE EAST

In the Middle East, the Emirate of Dubai, in particular, has been striving to position itself as a hub for the future economy, emphasizing the adoption of blockchain technology and virtual assets. In March of 2022, the Virtual Assets Regulatory Authority (VARA) was established in Dubai with the mandate to regulate all activities related to the virtual assets sector. By February 2023, VARA had issued the Virtual Assets and Related Activities Regulations 2023, a comprehensive regulatory framework governing virtual assets and associated activities within the Emirate. More than ten companies have either obtained or are currently in the process of securing the Virtual Asset Service Provider (VASP) license. In October, Qatar initiated a public consultation process aimed at the introduction of a cryptocurrency framework within the Qatar Financial Centre (QFC). This endeavor encompasses critical elements such as the establishment of tokenization protocols, formal recognition of digital assets, promotion of technology infrastructure development, and the formulation of compliance regulations.

### EU

In 2023, the European Union (EU) published the Markets in Crypto-Assets (MiCA) regulation. This comprehensive framework for crypto regulation aims to enhance transparency, safeguard investors, and create uniform rules across the EU's 27 member states. Alongside MiCA, the Transfer of Funds Regulation (TFR) was also published in June 2023, focusing on anti-money laundering measures for crypto transfers. Stablecoin regulations under MiCA will take effect in June 2024 and the remaining MiCA and TFR provisions will become applicable in December 2024. Under MiCA, the European Securities and Markets Authority becomes the primary regulator, responsible for approving licenses and imposing platform restrictions. It sets specific security and risk management standards for stablecoin issuers and custody providers, addressing environmental concerns by requiring disclosure of energy consumption. Additionally, the EU is developing tax transparency rules for crypto-asset transactions, with an anticipated implementation date of January 2026 under DAC8.

### UK

In the UK, recent digital asset regulation has seen the implementation of the Travel Rule in September 2023, requiring crypto firms to share beneficiary and originator details during asset transfers. Moreover, the UK has outlined plans for a comprehensive regulatory regime for digital assets, which will be introduced in phases. Initially, the focus is on regulating fiat-backed stablecoins, with expansion to cover other cryptoassets by

2024. To operate within this framework, crypto firms will need authorization from the Financial Conduct Authority (FCA) and undergo a "business test" for jurisdiction determination. The government is also set to establish disclosure frameworks, enforce market abuse regulations, and regulate custodial activities under anti-money laundering rules. Additionally, there's consideration of introducing a separate regime for on-chain staking services. Expectations are for fiat-backed stablecoin regulations to be rolled out in early 2024, incorporating them into existing frameworks such as Payment Services Regulations 2017 (PSRs 2017) and Financial Services and Markets Act 2000 (Regulated Activities) Order 2001 (RAO).

#### APAC

The Asia-Pacific (APAC) region has been proactive in developing crypto regulations. Singapore has consistently shaped its regulatory framework, starting with AML measures and the Travel Rule in 2020, followed by MPI licenses for DPT service providers. Over the past year, it introduced measures for consumer protection and stablecoin oversight, strengthening its framework with asset segregation and tighter controls on lending and staking, and finalizing stablecoin regulations. Hong Kong also saw significant crypto-friendly developments, passing the Anti-Money Laundering and Counter-Terrorist Financing (Amendment) Bill in December 2022, establishing a VASP licensing framework, and opening retail investor access with stringent requirements, with stablecoin regulations expected in 2024. Australia is in the early stages of developing a comprehensive framework, proposing licenses for digital asset exchanges and exploring a CBDC in collaboration with the Reserve Bank of Australia. Taiwan prioritizes customer protection through non-binding principles for virtual asset platforms. Japan is set to enforce stricter AML/CFT measures from June 1, including the "Travel Rule," while South Korea's parliament approved the Virtual Asset User Protection Act, introducing investor protection measures. This comprehensive overview highlights the dynamic regulatory landscape across the APAC region.

#### LATAM

Brazil's crypto regulation, implemented in December 2022 and effective from June 2023, represents a significant milestone in Latin America. This regulation grants the Central Bank of Brazil authority over virtual asset service providers, with token projects categorized as securities falling under the supervision of the Comissão de Valores Mobiliários (CVM). Notably, it introduces penalties for virtual asset-related fraud and mandates licenses for companies, including exchanges, operating as virtual service providers. The central bank governor supports blockchain technology and plans to launch a central bank digital currency (CBDC) within the next year. Brazil is particularly attentive to the growth of stablecoins among merchants and is concurrently advancing its CBDC project, Drex, with the aim of leveraging blockchain for efficiency

while maintaining centralized control over financial operations. As neighboring regions like Argentina and Colombia also develop their crypto regulations, Brazil's proactive approach sets a noteworthy example for the evolving landscape of crypto regulation in Latin America.

# SECTION 3

## BLOCKCHAIN PLATFORMS & SCALING

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This section provides an overview of the growing landscape of blockchain protocols, analyzing activity, network architecture and progress towards scaling across each. The section first summarizes Ethereum’s developments in 2023 and provides some challenges faced by the leading layer 1; primarily, in relation to scaling itself to serve more users during periods of high demand.

Despite its challenges, Ethereum has to continue to defend itself against many layer 1 blockchain competitors that offer various feature sets and go-to-market solutions to tackle scalability issues. Ethereum, itself, has opted for a modular approach, prioritizing the use of rollup solutions, moving forward with a rollup-centric roadmap.

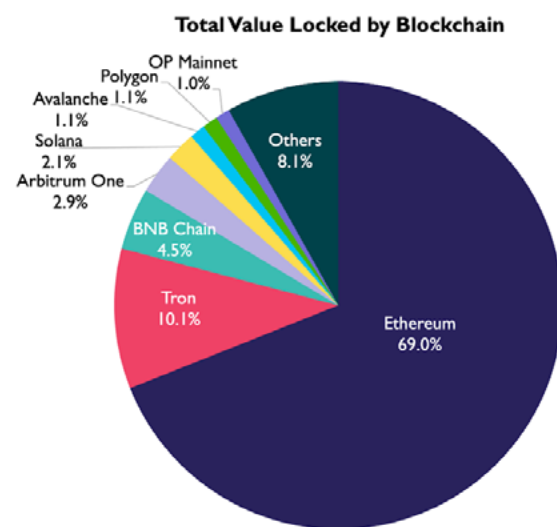
Other layer 1 blockchains, however, are very slowly nipping at Ethereum’s heels, in an attempt to collect more market share. These blockchains include Solana, Avalanche, Tron, and Cosmos all of which offer various takes on scalability. Solana, for instance, is championing the integrated system approach vs. Ethereum’s modular approach, convinced that an optimized singular general-purpose blockchain is the way to solve blockchain scalability and serve mainstream users. Others, such as the broader Cosmos ecosystem, have taken the modular approach to an extreme, progressing towards a fully multichain architecture.

Ethereum’s rollup-centric roadmap has led to the proliferation of dozens of rollups across four primary categories: optimistic, zero-knowledge, validiums, and optimiums. While Optimistic rollups are by far the most popular, this section dives into the data surrounding all rollup approaches. The rollup-centric roadmap also comes with the development of cross-chain interoperability protocols, commonly referred to as blockchain bridges, along with additional layers of infrastructure that support a modular approach.

Finally, this section summarizes new developments and scaling on the Bitcoin blockchain, focusing particularly on the Lightning Network, Ordinals, and BitVM.

## ETHEREUM REMAINS DOMINANT CONTEXTUALIZING ETHEREUM'S SUCCESS

Ethereum's position as the market leader across layer 1 (L1) smart contract platforms has continued in 2023, highlighted by continued dominance in nearly all measures of network usage, such as total value locked (TVL), trading volumes, and transaction fees, among others. Transaction fees are especially useful as indicators of network adoption, as they directly reflect the dollar amount that users are willing to pay for block space over a given period of time. From this perspective, it is clear that the majority of blockchain demand in 2023 was concentrated in the Ethereum network, above all other L1s.



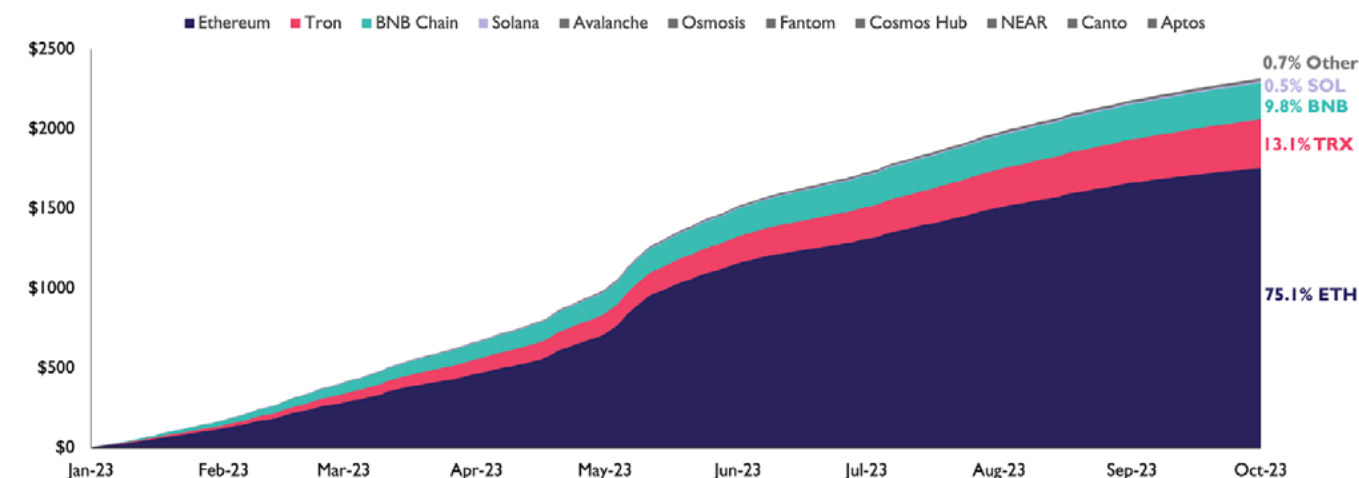
Source: DeFiLlama  
\* Data as of 11/30/2023

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After enduring one of the most calamitous years in crypto history, marked by the collapses of Terra UST, Three Arrows Capital, Genesis, and FTX/Alameda, 2023 became a year of survival for L1 ecosystems, many of which were significantly impacted by the market-wide volatility of 2022.

Over the course of our monthly [L1 landscape](#) recaps in 2023, we observed how, generally, the largest L1s by market cap were best able to retain value within their ecosystems in the form of total value locked. Despite the proliferation of alternative L1s and diverse scaling solutions, Ethereum continues to dominate the digital asset landscape, boasting a majority of TVL across various blockchains. Similarly, by the end of Q3 2023, Ethereum had garnered ~75% of transaction fees paid by L1 users, totaling ~\$1.75 billion.

Cumulative L1 Transaction Fees 2023

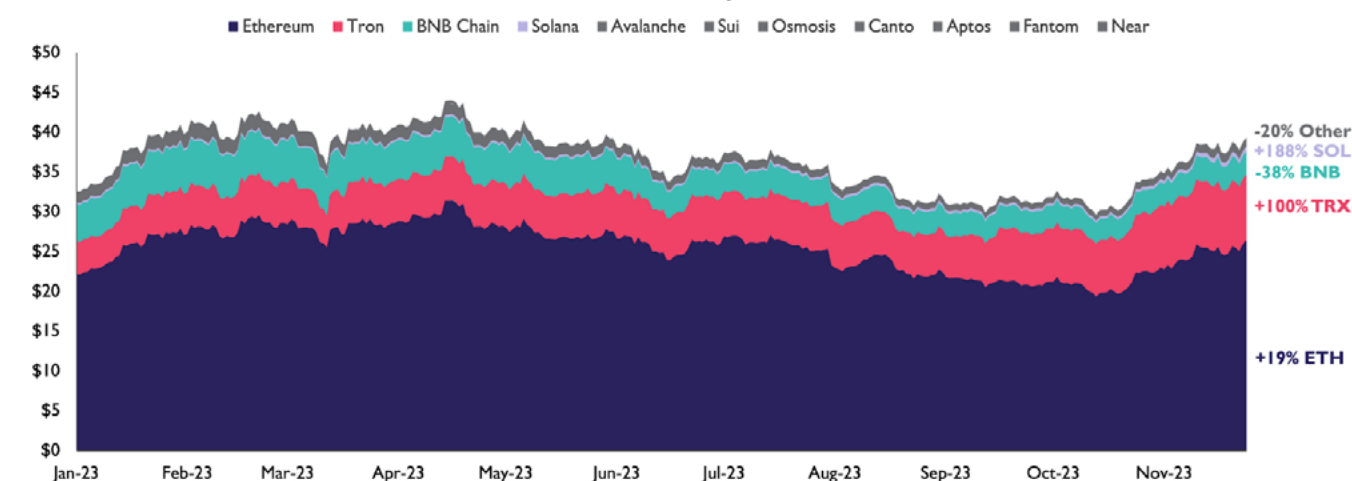


Source: The Block Pro Research.  
Note: U.S. dollars in millions.

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By December 2023, Ethereum's TVL had grown by ~19% YTD, compared to a loss of ~20% for the combined TVLs of Avalanche, Sui, Osmosis, Canto, Aptos, Fantom, and Near.

TVL in L1 Ecosystems



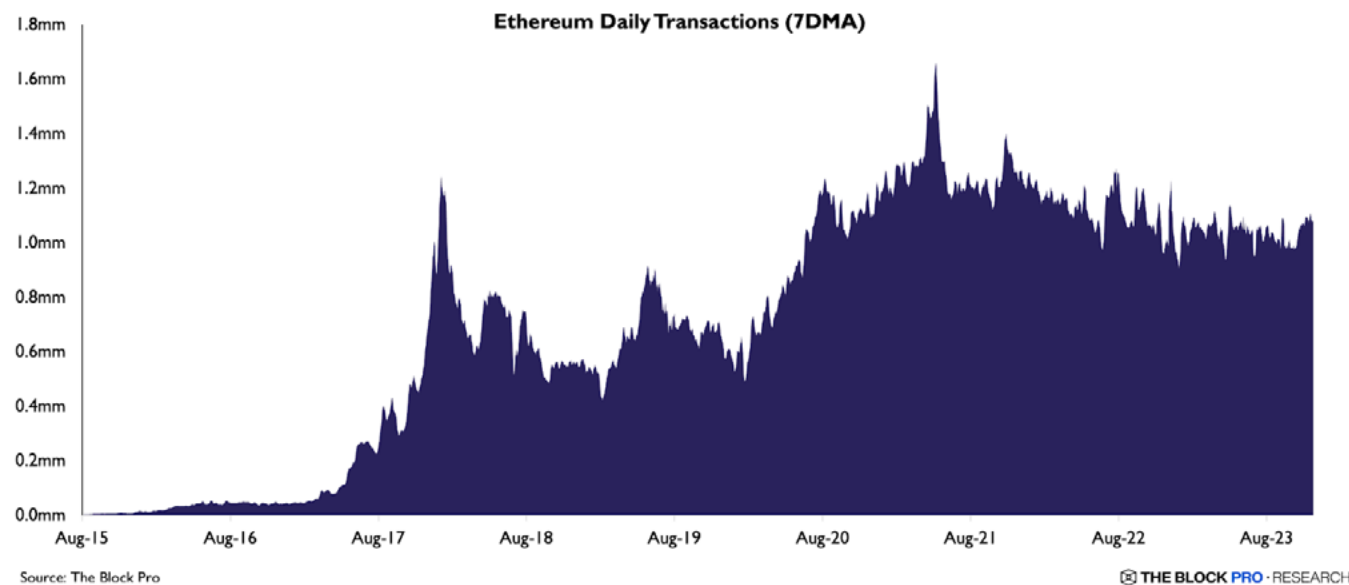
Source: The Block Pro Research.  
Note: U.S. dollars in billions.

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Ethereum's quasi-Turing complete Ethereum Virtual Machine (EVM) facilitates the permissionless creation and trading of both fungible and non-fungible tokens, in addition to sustaining the continuous and transparent operation of a myriad of decentralized applications (dApps). These functionalities give rise to numerous use cases, spanning value transfer, crowdfunding, prediction markets, decentralized finance (DeFi), decentralized autonomous organizations (DAOs), and non-fungible token (NFT) art, among others.

**ETHEREUM'S SCALING CHALLENGES**

As the demand for transactions continues to surge, Ethereum's finite blockspace encounters challenges in accommodating its escalating adoption. Ethereum's throughput has reached a plateau at approximately 15 transactions per second (tps), a figure significantly dwarfed by VisaNet's throughput ceiling of 65,000 tps. This juxtaposition underscores the inadequacy of the Ethereum network for widespread adoption.



Periods of heightened demand, exemplified by fervent first-come-first-served NFT minting events, result in network congestion that translates to prolonged transaction processing times and high transaction costs. While Ethereum's adaptive gas fee pricing mechanism serves as a deterrent against Sybil attacks, it inadvertently excludes numerous grassroots users and degrades the overall user experience, making Ethereum a victim of its own success.

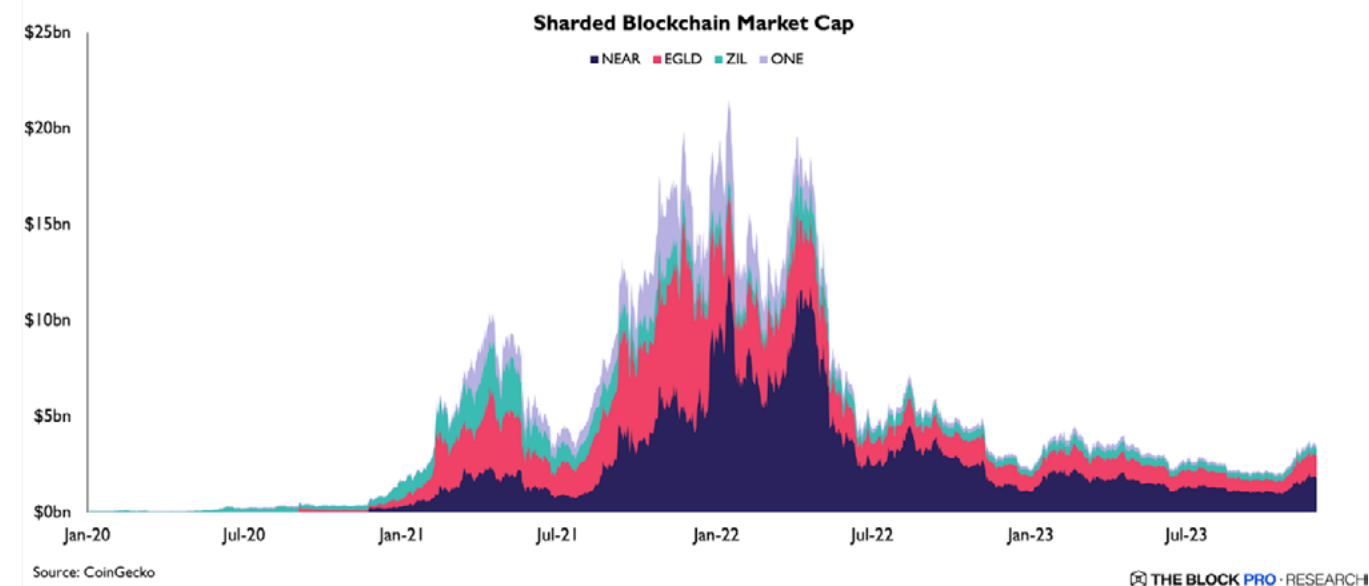
The issue of scaling Ethereum has been a contentious discourse for years. Its challenges are encapsulated by the blockchain trilemma, wherein distributed networks can only be optimized for two out of three properties: decentralization, security, and scalability. More specifically, endeavors to enhance scalability often necessitate compromising a degree of decentralization or security, a trade-off met with reluctance from the community.

As a result, initiatives to scale Ethereum proceed cautiously, involving extensive research and rigorous testing to uphold the network's integrity and reputation. The perceived gradual progress may seem

sluggish to many, which has prompted the emergence of numerous alternative L1s outside the Ethereum ecosystem that jump the gun and employ different scaling mechanisms.

Various approaches to scaling Ethereum can be broadly categorized into enshrined (on-chain) and adjunct (off-chain) methods. Enshrinement involves making modifications to the core Ethereum protocol, while adjunction entails establishing supplementary protocols and infrastructure on top of Ethereum. Enshrinement, though an efficient and intuitive concept, contradicts the minimal-enshrinement philosophy and potentially compromises Ethereum's credible neutrality. On the other hand, adjunction allows for quicker iterative experimentation but raises concerns about the potential centralization of the outside-the-protocol ecosystem.

The initial enshrinement proposal centered around sharding, a technique that involves partitioning the blockchain state and computation into multiple shards. Each node would then only need to store and validate a subset of the network. However, this proposal did not materialize as quickly as expected, prompting faster advancements in adjunct developments. Still, the concept of sharding has influenced alternative L1s, such as NEAR Protocol, MultiversX, Zilliqa, and Harmony, which are implementing various variants of sharding.



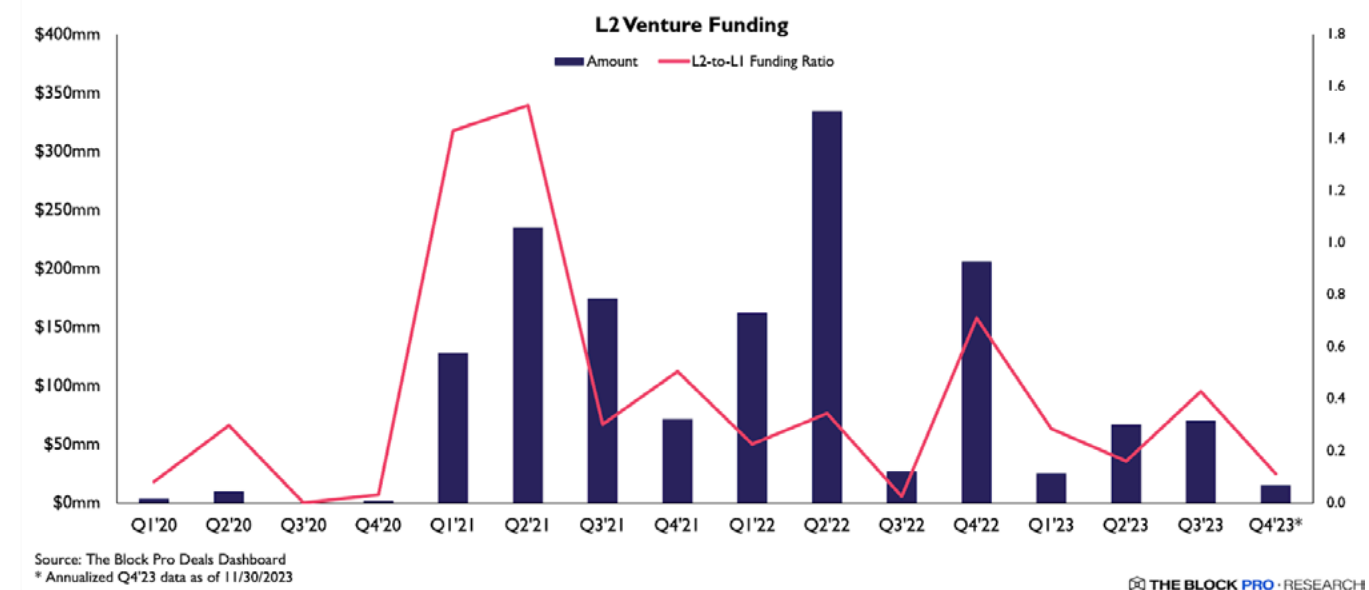
In contrast, early advancements in the adjunct realm, including sidechains and plasmas, gained traction due to their independence from the constraints of Ethereum’s slow social consensus.

Sidechains are distinct blockchains with their own consensus mechanisms and are connected to Ethereum through a canonical two-way bridge. Since they do not inherit Ethereum’s security, they are often viewed as an interim solution. Prominent examples include Polygon proof-of-stake (PoS), Gnosis Chain, SKALE, and Loom Network.

Plasmas, such as Polygon Plasma, represent early iterations of Optimiums featuring off-chain computation and data availability (DA), coupled with on-chain state commitment and a fraud-proof arbitration mechanism. However, their design is limited to basic token transfers and swaps, lacking support for generic computation. Consequently, plasmas have garnered comparatively less popularity among users.

Rollups have emerged as the predominant solution for enhancing Ethereum’s scalability in an adjunct manner. Distinguished by their ability to support generic computation and inherit security from Ethereum, rollups demonstrate superiority over sidechains and plasmas. In the rollup model, transactions are executed outside Ethereum, with transaction data and state commitments posted on-chain. Ethereum serves as the base layer for DA and settlement, while layer 2 (L2) rollups operate their own execution environment.

The optimism and enthusiasm surrounding rollups were met with a sustained level of venture funding from 2021 through most of 2022. Interestingly, the first two quarters of 2021 saw more funding directed towards L2 development than that allocated to L1 solutions. The notable decrease in funding observed in the subsequent period could be attributed to the challenges posed by a liquidity crunch under a high-interest-rate environment. This shift in funding dynamics suggests a nuanced response to prevailing market conditions, highlighting the impact of external factors on financing the development of blockchain scalability solutions.



## A MODULAR APPROACH TO SCALING

### OPTIMISTIC ROLLUPS

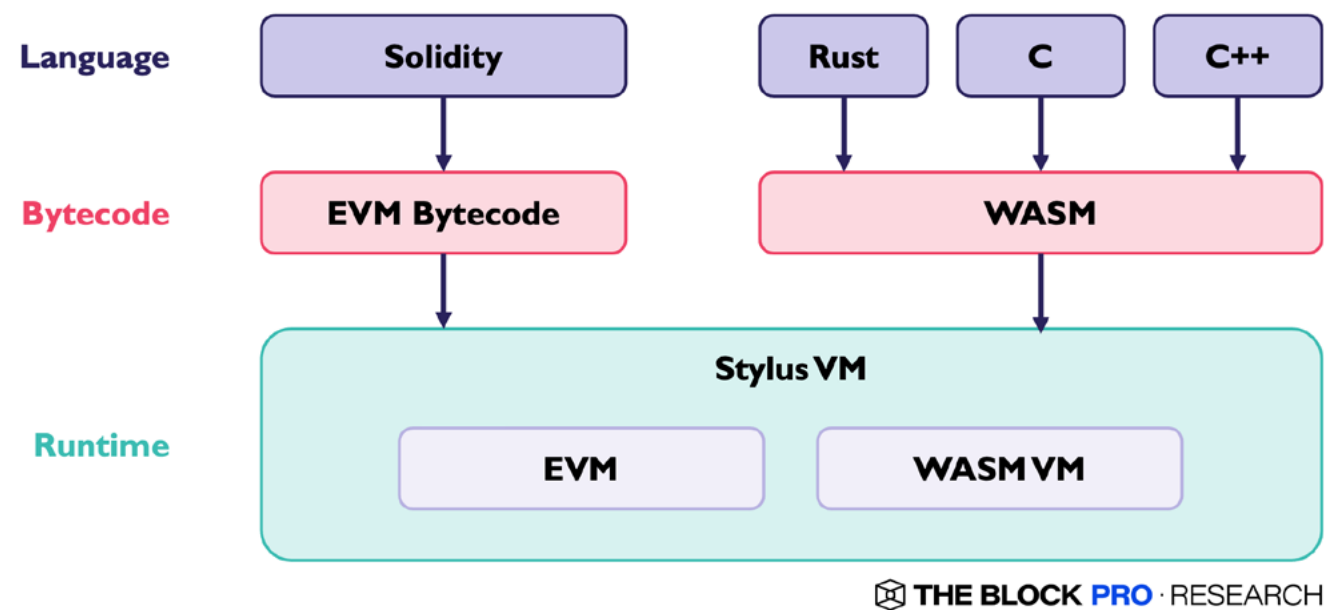
Two types of rollups have arisen since its initial conception in 2019: optimistic rollups (ORs) and zero-knowledge rollups (ZKRs). They employ different state validation mechanisms, with ORs relying on fraud proofs for dispute resolution and ZKRs utilizing zero-knowledge proofs (ZKPs) for proof verification. The prevalence of ORs in the current rollup landscape, compared to ZKRs, can be attributed to their first-mover advantage, as the development of ZKRs is often impeded by increased technical complexity, mainly due to the incorporation of zero-knowledge cryptography.

Among ORs, OP Stack has emerged as a prominent player this year. Developed by the Optimism Collective, OP Stack is an open-source and modular software stack that powers the OP Mainnet and various other ORs launched in 2023, including Base, Manta Pacific, Aevo, Zora, and more. Notably, OP Stack streamlines the installation of application-specific rollups, drawing a parallel to Shopify’s role in simplifying the setup of e-commerce platforms. Following the introduction of decentralized exchange (DEX)-focused Aevo, we can anticipate the introduction of additional OP Stack-powered application-specific rollups in the coming year, such as the social-focused DeBank Chain and the trading-optimized Lyra Chain.

Furthermore, with integrations with rollup-as-a-service platforms like Altlayer, the realization of the Optimism Superchains vision is gradually unfolding. This vision encompasses a network of standardized OP Stack L2s interconnected by a unified cross-rollup communication protocol. As these developments unfold, the rollup landscape is poised to witness increased standardization and interoperability.

Incubated by Coinbase, the largest cryptocurrency exchange in the U.S., Base, powered by OP Stack, has rapidly ascended to become the fastest-growing OR in 2023. Currently, it holds the position as the third-largest rollup by TVL. The remarkable success of Base in the rollup space has prompted competitors to emulate its model. Kraken, the second-largest cryptocurrency exchange in the U.S., is reportedly in discussions with rollup infrastructure providers to launch an L2 under its brand. The endorsement from well-funded industry giants is expected to expedite the overall growth of the L2 space.

On the technical front, the alpha-stage Arbitrum Stylus is set to enhance Arbitrum-based rollups by introducing a dual virtual machine (VM) structure. This includes a conventional EVM and a coequal WebAssembly (WASM) VM. WASM supports popular programming languages like Rust and C++, offering faster and more cost-effective programs than their counterparts.



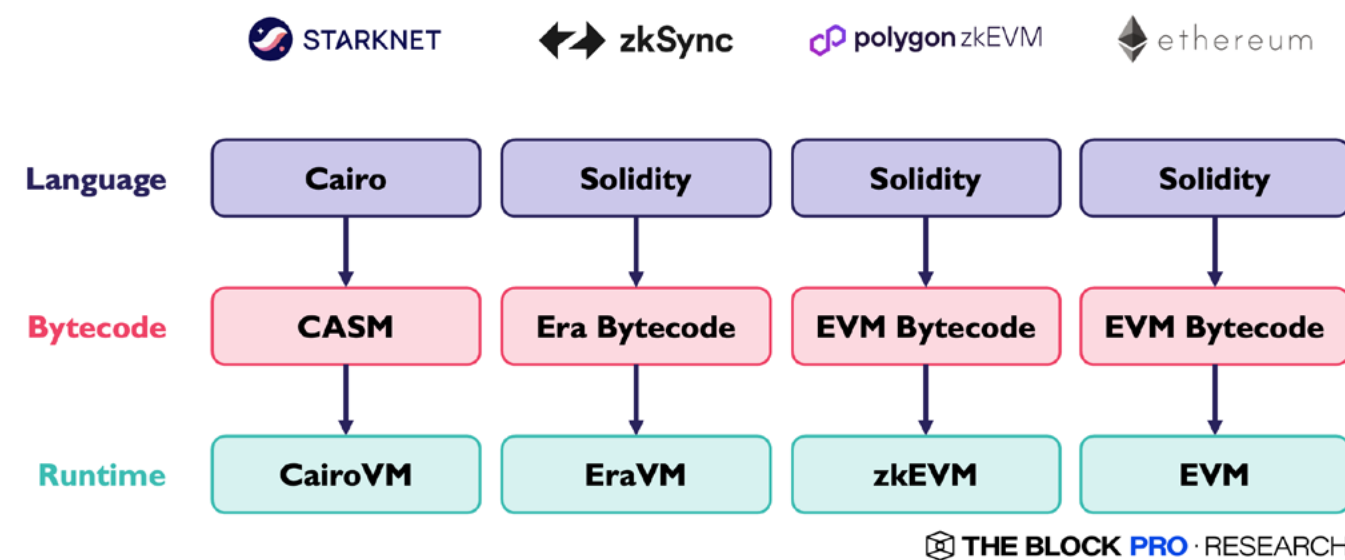
In terms of decentralization, the upcoming implementation of a bounded liquidity delay mechanism in the Arbitrum ecosystem will enable permissionless fraud-proof validation. Simultaneously, the completion of OP Stack's Bedrock upgrade in June 2023 opens avenues for the modular deployment of any fraud-proof system in any OP Stack rollup, such as Optimism's Cannon or RISC Zero's ZKP for hybrid rollups. These advancements underscore both Arbitrum's and Optimism's dedication to achieving maximal decentralization and aligning with the ethos of Ethereum.

ZERO-KNOWLEDGE ROLLUPS

On the flip side, the process of ZKP generation for generic computational programs entails converting each VM instruction into a set of polynomial constraints, making it a resource-intensive and time-consuming endeavor. Consequently, ZKRs are cryptographically more intricate to implement compared to ORs. This complexity contributes to the lag in the development and adoption of ZKRs relative to their counterparts.

In the domain of ZKRs, this year witnessed the continued evolution and introduction of alternative VMs. Notably, Starknet's new versions of CairoVM prioritize ZKP efficiency over Solidity compatibility following the sunset of the Warp transpiler in July 2023. Conversely, zkSync Era's EraVM prioritizes Solidity developer friendliness. Launched in Q1 2023, while not EVM-equivalent, EraVM is tailored to support the direct compilation of high-level Solidity (and Vyper) codes into proof-friendly bytecodes. Additionally, the in-development zkVM by RISC Zero is believed to have the capability to cost-effectively prove an Ethereum block within minutes.

While adapting EVM to integrate seamlessly with ZKPs poses technical challenges, 2023 serves as a pivotal year for zkEVM advancement. The launches of Polygon zkEVM, Linea, and Scroll in Q1, Q3, and Q4, respectively, demonstrate early versions of zkEVM with bytecode-level EVM equivalence, showcasing the ability to succinctly prove most low-level EVM opcodes.



Furthermore, Polygon CDK stands out as an open-source framework designed to streamline the launch of ZKRs. Taking inspiration from Optimism, Polygon aims to cultivate a zkEVM hub within the overarching Polygon Supernets, featuring cross-rollup messaging functionality. This strategic move positions Polygon to capture a substantial market share in the competitive landscape of ZKRs, challenging existing ZKR giants.

In the next few months, we expect multiple launches of Polygon CDK-powered ZKRs, including general-purpose Astar zkEVM and OKX-incubated X1, as well as Immutable zkEVM tailored for gaming applications. Additionally, some established blockchains are poised to make the transition to ZKRs using Polygon CDK technology, exemplified by Canto from the Cosmos ecosystem and the Manta Pacific OR.

Taiko will further push the frontier of zkEVM into being Ethereum-equivalent, where most parts of the Ethereum system remain unaltered. Ethereum-equivalent zkEVMs can reuse many existing Ethereum infrastructures, including execution clients and consensus clients, for executing and sequencing transactions, respectively. Also, the improving macroeconomic environment and digital asset market could provide a testbed for stress-testing ZKRs with elevated demand throughout the following year.

#### ROLLUP VARIANTS

The prevailing model in many rollups involves the reliance on centralized sequencers for transaction ordering, facilitating swift transaction confirmation but potentially compromising liveness. Recognizing this, Exspresso Systems is pioneering decentralized, shared sequencing technology specifically designed for the Arbitrum ecosystem. In a parallel development, the Optimism ecosystem is slated to introduce its own solution following the implementation of its fraud-proof system. Furthermore, the emergence of sequencing-as-a-service protocols, such as Astria and Rádus, would enable further democratization of sequencing in the broader rollup ecosystem.

Apart from sequencer centralization, ORs and ZKRs come with their own limitations. ORs exhibit high latency in finality as fraud proofs may take days to be resolved on the base layer. On the other hand, ZKRs incur higher costs due to the resource-intensive process of ZKP generation and on-chain validation. In response to these challenges, hybrid optimistic zero-knowledge rollups aim to combine the strengths of both approaches, offering quicker finality times with manageable additional costs. This is achieved by integrating on-demand ZKPs into ORs, generating ZKPs only when necessary, such as during fast withdrawal requests or when a challenge is raised against the validity of an unfinalized block. Collaborative efforts between AltLayer and RISC Zero are underway to develop a working implementation of hybrid

rollups, and we may witness the launch of various versions of hybrid rollups as the technology matures in the coming years.

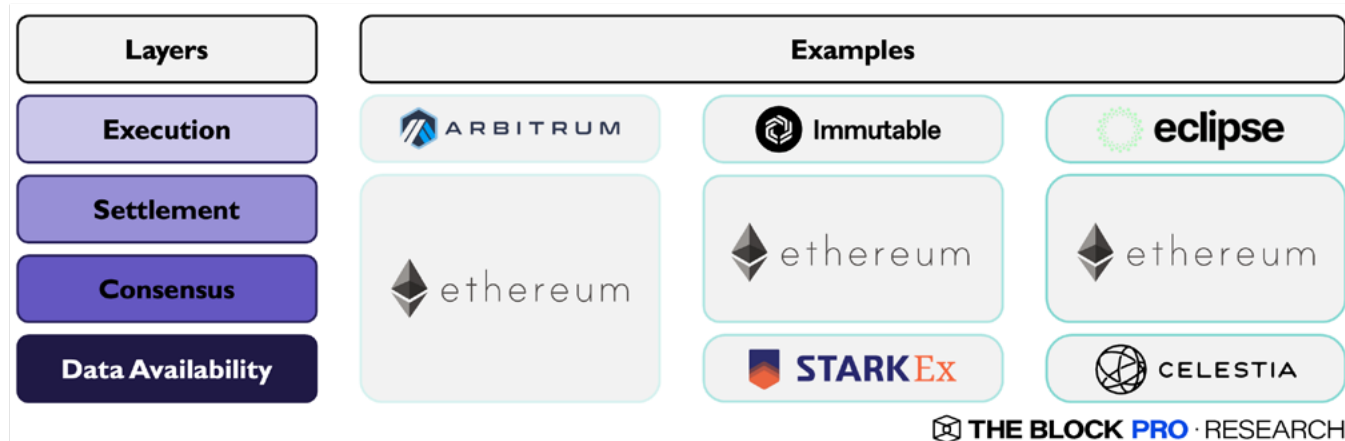
Beyond hybrid rollups, the exploration of various mechanisms seeks to push the limits of rollups to the extreme. Application-specific layer 3 (L3) rollups built on top of L2 rollups are considered to be able to provide more customizability. In the case of ZKRs on top of ZKRs, scalability can be further enhanced through recursive proving. Several L2 developers are concurrently developing L3 toolsets to capture the uncharted L3 market. Examples include Arbitrum Orbit, Starknet's fractal scaling, as well as zkSync Hyperchains. This trend underscores a fundamental philosophical divergence from L2-focused Optimism Superchains and Polygon Supernets. In 2024, we can expect the launch of numerous L3 solutions, such as Kakarot zkEVM on Starknet and gaming-focused Xai on Arbitrum One.

A recognized limitation associated with rollups is the necessity to post all transaction data on Ethereum, which incurs significant recurring costs. To address this, solutions like Validiums (utilizing ZKPs) and Optimiums (utilizing fraud proofs) significantly reduce the cost of L2 operation by storing transaction data elsewhere. This trade-off, however, shifts the security of DA from Ethereum to chosen DA providers.

In the realm of Optimiums, Mantle emerged as a key player this year. Launched in July, Mantle swiftly garnered market attention, establishing itself as the largest L2 with off-chain DA in TVL terms. Mantle has expressed its intention to adopt EigenDA as its DA provider once it becomes available. Meanwhile, Polygon PoS is undergoing a significant transition, shifting from being a sidechain to a zkEVM Validium by the first quarter of 2024. This strategic shift emphasizes its commitment to decentralization. These developments highlight the ongoing efforts to address scalability challenges while navigating the nuanced trade-offs between scalability, decentralization, security, and cost efficiency.

The advent of Validiums and Optimiums has given rise to DA service providers, which are optimized for the provision of modular, data-agnostic, and cost-efficient DA services. One notable player in this sector is Celestia, which was launched in November 2023. It has garnered attention for leveraging erasure coding to achieve highly efficient DA sampling and create probabilistic DA proofs. Looking ahead, Avail, EigenDA, and Synapse Chain are among those poised to contribute to the expanding ecosystem of solutions aimed at addressing the challenges associated with DA. As these providers bring novel approaches and technologies to the forefront, the diversity of options for DA optimization is set to increase, fostering innovation and competition within the space.





ROLLUP-CENTRIC ETHEREUM

Beyond the active development highlighted earlier in the realm of rollups, the Ethereum protocol is currently in the midst of transformative changes to align with a rollup-centric roadmap. Particularly, danksharding represents a modest adaptation of traditional sharding methodologies that introduces significant simplifications and is tailored to accommodate the needs of data-intensive rollups.

In the danksharding paradigm, a sole proposer is responsible for choosing all transactions and data for the upcoming slot, unlike typical sharding with multiple shards, each with their distinct blocks and block proposers. Simultaneously, danksharding introduces a novel data format known as “blobs,” which are large pieces of ephemeral data inaccessible to EVM execution. Together with enshrined proposer-builder separation (PBS) and DA sampling, validators will be able to verify blocks under reasonable computational and data bandwidth requirements. In essence, danksharding offers a conceptually independent storage space market for rollups to cheaply store data without imposing undue bandwidth demands on validators.

The realization of danksharding presents an intricate undertaking, and its ultimate implementation is anticipated to be a matter of years. However, the foundations for this ambitious endeavor are being meticulously established. The implementation of proto-danksharding (i.e., EIP-4844) is slated to take place in the upcoming protocol upgrade scheduled for Q1 2024. This proposal serves as a precursor, incorporating key rulesets and formats integral to enabling danksharding. Notably, proto-danksharding introduces a new transaction type — a blob-carrying transaction — without the immediate integration of PBS and DA sampling. This strategic step will mark a significant milestone toward establishing Ethereum as a DA-optimized base layer.

On the other hand, earlier Ethereum upgrades have introduced substantial modifications to the protocol,

fostering a more rollup-friendly environment. Notably, the implementation of the base fee in transaction fee pricing (i.e., EIP-1559) bestows predictability in gas fees. This predictability proves invaluable for L2 sequencers, as it enables them to confidently post data on Ethereum, ensuring a high likelihood of inclusion in the next block. Furthermore, the adoption of the proof-of-stake (PoS) consensus lowers the barrier to network participation. It also provides a pathway for securely splitting network responsibilities, as PoS has the benefit of always having a registry of all approved stakers, thereby preserving decentralization even as the network structure becomes more intricate.

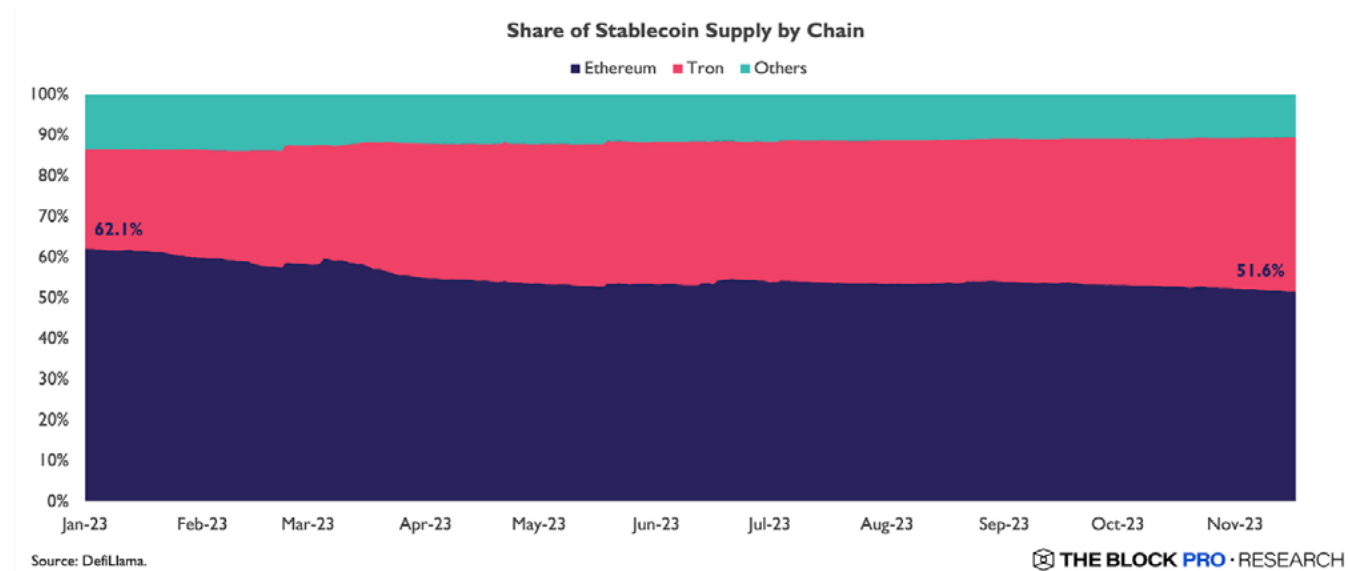
While it remains premature to precisely envision the future state of the Ethereum protocol in the coming years, a discernible trend is the deliberate choice of a path characterized by modularization and the delegation of execution optimization to external rollups. This emphasis on modularization stands in stark contrast to many monolithic alternatives that prioritize parallel processing through optimizing VM environments, such as Solana’s Sealevel runtime, MoveVM from Aptos and Sui, among others. On the other hand, the maturation of rollup technology has prompted discussions regarding the potential internalization of certain rollup components into the core Ethereum protocol. Alternative L1s, such as Tezos and Mina, have already embraced enshrined rollups, contributing to the ongoing experimentation within the broader blockchain ecosystem.

In this dynamic and rapidly evolving landscape, the diverse array of scaling solutions reflects the resilience and adaptability of the digital asset community. The coming years hold the promise of further breakthroughs, continued experimentation, and the maturation of Ethereum as a robust, scalable, and decentralized platform, solidifying its dominance within the blockchain landscape. However, rival blockchains have not remained passive in their developments. In 2023, we witnessed a sustained and robust development of alternative layer 1 ecosystems.

## LAYER 1 BLOCKCHAINS BID FOR MARKET SHARE

### EXOGENOUS PRESSURES CREATE WINNERS AND LOSERS (TRON AND BNB CHAIN)

In 2023, there were some notable shake-ups among the largest Ethereum competitors. Tron’s TVL grew by ~100% from the start of 2023 to December, while BNB Chain’s TVL fell by ~38% over the same period. These changes partly reflected the susceptibility of the crypto ecosystem to external forces, including both macroeconomic and regulatory events. For instance, Tron’s TVL gains were largely a product of a broader shift in stablecoin usage from USDC and BUSD to USDT.

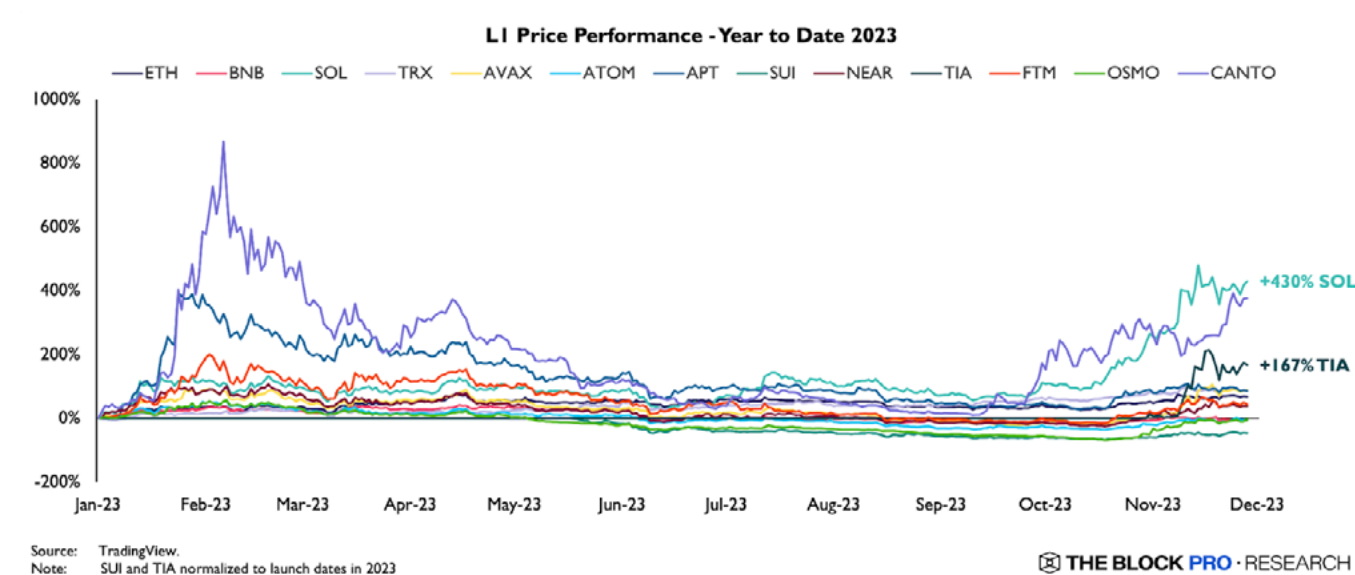


One of the main side effects of this transition from USDC to USDT usage was that Ethereum ceded significant stablecoin market share to Tron in 2023, given that ~50% of USDT supply exists on Tron and ~86% of USDC supply exists on Ethereum. By December 2023, Ethereum’s share of overall stablecoin supply had dropped to ~51.6%, from ~62.1% at the start of the year.

The BNB Chain ecosystem also endured the impacts of stablecoin market shifts – albeit in the opposite direction. Specifically, stablecoin supply on BNB Chain experienced continuous decline follow the halting of Binance USD (BUSD). Additionally, the BNB ecosystem likely suffered from a wave of regulatory actions against its principal agent, Binance throughout 2023, including lawsuits brought on by the U.S. Securities and Exchange Commission (SEC) and Commodities Futures Trading Commission (CFTC). In November,

regulatory fears around Binance culminated in the departure of CEO Changpeng Zhao (CZ) as part of a plea deal with the U.S. Department of Justice (DOJ), alongside a hefty fine for Binance. By December 1st, BNB’s market cap had dropped by over \$4.5 billion since the start of 2023, pulling the ecosystem’s TVL down as well.

Market valuations of L1 networks - as expressed by the price of their tokens - are a key variable in determining the health of particular ecosystems. These valuations are often intertwined with basic metrics such as TVL, as well as more multi-dimensional, intangible factors, such as economic security or investor sentiment around a particular technology or narrative. In 2023, one of the prevailing market narratives was the increasing concentration of mindshare behind two opposing scaling approaches: modularity, which we already touched upon above, and integration.

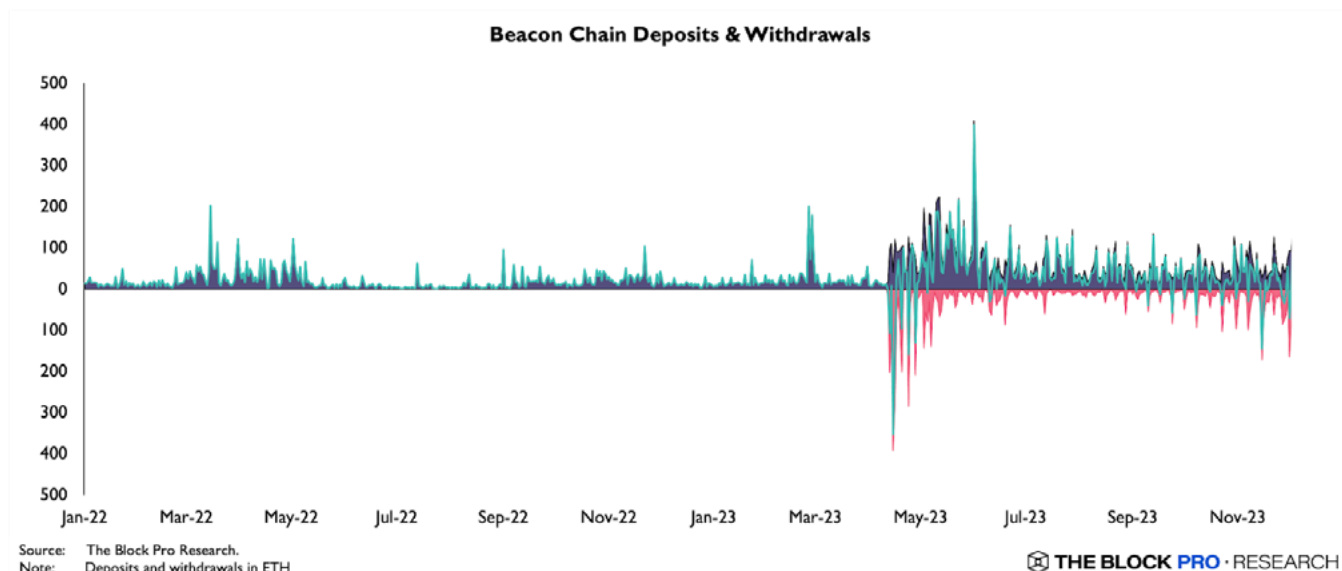


The market’s focus on these two overarching approaches is observable from the price history of SOL (Solana) and TIA (Celestia), which represent opposite sides of the integration vs modularity debate and which were among the top performers in 2023. Solana, with its monolithic architecture optimized for execution, represents an integrated systems approach to scaling, and its market cap grew by ~430% in the first 11 months of 2023. On the other hand, Celestia, as a data availability layer, embodies the modular approach to scaling, and its TIA token saw a gain of ~167% within a month of its launch in early November. In the next section, we take a closer look at the L1 landscape in 2023 through the lens of modular and integrated blockchains.

## MULTICHAIN & INTEGRATED SYSTEMS

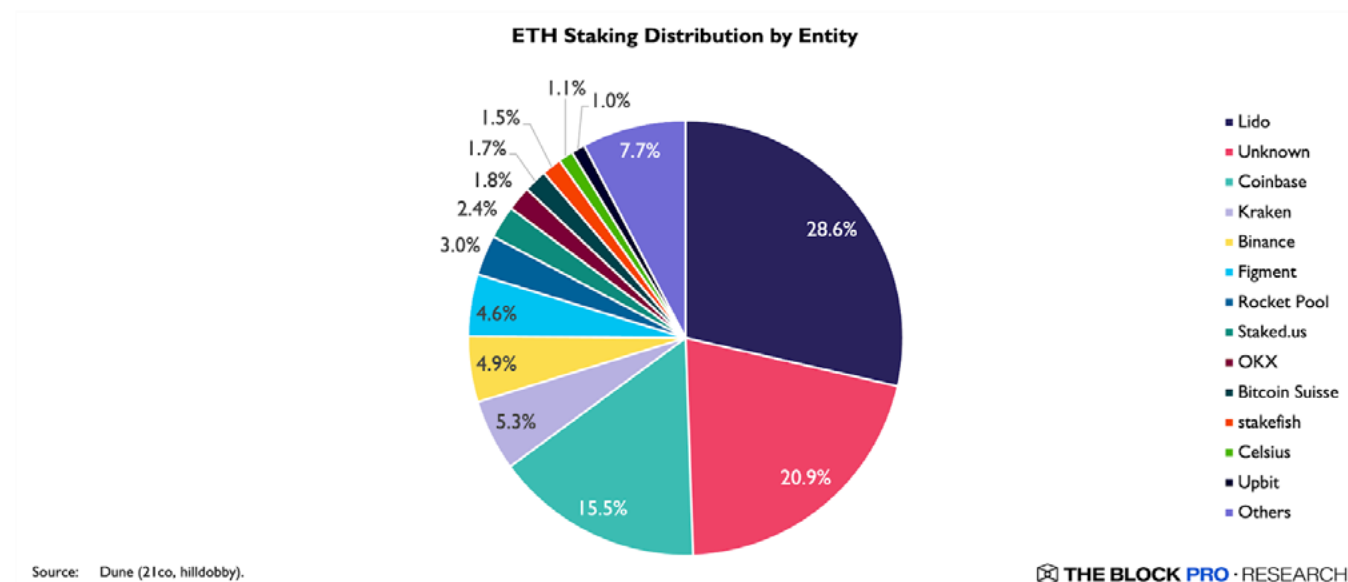
As described above, the Ethereum network is one of the most pertinent examples to consider in a modular blockchain framework. In addition to its enduring influence as the world's largest smart contract platform and de facto settlement layer, Ethereum has also undergone a notable shift from its original integrated design to a more modular, rollup-centric architecture in recent years. With its transition to proof-of-stake (PoS) consensus in September 2022 via The Merge, the network effectively demonstrated its ability to adopt individual components of blockchain functionality through client updates. Since then, modularity has remained a core part of the Ethereum scaling roadmap, as highlighted by the focus on rollups and improving scalability in the forthcoming [EIP-4844 upgrade](#), slated for early 2024.

For the most part, Ethereum's role within modular frameworks has been primarily viewed in the context of consensus and security rather than scalability. The question of Ethereum's ability to remain secure and uncensorable became amplified with the network's Shanghai upgrade in April, which enabled Ethereum validators to claim their ETH rewards and unstake their holdings for the first time. Despite initial concerns that the Shanghai upgrade might incite a mass exodus of validators and thus threaten the network's security, the total amount of staked ETH remained on a positive uptrend throughout 2023.



Even so, the importance of maintaining stake in PoS networks for security - and how to do so - became a central point of contention for Ethereum and other L1s in 2023. Across L1 ecosystems, the leading solution to this question appeared to come in the form of liquid staking tokens (LSTs), which effectively allow users to earn staking yield while retaining the ability to transfer or sell their staked positions at any time. On Ethereum, Lido continued to extend its dominance in the LST segment, gaining ~4.6 million ETH deposits YTD as of December 1st, worth ~\$9.6 billion as of this writing.

New protocols built around LSTs were among the fastest growing in 2023 as well. Prisma Finance, a LST-backed stablecoin protocol launched in September, and EigenLayer, an ETH re-staking (and future data availability) protocol launched in July, have attracted ~\$530 million in TVL as of December 1st. Most recently, the bridge contract for the upcoming LST-backed Blast rollup gained ~\$650 million in ETH deposits within just 8 days after deploying on November 22nd. Interest in LSTs as a solution for network security saw clear growth in 2023, but the drawbacks of this growth began to emerge as well. Specifically, increasing usage of liquid staking providers such as Lido has created a situation where only a handful of entities are in control of the overall staked ETH supply.



As of December 1st, Lido validators alone accounted for ~28.6% of staked ETH, which raises legitimate concerns about the network's centralization - and risk of single points of failure. It's worth noting, however that Lido stakes this ETH across 37 entities. Many of the trends and concerns seen on Ethereum also

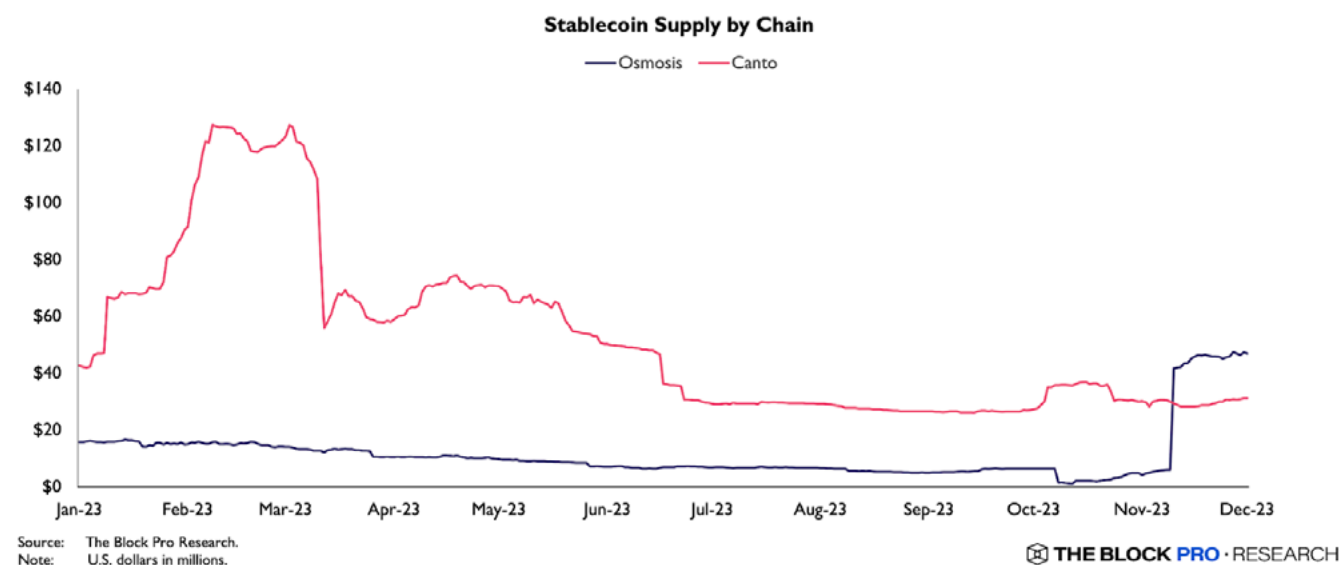
arose in other ecosystems throughout the year, particularly in those like Cosmos, where a multi-chain design makes it especially challenging for individual app-chains to maintain sufficient levels of liquidity and economic security.

**LIQUIDITY AND SECURITY CHALLENGES IN MULTICHAIN ECOSYSTEMS (COSMOS AND AVALANCHE)**

The Cosmos community has embraced the concept of modularity since its inception. Thanks to native infrastructure and tooling such as Inter-Blockchain Communication (IBC) and the Cosmos SDK, the process of launching a new blockchain is arguably more accessible in the Cosmos ecosystem than any other blockchain ecosystem today. Developers have the ability to customize their chain parameters, such as inflation, unbonding time (for staking), validator rewards, governance voting parameters, and more, while IBC enables turnkey interoperability with other Cosmos chains.

However, the benefits of this innate modularity come at the cost of fragmented user attention and liquidity between Cosmos chains. Although IBC allows users to send assets between Cosmos chains, these assets are still non-fungible unless they pass through the same IBC channels - e.g., ATOM sent via IBC from Osmosis to Canto is not equivalent to ATOM sent from Cosmos Hub to Canto. As a result, Cosmos app-chains are at a disadvantage compared to general-purpose L1s when it comes to composability and, by extension, concentration of liquidity.

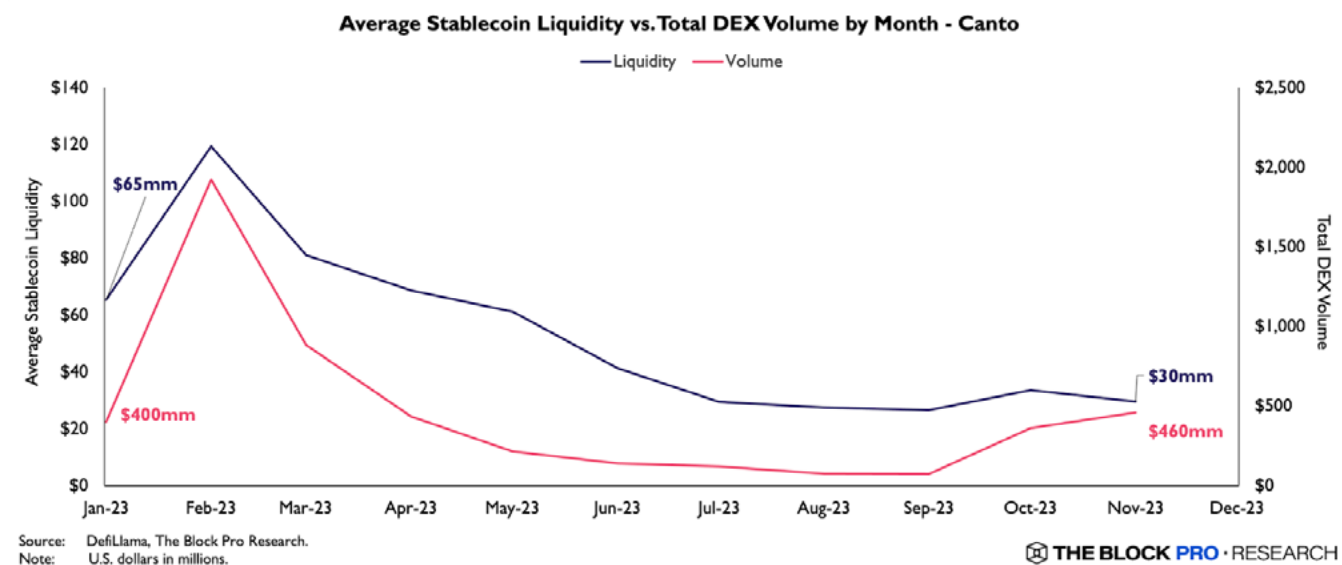
On December 1st, Osmosis and Canto had a combined stablecoin market cap of just ~\$78 million, far below



even their mid-sized L1 competitors such as BNB Chain or Solana, which had ~\$5.0 billion and \$1.6 billion worth of stablecoins on their networks at the same point in time. For additional context, Osmosis and Canto generally produce the highest DEX volumes among chains in the Cosmos ecosystem, underscoring their relatively lower liquidity and trading activity compared to larger, general-purpose L1s. Notably, Osmosis' stablecoin supply spiked to yearly highs in November, benefitting from Circle's deployment of native USDC through Noble in September, as well as the launch of the Celestia mainnet on October 31st, demonstrating the effect that expected trading demand can have on a particular chain's liquidity.

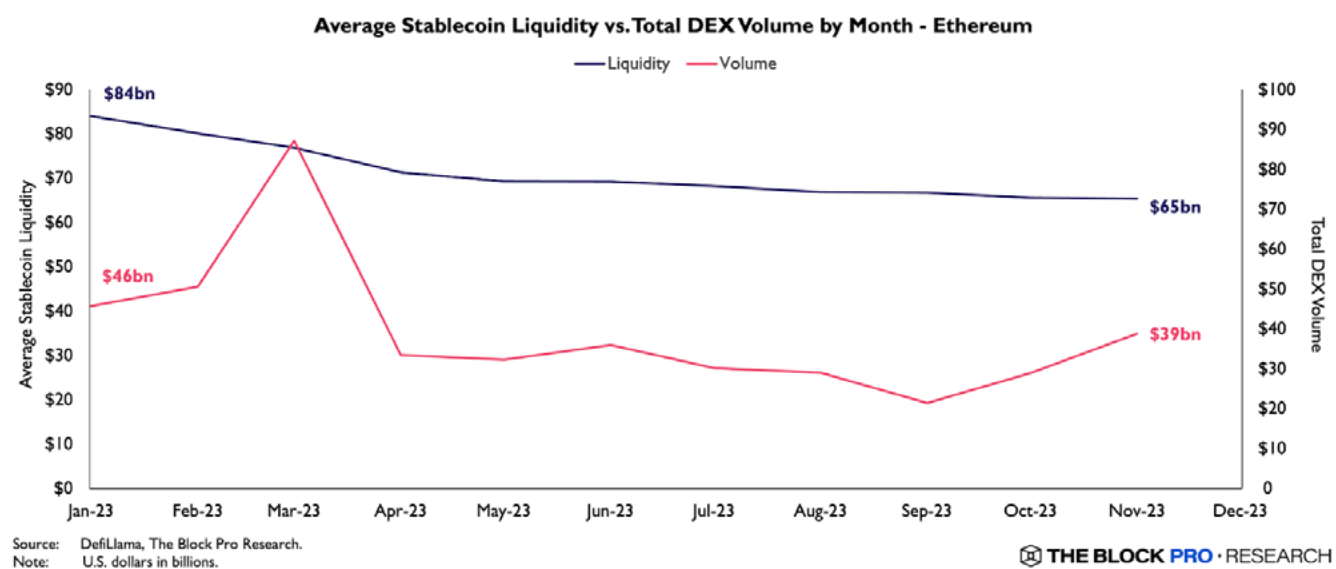
Aggregation of liquidity is especially important given the correlation between liquidity and trading volumes. This can work both ways; higher liquidity begets higher volume, while lower liquidity often results in lower volume. With less volume - and fees paid by users - the benefit of providing liquidity becomes weaker for LPs as well. These effects are more pronounced for chains with relatively lower liquidity, such as those in the Cosmos ecosystem. In the chart below, we compare DEX volume on Osmosis with its average monthly stablecoin liquidity in 2023 (note: using stablecoin liquidity instead of a broader metric, such as TVL, reduces the influence of native token price for this comparison).

Over the course of the year, decreasing stablecoin liquidity was correlated with decreasing DEX volume on Osmosis. In October, it appears that increased trading volume temporarily preceded a corresponding rise in stablecoins on-chain before both metrics spiked in November during the Celestia token launch.



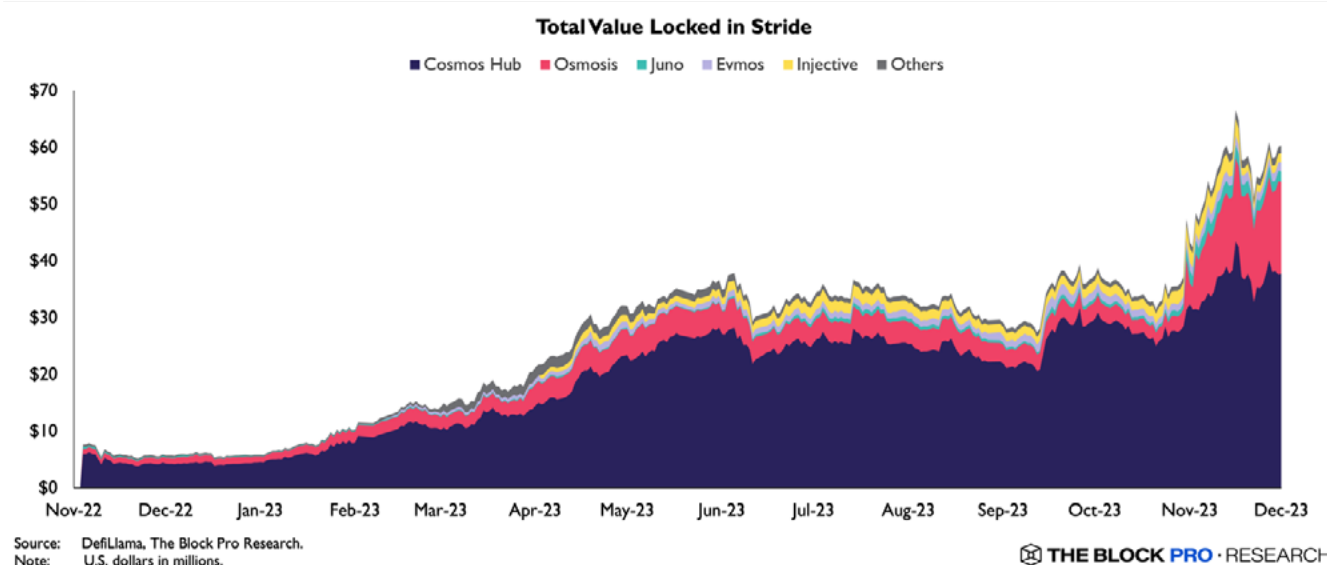
On Canto, stablecoin liquidity and DEX volumes had a similarly noticeable correlation throughout 2023, though the network did not benefit from the interest around Celestia due to an absence of liquidity for the TIA token.

This relationship between liquidity and volume holds true even for larger ecosystems like Ethereum, where both metrics declined steadily over the course of 2023. One notable difference is that the significantly larger liquidity base on Ethereum makes it less susceptible to reflexive changes in stablecoin supply in response to significant swings in volume.



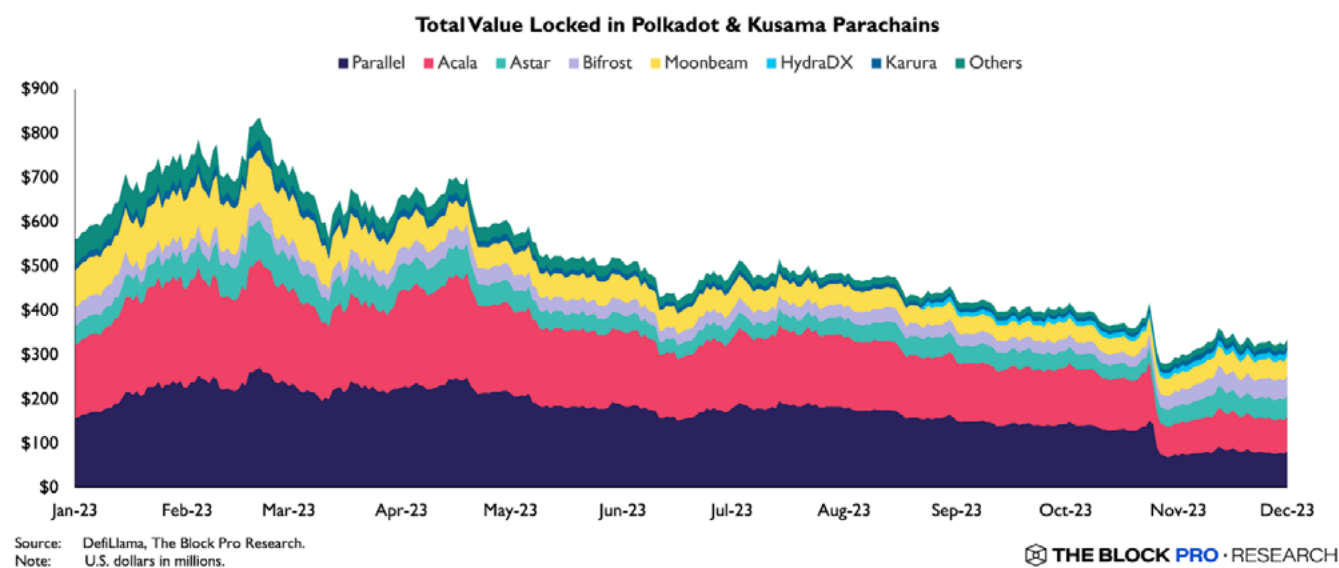
A key takeaway from these trends is that retaining liquidity is particularly challenging for smaller blockchains, yet also crucial for enabling typical user activity. When on-chain capital is scarce in PoS networks, the possibility of stakers or validators deciding to unstake their holdings becomes more impactful, posing a risk to the overall security of the network. With this reasoning in mind, the Cosmos ecosystem saw steady growth in LST adoption throughout 2023, emulating the continued rise of LSTs in the Ethereum ecosystem, which are largely seen as a net benefit to users as well.

LST growth in the Cosmos ecosystem was led by Stride in 2023, which offers liquid staking for multiple Cosmos chains. TVL in Stride grew by ~\$54 million over the course of the year, with the Cosmos Hub's ATOM token accounting for ~63% of cumulative deposits as of December 1st.



Encouraging LST adoption was a key aspect of the [ATOM 2.0 proposal](#) for the Cosmos Hub introduced in late 2022. Though the proposal was ultimately rejected in a contentious vote, many of the original ideas regarding the need to increase value accrual to the ATOM token remained compelling enough to be tweaked and ultimately implemented through smaller proposals in 2023. For example, some of the key proposals approved during the year include the [addition of Stride](#) to the "ATOM Economic Zone," which allows Cosmos Hub validators to provide security for Stride in exchange for revenue share, as well as [the reduction](#) of ATOM's maximum inflation rate from 14% to 10%. Notably, the continued addition of "consumer chains" such as Stride and [Neutron](#) that rent security from the Cosmos Hub via [Replicated Security](#) implicitly recognizes both the difficulty of building an economic moat on smaller blockchains, as well as the importance of sustaining value and economic incentives for stakers and validators.

Variations of the shared security model have become standard in multichain ecosystems such as Polkadot, which consists of parachains that inherit security from a single Relay Chain, and Avalanche, where subnets utilize a subset of C-Chain validators for execution and consensus. Both Polkadot and Avalanche struggled to see significant traction for the chains in their ecosystems in 2023, again highlighting the challenges of sustaining user activity and capital across multiple blockchains. Over the course of the year, the aggregate TVL in Polkadot parachains decreased from ~\$561 million to ~\$335 million by December 1st



A major reason for this decline was the stagnant pace of development for Polkadot’s XCMP (Cross-Consensus Message Passing) protocol, which is intended to enable cross-parachain communication and asset transfers, similar to IBC in Cosmos. Though it was first introduced in 2021, XCMP remains under active development as of December 1st, effectively becoming a bottleneck for parachain development and growth.

In the Avalanche ecosystem, the number of live subnets continued to grow in 2023, but user activity remained low compared to the main Avalanche C-Chain. Overall capital influx to subnets was also limited, with the two most active subnets - DFK Chain and Beam - reaching a combined total of ~\$8.8 million in TVL by December 1st. Avalanche subnets share similar challenges with newly launched Cosmos chains, wherein network security becomes a critical issue upon inception due to the need to bootstrap an economic moat large enough to prevent economic attacks. As of this writing, most Avalanche subnets have less than 10 validators in total, with the largest being the MELD subnet at 16 validators. Given that Avalanche validators are required to stake a minimum of 2000 AVAX at a price of ~\$26.50 per AVAX, this means that most subnets theoretically bear the risk of consensus failure with less than ~\$300K of starting capital, assuming 2/3 validators are needed to compromise the network.

At the moment, similar issues are avoided for consumer chains in the ATOM Economic Zone because all Cosmos Hub validators are required to provide security for new consumer chains once they have been accepted through the governance process. Over time, this is expected to induce greater hardware

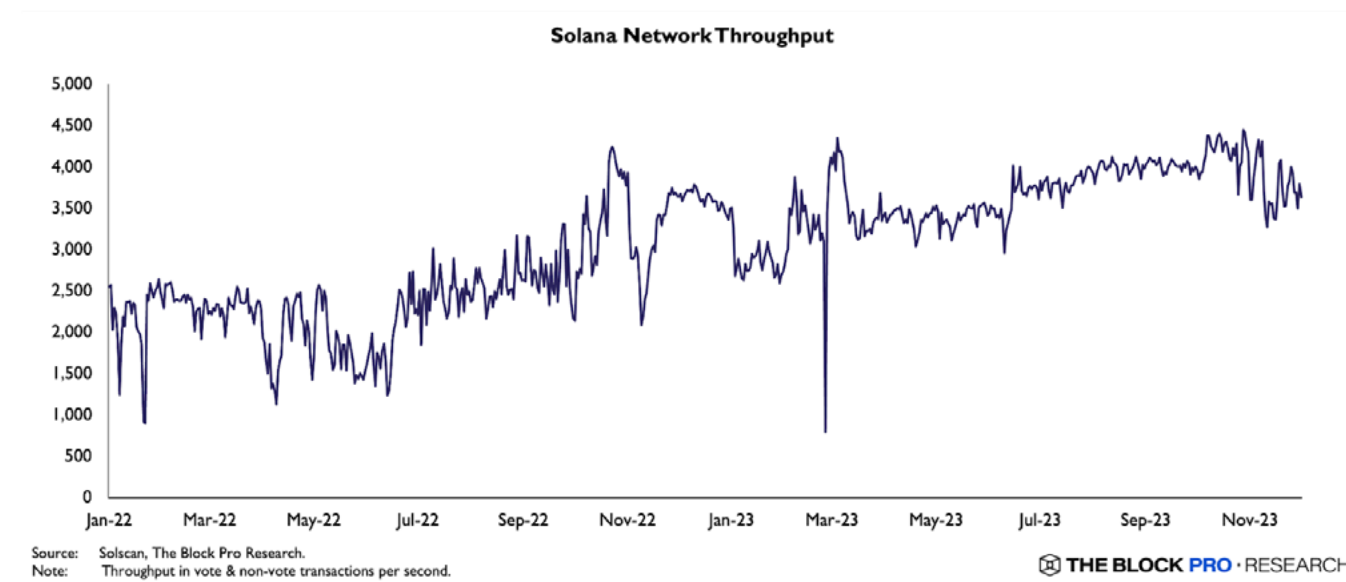
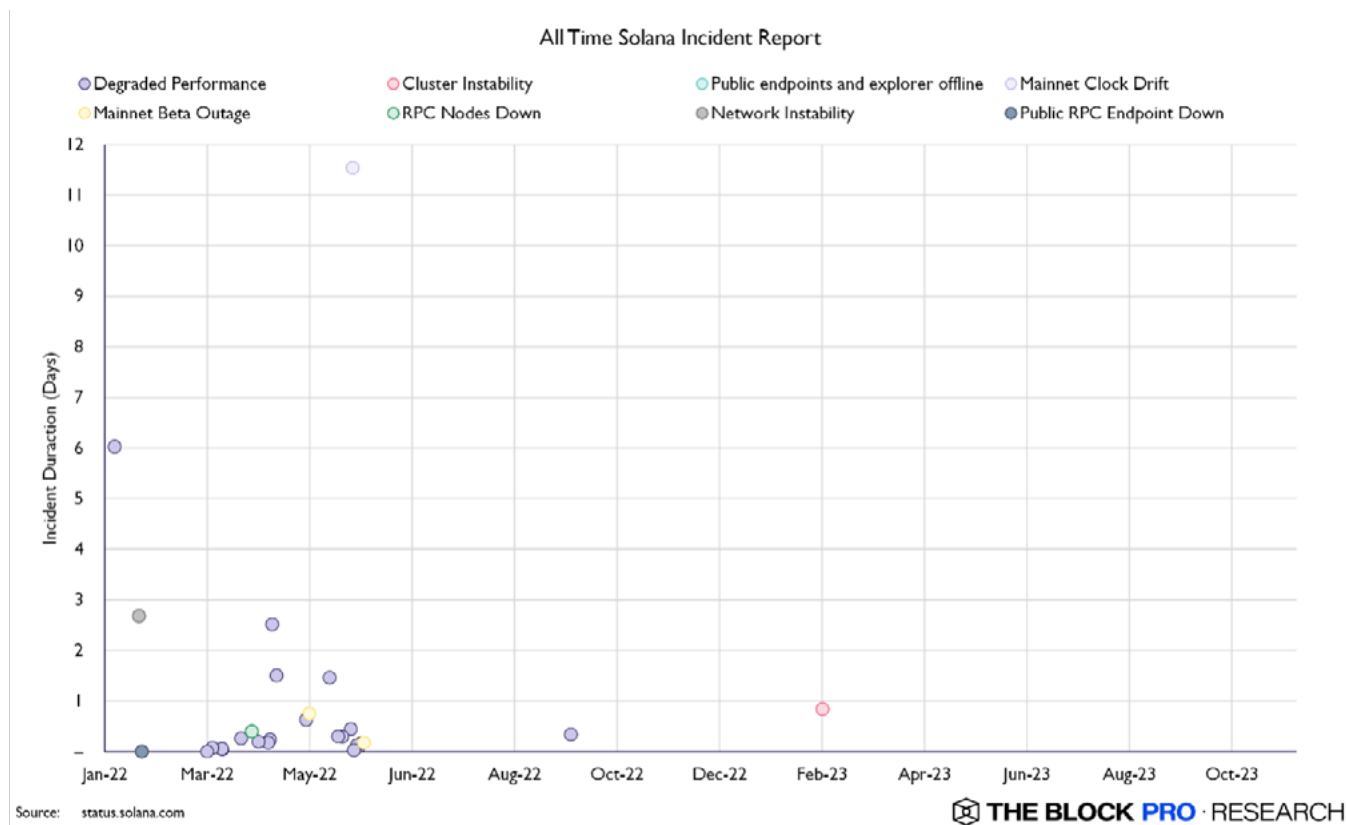
requirements on validators, and validators would need to have the option to “opt-in” to service new consumer chains to avoid spiraling costs. Then again, it is not entirely unreasonable to expect that validators, in general, will need to upgrade their hardware to support greater demand and blockchain functionality in the future. In October and November, the Cosmos Hub passed back-to-back proposals to increase the max block gas limit and increase the max block size, suggesting a growing focus on scalability for an ecosystem that has historically been concerned primarily with modularity and decentralization. For the most part, these scaling optimizations are typically prioritized moreso by integrated or monolithic chains, but it is clear that execution will become increasingly relevant as demand grows over time. One last observation worth noting is that despite the Cosmos ecosystem’s emphasis on app-specific chains and developer flexibility, the most active chains thus far - such as Osmosis and Canto - are among the most vertically integrated, featuring DEXs, lending protocols, collateralized debt protocols, and more. In the following section, we take a look at the state of L1 developments in 2023 from the perspective of integrated systems.

**REVIVAL OF INTEGRATED SYSTEMS (SOLANA)**

One of the most prominent narratives of 2023 was the resurgence of Solana, both in terms of its valuation and market acceptance of its integrated scaling approach. Among the top smart contract protocols by TVL, Solana is unique for its use of its custom execution environment, the Solana virtual machine (SVM), which allows the network to execute transactions in parallel. In order to enable high throughput and scalability at low costs to users, Solana validators must be able to facilitate a complex array of processing tasks in coordination with other validators in the network. This is made possible by a number of custom technologies, such as the Proof of History synchronization mechanism and the Turbine block propagation protocol, among others, all of which ultimately result in higher requirements for Solana validators compared to other L1s.

These efforts to push L1 transaction throughput to its theoretical limits have required a ground-up approach to blockchain architecture, which has contributed to significant difficulties with Solana’s network stability in the past. In the first half of 2022, amidst widespread volatility in the broader financial markets, Solnftana faced a string of downtime incidents consisting of prolonged periods of network downtime, often requiring a full network restart in coordination with validators. For instance, in January 2022, the network was so severely affected by congestion issues that it was only live for ~96% of the month.

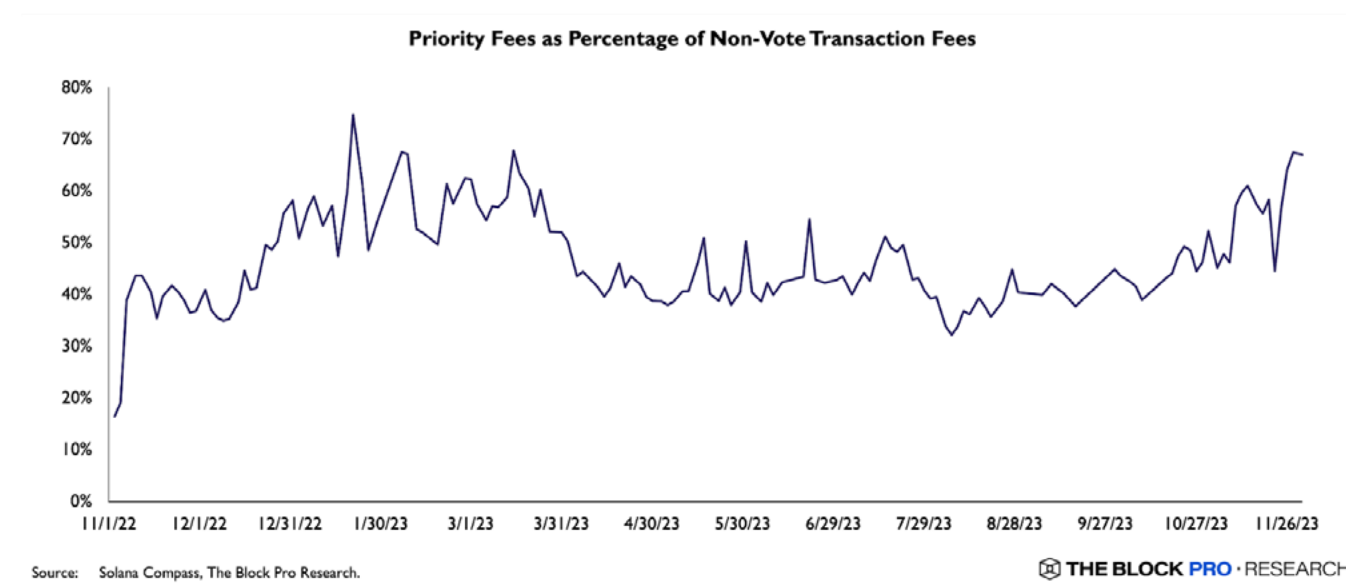
Over the second half of 2022 and extending into 2023, the Solana core team implemented a series of key



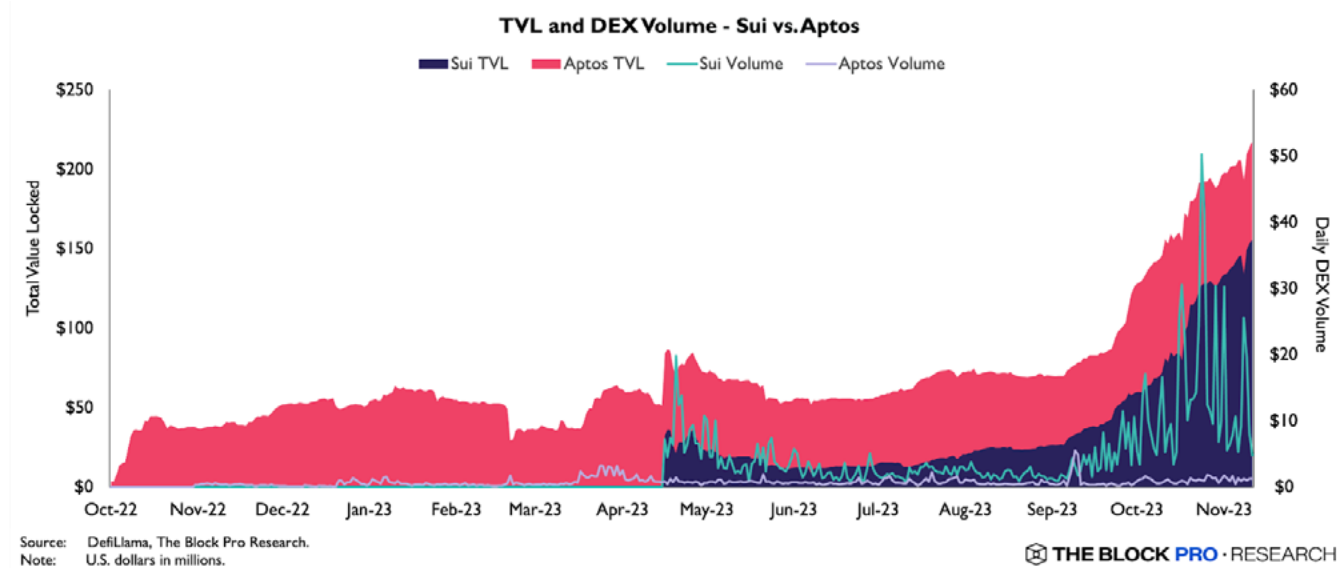
upgrades that have ostensibly allowed the network to operate with far greater reliability than in previous years. The most impactful among these upgrades are the implementation of [QUIC](#) packet filtering, stake-weighted quality of service (QoS), and local fee markets. At a high level, QUIC allows validators to more efficiently [filter spam](#) transactions that had been plaguing the network during periods of high stress for much of 2022.

Stake-weighted QoS serves to mitigate these issues more so through economic forces, scaling the amount of transactions that can be transmitted from validators to leader nodes according to the size of their SOL stake. Meanwhile, local fee markets and priority fees allow users to pay higher fees in order to increase the likelihood of their transactions being confirmed quickly. The unique aspect of local fee markets compared to the fee markets on EVM chains is that demand spikes for specific applications will only increase transaction fees for users interacting with the contracts underlying those applications. For instance, a hotly contested token launch on Solana would not drastically affect transaction fees for users looking to make a simple SOL transfer.

The effectiveness of these measures was validated during several periods of major demand spikes in 2023. During both the [Mad Lads](#) NFT mint in April and the [PYTH token launch](#) in late November, the Solana network saw a large spike in user transactions but did not experience a major decline in throughput, as measured by transactions per second. Priority fee usage rose steadily over the course of 2023 as well, indicating a growing adoption of the feature among users and support among app developers.



At the time of this writing, Solana is perhaps the most well-known L1 with an integrated architecture, as well as the most widely used. Over the past two years, alternative L1s hoping to offer a similar value proposition - parallelized execution at low cost - have begun to emerge as well. Two of the most notable are Aptos and Sui, both of which were spun off from the former Diem project by Meta and utilize the Move virtual machine as their execution environment. As of December 1st, the two chains have attracted a combined total of ~\$255 million in TVL, with growth accelerating in the latter half of the year.



Trading volume on-chain also increased late in the year, suggesting that users may be starting to explore newer, alternative L1s in the wake of Solana’s noticeable traction in 2023. It is worth noting Sui’s accelerated growth over the past year relative to Aptos - where it surpassed the latter in terms of both TVL and volume - but this may be related to an incentive program that ran throughout the year. For now, it remains too early to tell whether the Move ecosystem will end up posing a serious challenge to the market Solana has carved out within L1s that support parallel execution, as only organic spikes in user demand can serve as a true indicator of network performance. Overall, 2023 has given indications that integrated L1s - especially those offering parallel processing - may have a growing role to play in the smart contract platform landscape, but the road to overcoming the entrenched dominance of the EVM remains long and relatively uncertain.

## INTEROPERABILITY IS KEY

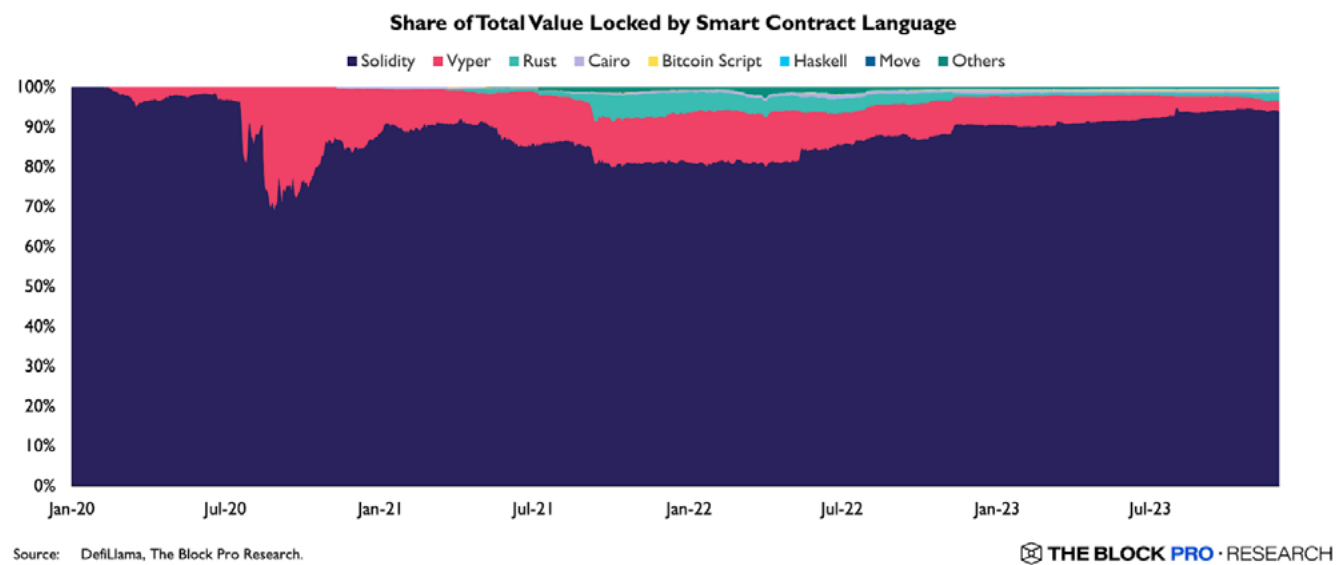
At the center of the growing rift between modular and integrated blockchain scaling approaches is an underlying challenge that is becoming increasingly relevant over time: interoperability. Broadly speaking, interoperability in blockchains refers to the ability of disparate systems to communicate and interact with one another. The precise nature of this trait can vary within different contexts, but the core principles remain largely the same. All blockchains ultimately have the same handful of key functions: execution, settlement, consensus, and data availability.

Integrated systems in crypto, commonly referred to as monolithic blockchains, perform all of these tasks within a single architecture. In their case, all of the components that enable each task are intrinsically interoperable - otherwise, their networks would not be able to function. Interoperability becomes more complex in the case of modular systems, wherein individual modules that perform different tasks must be able to coordinate seamlessly and securely with other modules. This has become especially true in recent years with the rise of highly specialized blockchain layers that focus solely on one or two key functions.

For example, [Celestia](#) only serves as a data availability and consensus layer for other blockchains lacking these capabilities themselves, such as rollups. Similarly, rollups typically only perform execution, leaving settlement, consensus, and data availability to an underlying L1, such as Ethereum. For these function-specific blockchains, interoperability with other modules is of paramount importance. If, for instance, the sequencers that power optimistic rollups like Optimism and Arbitrum post incorrect data to the Ethereum consensus layer, then all of the transactions bundled in that data become null and void.

Another important way to consider interoperability is in the context of execution environments, which largely define the user and developer experience for various blockchains. Shared execution environments can be highly beneficial for sustaining user adoption and capital within an ecosystem, as well as developer interest and mindshare. The most prominent example of this effect is the Ethereum Virtual Machine (EVM), which, as of this writing, serves as the execution environment for 9 of the top 10 smart contract platforms by TVL.





The EVM's dominance extends from the protocol layer up to the application layer, with 96.7% of DeFi TVL residing in smart contracts coded in Solidity and Vyper, the two primary programming languages supported by the EVM. As such, it is no surprise that many of the most popular non-EVM ecosystems have seen a gradual rise in protocols dedicated to hosting EVM-based smart contracts atop alternative native execution environments. In the Cosmos ecosystem, EVM-compatible chains Cronos and Kava sit atop the TVL leaderboard, with a combined TVL of ~\$574 million as of December 1, 2023. Another EVM-compatible Cosmos chain, Canto, saw its TVL spike to a peak of ~\$205 million in Q1 2023 before declining to ~\$63 million as of this writing, though it remains the 6th largest Cosmos chain by TVL.

Similarly, in the Polkadot ecosystem, despite seeing muted activity for most of 2023, the top three chains by TVL - Moonbeam, Astar, and Acala - are all EVM-compatible. Overall, blockchains that feature their own native execution environment face an uphill battle in terms of attracting existing EVM users and developers. In the Solana ecosystem, which remains the largest non-EVM ecosystem by TVL, efforts to popularize the Solana virtual machine (SVM) are being led by the Eclipse team, which aims to enable developers to create smart contracts in the SVM that can be executed on Ethereum and Polygon.

Ultimately, the context in which interoperability is most notable today for the broader crypto ecosystem is in cross-chain communication. The ability for blockchains to pass messages between one another is essential for multichain protocols like Cosmos, Polkadot, and Avalanche subnets, as well as those that hope to utilize sharding to enhance scalability, such as NEAR. At a higher level, this ability is also critical for enabling capital to flow between different blockchains, most commonly through the use of cross-chain bridges.

**CROSS-CHAIN BRIDGES**

Permissionless cross-chain bridges have evolved into a crucial component of blockchain infrastructure in recent years, facilitating the seamless interoperability of assets and streamlining capital transfers across blockchains. The expanding array of blockchains has given rise to a proliferation of bridges, encompassing both native and third-party solutions, each characterized by distinct designs and underlying trust assumptions. These variations significantly influence the overall user experience.

Facilitating asset transfer across blockchains involves two key phases from a user's standpoint. First, sending tokens from the origin chain to an escrow contract, and, second, receiving tokens on the destination chain from another escrow contract. The execution mechanism of bridges pertains to the mathematical logic embedded in escrow contracts, governing the processes of deposits and withdrawals into/from escrow.

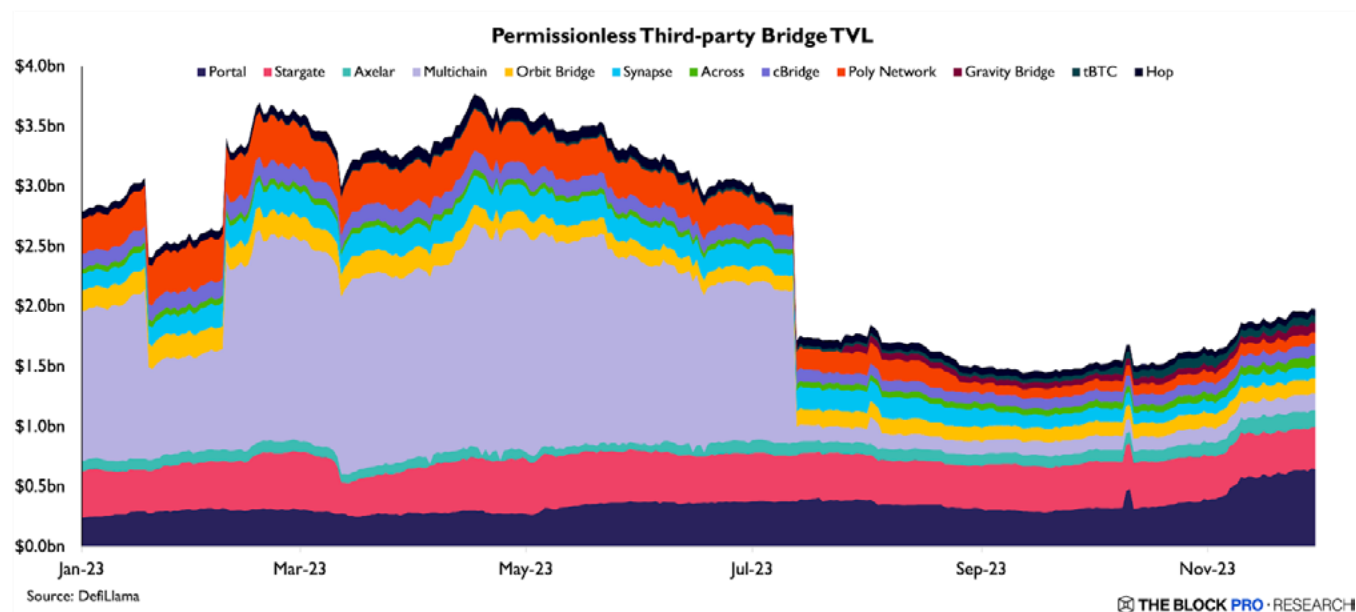
The lock-and-mint mechanism is the most prevalent among major execution mechanisms for cross-chain bridges. A lock-and-mint bridge locks up native assets from the origin chain and issues an equivalent amount of "wrapped" tokens to the user on the destination chain. These wrapped tokens essentially serve as IOUs that can be redeemed to retrieve the underlying asset on the origin chain.

This mechanism offers capital efficiency, enabling slippage-free cross-chain transfers without the need for excess collateral or liquidity. Additionally, it does not mandate bridges to have an equivalent native asset on the destination chain, simplifying the process of bootstrapping capital for nascent blockchains. Canonical lock-and-mint L2 bridges play a crucial role in nurturing a vibrant L2 ecosystem by safeguarding the transfer of billions of dollars worth of digital assets into L2s.

Another common execution mechanism is cross-chain liquidity pools, where bridges act as cross-chain automated market makers. While they are more liquidity-hungry, they address the issue of liquidity fragmentation, which can occur with different versions of wrapped tokens issued by various lock-and-mint bridges. Token fungibility enables pool-based bridges to operate as a multi-chain bridging hub without causing liquidity fragmentation, unlike lock-and-mint bridges, which are primarily bidirectional.

Permissionless third-party bridges maintained their prominence throughout 2023 despite the security breach Multichain experienced in July. The Wormhole-powered lock-and-mint-based Portal exhibited steady growth and emerged as the largest bridge by TVL. This growth was propelled by the renewed momentum in Solana activities during Q4, with Portal benefiting as the de facto gateway to the Solana ecosystem.

The LayerZero-powered pool-based Stargate closely followed as the second-largest bridge with stable TVL, reflecting moderate activities in the broader landscape of alternative L1 blockchains. The cross-chain ecosystem witnessed substantial relative growth, driven by the expanding activities in Layer-2 solutions throughout the year. Of noteworthy mention is Across, which experienced considerable relative growth, a phenomenon primarily attributed to the escalating L2 activities throughout the course of the year. The adoption trends of bridges are closely intertwined with the dynamics of the blockchains they connect.



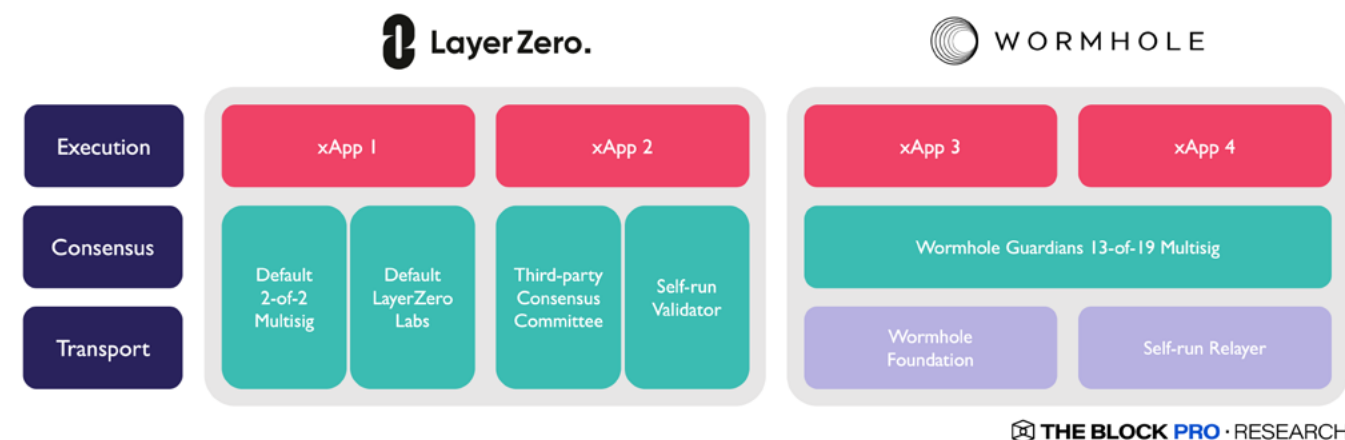
Looking ahead, we anticipate a heightened adoption of Circle’s Cross-chain Transfer Protocol (CCTP) with its novel burn-and-mint mechanism. CCTP is poised to facilitate seamless and permissionless transfers of native USDC across supported blockchains, mitigating issues related to liquidity fragmentation and slippage. Its broad compatibility extends to major blockchain ecosystems, encompassing prominent Ethereum L2s, Solana, and the Cosmos ecosystem through Noble, among others.

**GENERIC MESSAGING FRAMEWORKS**

Cross-chain messaging requires a sophisticated architecture that encompasses both on-chain and off-chain operations. Notably, not every cross-chain protocol possesses the requisite technical bandwidth and resources to effectively manage this intricate process. Generic cross-chain messaging frameworks can simplify the complexities associated with cross-chain communication by offering a standardized interface for cross-chain applications (xApps).

These frameworks facilitate the development of diverse xApps that extend beyond asset bridges. An illustrative example is the creation of “omnichain” money markets, where users can seamlessly deposit collaterals on one blockchain and, subsequently, borrow assets from another chain. This versatility in xApp creation enhances the overall interoperability and functionality of the blockchain ecosystem.

The process of cross-chain communication can be delineated into three primary tasks: the transmission, verification, and interpretation of data payloads originating from an origin chain. In order to handle these responsibilities systematically, messaging frameworks are modularized into transport, consensus, and execution layers, respectively. This modular approach ensures a structured and efficient handling of cross-chain communication.



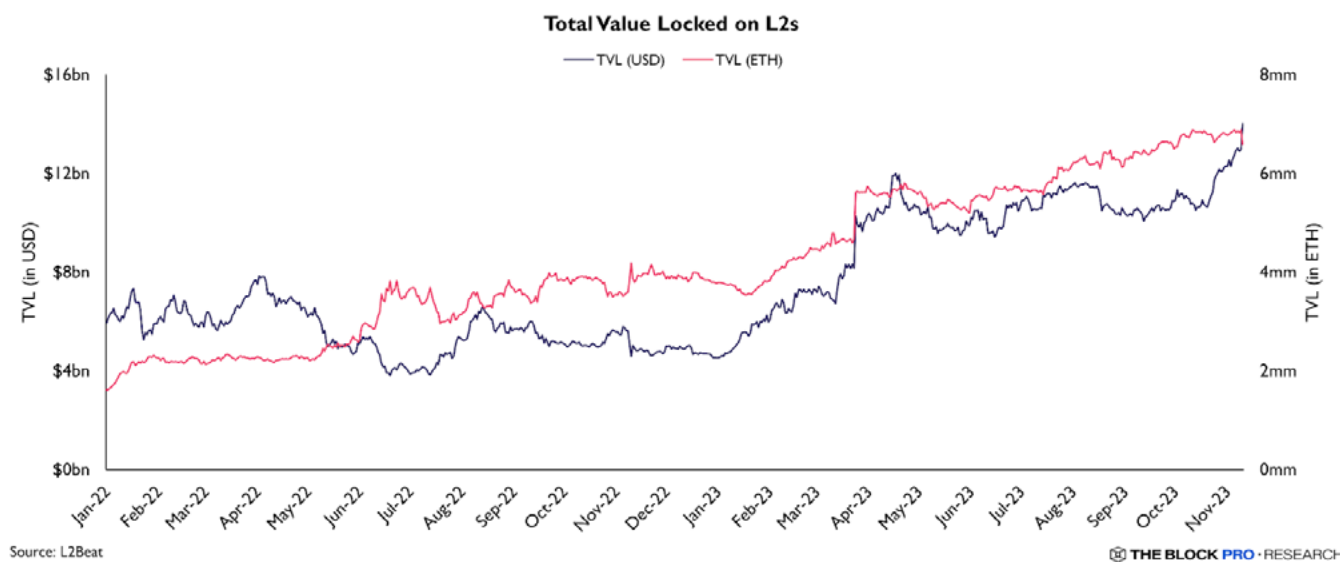
Throughout 2023, the adoption of cross-chain messaging frameworks witnessed a notable uptick following the rise of several xApps, with LayerZero and Wormhole emerging as key contenders vying for market dominance. These modularized frameworks provide a degree of flexibility to xApp developers. For instance, LayerZero necessitates that consensus and data transport be validated by two independent entities, with the choice of these entities configurable by each xApp. Conversely, Wormhole relies on its multi-sig for consensus and provides configurability on the transport layer. This modular structure empowers xApp developers to customize their choices based on considerations such as cost efficiency, security, and liveness. This flexibility contributes to the ease of xApp deployment and maintenance, which will help foster a more interoperable and adaptable blockchain landscape.

# ADOPTION OF ETHEREUM SCALING SOLUTIONS

## ETHEREUM ROLLUPS

### OPTIMISTIC ROLLUPS

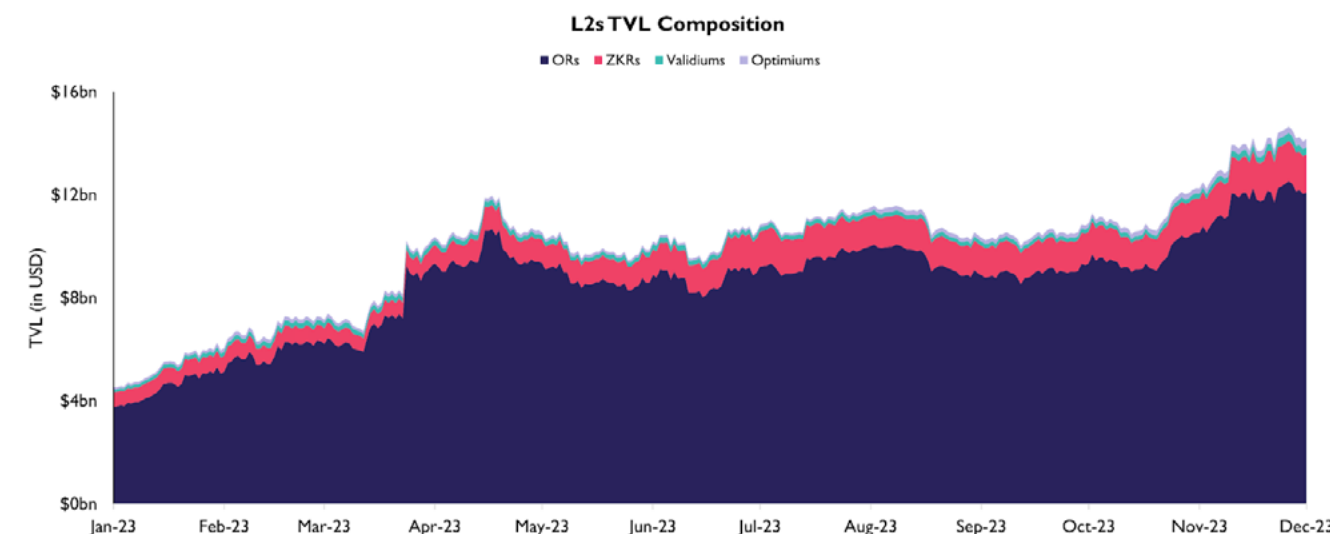
Owing to the periods of prolonged heightened demand for Ethereum transactions, resulting from the 2021 bull market, many layer 2s (L2s) saw increased adoption as they offered a cheaper means for users to engage with the Ethereum ecosystem. In 2023, total value locked (TVL) on L2s has grown from just under



\$4.5 billion to over \$13 billion despite the market just coming out of a recent bearish rut.

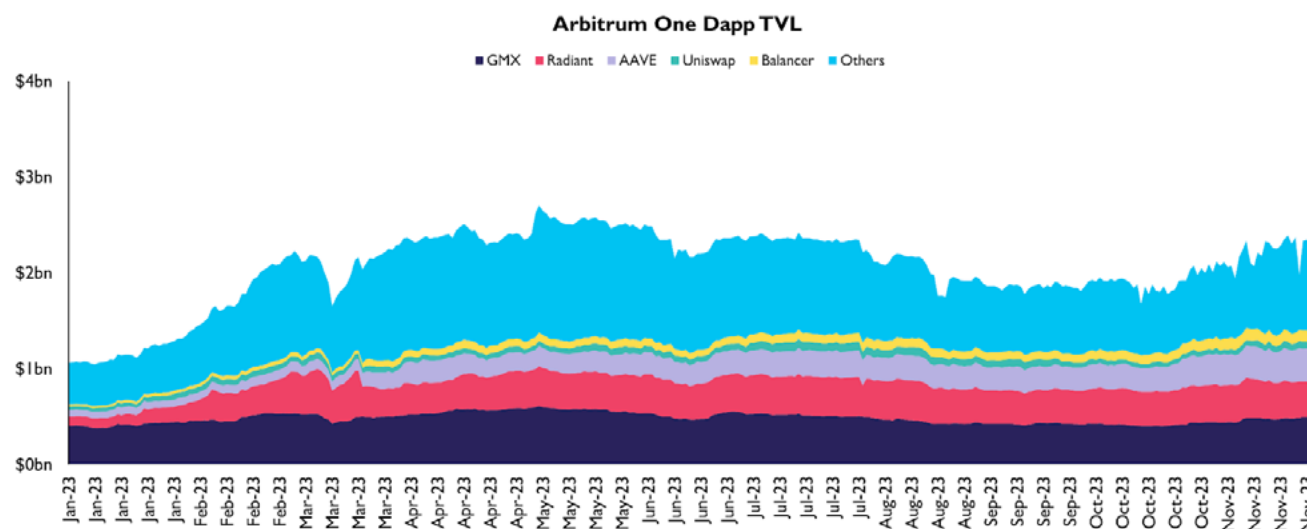
Optimistic rollups (ORs) have captured the largest TVL of the four categories of L2s on Ethereum due to the launch of two major governance tokens and the robustness of its ecosystems.

Leading the pack by TVL is Arbitrum One, the largest L2 even prior to the launch of its ARB governance token. Following the launch of the ARB token, over \$2 billion worth of liquidity was introduced into the Arbitrum One ecosystem, further propelling Arbitrum One ahead of all other L2s. However, not all of these tokens were unlocked, so the net injection of accessible liquidity was closer to \$1.25 billion at the time. Over time, the Arbitrum DAO plans to continue distributing ARB grants to incentivize protocols to develop on Arbitrum One and attract more users into the ecosystem.



Source: L2Beat

THE BLOCK PRO · RESEARCH



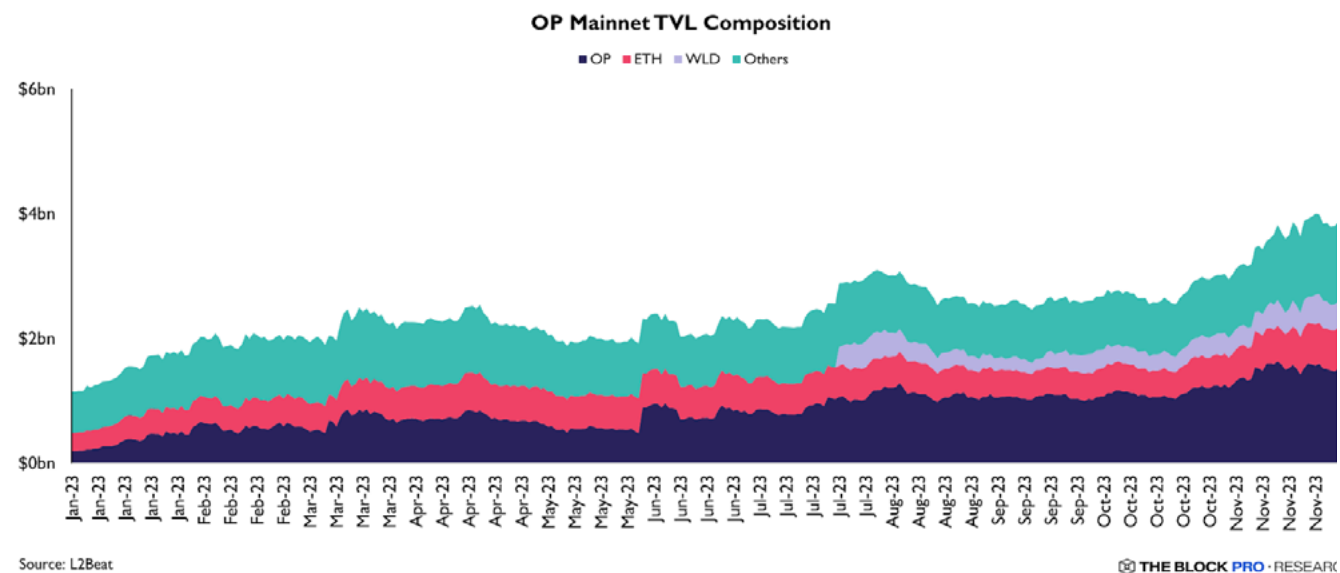
Source: DeFiLlama

THE BLOCK PRO · RESEARCH

Arbitrum One's ARB liquidity injection has boosted the growth of decentralized applications (dapps) on its blockchain. The largest Arbitrum One dapp by TVL is GMX, a perpetual exchange, followed by Radiant, a lending platform, both of which take up a majority TVL market share. Other notable inclusions include Aave, Uniswap, and Balancer. Because GMX and Radiant are both native to Arbitrum One, it stands to reason that we will see top dapps on other L2s being native to their ecosystems as well, as ecosystem participants would likely favor, use, and incentivize applications built primarily for their blockchains.

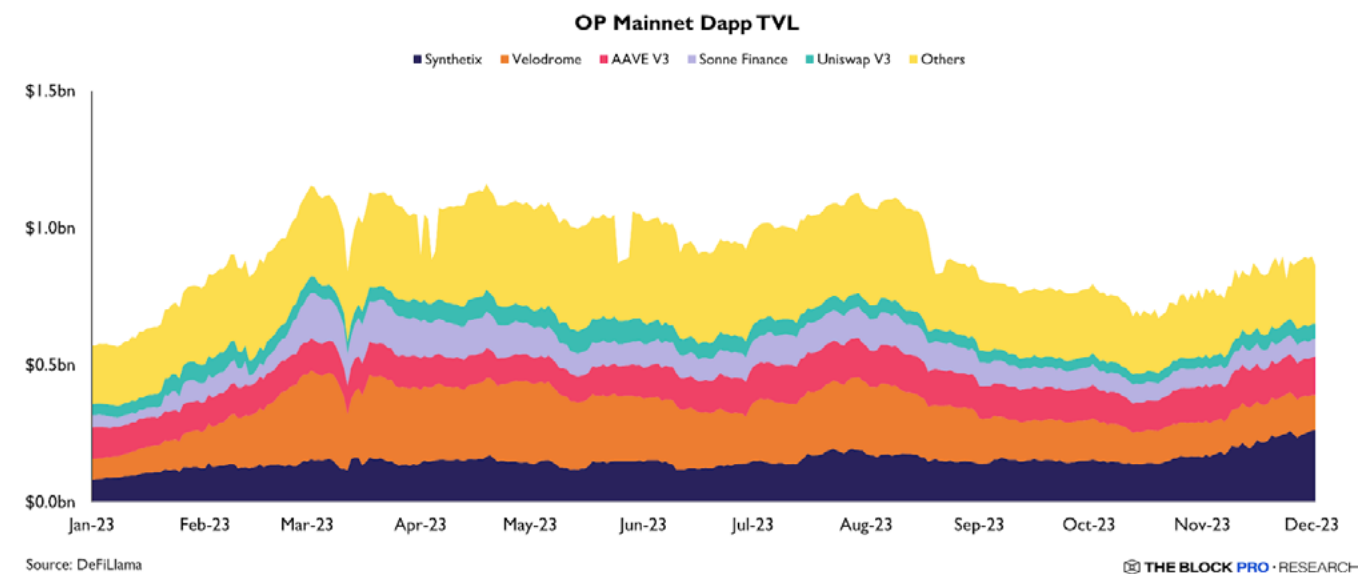
The ARB token airdrop was the most noteworthy event for Arbitrum One in 2023, with over 625,000 addresses out of the 4 million unique addresses that were on Arbitrum One that were eligible to claim the airdrop, at that time, which accounted for 15.7% of all addresses on Arbitrum One. Since then, unique addresses have skyrocketed, with the total count being over 14 million.

The second largest OR by TVL is OP Mainnet, formerly known as Optimism, which has over \$3.4 billion. OP Mainnet's governance token, OP, had its airdrop a year earlier than Arbitrum One, in May 2022. Since then, OP Mainnet has seen its TVL increase steadily, albeit much slower than Arbitrum One.

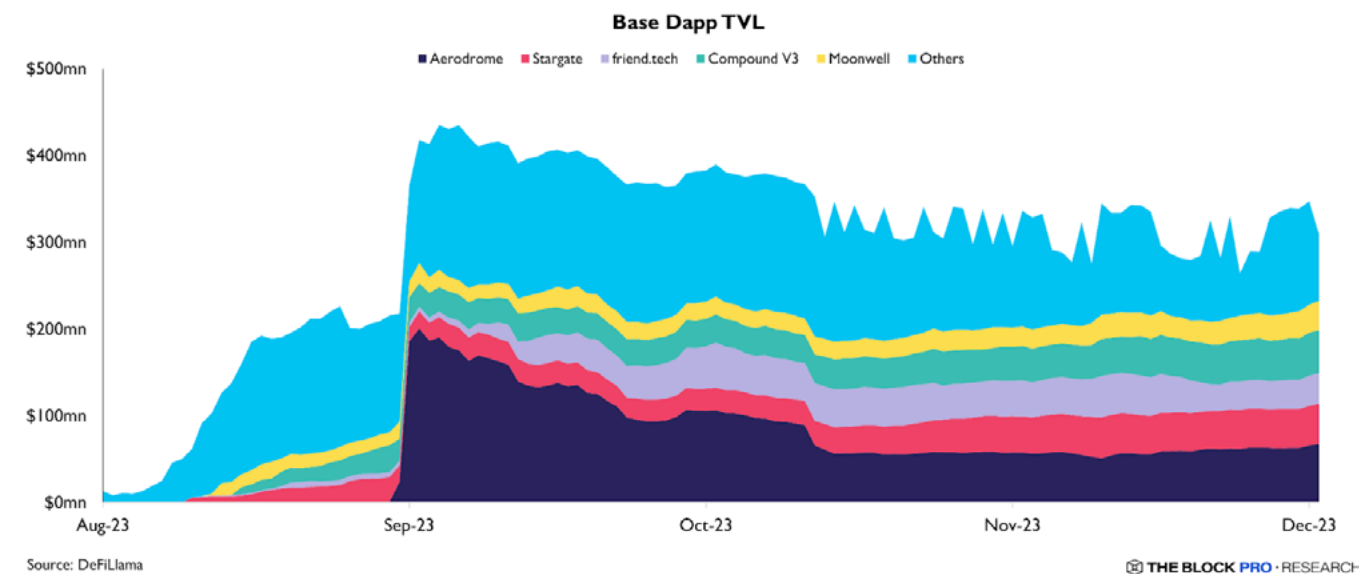


A noticeable increase in OP Mainnet's TVL can be observed in July 2023 due to the launch of Worldcoin's token, WLD. The launch brought notable on-chain activity to OP Mainnet, with over 700,000 users that have claimed their WLD airdrop. Worldcoin, co-founded by OpenAI co-founder Sam Altman, aims to become the largest digital identity and financial network, and the WLD airdrop is used to bootstrap its network, incentivizing new users to register with the application.

The top two dapps on OP Mainnet are Synthetix, a synthetic derivatives protocol, and Velodrome, a decentralized exchange. As mentioned earlier, it is reasonable to expect native applications to possess the largest market share in their respective ecosystems. For example, Uniswap on OP Mainnet only has \$55 million in TVL, which is just slightly higher than one-third of Velodrome's \$145 million.

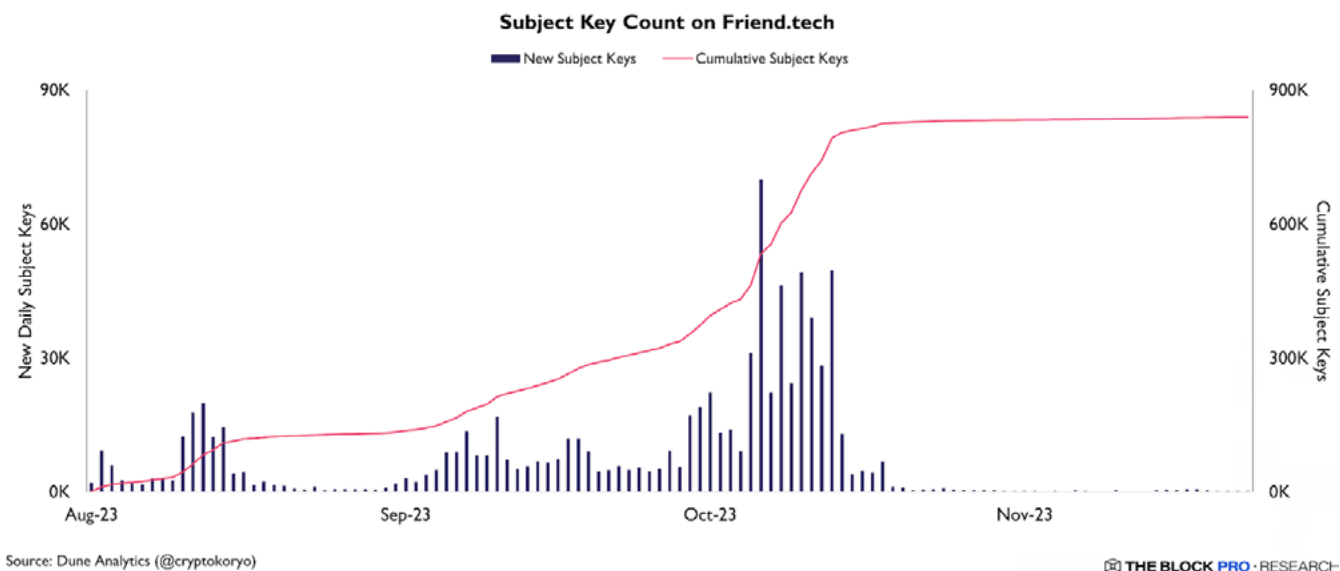


One of the most notable developments for OP Mainnet is the open-sourcing of the OP Stack in August 2022. OP Stack is the development stack that powers OP Mainnet, that was built and maintained by the Optimism Collective. The current version of the OP Stack is also referred to as Optimism Bedrock, and it allows developers to use the same technology that OP Mainnet uses for their own optimistic rollups, though the OP Stack can eventually extend to blockchain tools like block explorers, and even governance.



As a result of its open-sourcing, there have been numerous developments that have leveraged the OP Stack, with the most prominent one being the launch of Coinbase’s Base Mainnet in August 2023. Base launched to provide the exchange’s users with access to decentralized applications. Despite its recency, Base has quickly risen the ranks of L2s to become the third largest L2 by TVL, benefiting from the well-established brand and existing customer base of Coinbase.

Due to Coinbase’s retail-heavy and comparatively less savvy userbase, its future growth will be heavily dependant on Base introducing dapps that can appeal to the type of customers that Coinbase typically onboards. As such, Base will need more than just decentralized exchanges and lending dapps to bring in new users. Leading the charge of consumer-friendly dapps is friend.tech, a novel Web3 social application built exclusively on Base.



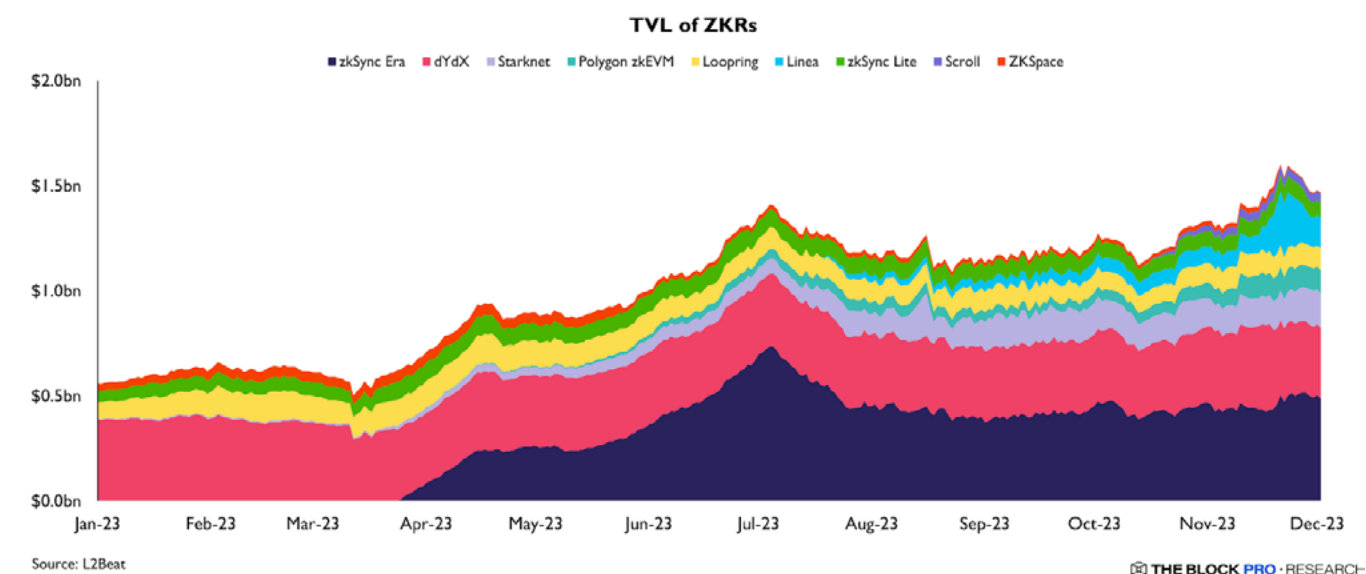
Friend.tech is a pay-to-enter chat application that allows users to purchase the right, in the form of an NFT, to access a key opinion leader (KOL) chat group. The user may choose to purchase multiple NFTs or sell the NFTs back to the app. The price of purchasing a new NFT is dependent on the number of outstanding NFTs. Essentially, the more demand there is to access a specific KOL’s chat group, the more costly it will be to purchase the NFT to enter. Friend.tech generates revenue by charging a 10% fee on all transactions, half of which goes to the platform and the other half to the corresponding KOL. We have yet to see how Coinbase plans to incentivize the creation of unique consumer-friendly dapps like Friend.Tech, but its

Onchain Summer initiative shows the leading exchange is well aware of how it should position its rollup for widespread adoption.

Optimistic rollups dominate the scaling landscape for Ethereum right now, both in terms of TVL and transaction processed. Although zero-knowledge rollups (ZKRs) are considered a more secure scaling approach for Ethereum, it seems that ORs are proving to be a far more practicable approach, considering that ORs are much easier to implement.

**ZERO-KNOWLEDGE ROLLUPS**

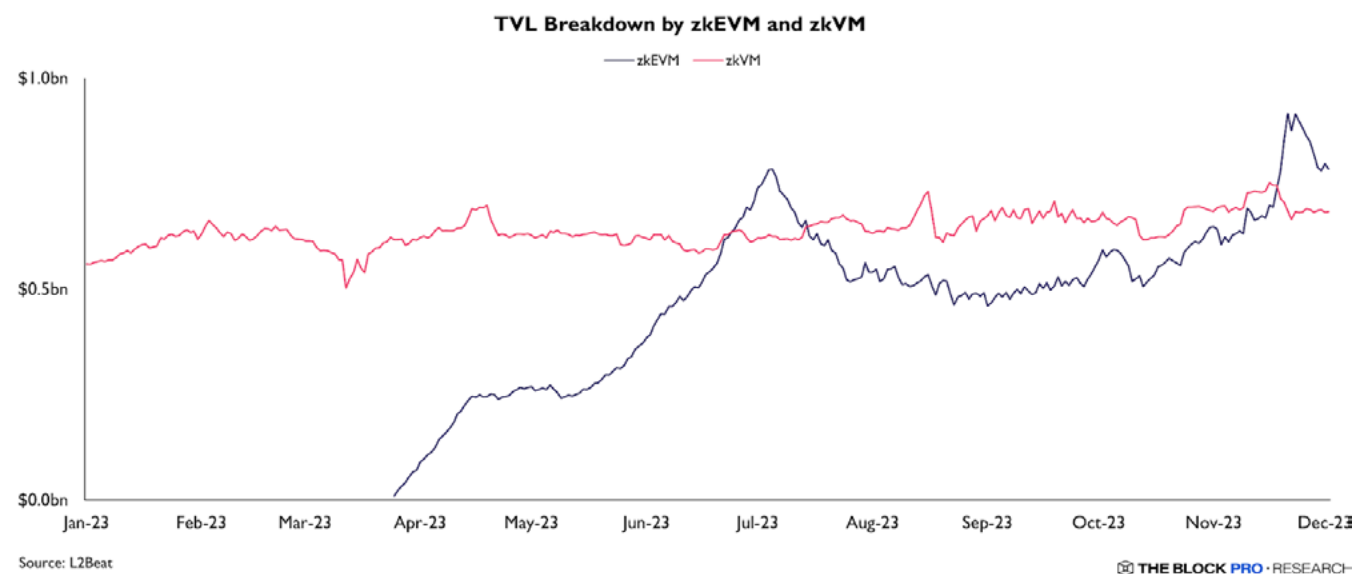
In the ZKR domain, there are currently no clear leaders. Although dYdX has dominated the ZKR space in TVL for quite a while, it has already begun its transition to a Cosmos layer 1 chain. The next two ZKRs that are competing fiercely are zkSync Era, with \$440 million in TVL, and Starknet, with \$140 million in TVL. Though zkSync Era has significantly more TVL than Starknet, part of its TVL originally came from zkSync Lite. With these two ZKRs potentially dropping governance tokens in 2024, they currently garner a great deal of interest and activity.



Following closely behind zkSync Era and Starknet, we have Polygon zkEVM, Loopring, and Linea. With the exception of Loopring, the four ZKRs mentioned here are all general-purpose rollups, meaning that they are capable of supporting applications with different logic. This is particularly unique to ZKRs, as some

ZKRs have chosen to be application-specific because the infrastructure for generating a validity proof can get quite complex, making it difficult to build a general-purpose ZKR compared to an app-specific one.

Aside from building ZKRs to be general purpose, there is also a focus on building zkEVMs, with the likes of Polygon zkEVM, Scroll, and Taiko all making headway. The push for zkEVM is targeted towards improving the user experience when compared to ORs since ORs provide a similar experience to using Ethereum due to their compatibility with their parent chain.

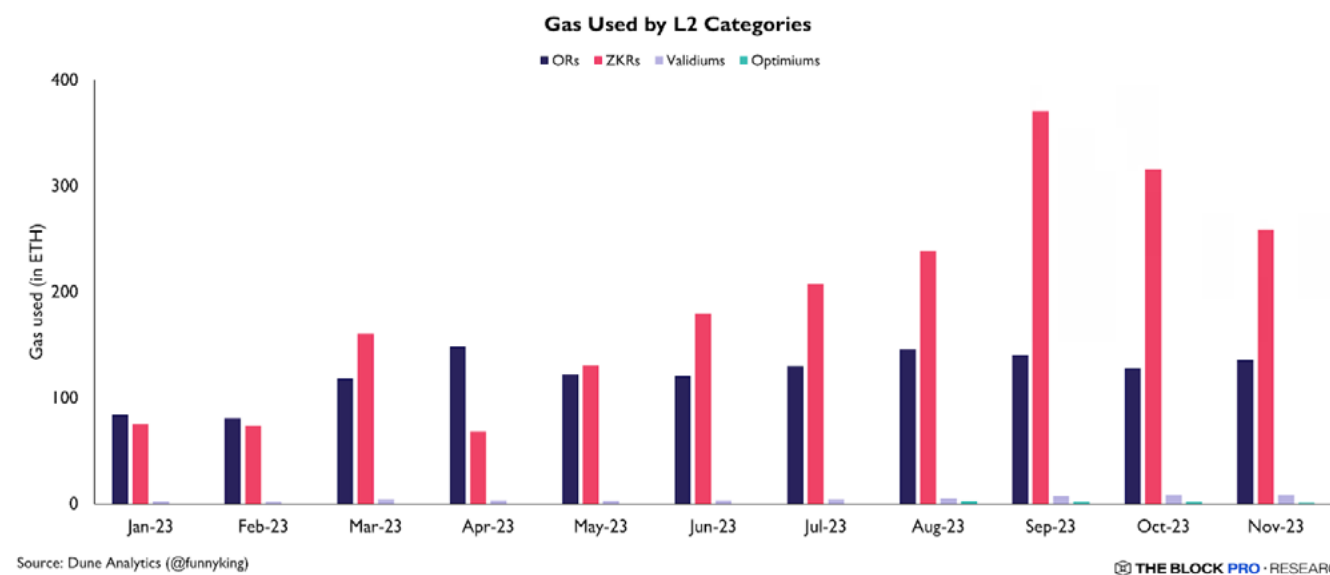


Recent data, however, suggests that the zkEVM narrative may not necessarily prove to be the only compelling one, seeing as how dYdX used to be the largest ZKR by TVL. Starknet, the second largest ZKR by TVL, has also opted to build a more performant zkVM instead of zkEVM. As of this writing, TVL on zkEVMs is nearly \$100 million more than TVL on non-zkEVM ZKRs. While one may expect zkEVMs to pull ahead of non-zkEVMs, the adoption of ZKRs is unlikely to hinge on EVM compatibility alone, but rather, the utility of applications and ease of use.

**VALIDIUMS AND OPTIMIUMS**

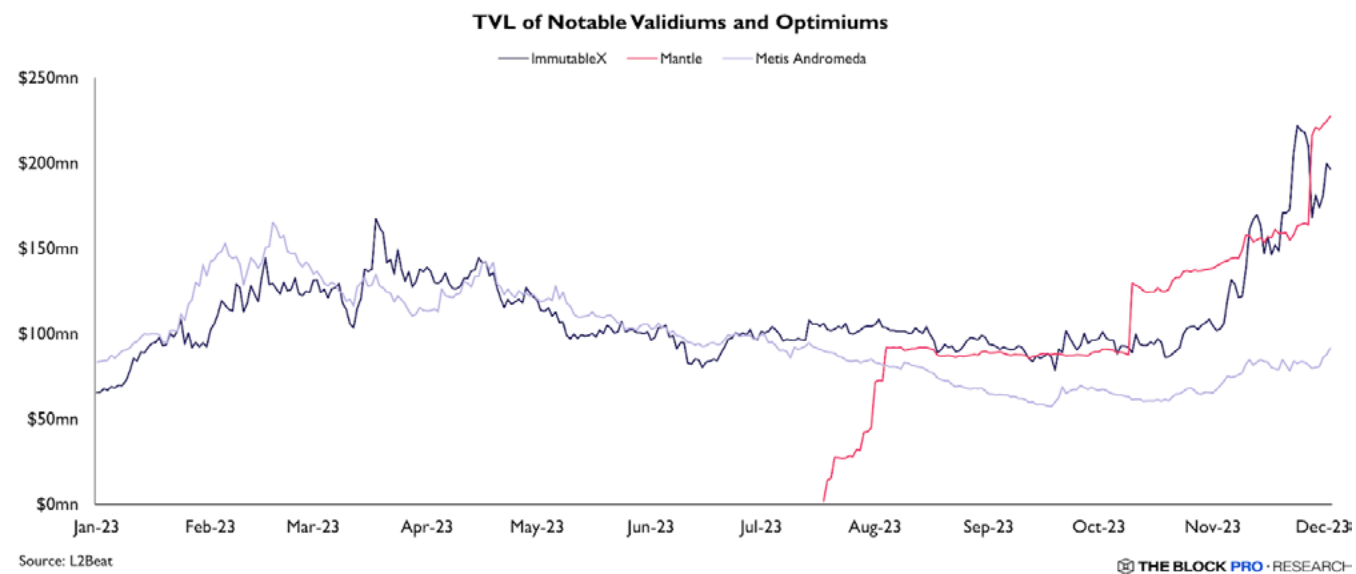
While rollups have generally dominated the scaling landscape for Ethereum, it is, however, constrained by the cost of posting transaction data. As a result, L2s that utilize off-chain data availability (DA) are becoming increasingly common. In general, L2s leveraging off-chain data availability that rely on fraud

proofs are known as Optimiums, while those that rely on validity proofs are called Validiums. While there is some degree of tradeoff in security when opting for off-chain data availability, the cost savings of hosting transaction data off-chain can be quite significant. However, there is evidence that suggests the security trade-offs made by the use of off-chain DAs to lower costs are not a risk many users are willing to take.



Although the gas usage of Optimiums and Validiums are far lower than optimistic rollups and zk rollups, respectively, their adoption levels are also significantly lower, evidenced by the lower TVLs on both. Consider ImmutableX, an NFT-specific L2 marketplace, which has \$150 million in TVL, the highest amongst all other Validiums. ImmutableX's TVL pales in comparison to dYdX, which is also application-specific but was built as a ZKR.

Even general-purpose Validiums and Optimiums do not see better adoption metrics. Mantle, the largest general-purpose Optimium by TVL, did see significant growth in its adoption, amassing over \$200 million in TVL over the past six months. However, Mantle still lags far behind general-purpose ORs like Arbitrum One and OP Mainnet, which have over \$7 billion and \$3 billion respectively. Metis Andromeda, an Optimium that has been around since November 2021, also lags significantly in TVL, with a daily average of \$98 million in 2023 thus far.



Put simply, so far, the utility of lowered transaction costs does maintain its value over time. In a bull market, when more users are transacting on-chain and priced out by high transaction costs, it might prove to be valuable, but in the past year, when markets were bearish and on-chain activity, such a value proposition was unconvincing. Nonetheless, we are still seeing some overall growth in both Validiums and Optimiums, which may show potential when the bull market returns, when on-chain transaction congestion begins to impact ORs and ZKRs.

## EXTENDED ECOSYSTEM OF SCALING

### ROLLUPS AS A SERVICE

As the rollup landscape matures, we are starting to see rollups used as a form of versatility rather than scaling. An application that wishes to have its customizable execution layer can choose to spin up its rollup and have an abundance of block space by sacrificing some extent of decentralization and security. With that in mind, Rollups-as-a-Service (RaaS) applications have started to surface, offering dapp developers the ability to quickly spin up new rollups for deployment. Notable examples include Altlayer, an EVM-focused RaaS framework, and dYmension, a Cosmos-focused RaaS framework.

Altlayer introduced a novel concept of deploying Flash Layers, which are ad-hoc rollups deployed for short-term arbitrary purpose, such as an NFT mint, and can later be settled on another layer of the developer's choice upon the completion of the mint or an expiry date. The notion of having a deployable layer that provides additional block space on demand allows for spare capacity when required and no waste of

resources when the space is not needed. It will likely become a commonly used feature should blockchains start experiencing the same levels of congestion as they did in the 2021 bull market.

### LAYER 3

As discussed earlier, L2s have also begun experimenting with Layer 3s (L3s). For example, both Starknet and zkSync Era have previously mentioned that they could theoretically build L3s on top of the existing L2 infrastructure by leveraging the recursion of validity proofs. However, these solutions are not a priority now since both Starknet and zkSync Era are focused on the development of their L2s. Moreover, the use of L3 is targeted at allowing developers to quickly deploy customizable execution environments, analogous to what RaaS offers.



### DATA AVAILABILITY LAYER

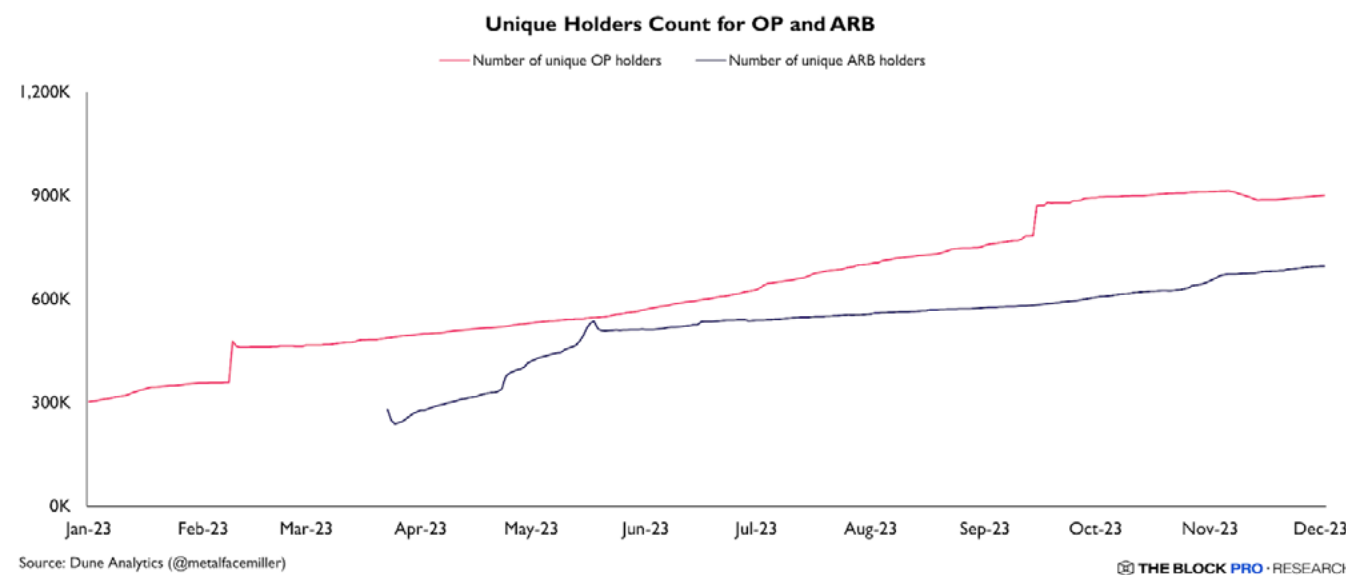
The most prominent scaling solution that was deployed in 2023 would have to be Celestia. Valued at \$1 billion at the time of writing, there was significant hype for Celestia's scaling solution: a data availability layer. As previously mentioned, Celestia provides probabilistic guarantees for DA. This reduces the total storage space required for every node and also shifts the load of hosting data from a monolithic blockchain to an external layer. However, as established earlier, off-chain data availability may not necessarily be an

optimal design choice for blockchains, considering how much lower adoption is for blockchains utilizing off-chain DA. Moreover, the revenue model for Celestia nodes is still untested, and it is still uncertain how much value Celestia can create for existing rollups and new rollups.

As of this writing, Celestia has launched its utility token, TIA, which has seen significant price volatility. Celestia's airdrop had over 580,000 eligible addresses, of which only 191,000 were claimed, which created the impression that there was little hype around it. However, the run-up in TIA's price following the airdrop has started catching the attention of the broader crypto community. It will take some time for Celestia to establish its value proposition for rollups, especially since there is a negative stigma towards off-chain DA, but with the potential deployment of various other DA layers, such as Avail and EigenDA, we may soon see a paradigm shift in the norm for DA.

### STATE OF ROLLUP DECENTRALIZATION

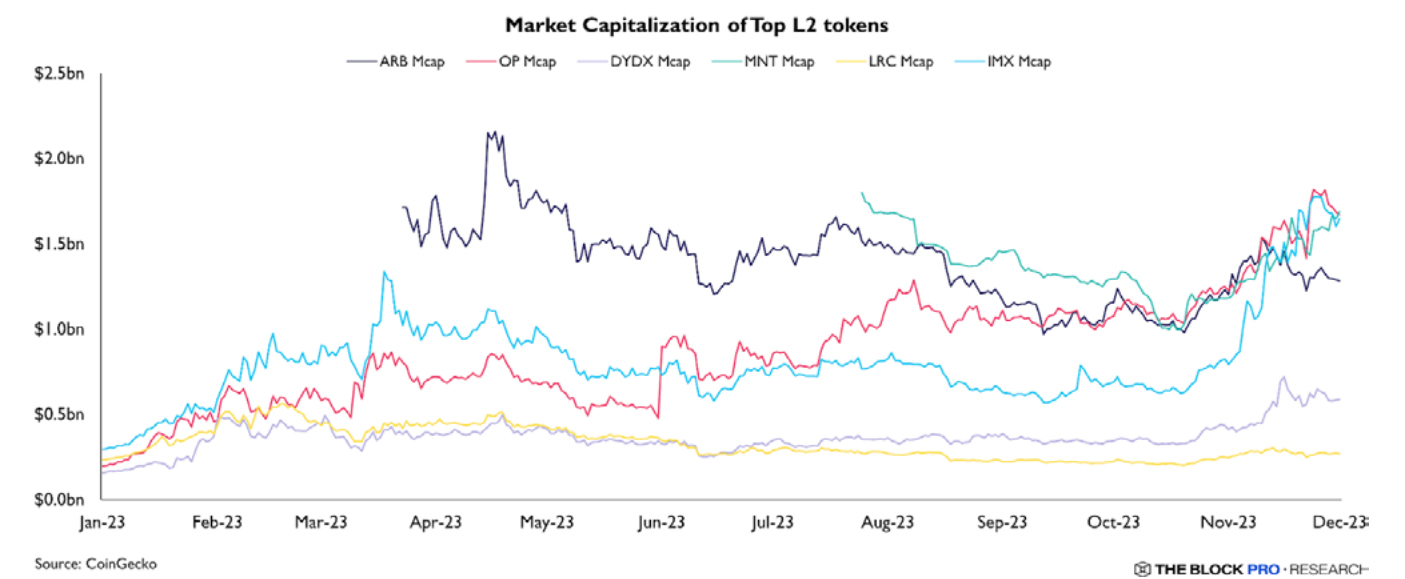
One of the biggest concerns for L2s is their state of decentralization as the ethos of public and permissionless blockchains is centered around having decentralized systems. As such, scaling solutions that sacrifice decentralization would be misaligned with the long-term vision of public blockchains. That said, all L2s today are centrally operated, and yet, they still see high levels of adoption, showing that users, for now, do not heavily weigh decentralization as a factor when deciding on a blockchain to use.



Nonetheless, having an active Decentralized Autonomous Organization (DAO) to govern each of these L2s is highly important, especially since robust governance is an indicator of organic adoption and also a precursor for a protocol's sustainable development. As such, it is crucial for L2s to distribute their governance tokens to their communities as optimally as possible.

The two most notable governance tokens for L2s is ARB and OP, the tokens for Arbitrum One and OP Mainnet, respectively. As these tokens are also used to align the interests of all stakeholders within the community, there is also significant attention on their relative valuations over time since bullish price actions can entice more users and developers and conversely, bearish price action would result in waning interest in the ecosystem over time. This is a trend that we have seen play out with other L2s whose tokens have declined in value significantly with relatively less price action thereafter.

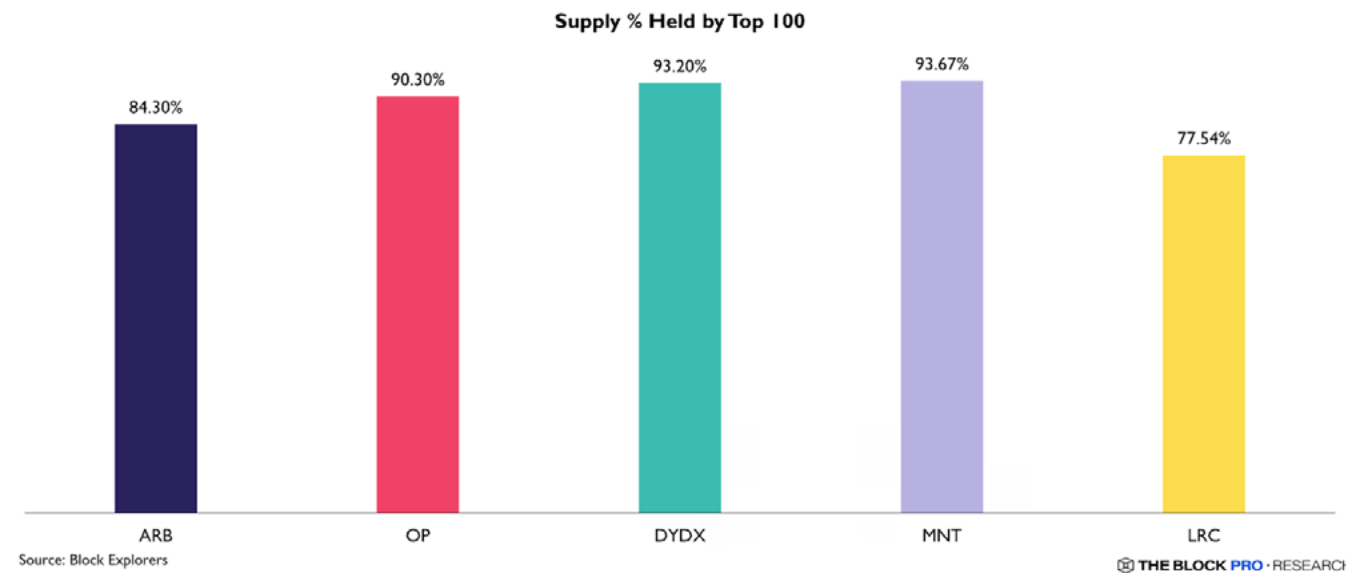
It is clear that both Arbitrum One and OP Mainnet have pulled ahead of the curve in terms of their adoption but the takeaway is how the governance token creates a positive feedback loop for the organic growth of the ecosystem. Well-aligned incentives make for a more active community, creating a more robust ecosystem and that instills deeper confidence in the future of the protocol. A brighter prospect for the protocol will bring more long-term demand for the governance token over the long run and also help the protocol retain both users and developers over time.





There are other relevant metrics to evaluate the state of decentralization for an L2, such as the concentration of holdings across token holders, as well as the fallbacks in the event of a sequencer or proposer failure. The former would demonstrate how democratic the DAO is while the latter is critical for ensuring that the L2 can maintain its security in the worst-case scenario.

Currently, most L2s have yet to achieve significant success in diversifying the concentration of tokens across their token holders but this is a trend that would take a fairly long time to play out. For example, Loopring, which has 77.5% of all LRC tokens held by the top 100 holders, launched its token in October 2017, years before both Arbitrum One and OP Mainnet. It would be optimal for the concentration to decline over time for these rollups' governance to be sufficiently decentralized.



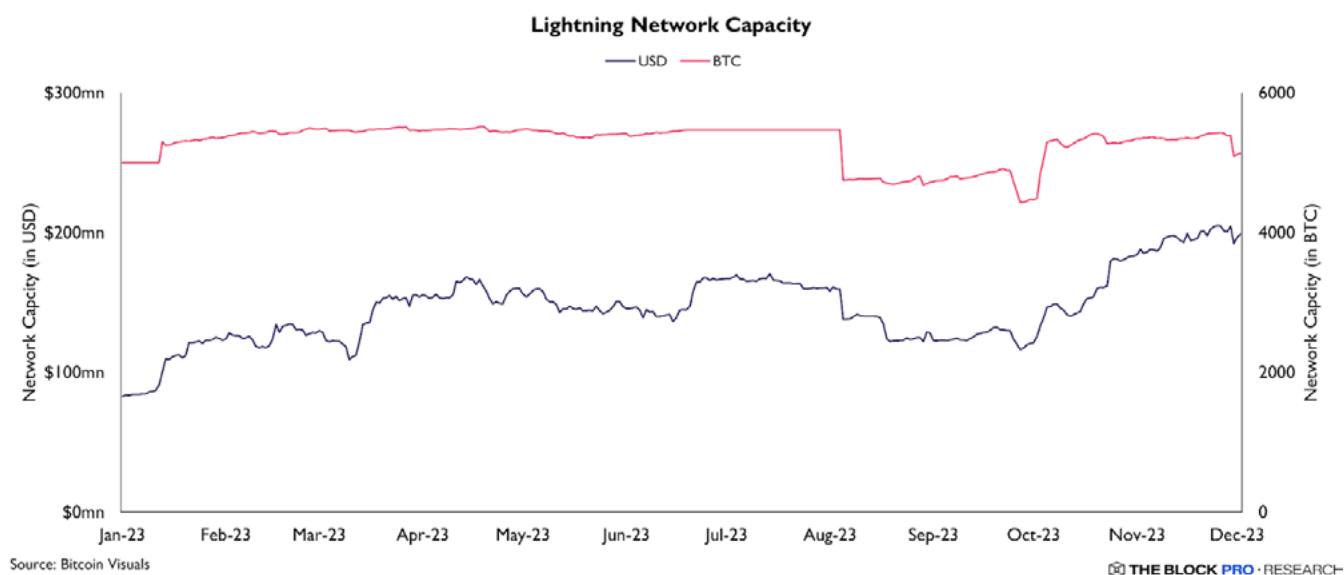
Last but not least, we have the technical aspect of a L2's decentralization, that is, how the L2 holds up in the event of an operator failure. A L2 operator consists of two main roles: a sequencer and a proposer. The former is responsible for sequencing transactions on the L2 while the latter is responsible for submitting L2 state changes to L1. Both roles are equally important, as their failure can result in the L2 malfunctioning or leaving funds stuck on L2, both of which are undesirable outcomes. Decentralizing these roles would create redundancies that can reduce the likelihood of encountering either outcome. Nonetheless, none of the L2s have sufficiently decentralized their sequencer or proposers thus far. A handful of them have introduced alternative mechanisms, such as an escape hatch for withdrawals, as a temporary solution to either a sequencer failure or proposer failure.

Layer 2	Sequencer Failure	Proposer Failure
Arbitrum One	Enforced sequencing	Self-propose
OP Mainnet	Enforced sequencing	Whitelist only
Base	Enforced sequencing	Whitelist only
zkSync Era	Enqueue sequencing	Whitelist only
dYdX	Enforced sequencing	Escape hatch
Starknet	None	Whitelist only
Mantle	Enqueue sequencing	Whitelist only
Immutable X	Enforced sequencing	Escape hatch
Loopring	Enforced sequencing	Escape hatch
Linea	None	Whitelist only
zkSync Lite	Enforced sequencing	Escape hatch
Polygon zkEVM	None	Self-propose
Metis Andromeda	Enqueue sequencing	Whitelist only
ApeX	Enforced sequencing	Escape hatch
Arbitrum Nova	Enforced sequencing	Self-propose
ZKSpace	Enforced sequencing	Escape hatch
Sorare	Enforced sequencing	Escape hatch
Scroll	None	Escape hatch
Rhino.fi	Enforced sequencing	Escape hatch
Manta Pacific	Enforced sequencing	Whitelist only

## SCALING BITCOIN

### LIGHTNING NETWORK

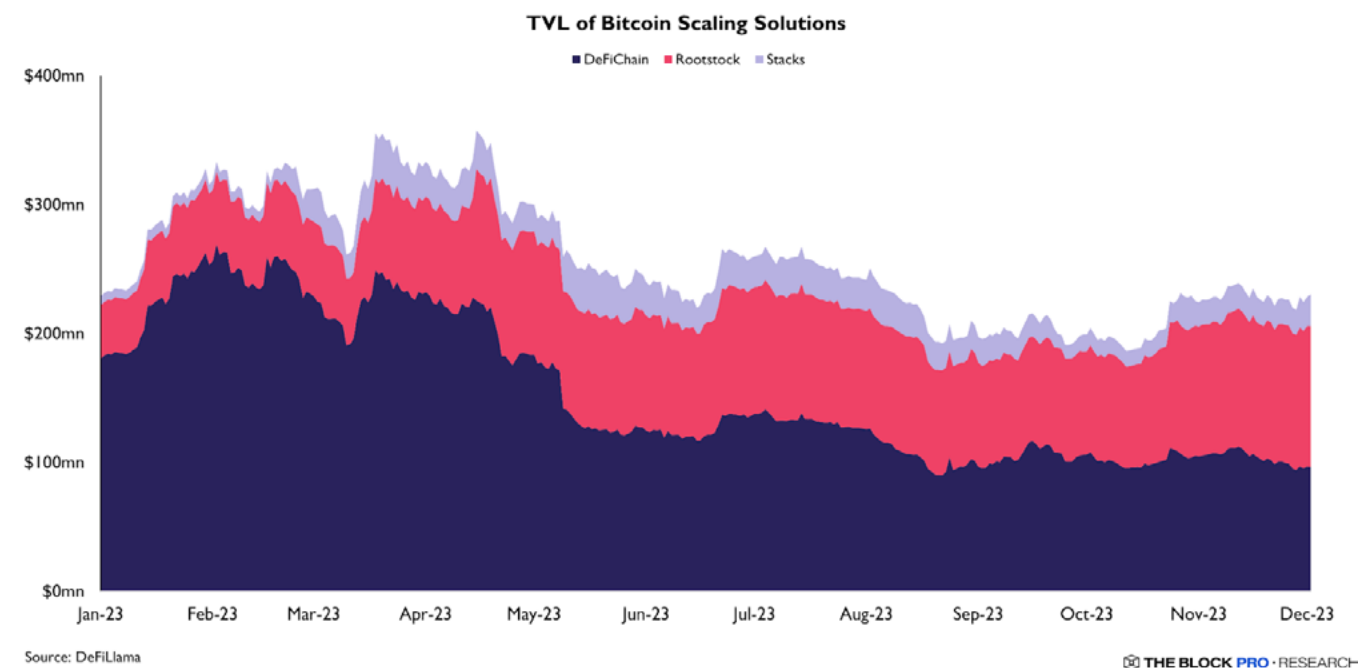
The Lightning Network is, undisputedly, the most prominent scaling solution for Bitcoin. Additionally, it is also the largest one by TVL. Its TVL has surged from approximately \$85 million in January 2023 to nearly \$200 million as of this writing. However, a more accurate measure of the Lightning Network's growth would be the 7.0% increase from 5,000 Bitcoins in January 2023 to 5,346 Bitcoins in November 2023. This demonstrates that the growth in TVL was primarily driven by the rise in Bitcoin's price instead of actual Bitcoins being committed to the Lightning Network.



The increase in the Lightning Network's capacity can be attributed to the integration with a decentralized messaging protocol, Nostr, that enables censorship-resistant social media. Nostr leverages the Lightning Network for micropayments, allowing its users to tip each other in a censorship-resistant manner as well. Although the adoption for Nostr is nowhere near mainstream social media applications like X (prev. Twitter), Nostr demonstrates a viable use case for censorship-resistant technology and how the Lightning Network can be incorporated with it.

### SIDENCHAINS, LAYER 2S, AND MORE

There are a handful of other Bitcoin scaling solutions, ranging from sidechains to L2s. Notable sidechains include DeFiChain, Rootstock, and Stacks. While there is demand for Bitcoin scaling, it appears that sidechains are not meaningfully capturing said demand, with DeFiChain, Rootstock, and Stacks having TVLs of \$173, \$106, and \$19 million, respectively, lower than that of Lightning Network's \$200 million. Not to mention, the TVL of sidechains like DeFiChain and Rootstock includes the value of their native tokens, DFI and RSK, respectively, which means that the organic adoption of these solutions is significantly lower than the Lightning Network.



Compared to the Lightning Network, sidechains often come with higher security tradeoffs. For instance, DeFiChain requires nodes to stake DFI tokens to validate transactions, while Stacks uses a Proof-of-Transfer mechanism that provides some degree of crypto-economic security to its sidechain. Unlike the Lightning Network, which fully inherits security from the Bitcoin blockchain, these scaling solutions only partially inherit a partial extent of Bitcoin's security. Nonetheless, these solutions are aligned with the vision of scaling the Bitcoin blockchain, but it should be noted that these chains do not fully inherit the security of Bitcoin itself.

There are few projects in the realm of Bitcoin L2s, such the ZK rollup being developed by [Alpen Labs](#). Most other nascent projects are other types of sidechains, such as [Botanix](#) and [Mintlayer](#). Perhaps the main reason for a lack of L2s on Bitcoin is due to the lack of expressibility with Bitcoin's Script, thereby making it challenging to implement validity or fraud proofs on Bitcoin itself. However, with future innovation, it may be possible to improve the expressibility of Bitcoin's Script and enable L2s to proliferate on Bitcoin.

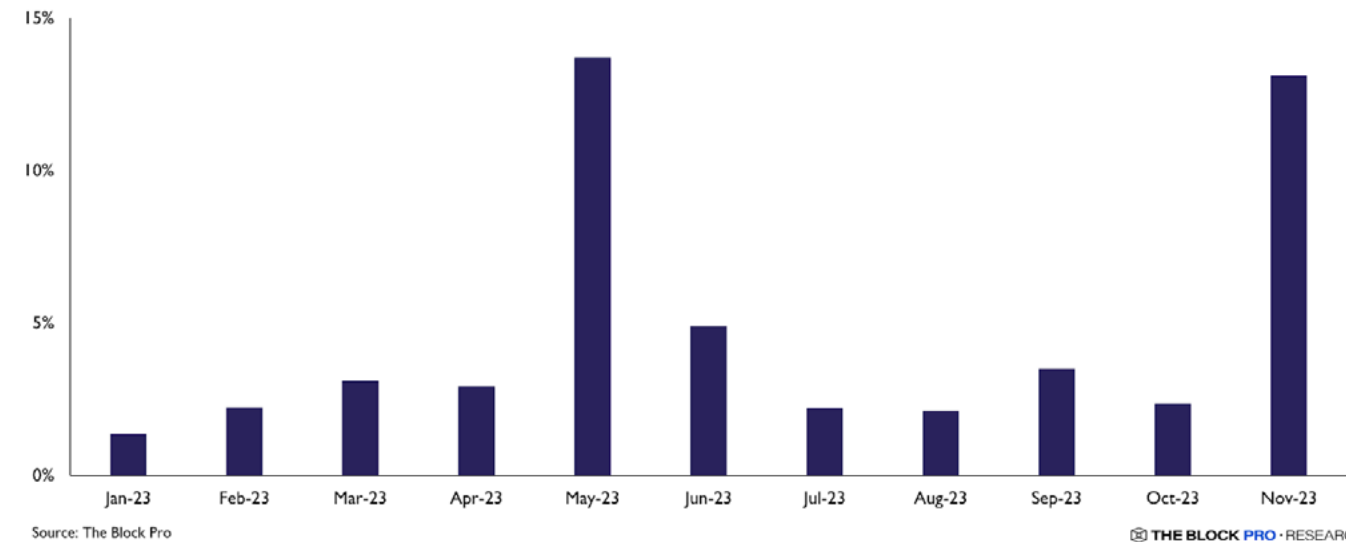
BitVM is the latest proposed upgrade to the Bitcoin blockchain, which is meant to bring the expression of Turing-complete programming to Bitcoin. However, BitVM does not technically make Bitcoin Turing-complete. Instead, it allows for the expression of Turing-complete Bitcoin contracts by utilizing bit-value commitments and extrapolating that to form logic gate commitments. In theory, being able to represent logic gates without constraints should allow any arbitrary logic to be expressed, and this can be done without altering Bitcoin network's consensus rules.

As such, arbitrary logic can be encapsulated and posted on-chain, with its execution processed off-chain. The verification of the execution will then be done via off-chain fraud proofing, though the fraud-proofing can be done on-chain if an entity decides to challenge the proposer on-chain. This way, any smart contract logic can be expressed on-chain, executed off-chain, and have its results posted and verified on-chain. Although this seems fairly cumbersome now, the potential of Turing-complete programmability for Bitcoin far outweighs the limitations it currently presents. Over time, BitVM will likely bring another wave of innovation to Bitcoin.

**ORDINALS AND BRC-20S**

Bitcoin Ordinals are satoshis that are assigned a unique identifier and hold extra metadata, leveraging SegWit's lower transaction fees as well as the Taproot upgrade. This unique identifier and extra data enable individual satoshis to be used as NFTs. This same framework was later extended to mint fungible tokens, termed BRC-20s. Both BRC-20s and Bitcoin NFTS were subjected to great speculation, bringing significant on-chain activity to the Bitcoin blockchain, causing a spike in the share of Bitcoin miners' revenue that comes from transaction fees.

**BTC Tx Fee share of Bitcoin Miners' Revenue**



Although the framework used to deploy Ordinal NFTs and BRC-20 tokens is not technically meant to scale Bitcoin, it does show that innovation is possible on the Bitcoin blockchain. Furthermore, the rise of Bitcoin Ordinals was an accidental byproduct of both the SegWit and the Taproot upgrades. It is well possible that we will see further innovations with the Bitcoin blockchain, albeit slower than most other blockchains, considering the limitations of Bitcoin's scripting language.

# SECTION 4

## ON-CHAIN APPLICATIONS

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This section provides an overview on the development, growth, and usage of blockchain applications. Two of the largest sectors for blockchain applications are decentralized finance and non-fungible tokens.

The collapse of FTX and other centralized crypto entities have resurfaced the need for and value of decentralized finance. Uniswap, Aave and Lido have maintained their dominant positions as the leading decentralized exchange, decentralized money market, and liquid staking protocol, respectively. This year has also seen the growth into additional sectors, such as the growth of decentralized derivatives, prediction markets, and real-world asset tokenization.

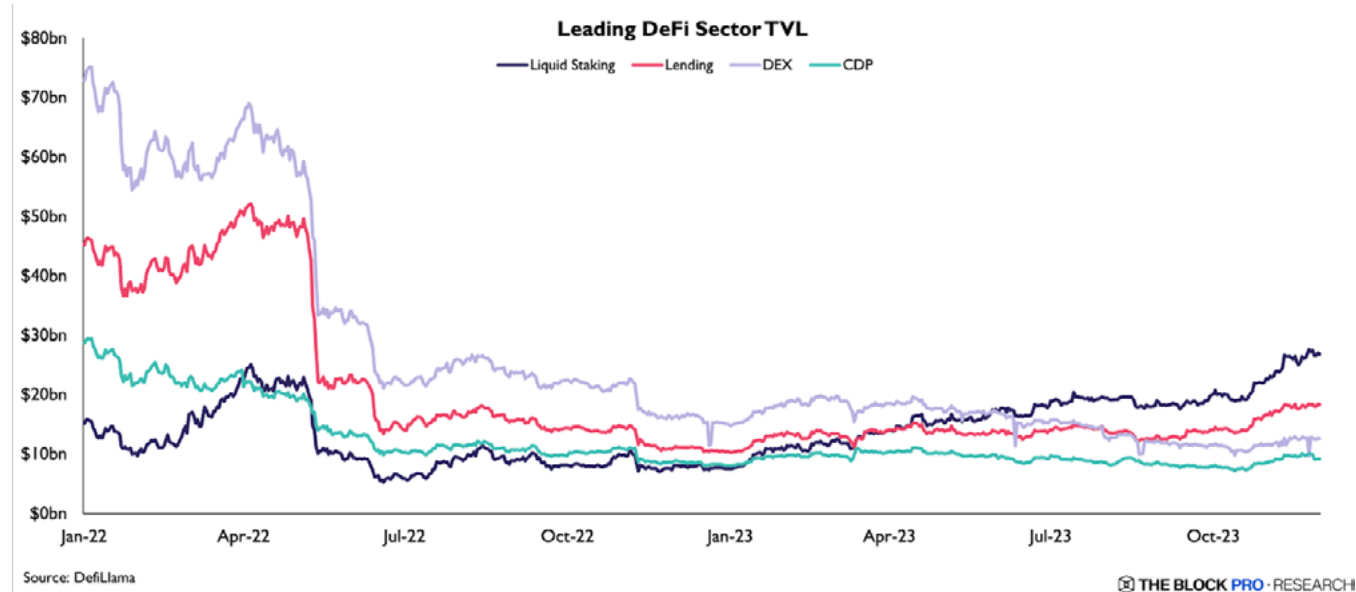
In the non-fungible token sector, we explore the onslaught of competitors against OpenSea, which resulted in the latter bleeding market share throughout 2023. We also explored the growth and adoption of financial applications for non-fungible tokens, such as money markets. The introduction of Ordinals on Bitcoin, also briefly touched upon in the previous section, has led to a flourishing of non-fungible tokens on the world's largest blockchain.

As part of this section's dive into non-fungible tokens, we also explore the entry of corporations into the blockchain space via metaverse initiatives and non-fungible token drops. Additionally, we examine the emergence of decentralized social protocols and their adoption.

## DECENTRALIZED FINANCE

Through its dynamic evolution since gaining prominence in 2020, DeFi has navigated a series of peaks and valleys. The euphoria of the “DeFi summer” during the preceding bull market illuminated the potential of an alternative financial system, offering users permissionless and borderless access to financial instruments. However, subsequent setbacks, exemplified by the Luna collapse, underscored the technology’s infancy and the inherent risks associated with the absence of regulatory oversight.

Despite the market turbulence experienced in 2022, 2023 emerged as a year characterized by consolidation and resilience within the DeFi space. It marked the consolidation of major DeFi sectors, including DEXs, lending markets, and liquid staking, among others. Liquid staking, in particular, claimed its position as the largest DeFi sector by TVL, showcasing the stability and competitiveness of liquid staking yields.

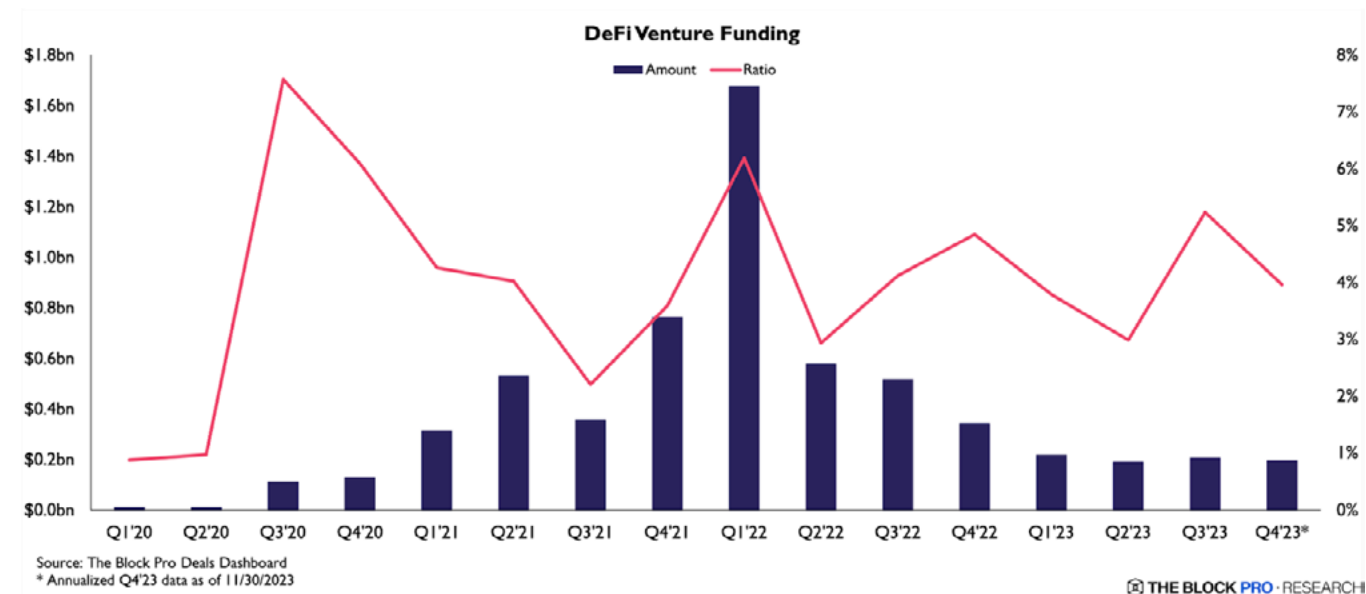


Protocol leaders within each major sector exhibited notable resilience, maintaining their quasi-monopolistic standing. Concurrently, the DeFi landscape witnessed innovation, with new protocols targeting more niche and specific audiences. This ongoing innovation highlights the adaptability and evolution of the digital asset industry, even amid a challenging macroeconomic environment.

On the other hand, venture funding in the DeFi sector continued to deteriorate, reaching levels not seen since the second half of 2020. However, this decline was in harmony with the broader digital asset

landscape, grappling with a market-wide liquidity crunch. The ratio of digital asset services-related funding allocated to DeFi development demonstrated stability, fluctuating between 2% and 5%. This pattern reflects the maturation of the DeFi sector, marked by a more measured environment compared to the euphoria witnessed near the peak of the last bull market.

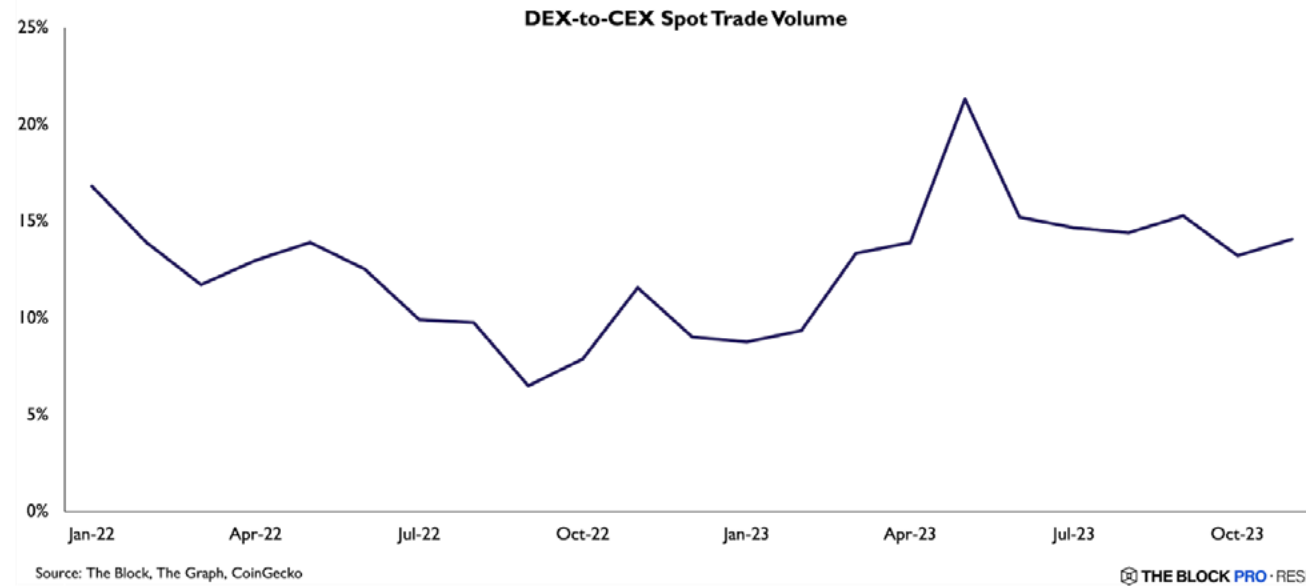
The modest uptick in DeFi funding observed in Q3 2023 might serve as an early indicator of a potential trend reversal. This could signify renewed interest and confidence from investors, allowing the DeFi sector to sustain its momentum with continued research and development initiatives. Despite the challenges posed by market dynamics, the DeFi ecosystem appears resilient and is poised for potential growth and innovation in the coming periods.



## MATURED SECTORS

### DISTRUST IN EXCHANGES CONSOLIDATES UNISWAP DOMINANCE

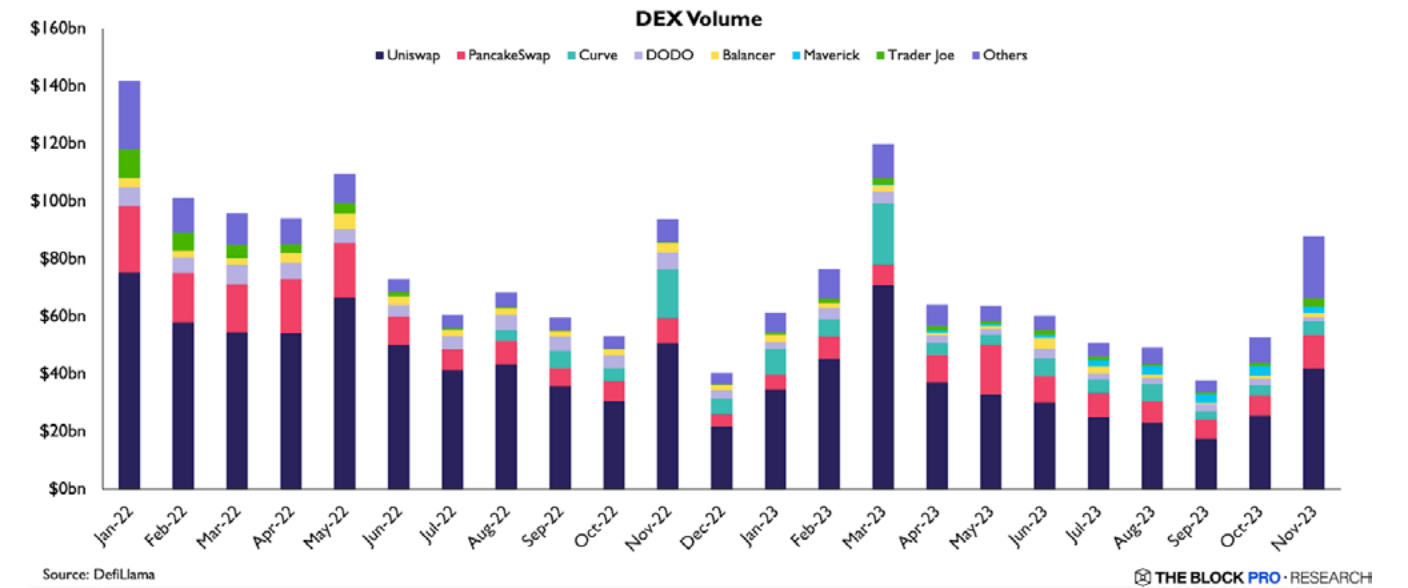
In the first half of 2023, many spot traders absconded from CEXs to decentralized venues in response to the FTX bankruptcy, intensifying concerns about the reliability of centralized custodians. The recurring failures of centralized actors in the digital asset space in 2022 accentuate the importance of decentralization and emphasize the unique advantages offered by DeFi.



Spot DEX volumes demonstrated fluctuations throughout 2023 against the backdrop of a prolonged bear market characterized by subdued market interest, followed by indications of market recovery in Q4. March stood out as an anomaly, witnessing a monthly DEX volume of \$120 billion. This surge was primarily attributed to the brief de-pegging of Circle's USDC, the second-largest stablecoin by market cap, occurring over a weekend. The market reaction was marked by fear over potential contagion stemming from the collapse of Silicon Valley Bank, which held a portion of Circle's reserve.

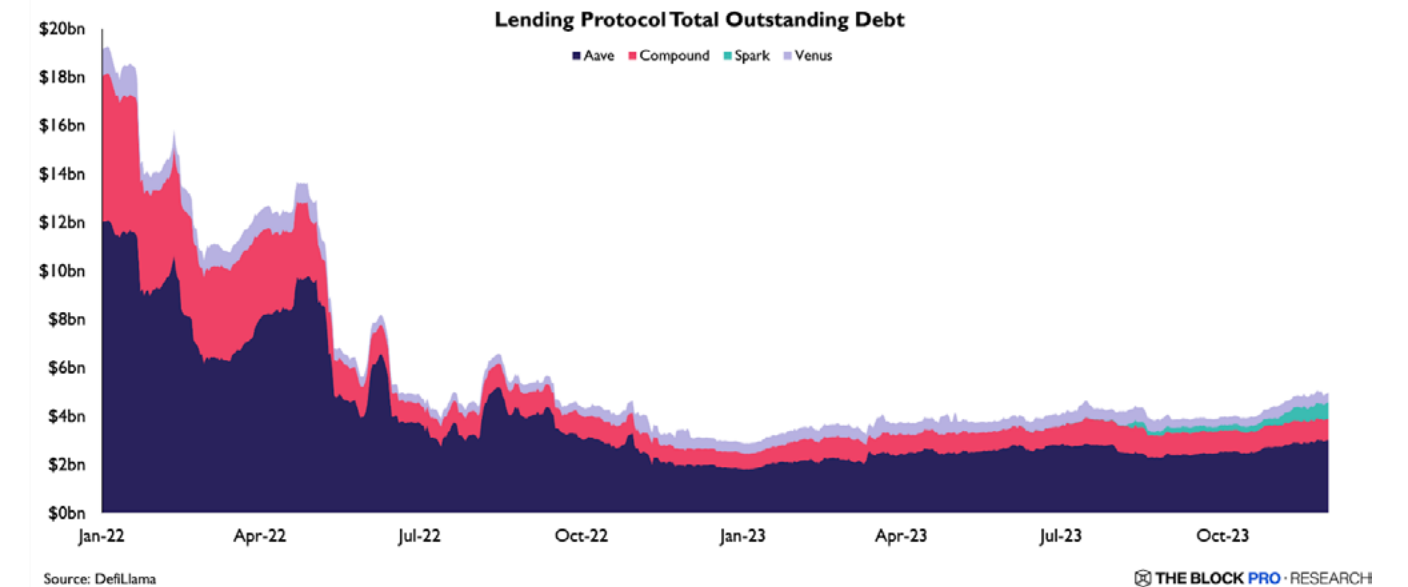
The variation in trading volume had a mostly uniform impact across all DEXs. Uniswap maintained an unrivaled lead, capturing a 53% volume share in 2023, with the majority of its volume originating from Ethereum and Arbitrum One, the largest L2 by TVL. Simultaneously, the BNB Chain-based PancakeSwap retained a moderate market share following its v3 launch in April, featuring concentrated liquidity provisioning and limit orders.

In contrast, Curve experienced a reduction in volume share from 10% the previous year to 3.7% in the current year. This decline can be attributed to market contraction hindering the diversity of the stablecoin landscape, thereby diminishing the relevance of stableswap DEXs. The shifting dynamics in the DEX space reflect the broader challenges and opportunities presented by market fluctuations.



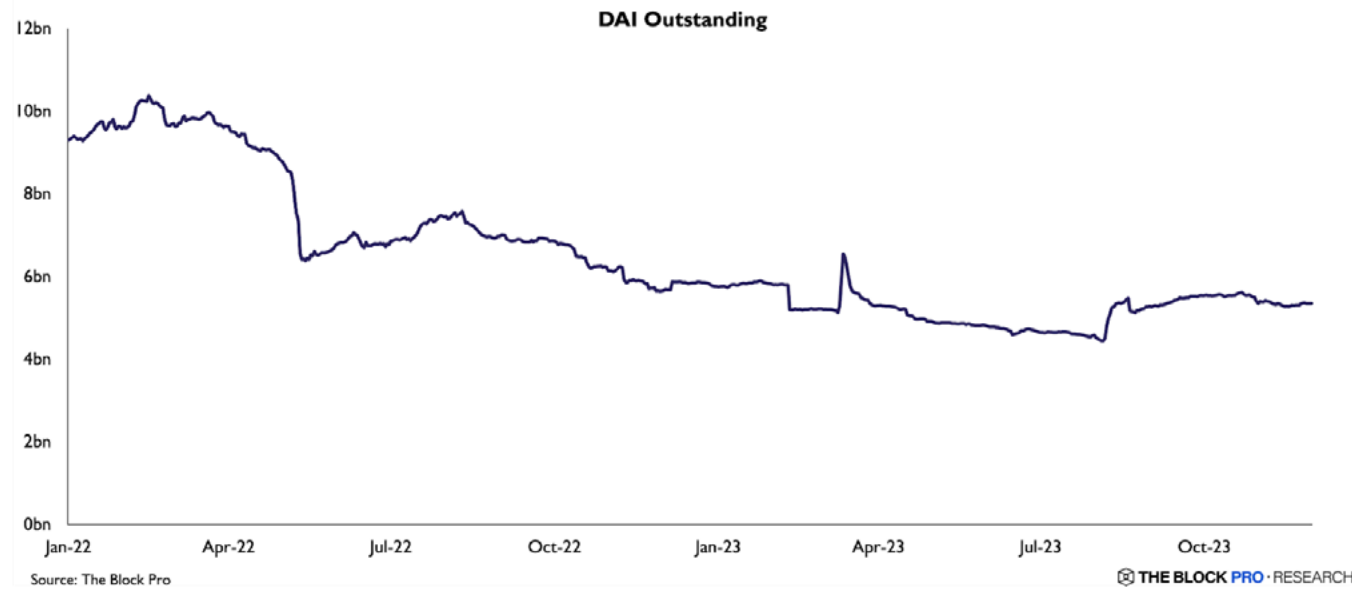
**BORROWING ACTIVITIES RECOVER AMID MAKER'S EXPANSION**

The lending landscape has also witnessed a parallel trend of consolidation, with Aave retaining its dominant position, commanding a market share of over 60% in total outstanding debt, while Compound continued to lag behind as a distant second. In contrast to the declining trajectory observed in DEX volumes throughout much of 2023, borrowing activities exhibited a gradual resurgence, steadily recovering from the leverage wipeout in 2022. Unfazed by the events surrounding Euler's exploit in March, the measured increase in total outstanding debt was influenced by the modest valuation uptick in digital assets throughout this year.

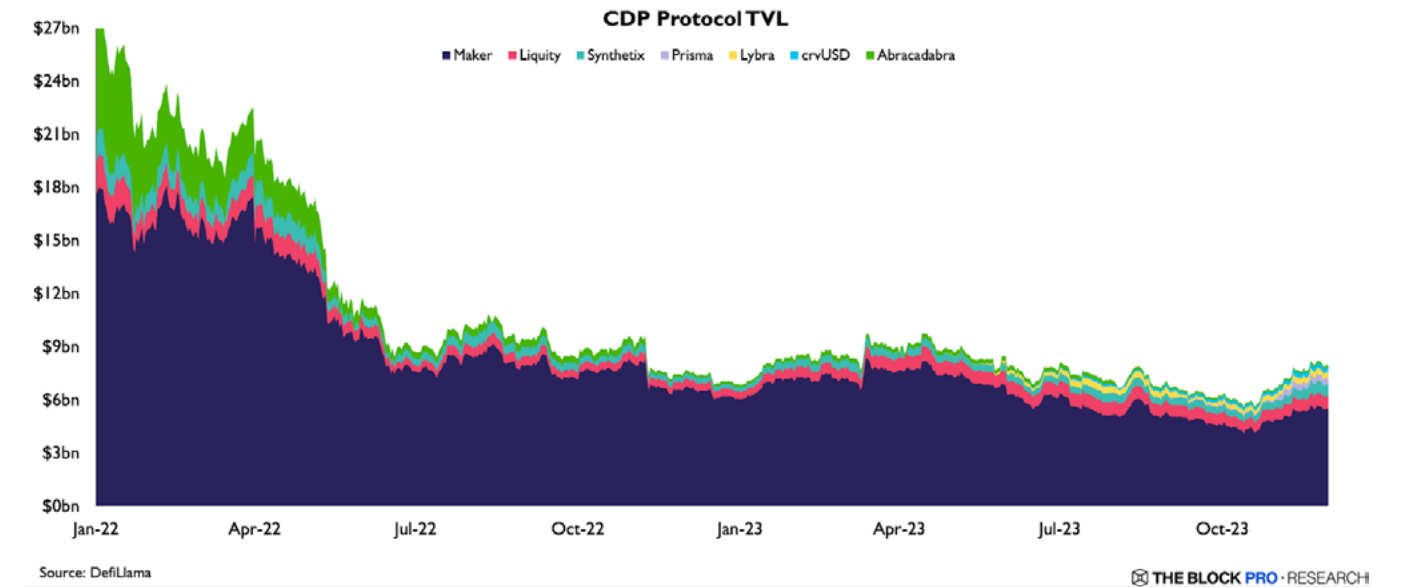


A notable development in May was the entry of Maker-branded SparkLend into the lending arena. The Aave fork swiftly gained traction and rapidly ascended to become the third-largest lending protocol by total outstanding debt, surpassing the \$600 million mark six months after its inception. SparkLend distinguishes itself by providing predictable rates for DAI borrowing, the largest decentralized stablecoin by market cap, achieved through leveraging a credit line directly from Maker.

In the landscape of collateralized-debt-position (CDP) stablecoins, Maker preserved its leadership position even though it experienced a contraction in TVL, reaching a cycle low of \$4 billion in October. The amount of DAI outstanding also experienced a decline in the middle of the year before rebounding in August, aligning with the rapid adoption of the aforementioned SparkLend.

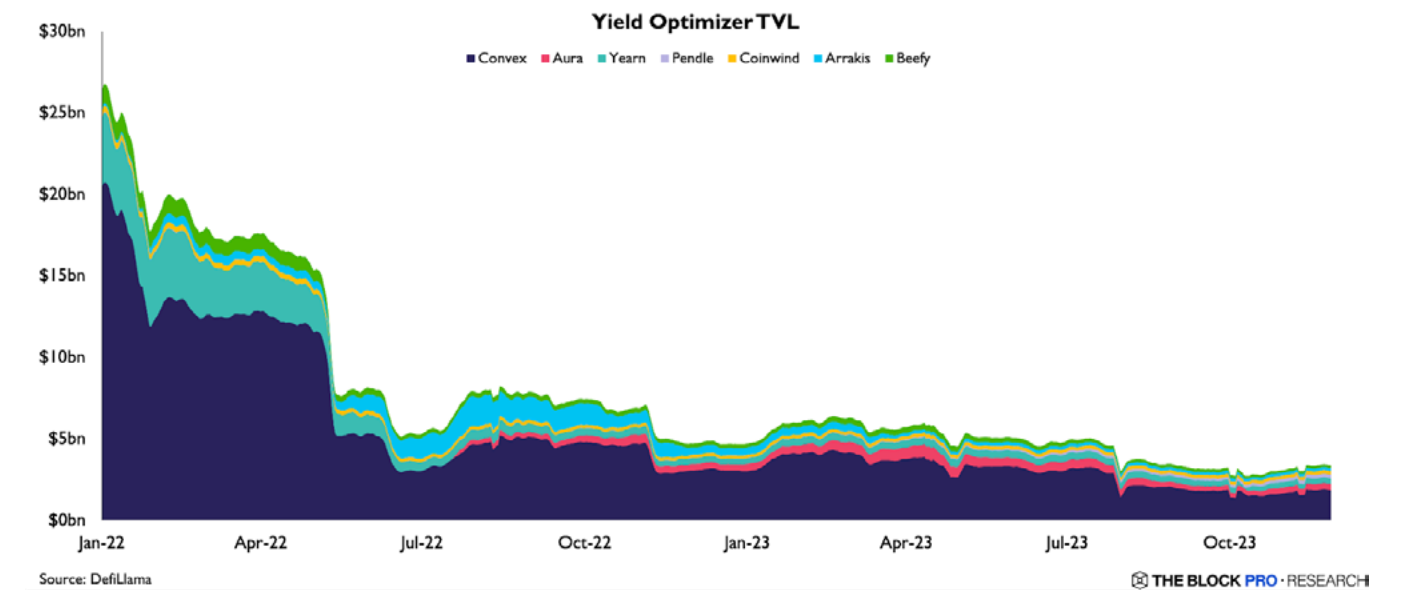


Despite Maker's continued preeminence, the surge of liquid-staking-themed CDP protocols remained unhindered. The introduction of Prisma and Lybra this year garnered measured market attention, as these platforms embrace a diversified basket of liquid-staked ETH as collateral. Liquid staking remained a focal point in 2023, and these protocols contributed to enhancing the utility of liquid-staked ETH, thereby fostering a narrative of "liquid staking finance."



**YIELD OPTIMIZER SEE CONSTRAINED ACTIVITIES**

The maturation of the aforementioned DeFi sectors has played a pivotal role in shaping the evolution of yield optimizers. Given that yields are commonly derived from well-established sectors like DEXs for liquidity provisioning or lending markets, the extended bear market characterized by subdued volatility and diminished borrowing interest has significantly constrained the capturable yield from on-chain venues, thereby impeding the growth of yield optimizers.

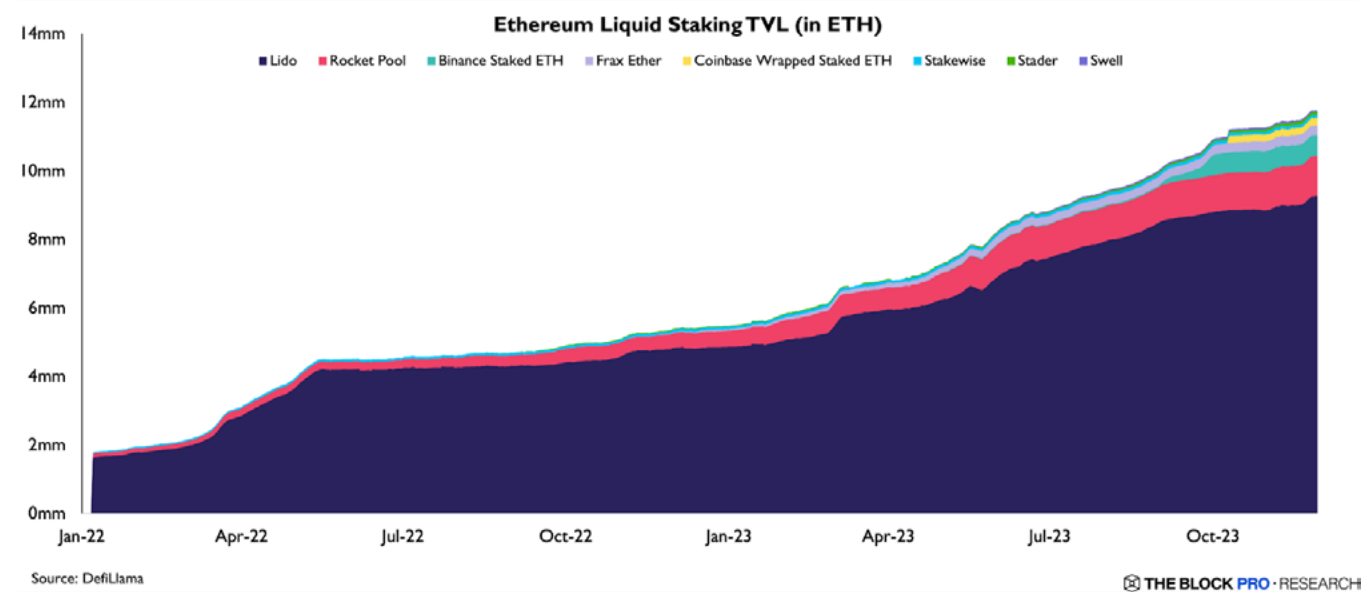


Convex, while maintaining a significant \$1.9 billion in deposits, faced a decline in appeal due to the diminishing volume on the Curve DEX. In contrast, Pendle strategically capitalized on the growing trend of “liquid staking finance” by providing interest-rate swaps tailored for liquid-staked tokens. Ultimately, the trajectory of the yield optimizer sector is intricately intertwined with market activities in other sectors, highlighting its dependency on the broader dynamics of the DeFi landscape.

**ETHEREUM LIQUID STAKING’S UNDETERRED GROWTH**

The Ethereum liquid staking sector showcased remarkable resilience, positioning itself as a standout performer within the DeFi space in 2023. This exceptional performance can be attributed to two key factors. Firstly, the consistent yield generated from liquid staking became relatively more appealing than other DeFi activities during a bear market characterized by subdued volatility and diminished borrowing interest. Secondly, the proliferation of the above-mentioned “liquid staking finance” protocols augmented the utility of liquid-staked tokens.

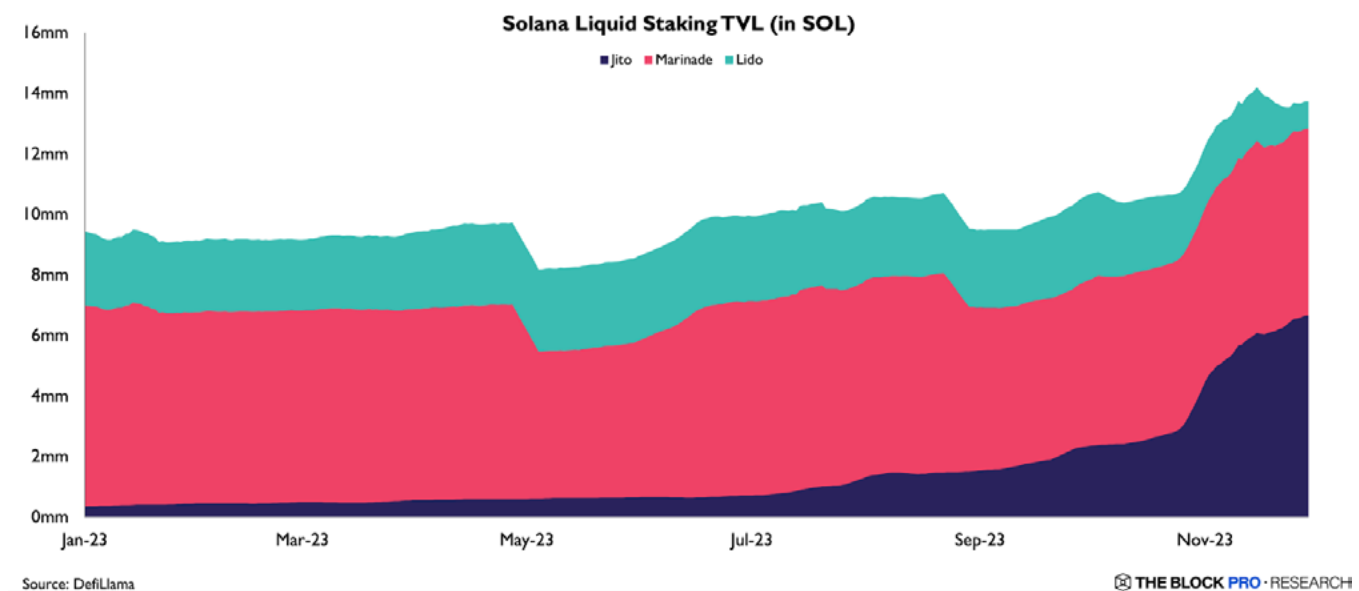
Although the demand for liquid-staked ETH appeared to have plateaued in the latter half of 2022, the current year experienced accelerated growth, unaffected by the availability of staking withdrawals starting in April. Lido retained its dominant position in the Ethereum liquid staking sector, capturing a commanding market share of 78%, while Rocket Pool upheld its status as a distant second with a 10% share.



**EMERGING SECTORS**

**SOLANA LIQUID STAKING UP FOR GRABS**

While the liquid staking landscape on Ethereum has reached a level of maturity, the liquid staking arena in Solana is emerging rapidly. In a noteworthy development, Jito surpassed Marinade in TVL in November, securing its position as the leading liquid staking protocol on Solana. This shift accentuates the initial success of Jito’s rewards program that rewarded its user base with an airdrop.

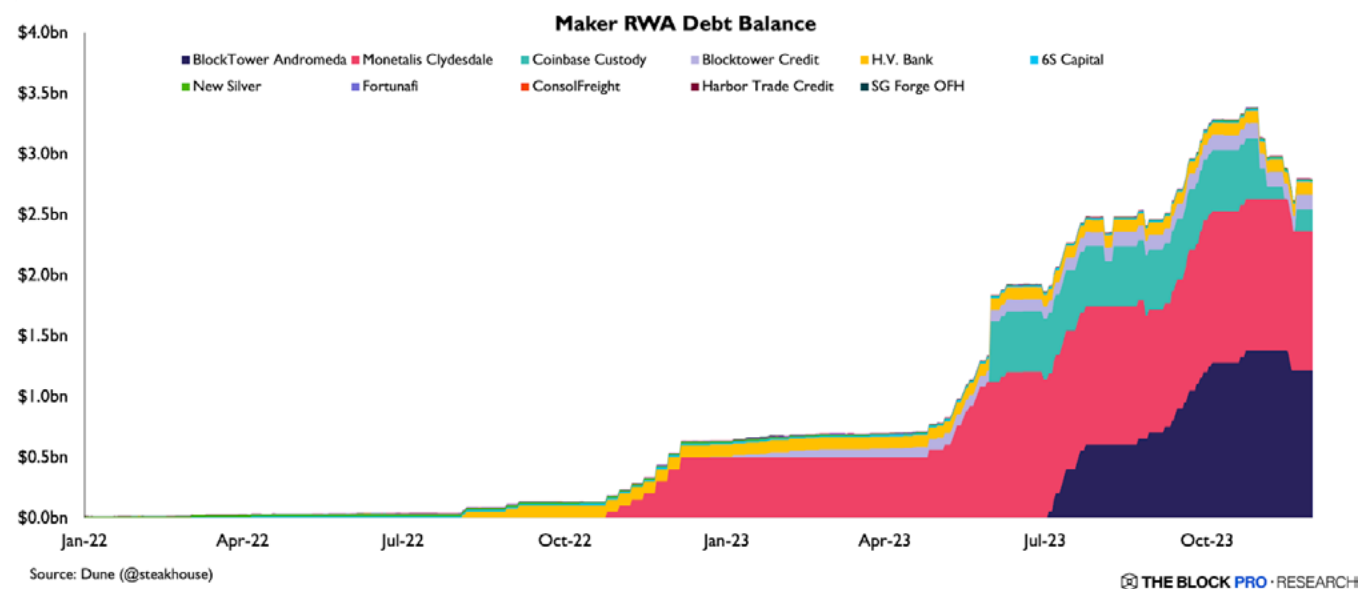


Despite Lido sunsetting its operation on Solana in Q1 2024, the competitive dynamics within this sector point towards substantial growth on the horizon, with Jito and Marinade contending for the top position. This suggests an evolving landscape where various protocols vie for dominance, underscoring the potential for significant expansion in the foreseeable future.

**MAKER EMBRACES RWAS AS MAJORITY COLLATERAL**

Amidst the rise of “liquid staking finance” and the burgeoning Solana liquid staking sector, several other segments within DeFi also emerged in 2023. Particularly, the market for real-world asset (RWA) tokenization (excluding fiat-backed stablecoins) witnessed explosive expansion, propelled by Maker’s proactive inclusion of RWA collateral. Notably, 2.8 billion DAI has been issued from RWA-collateralized debt positions, constituting over half of the entire 5.4 billion DAI supply. The fees generated from these RWA positions accounted for a substantial 80% of Maker’s revenue.



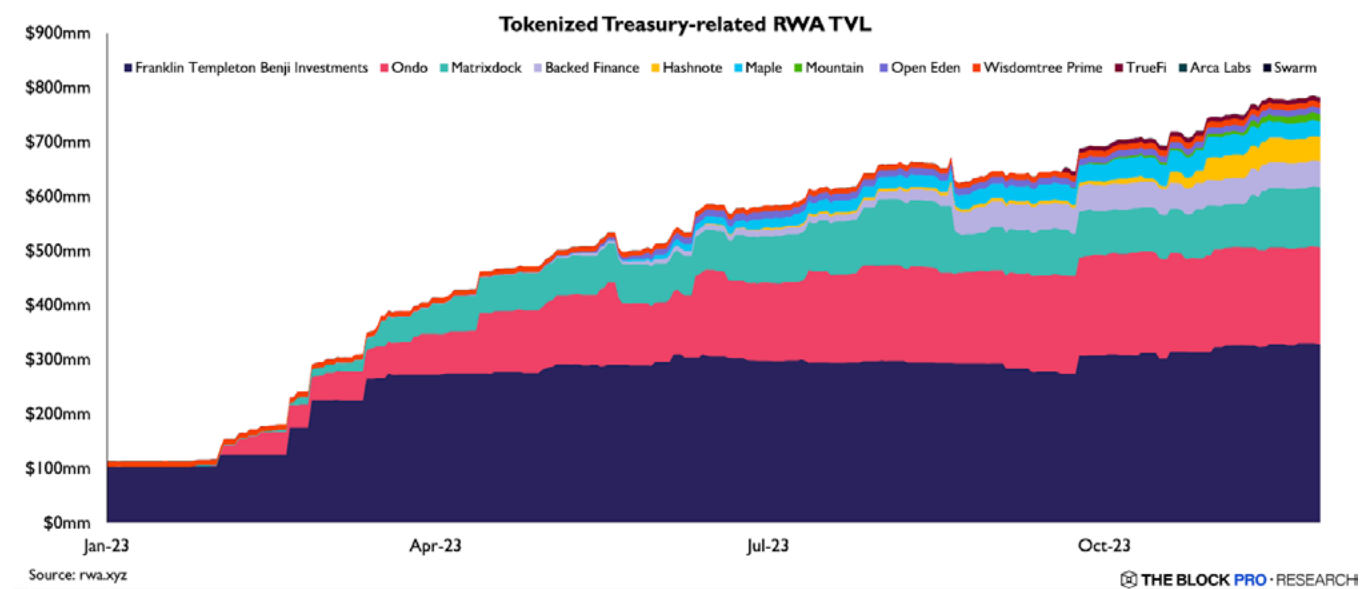


Maker’s foray into RWAs was met with controversy due to the introduction of significant counterparty risk. However, this extension into the realm of RWA significantly broadened the total addressable market (TAM) for Maker and the DeFi sector at large. Regardless of the debate surrounding this decision, it played a pivotal role in maintaining Maker as the second-largest DeFi protocol by TVL, only trailing behind Lido.

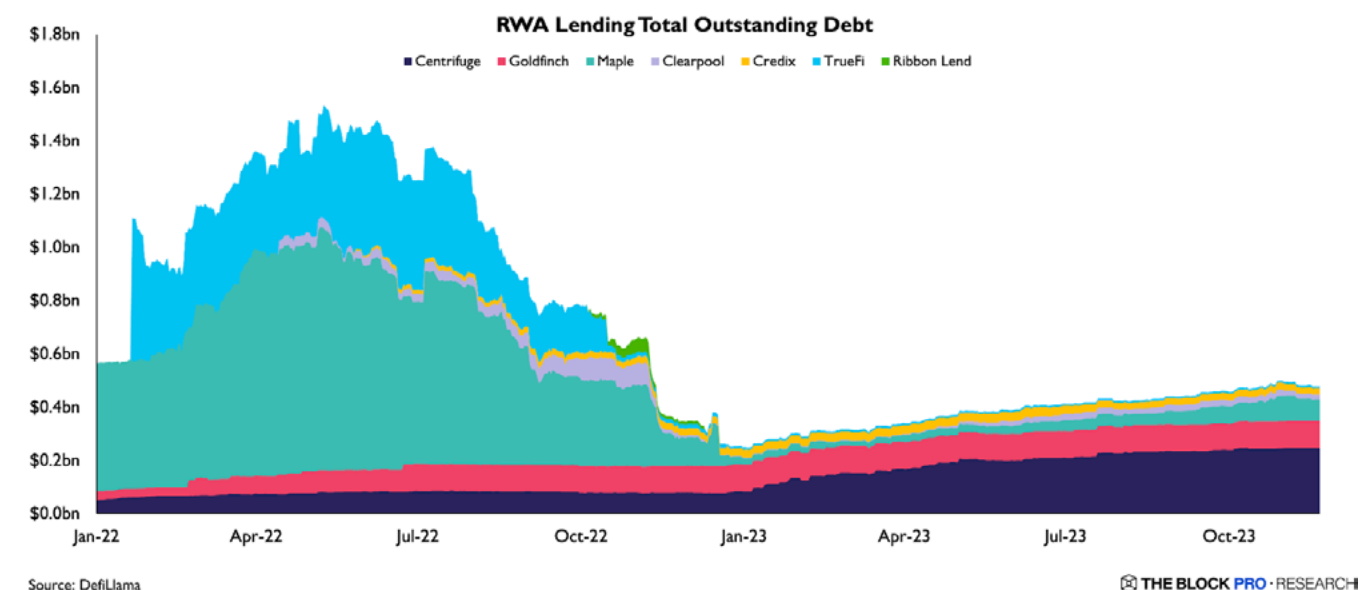
**RWA ADOPTION FUELED BY HIGH-YIELD RETURNS**

Beyond Maker’s endorsement, tokenized securities have seen growing adoption, particularly from users seeking exposure to U.S. Treasuries in the current high-interest-rate environment. The TVL in tokenized securities with U.S. Treasury exposure experienced a significant surge, reaching \$782 million. This growth was spearheaded by the Stellar-based Franklin OnChain U.S. Government Money Fund and the Ethereum-based Ondo Short-term U.S. Government Bond Fund. Ondo’s tokenized ETF holds an additional utility, as it can serve as collateral for borrowing stablecoins on platforms like Flux. This innovative approach unlocks liquidity for ETF holders, allowing them to leverage their holdings to access additional liquidity. This intersection of traditional securities and DeFi reflects the dynamic evolution and expanding use cases within the DeFi ecosystem.

On the other hand, private credit experienced a modest resurgence this year following a severe liquidity crunch in 2022. With numerous institutional borrowers defaulting, the challenges faced in the previous year had instilled uncertainty in the RWA industry. The renewed interest in private credit within DeFi can be attributed to the implementation of more robust due diligence processes. While established platforms such as Maple and TrueFi continued to play a role in facilitating private credit services, they were surpassed by Centrifuge and Goldfinch in terms of total outstanding debt. This shift in market leadership highlights the evolving nature of the sector.



The increasing adoption of tokenized securities and private credit presents a stark contrast to the TVL downturn in yield optimizers, as the emerging RWA sector generally offers higher returns, albeit with higher associated risks, compared to matured on-chain venues during the bear market. By incorporating traditional financial instruments and assets into the DeFi ecosystem through tokenization, the industry can significantly expand its TAM and offer users access to a broader range of investment opportunities, potentially yielding higher returns at certain stages of a financial cycle. This diversification beyond on-chain strategies showcases the versatility of DeFi in accommodating a variety of financial products and attracting a wider user base.

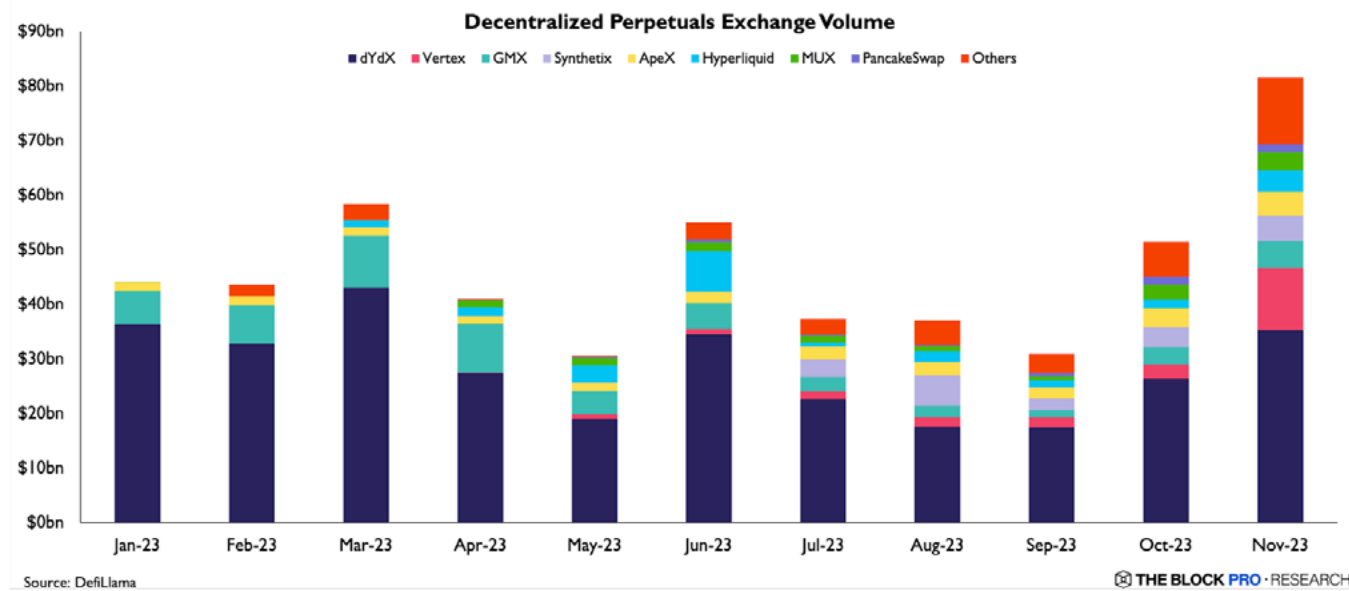


DERIVATIVES VOLUME SHOWS SIGNS OF GROWTH

The trajectory of decentralized perpetual futures (perps) exchanges in 2023 depicted a vibrant landscape. Notably, November saw a zenith in perps trading volume, reaching a year-high pinnacle.

dYdX maintained its position as the top perps DEX, although with a diminishing market share. The second spot became a fiercely contested arena, with platforms like Vertex, GMX, Synthetix, ApeX, and others vying for prominence. dYdX's progressive migration from an Ethereum-based StarkEx ZKR to a Cosmos sidechain adds an additional layer of competition within the perps DEX space. This move may stimulate further exploration among existing users within the broader Ethereum ecosystem for alternative solutions.

Simultaneously, decentralized options gained momentum from Q3 following the launch of Aevo. Aevo has emerged as the leading decentralized options exchange, surpassing Lyra by a considerable margin in terms of volume. The dynamics observed in the volume of decentralized derivatives throughout the year underscore the nascent nature of this sector, signaling that opportunities abound as it continues to evolve and mature.

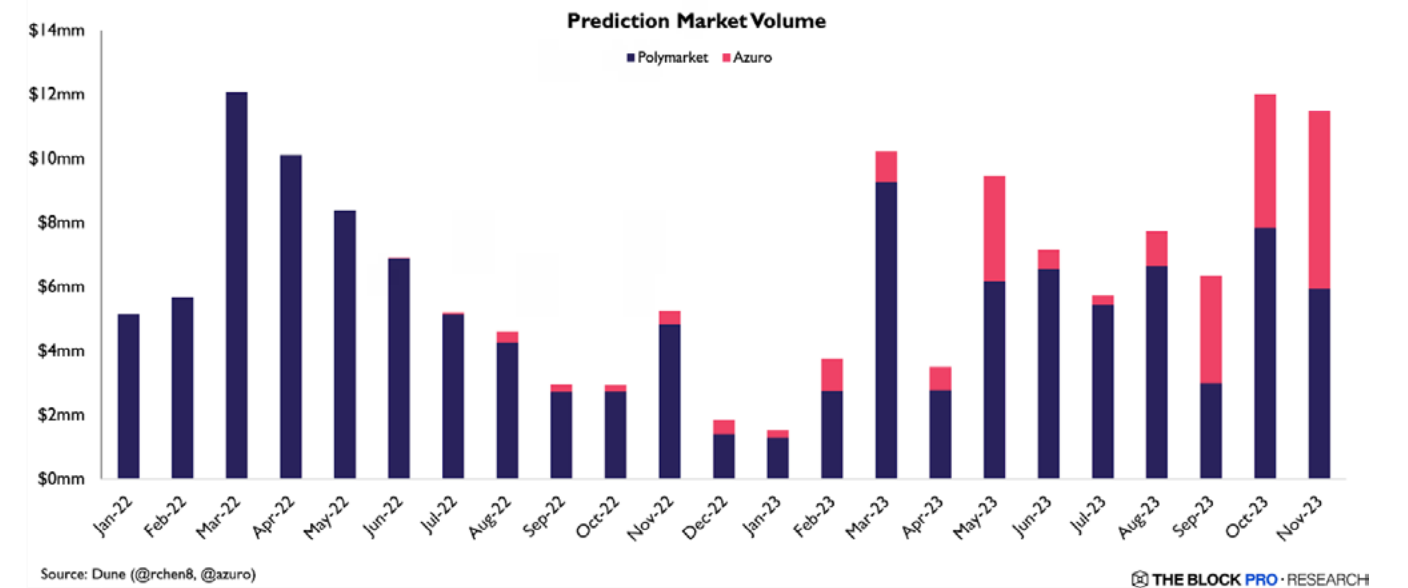
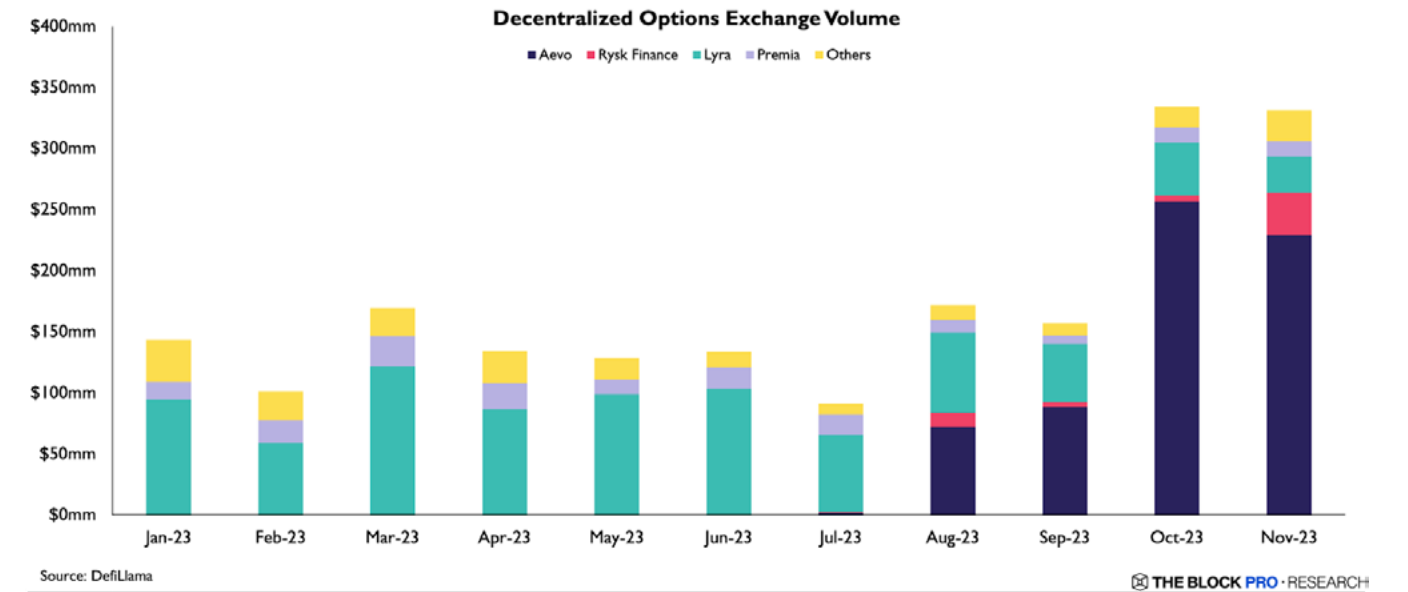


PREDICTION MARKET BOUNCES BACK

The event-based binary options market has witnessed a modest resurgence, and Polymarket has maintained its position as the leading prediction market in terms of volume. As the upcoming U.S. presidential election looms on the horizon, Polymarket is believed to be well-positioned to generate even more volume in 2024.

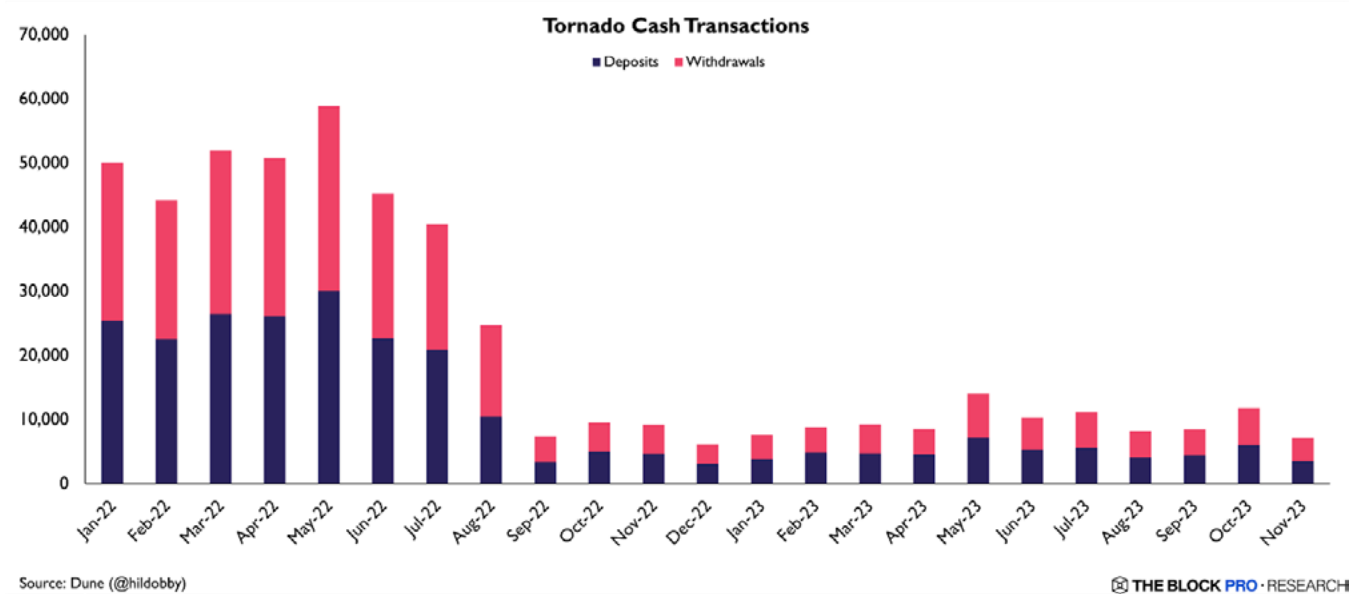
Additionally, Azuro, a sports betting market, has emerged as a notable player in the space, capturing a monthly volume in the millions starting in September. This trend coincided with the season openings of many major sports leagues, contributing to Azuro's growing presence and activity in the space.

STAGNATING SECTORS



**PRIVACY PROTOCOLS SUFFER UNDER REGULATORY SCRUTINY**

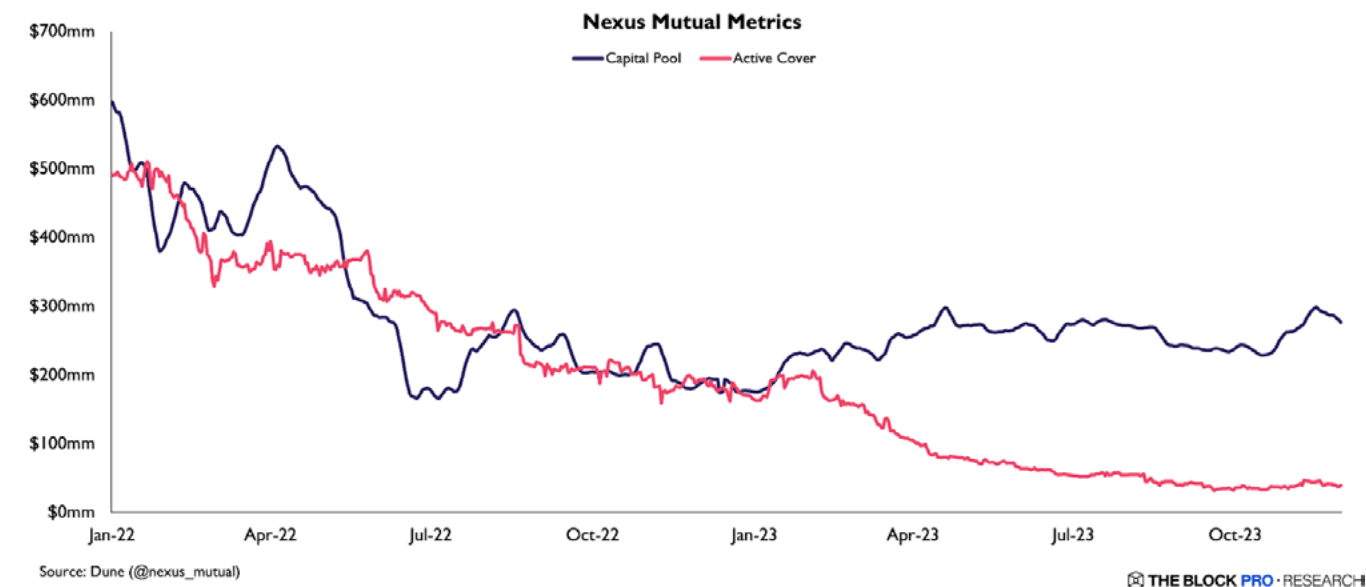
Despite witnessing sustainable volume and usage across various sectors within DeFi, not every sector has prospered. One of the sectors that faced significant challenges is the privacy sector, particularly following the sanctions imposed by the U.S. Treasury’s Office of Foreign Assets Control (OFAC) on Tornado Cash in August 2022. Being the largest decentralized privacy protocol in terms of both volume and TVL, Tornado bore the brunt of these regulatory actions. While it exhibited a slight increase in transaction count in May 2023, it demonstrated limited signs of recovery to pre-sanction levels, recording 105 thousand transactions throughout the entirety of 2023. The regulatory scrutiny and sanctions imposed on Tornado underscore the impact that regulatory actions can have on privacy-focused protocols within the ever-evolving landscape of DeFi.



Despite Tornado’s relatively subdued performance this year, significant resources dedicated to the research of ZKRs with succinct proofing are concurrently being leveraged for the development of next-generation privacy technologies. Notable examples include Aztec Noir and Polygon Miden, which are state-of-the-art privacy products poised for introduction in the coming years. The emergence of these advanced privacy protocols holds the potential to spark renewed interest and innovation within the privacy sector.

**INSURANCE DEMAND CRUMPLES**

Decentralized insurance was one of the underperforming sectors in DeFi. Despite the leading insurance protocol, Nexus Mutual, maintaining a sustainable capital pool for cover underwriting, the amount of active cover experienced a 76% decline throughout the year. This enormous decline may be attributed to a mismatch between demand and supply, potentially stemming from cover overpricing.

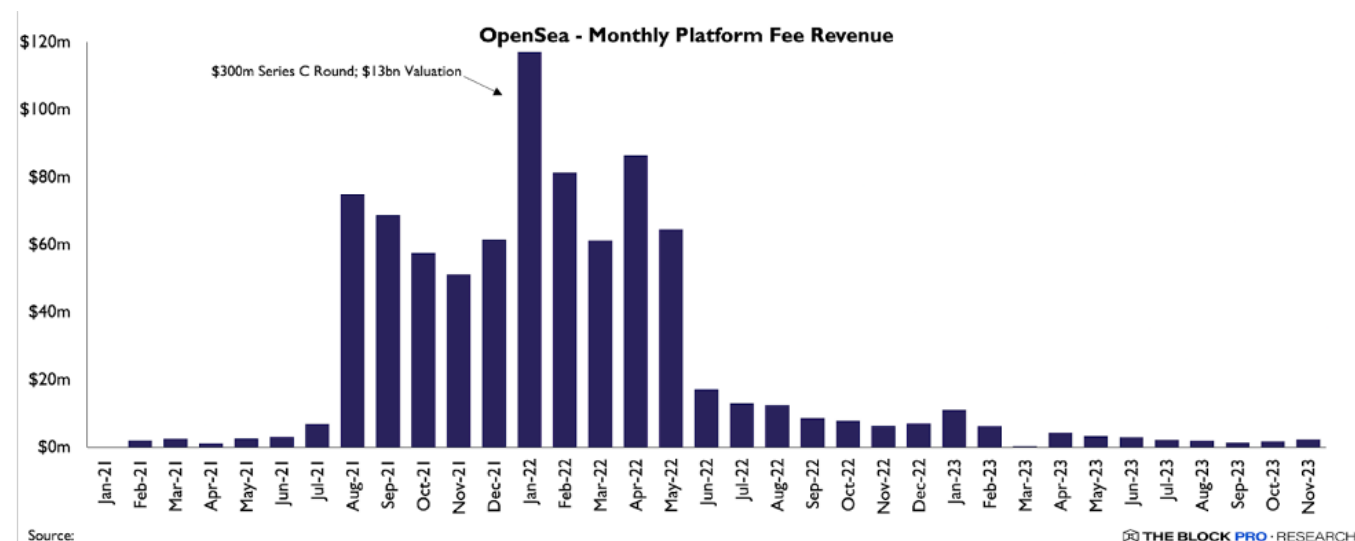


The challenges faced by the privacy and insurance sectors underscore the susceptibility of DeFi protocols to external influences. These struggles emphasize that not all sectors within the digital asset space experience uniform growth, highlighting the nuanced nature of the DeFi ecosystem. On the flip side, the opportunistic rise of RWAs and derivatives DEXs showcases the dynamic and ever-changing nature of the DeFi landscape. This suggests that, despite challenges faced by certain sectors, there are always opportunities for growth and innovation within the digital asset space.

**NON-FUNGIBLE TOKENS**

In 2023, the Non-Fungible Token (NFT) market witnessed a pivotal shift, signaling the rapid financialization of digital assets. The year marked a departure from high platform fee models, which had been a primary revenue source but increasingly came under scrutiny for their impact on market liquidity and trading activity.

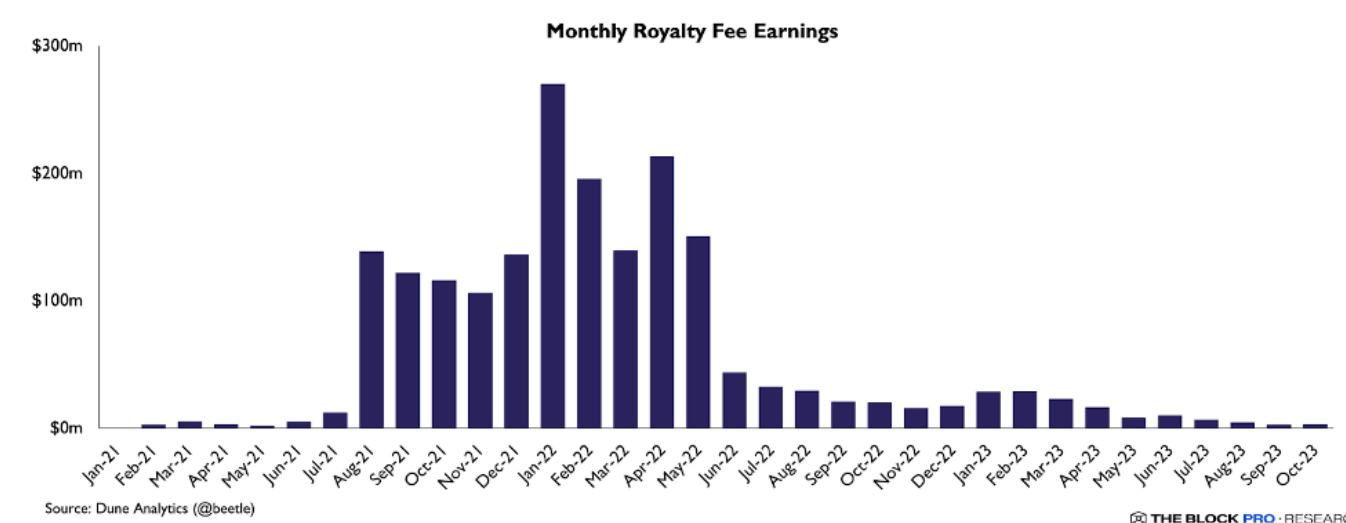
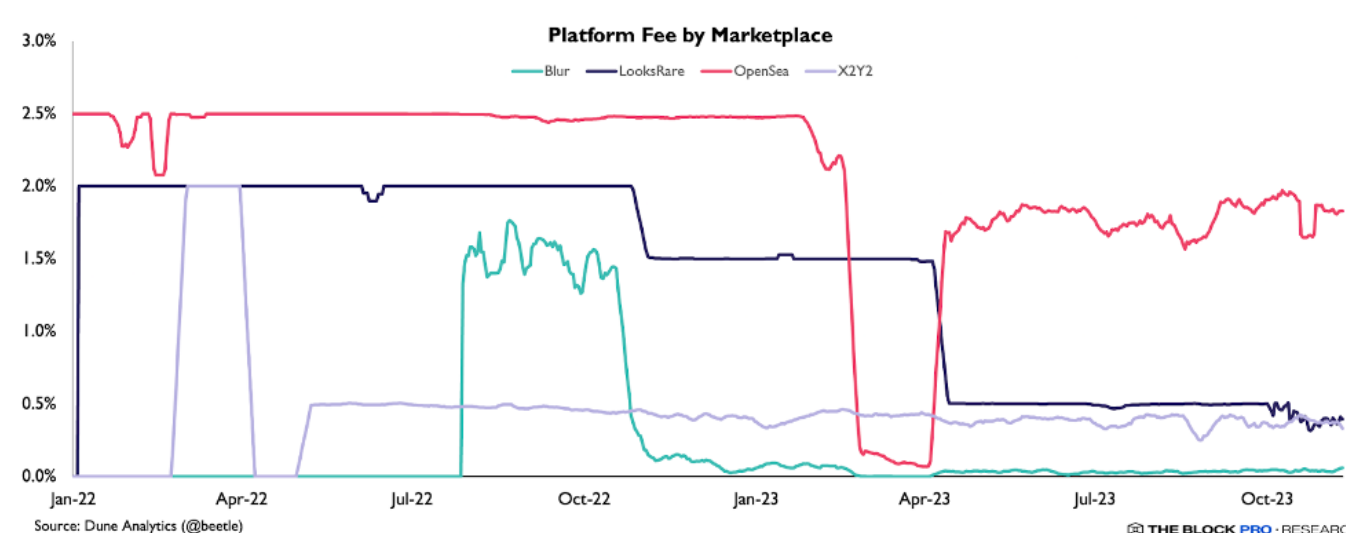
This shift, driven by emerging platforms like Blur, has disrupted the industry by prioritizing efficiency and liquidity over traditional fee structures that have long rewarded creators in the space. A prime example of this transformation was observed in the performance of OpenSea. At the beginning of 2022, OpenSea was a juggernaut in the NFT space, valued at \$13.3 billion following a \$300 million Series C funding round and commanded over 80% volume across all secondary markets. Its revenue model was heavily reliant on platform fees, with monthly earnings ranging from \$50 to \$120 million, amounting to more than \$1 billion in annualized revenue through the beginning of 2022.



However, by mid-2023, there was a stark reversal as their platform revenue dwindled to less than \$2 million per month. This drastic reduction, a near 90% markdown from previous earnings, can primarily be attributed to the rise of zero-fee platforms, which siphoned away trading activity from platforms like OpenSea to zero-fee platforms like Blur. This decline underlines one of the broader trends throughout the year, where NFT marketplaces are reevaluating traditional fee-based models in favor of more dynamic, liquidity-focused strategies.

**EVOLVING CREATOR COMPENSATION AND ROYALTY FEES**

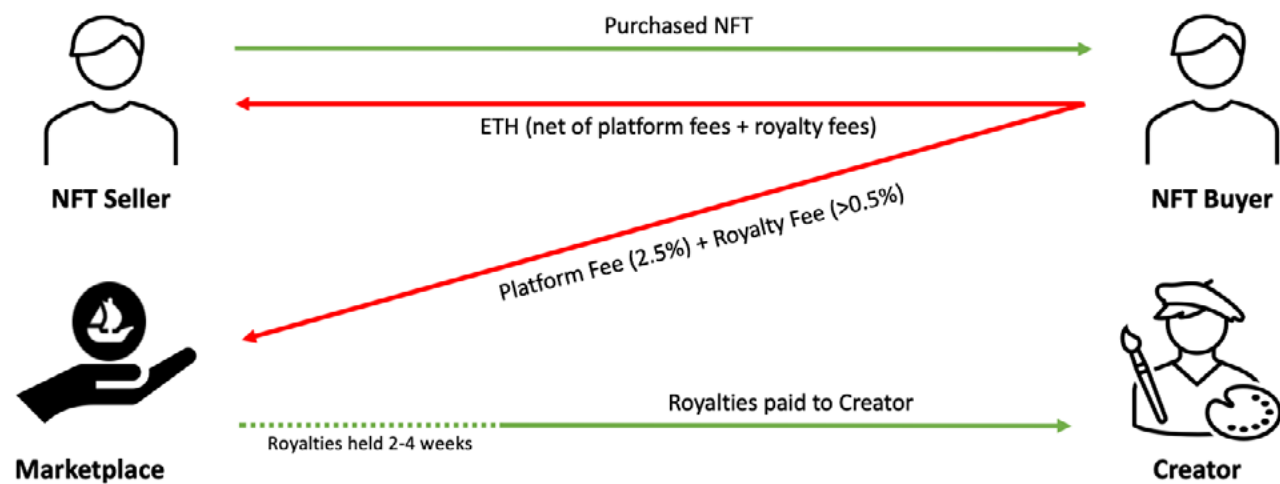
2023 also brought significant changes to the royalty fee model for NFT creators. Traditionally, these fees served as a critical revenue mechanism for creator compensation, ensuring that artists and creators received ongoing revenue from secondary sales of their works. Since 2020, over \$2 billion in royalty earnings have been distributed to NFT creators. While this is an impressive feat, creators are now earning less than 98% less in royalty fees in comparison to their peak at the beginning of 2022.



The technological infrastructure underlying NFTs, particularly the reliance on smart contracts, presented unique challenges to this model. Unlike the art and real estate markets, where commission structures are well-established, NFT royalties required a new approach, often relying on marketplaces to enforce these payments as a social contract.

The trend towards reducing or eliminating royalty fees, as seen with platforms like Blur and Sudoswap, raised pressing concerns about the sustainability of creator compensation. While these moves were aimed at maximizing liquidity and trading volume, they sparked a heated debate within the NFT community. On one side, there's a push for efficiency and a free market approach, while on the other, there's a call to uphold the original ethos of the NFT space – supporting creators and ensuring they are fairly compensated for their work.

**Anatomy of a Secondary Market NFT Sale**

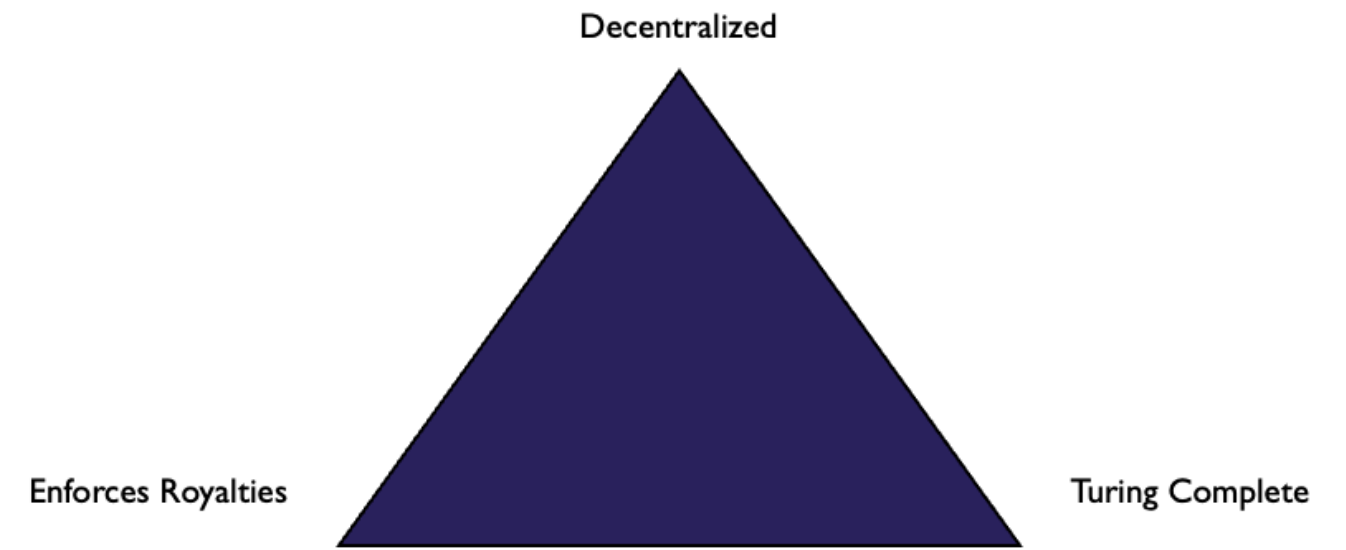


Source: Galaxy Research

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The changes in marketplace revenue models and the debate over creator royalties are reshaping the NFT market's competitive strategies as royalty fees get pushed lower. The traditional dominance of platforms like OpenSea is being challenged by new entrants prioritizing different aspects of the trade, indicating a shift towards a more complex and finance-oriented ecosystem. These evolving market dynamics, highlighted by the declining revenues of once-dominant players and the reevaluation of royalty structures, reflect a broader trend toward a market that values efficiency, liquidity, and accessibility.

**Trade-offs in Enforcing NFT Royalties**

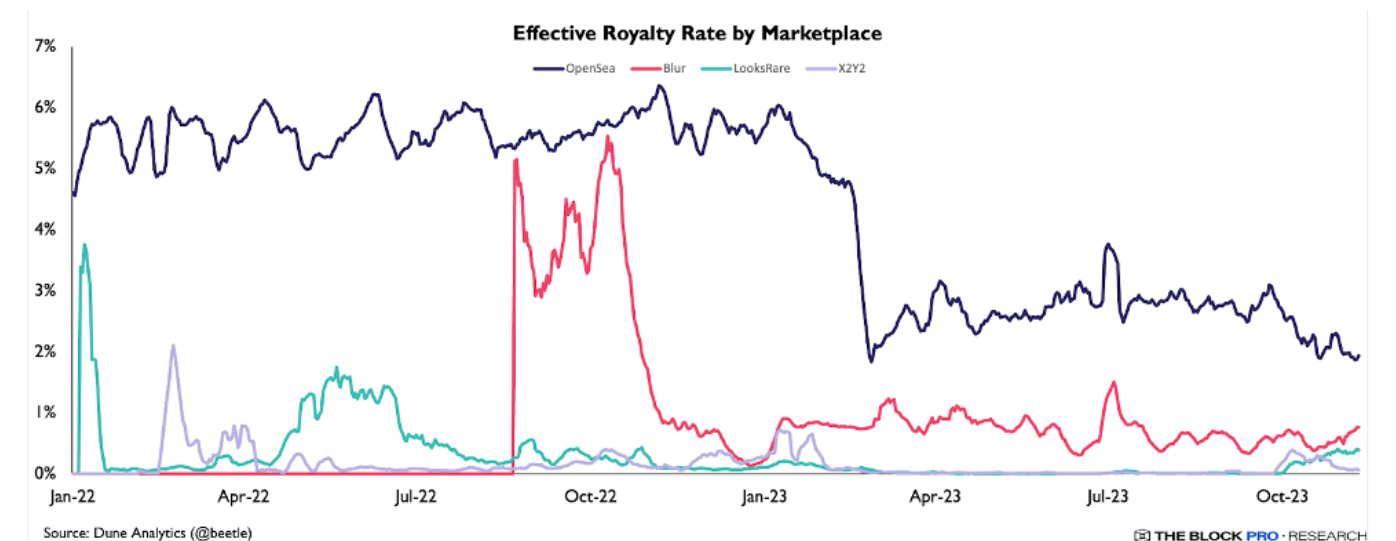


Source: Galaxy Research

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**MARKET SEGMENTATION & USER BEHAVIOR**

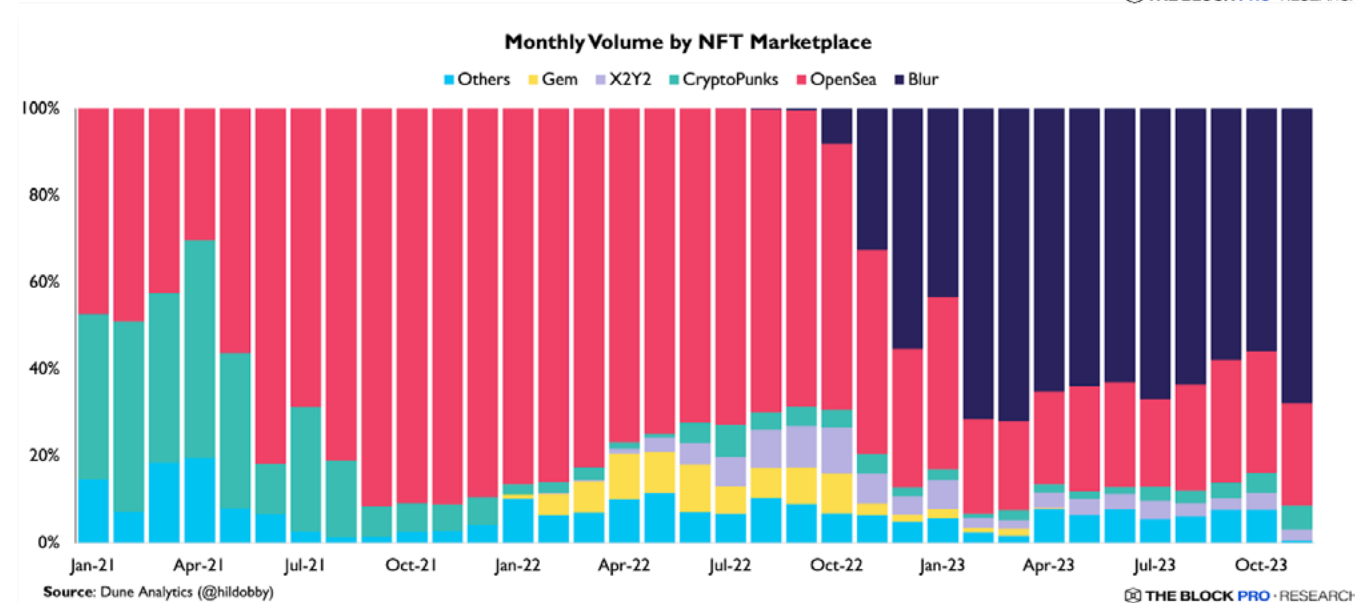
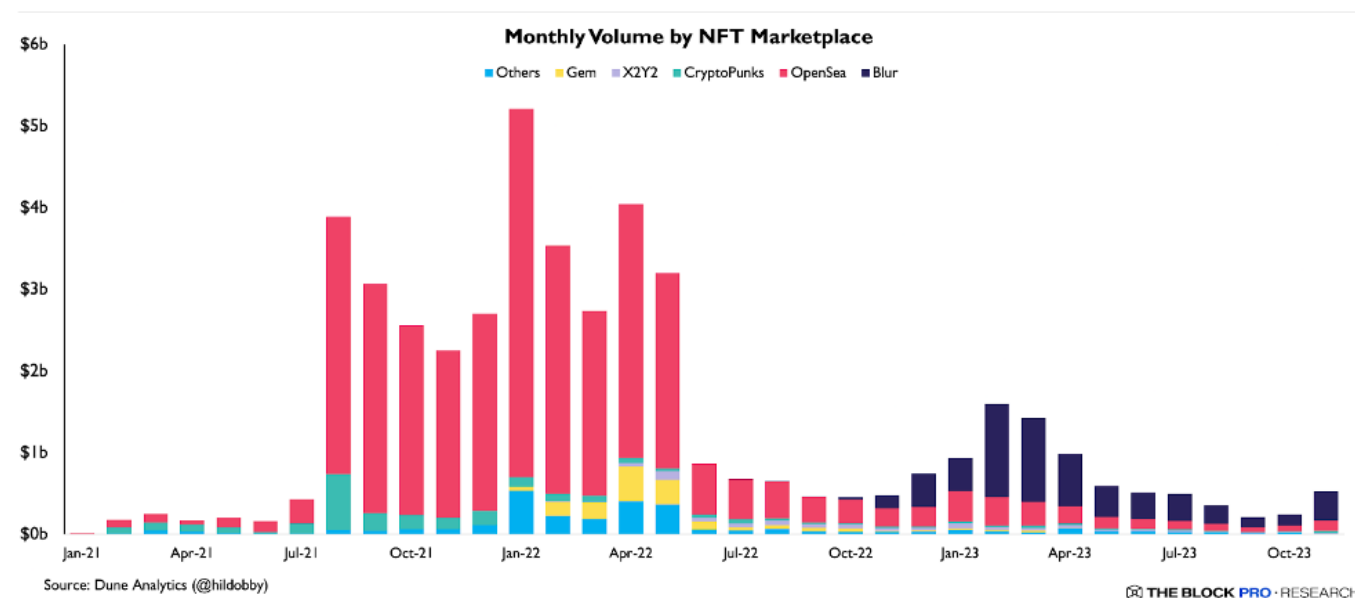
The battle between Blur and OpenSea has been one of the most followed events in the NFT ecosystem this year. Following the Blur token airdrop in February, their trading volume dominance reached an all-time high of 80% market share, with OpenSea's trading volume market share diminishing to less than 15%. This activity was largely due to airdrop farmers positioning themselves for Blur's token incentive program.



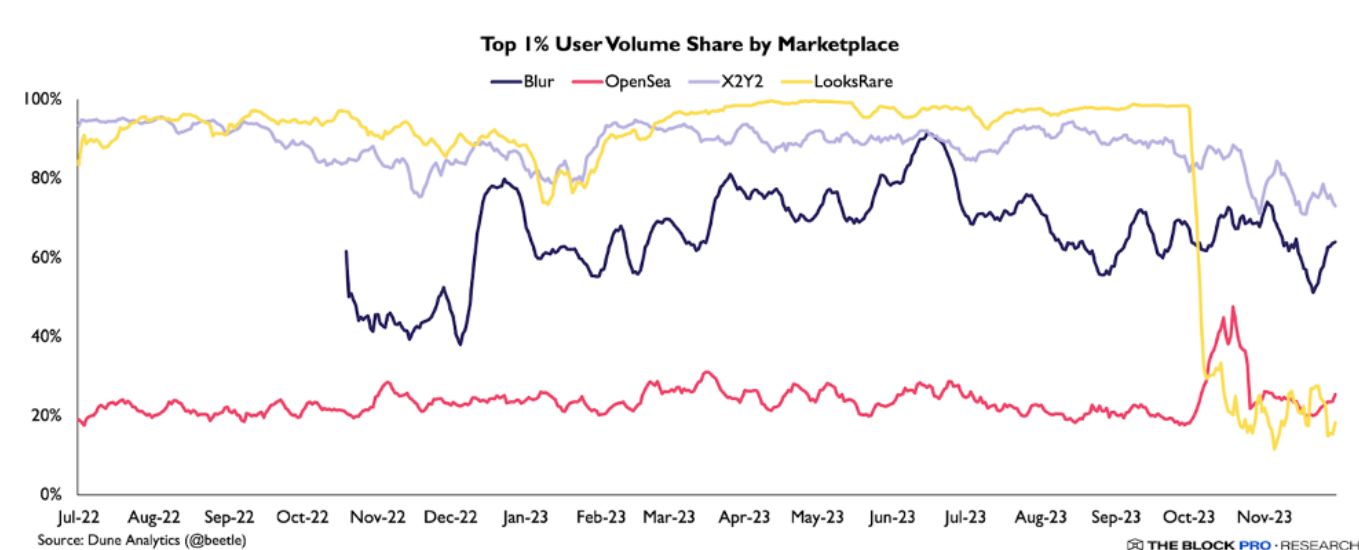
Source: Dune Analytics (@beetle)

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Platforms like OpenSea largely cater to a broad spectrum of collectors, while newcomers like Blur attract a segment of professional traders. On Blur, the top 1% of traders are responsible for approximately 68% of the platform's trading volume, whereas on OpenSea, the top 1% of traders contribute a mere 24% of trading volume. Such differentiation is a natural progression in a market that is becoming increasingly complex and nuanced as different investor types with varying risk appetites and investment horizons seek out platforms that align with their specific needs. The continuing trend toward market segmentation in 2024 is likely to further intensify as NFT platforms evolve to cater to the specific demands of their user base.



With retail NFT collectors much less active and more price-sensitive in the bear market, OpenSea has begun taking steps to court the professional NFT trading cohort that comprises Blur's active user base. Despite reducing creator royalty fees to 0.5%, and launching a "pro" trading platform, OpenSea Pro, Blur still dominates on volumes, though OpenSea continues to dominate on users. Ultimately, OpenSea's user base seems to be more organic and perhaps durable in the long term, while Blur's is almost exclusively high-volume traders. The introduction of Blur's new lending product (Blend) is already altering market dynamics, reaffirming their volume dominance but also helping to push floor prices up as traders and users can purchase expensive NFTs with smaller amounts of capital.



## NFT FINANCE

The year 2023 has been a watershed moment for the NFT market, reflecting a shift towards innovative liquidity solutions. NFT lending platforms have catalyzed this transformation, providing asset holders with the unprecedented ability to unlock the value of their digital assets. This emerging hyper-financialization of NFTs marks a critical evolution in the sector, particularly for non-PFP collections that have traditionally experienced less liquidity.

As NFT trading on platforms like OpenSea has been dominated by retail trading, NFT lending platforms are primarily catering to the more risk-averse, high-frequency traders by introducing new forms of leverage

within the ecosystem, akin to traditional asset-backed lending. This shift has already enabled a cumulative loan volume that has soared past \$3.3 billion, illustrating the increasing demand for such services. The sector's complexity and the diverse needs of its participants are mirrored in the variety of lending models on offer, ranging from peer-to-peer (p2p), perpetual peer-to-peer, and peer-to-pool (p2pool) systems.

Blend, a platform launched by Blur, has distinguished itself as the dominant platform amongst its peers. Its innovative approach has led to record-breaking weekly lending volumes, reaching \$197 million in Q2 2023. With over 6,100 borrowers and 3,300 lenders, Blend's activities have contributed significantly to the total lending volume, which has increased by 270% year-to-date. Despite this, a closer examination reveals that a minority of users—a mere 10% of lenders and 26% of borrowers—account for a disproportionate volume of transactions.

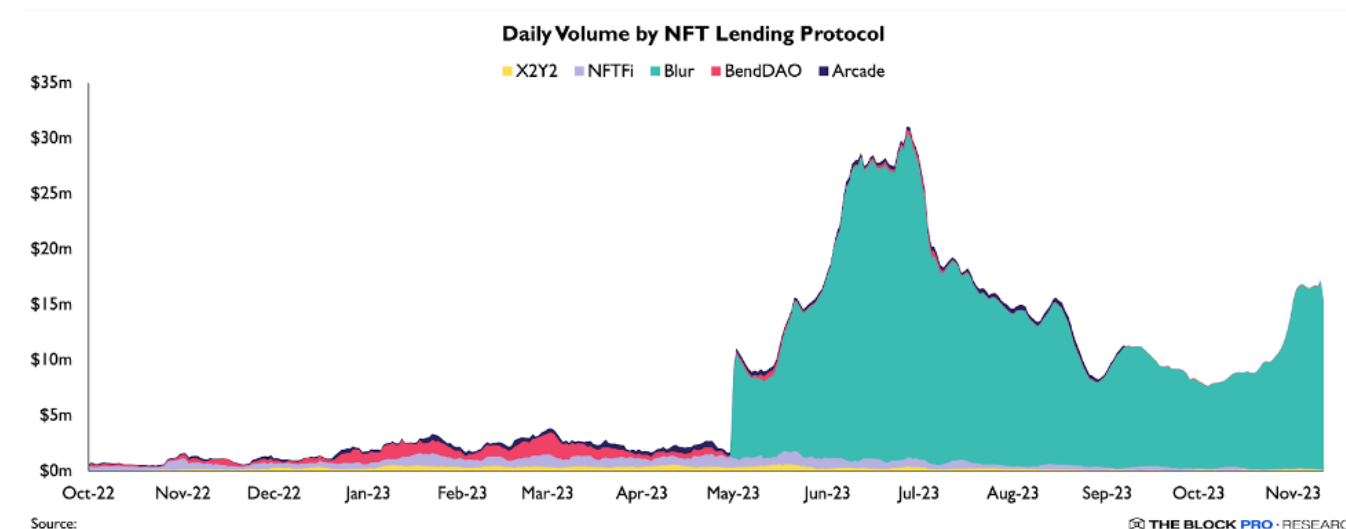
NFT Lending Protocol Comparison

Category	Peer to Peer (P2P)	Perpetual Peer to Peer	Peer to Pool (P2Pool)
<b>Description</b>	Direct lending and borrowing of cryptocurrencies between two individuals using NFTs as collateral	Continuous loan system without expiration dates or oracle prices	Borrowers leverage NFT collateral for loans, while lenders earn passive income by providing liquidity to pools
<b>Example</b>	NFTfi, Arcade, X2Y2	Blur	BendDAO, Paraspace
<b>Loan Expiration Date</b>	Negotiated by parties	No expiration	No expiration
<b>Automatic Liquidations</b>	No	Depends on Dutch auction result	Yes, under certain conditions
<b>Valuation Method</b>	Individual appraisal	Individual collection basis	Price oracles
<b>Key Pros</b>	- Customized conditions for borrowers - No auto-liquidations	- No expiration or oracles - Dutch auction refinancing can help find new terms	- Expediency for borrowers - Passive income for lenders
<b>Key Cons</b>	- Time and effort for lenders. - Lower LTV ratios can be less attractive for borrowers	- Higher risk for lenders. - More complex process than normal P2P lending	- Limited control for lenders. - Reduced customization for borrowers

Source: The Block Research

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However, the sustainability of this growth is under scrutiny. The reliance on incentive mechanisms like airdrop farming, which currently drives an overwhelming majority of Blend's lending volume, poses a question about the long-term viability of the lending volumes once these incentives are withdrawn. The lending landscape prior to Blend's emergence was recovering from lows in late 2022, but the entrance of new competitors like X2Y2, Arcade, and Paraspace has diversified the market share, creating a more competitive lending environment.



The rise of NFT lending has also coincided with a significant reduction in platform fees, enhancing market efficiency and providing sophisticated financial tools for asset holders. However, this efficiency comes at a cost, potentially diminishing the royalty fees that are crucial for creators' earnings. Platforms such as Blend have addressed the liquidity needs of digital asset holders but have also sparked a debate over the balancing act between liquidity and fair compensation for creators. The lending models have indeed introduced new users to complex trading strategies and incentivization mechanisms, yet their long-term sustainability remains an area for exploration. The challenge for NFT lending platforms is to find a sustainable product-market fit that caters not only to sophisticated traders but also to retail collectors and creators seeking to monetize their work in the short term. This delicate balance—between fostering a vibrant, liquid market and ensuring that the artists and creators at the heart of this market are fairly compensated—remains the pivotal focus for the future of the NFT economy.

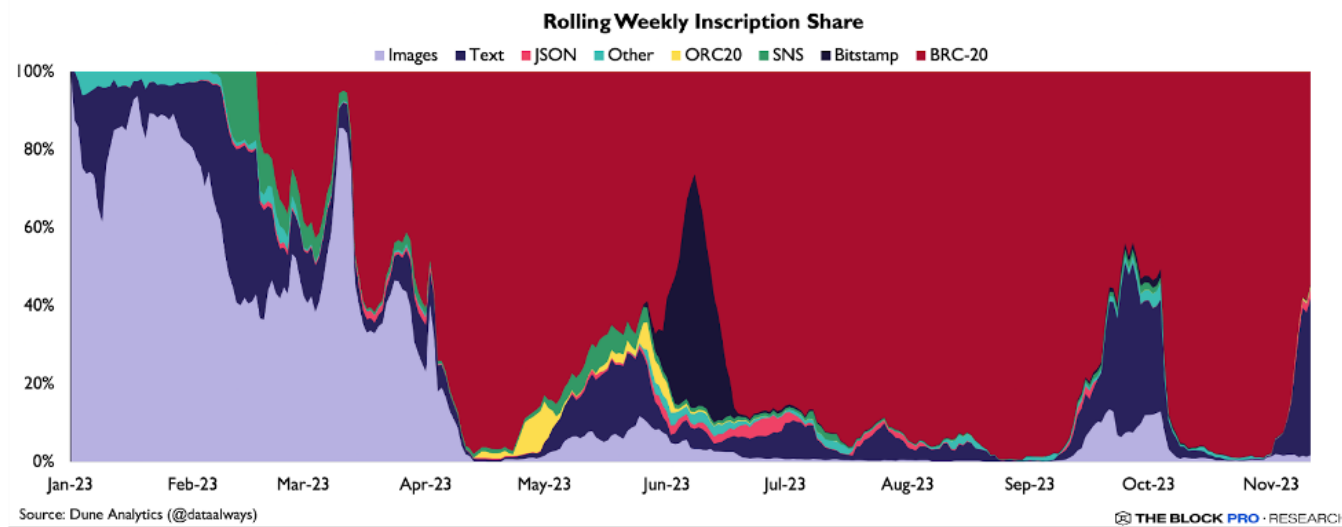
## BITCOIN NFTS

### INSCRIPTIONS & FEE MARKET DYNAMICS

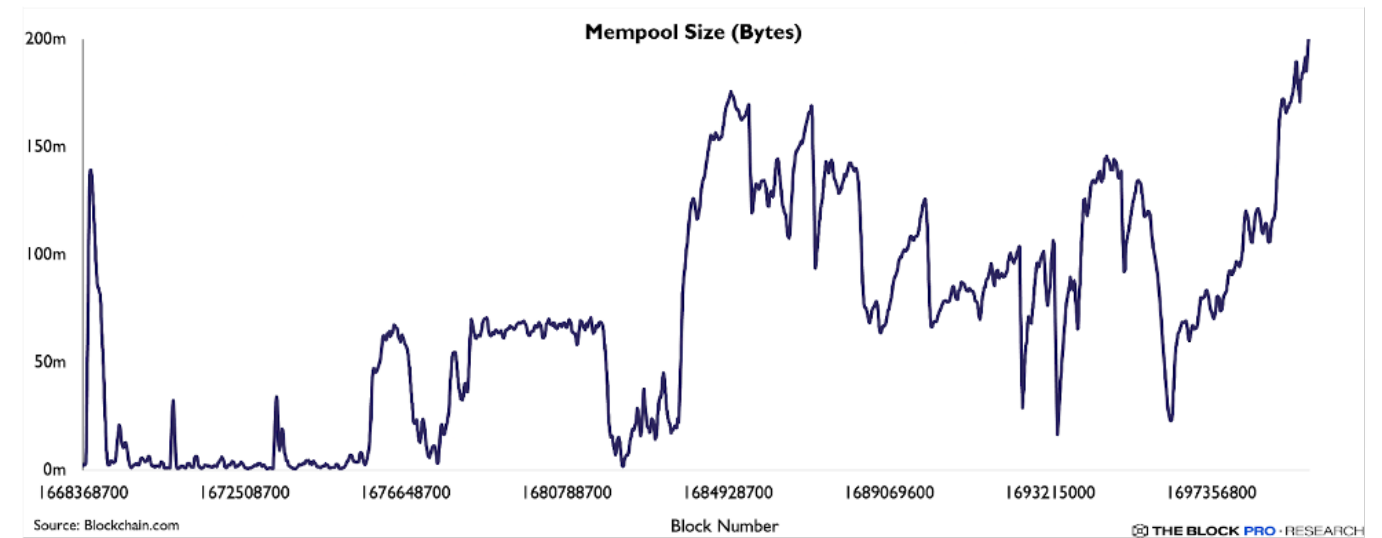
Ordinals, integral to Bitcoin's architecture, are unique identifiers for each transaction. They play a critical role in verifying the authenticity, ownership, and uniqueness of digital assets, including NFTs and BRC-20 tokens - Bitcoin's answer to Ethereum's ERC-20 tokens. The Ordinals Protocol, conceptualized by Casey Rodarmor, allows for data to be embedded directly onto the Bitcoin blockchain. This mechanism

splits Bitcoin's smallest unit, Satoshi (Sats), into numbered ordinals, and these Sats can be inscribed with arbitrary content, ranging from images to code, effectively creating a new genre of Bitcoin-native digital artifacts. Through roughly 10 months of Ordinals development, Bitcoin developers have built tooling for NFTs comparable to the tooling for NFTs on other major Layer 1 blockchains such as Ethereum, Polygon and Solana. The Ordinals ecosystem showcases remarkable versatility, supporting a wide array of inscription types, including images, text, applications, and audio. This diversity has fostered the development of influential meta-protocols, most notably the BRC-20 token standard. While initial inscriptions post-mainnet launch were predominantly images, the rise of BRC-20 tokens has dramatically altered the inscription landscape, representing over 95% of new inscriptions as of the time of this report.

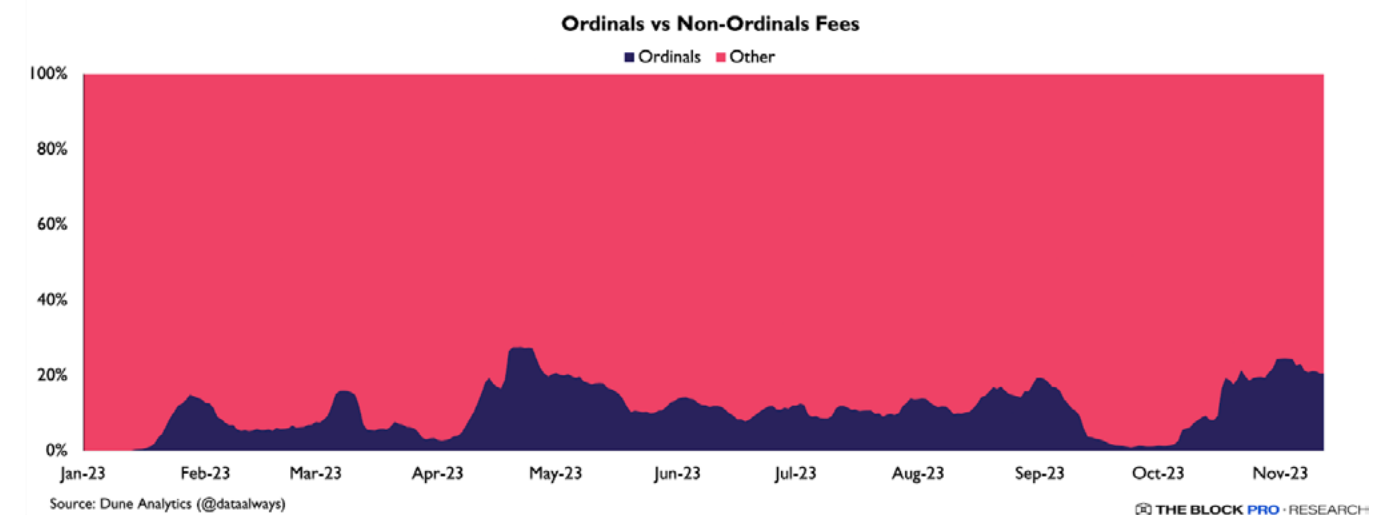
Throughout 2023, the Bitcoin ecosystem experienced a significant shift due to the rising popularity of inscriptions. Since the beginning of the year, miners accrued over \$530m in total fees, of which \$90m originated from Ordinal-related activities. These inscriptions have led to increased fees and congestion within the Bitcoin mempool, as the aggregate size in bytes of transactions waiting to be confirmed is sitting at its ATH.



Users, aiming for quicker transaction confirmations, have begun attaching higher fees, further intensifying competition for the limited space available in each block. This surge in transaction fees began in early 2023 and saw a notable spike around April, driven primarily by the creation of BRC-20 meme tokens. Despite ordinals accounting for a significant percentage of total transactions, they did not dominate in terms of transaction fees, indicating that while they were prevalent, they weren't necessarily the most profitable for miners.

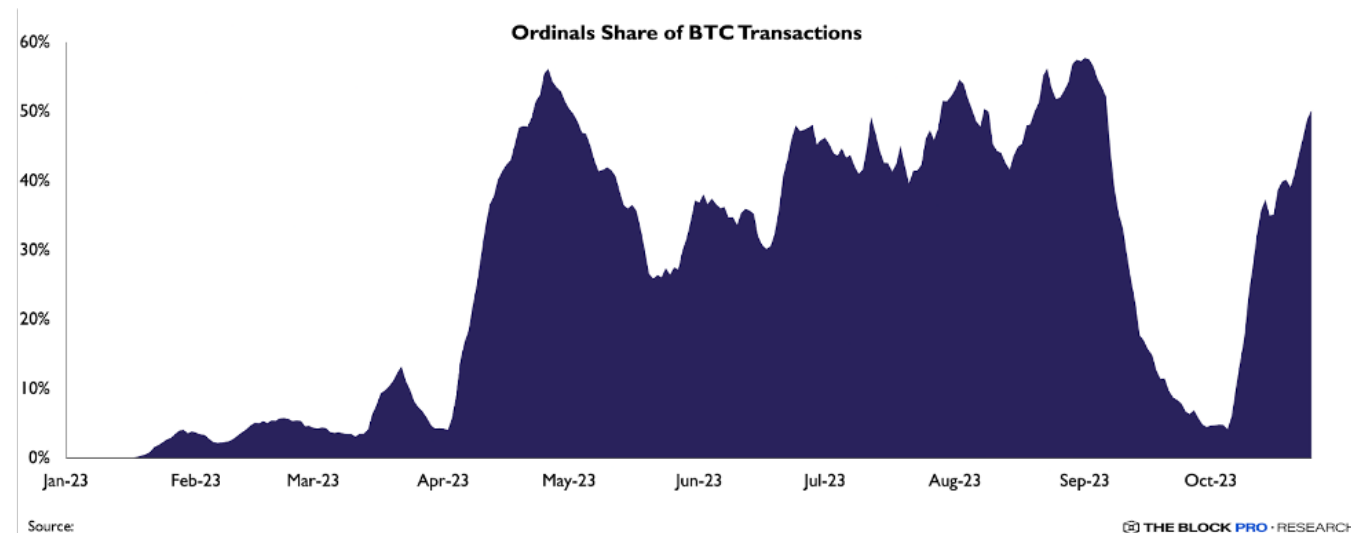


Inscription-related transactions currently account for an astonishing 49% of daily transactions on the Bitcoin network. While this dominance has since reduced slightly from levels seen earlier in the year, it underscores the impact of ordinals on Bitcoin's blockspace economics, particularly as block rewards continue to diminish. This shift in the transaction landscape has compelled miners to adapt their strategies in response to the changing dynamics of block rewards and transaction fees.





Looking ahead, there will likely be an influx of new participants seeking to take advantage of meme token types and NFTs on the Bitcoin network, driven by the desire to make profits through speculation. This may increase creation and transfer activity of ordinals, potentially driving up the fee market in a similar fashion to the mid-2023 fee spike. Additionally, the entry of platforms such as Magic Eden into the Ordinals space marked a significant shift in market dynamics. Previously dominated by early platforms like Ordinals Market

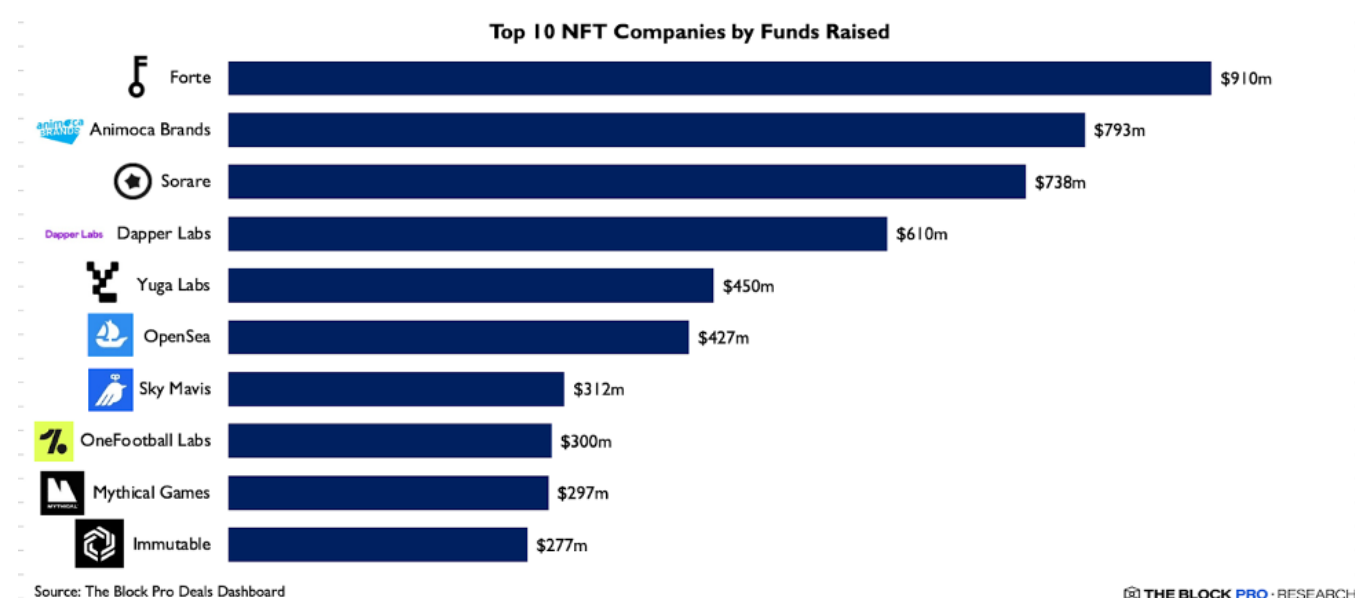


and Ordinals Wallet, Magic Eden's integration of Ordinals, being a major NFT marketplace, catalyzed a substantial change. Notably, trading volumes peaked in early May 2023 at around \$10 million per day, driven by a surge in BRC-20 tokens minted through platforms like Unisat and Ordinals Wallet. The market has since stabilized, with average daily trading volumes hovering around \$1 million.

## GAMING & METAVERSE

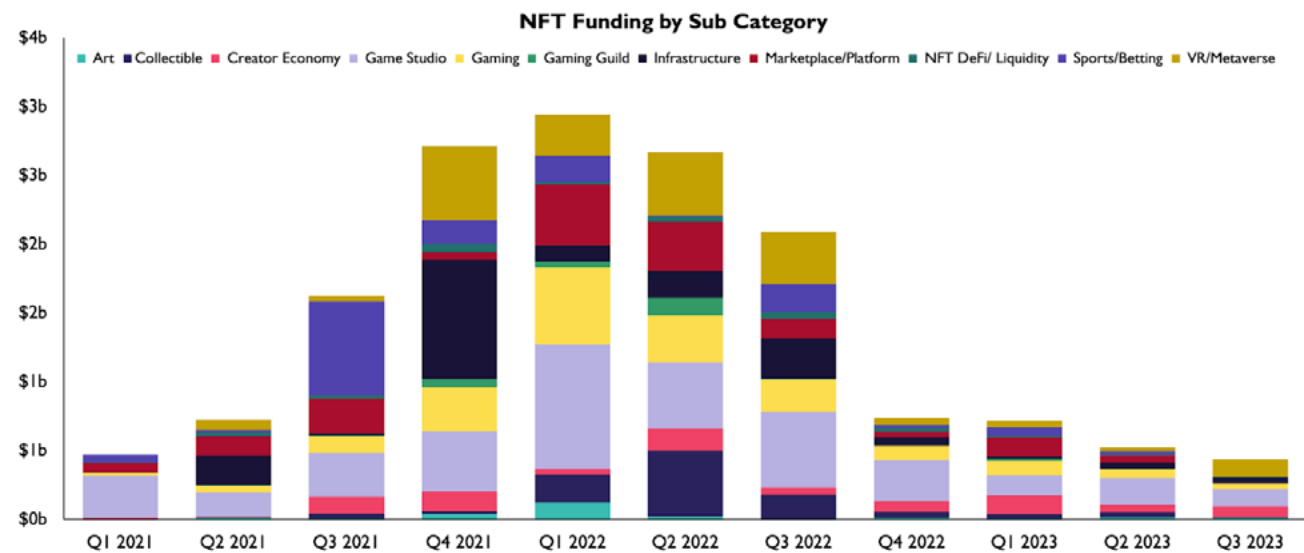
Historically, the crypto use cases embraced most frequently by Fortune 100 companies have been tokenization, blockchain infrastructure, crypto asset trading products, and payments/settlements. This is followed by NFTs/collectibles. While NFTs may be less a focus of projects and plans, they are driving retail's recent surge in share of Web3 initiatives. This diversification is helping to expand sector participation beyond tech and financial services and offers companies a path to return on investment. Across 40+ distinct NFT collections launched, Fortune 100 companies together have accumulated royalty revenue of ~\$103 million from over 125,000 distinct consumers. Collections linked to Fortune 100 companies have generated substantial secondary market volume, exceeding \$1.64 billion across all collections.

In late 2022, Lowe's launched "Projects Unlock," using blockchain to combat organized crime. This initiative assigns unique NFTs to its power tools to create a secure, public, anonymized record of legitimate purchases. This helps customers ensure they're not purchasing stolen goods and aids law enforcement in cracking down on professional shoplifting rings. Additionally, in June 2023, EA Sports and Nike announced a partnership to integrate virtual assets from O Swoosh, Nike's Web3 marketplace platform, into future



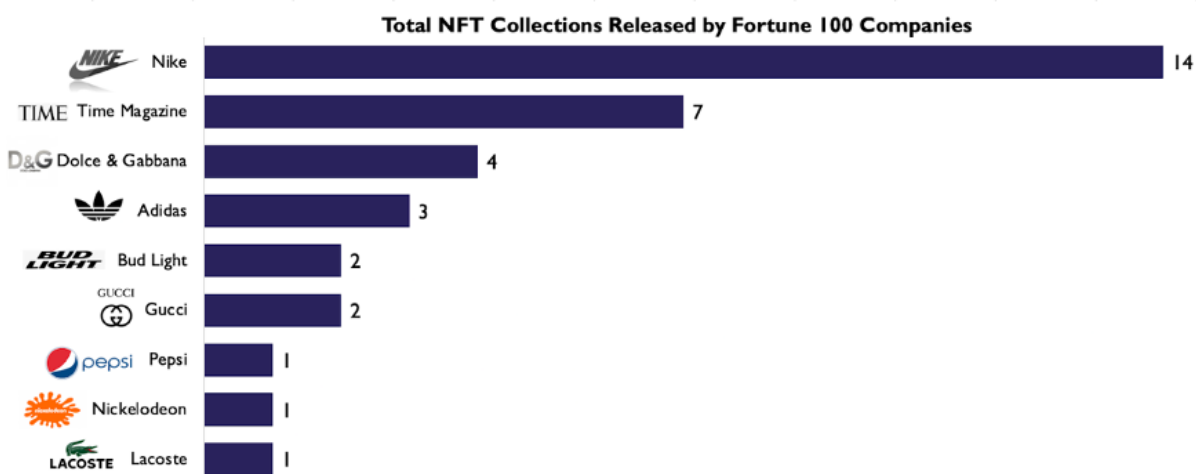
Starbucks starts NFT-based loyalty program.	Reddit mints 5 million collectible avatar NFTs.	Adidas Originals creates NFT collection <i>Into the Metaverse</i> .
Tiffany & Co. crafts jewel-encrusted pendants for CryptoPunks NFT owners.	Nike makes NFT platform .Swoosh for digital sneakers.	Porsche launches NFT collection and virtual experiences centered around the iconic Porsche 911.
Budweiser purchases beer.eth ENS name and debuts multiple NFT collections.	Nickelodeon bases NFT collectibles on <i>Rugrats</i> and <i>Hey Arnold!</i> characters.	Gucci showcases collectible NFTs in art exhibit called <i>The Next 100 Years of Gucci</i> and partners with Yuga Labs' metaverse project.
DraftKings opens marketplace focused on mainstream NFT accessibility.	TIME introduces NFT initiative TIMEPieces.	Louis Vuitton lets players collect NFTs in a self-branded mobile game.

EA Sports games. These assets primarily include virtual footwear and apparel, with more details to come. NFTs are just one example of growth in successful consumer engagement and company ROI. Educating consumers about how other corporate uses of blockchain can benefit them personally can also build demand. The hope is that the range of other use cases and accompanying trends and data in this report will spread understanding of the potential for corporate web3 initiatives. Since the beginning of 2017, NFT/Metaverse-related companies have raised north of \$16 billion.



Source: The Block Pro Deals Dashboard

THE BLOCK PRO RESEARCH



Source: The Block Pro Deals Dashboard

THE BLOCK PRO RESEARCH

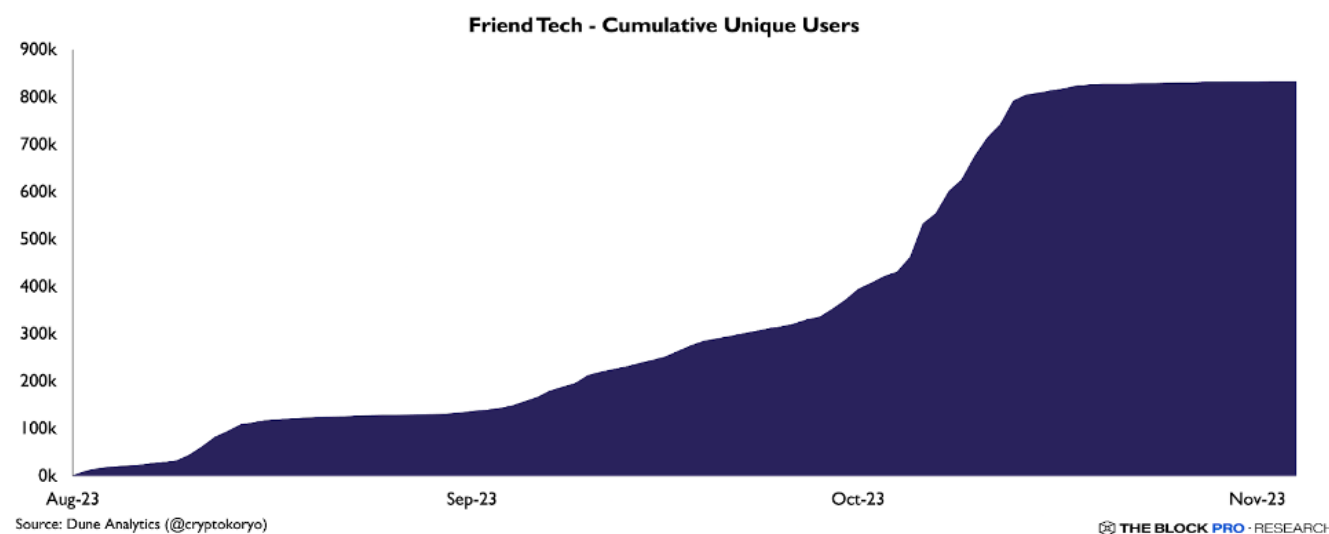
## DECENTRALIZED SOCIAL

### FRIEND TECH & SOCIAL FINANCE

Reflecting on the not-so-recent past, when the crypto landscape was overflowed with high-profile ads featuring celebrities like Tom Brady and major sports league sponsorships, it's apparent how the mainstream perception of cryptocurrency has shifted, particularly following the FTX collapse. Despite this setback, the crypto community remains vibrant and active. The Social Finance sector, particularly Friend.tech, has become a beacon of hope for many industry participants. Social Finance, dubbed SoFi, feels like it has been all the rage since the poster child platform friend.tech launched back in August on Coinbase's new optimistic rollup solution, Base.

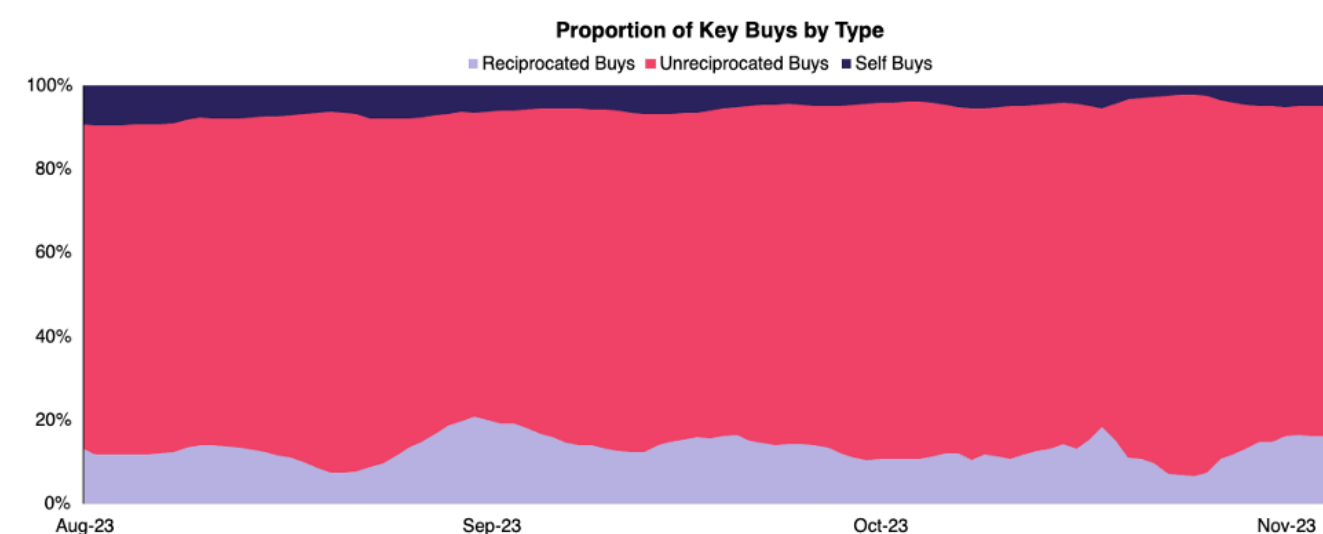
Friend.tech is a mobile-based social media platform with a cryptocurrency twist. The app markets itself as "the marketplace for your friends" on its website. Much like other non-crypto social media platforms that are in beta, Friend.tech requires users to have an invite code from other users in order to sign up. Friend.tech's new and novel means of buying peoples' "keys" to allow users to message them attracted many people to the protocol. It also helped that it was built on the hottest new layer 2 of the summer and that many well-known Crypto Twitter personalities were using the SoFi platform. In less than three months since launch, it has captured the community's attention, with over 900,000 unique users across the platform and \$475 million in trading volume.

At its heart, FriendTech's success hinges on the deeply ingrained human desire for recognition and esteem. The public display of one's 'score' or value on FriendTech is a powerful motivator. Additionally, the chat functionality of FriendTech has been instrumental in bootstrapping users by fostering a strong sense of personal connection between creators and their supporters. Such interaction enhances the user's identification with the platform, leading to a profound psychological investment. This identity connection is not merely incidental but forms the bedrock of FriendTech's appeal, tapping into the fundamental need for acknowledgment and validation that is hardwired into our social psyche, which can be seen in their weekly chat retention outpacing traditional social platforms.

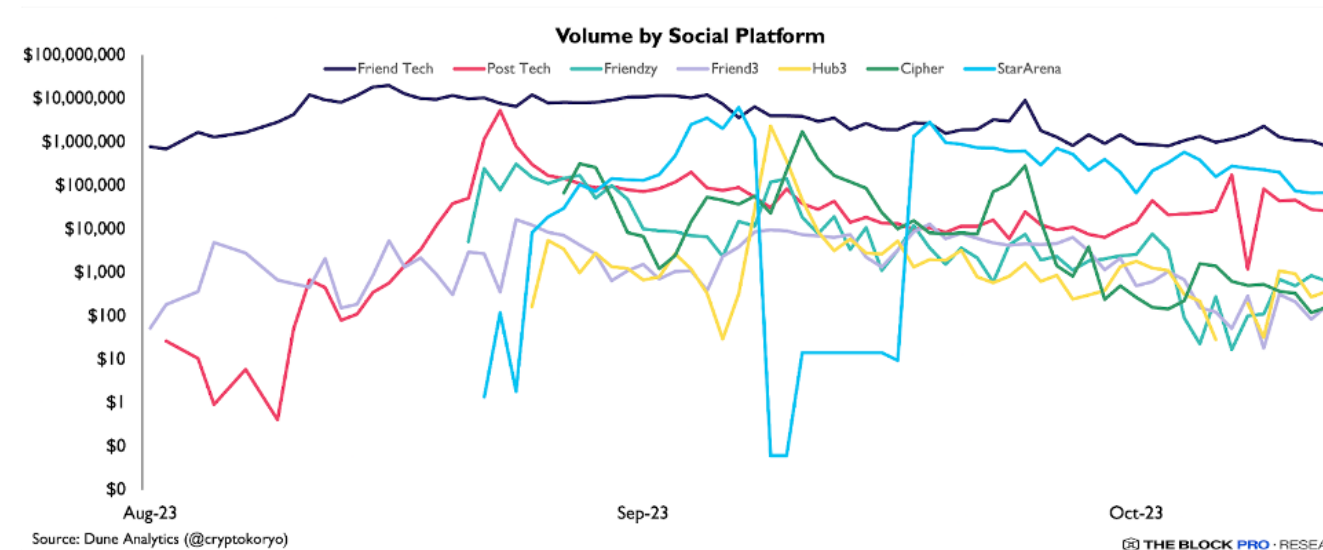


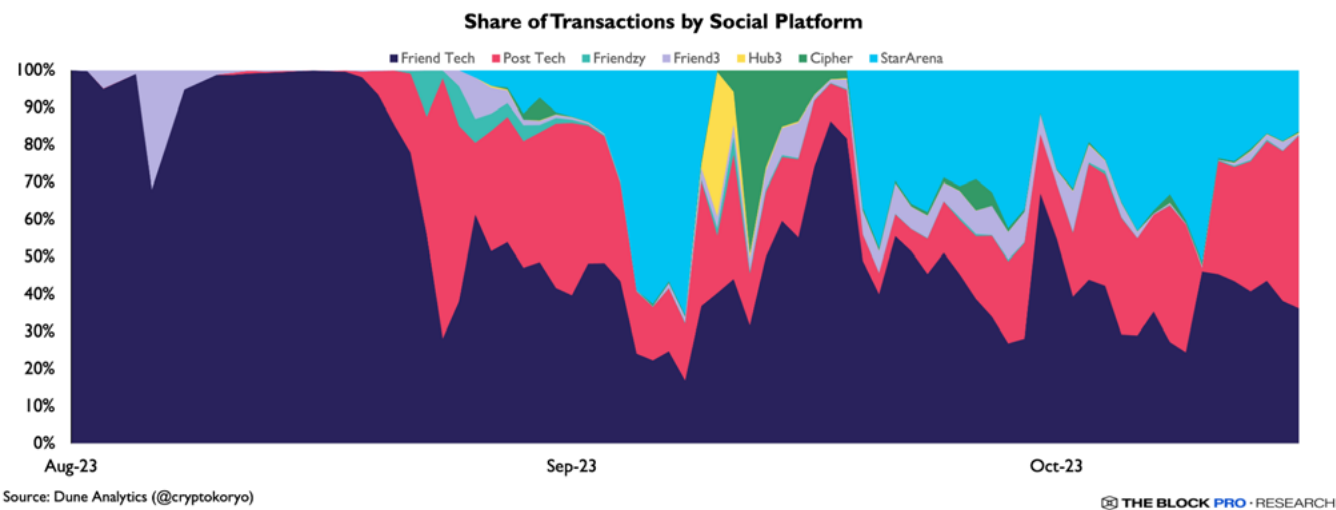
FriendTech cleverly capitalizes on one’s drive to be perceived as valuable by providing a stage for individuals to demonstrate their worth and respectability to a broader audience. This social signaling mechanism is distinct from the identity extension typically associated with luxury brands. Similarly, FriendTech, often likened to platforms like OnlyFans, but presents a twist. Here, the primary currency is not monetary but social and reputational capital. Users engage in this high-stakes game not for financial gain but for social recognition. In this environment, users are expected to be net spenders, investing in enhancing their own or others' perceived value. This investment manifests in various ways, from offering exclusive services to participating in mutual support networks. However, the primary focus remains on building and maintaining social and reputational capital.

The valuation of keys within FriendTech involves a complex interplay of factors like popularity, reputation, and perceived utility. The platform’s pricing mechanism is not merely a reflection of surface-level popularity; it could evolve into a true representation of an individual's social standing. The concept of '3,3,' or mutual endorsement, is a digital incarnation of existing social behaviors where friends support and vouch for each other’s reputations. This concept can be seen in the rise of trades that are reciprocal buys - around 20% of all sales are derived from users engaging in a social contract of holding each other’s keys and not selling, thereby increasing each other’s share price.



Additionally, the success of FriendTech has inspired forks on other blockchains like Solana, Avalanche, and BNB Smart Chain, but none have matched its success. Stars Arena on Avalanche did show promise but then faced exploits that drained \$3M from the protocol on October 5th.





FriendTech, along with many other social-fi platforms, have the potential to transform into a robust, reputation-centric ecosystem. This could not only foster positive behaviors by becoming synonymous with authenticity and integrity but also significantly deter fraudulent activities. Those abstaining from the platform might be viewed with skepticism, as such platforms can offer a transparent, quantifiable measure of an individual's social and professional standing. Although the hype around FriendTech has appeared to considerably cooled down, it is instructive as a promising framework to study successful social-fi applications – many of which will likely iterate on similar strategies.

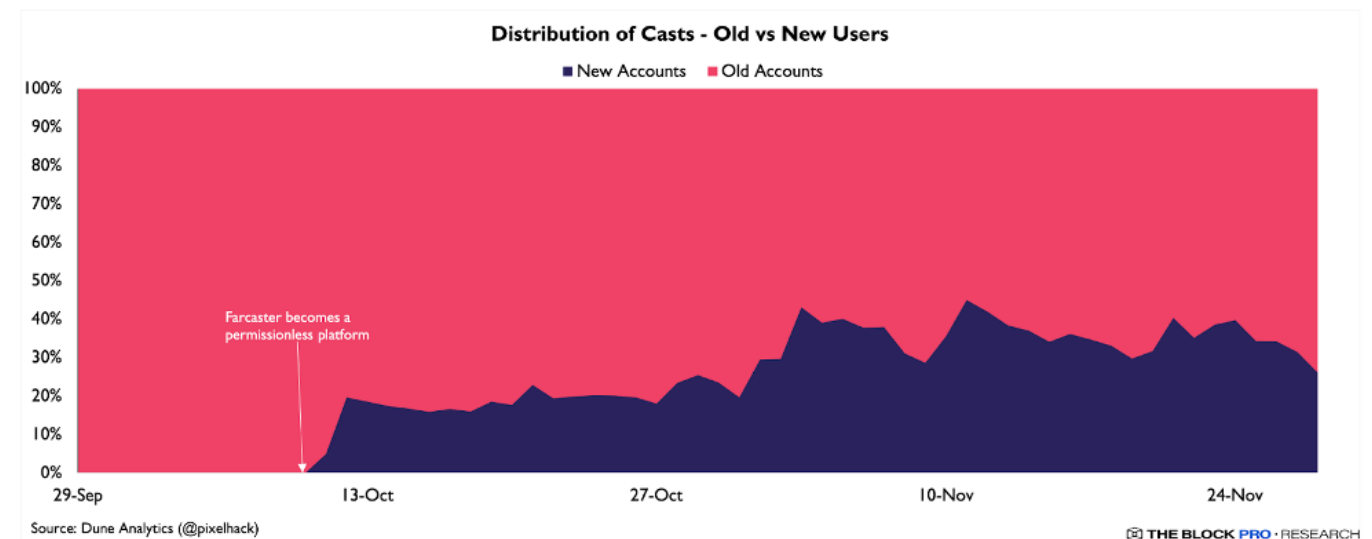
**FARCASTER & LENS**

Farcaster, built on the Ethereum blockchain, utilizes an off-chain peer-to-peer network known as Farcaster Hubs. This design allows for secure, human-readable user identifiers and real-time updates across its network. Farcaster's emphasis on quality conversations is demonstrated through its annual renewal of user handles, a strategy aimed at maintaining a high-caliber user base and fostering engaging community interactions. Its delta-graph system facilitates consensus without the need for coordination, which is crucial for efficient message synchronization. Additionally, the protocol's focus on high-quality discussions, combined with its unique approach to identity management through Ethereum contracts, ensures a secure, decentralized ownership of identities. Lens Protocol, in contrast, operates on the L2 Polygon blockchain and integrates blockchain wallets with social graphs. This integration simplifies access across diverse applications, mirroring the functionality of traditional platforms like Instagram or Twitter, but with the added benefits of decentralization and portability. Lens Profiles, represented as NFTs, allow users

to publish content and customize their digital identity with ease. The protocol's extendable functionality, equipped with various modules, marks a significant advancement in flexible social networking. Lens's model of one-time profile creation without the need for renewal contrasts with Farcaster's approach, catering to a different user demographic.

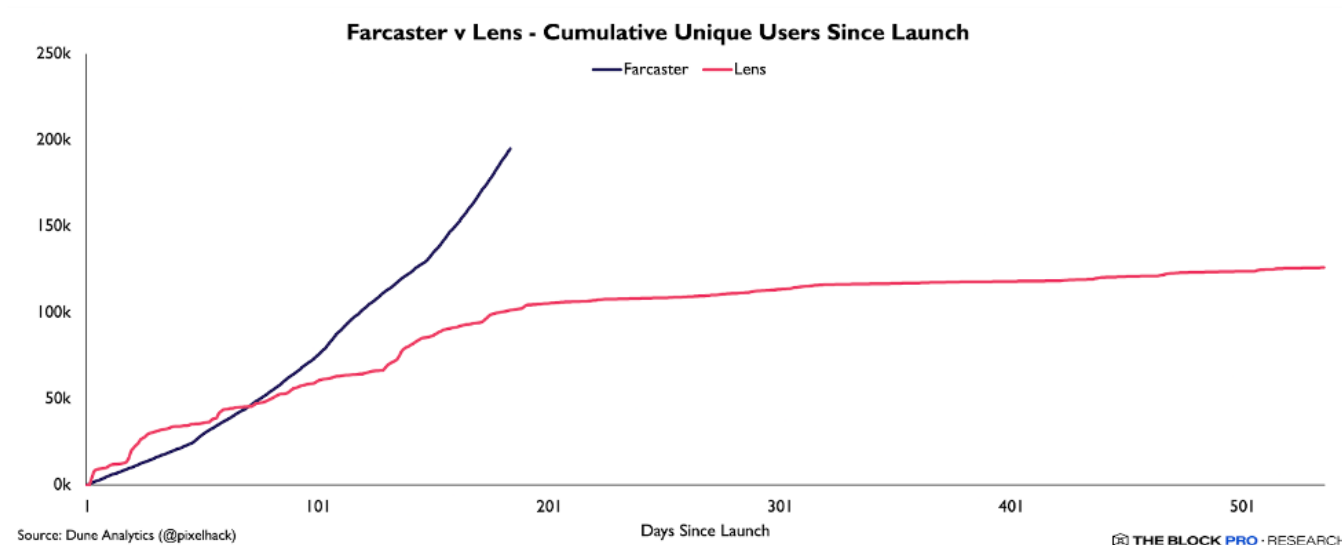
Farcaster's protocol architecture is two-fold: it features an on-chain registry where users secure unique usernames and an off-chain host for social data storage. By harnessing blockchain data for the identity layer and a peer-based distributed gossip network (Hubs) for message storage, Farcaster achieves a blend of security and efficiency. This structure not only provides human-readable user identifiers but also facilitates real-time updates across the network.

On October 11th, Farcaster marked a significant milestone by transitioning to a permissionless onboarding structure following its migration from the Ethereum mainnet to Optimism. This shift opened the floodgates for developers, offering them extensive access to the platform's data/APIs, along with allowing users the freedom to choose their preferred clients. The transition to a permissionless model, coupled with an annual renewal fee of \$5 for user handles, aimed to cultivate a high-quality, community-oriented user base. Post-migration, Farcaster witnessed a remarkable surge in user engagement, with daily registrations doubling and new users contributing to approximately 30% of the network's activity.

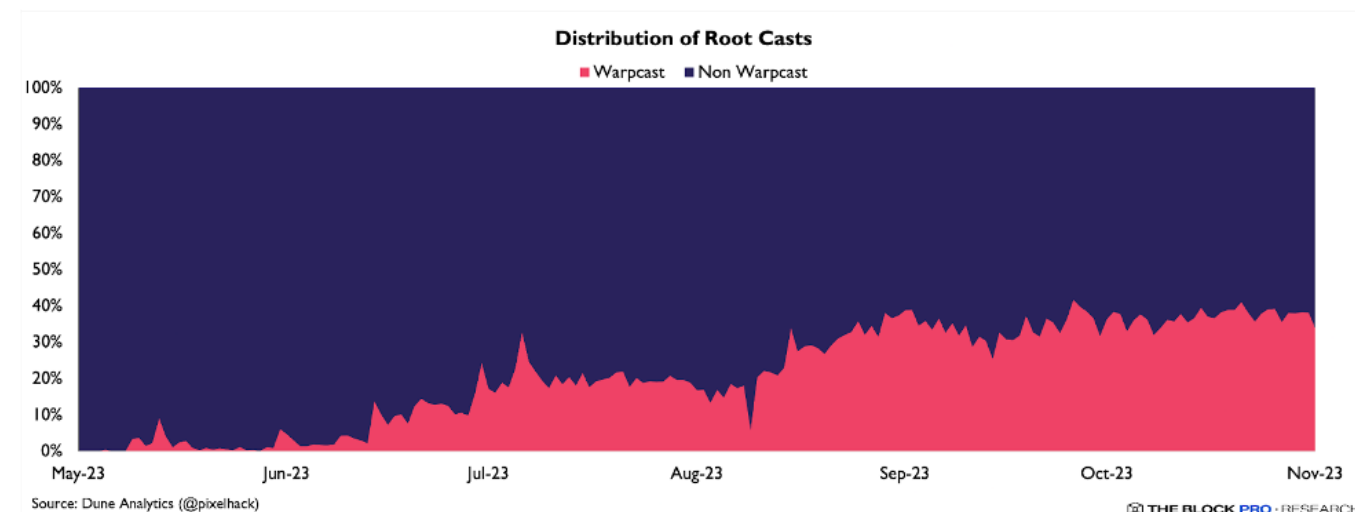


In comparison, the developers of Aave first introduced Lens in February 2022. As explained in our previous report on Lens, it operates on the Polygon blockchain and empowers creators to own the links between themselves and their community, forming a fully composable, decentralized social graph. Upon signing up, users' Ethereum wallets are instantly integrated into their profile, mapping out their existing social networks and guiding them towards content and interactions that align with their interests and history.

With over ~196k IDs registered on Farcaster, compared to ~126k profiles on Lens, it is evident that Farcaster is the more active platform amongst users. Farcaster is largely known for appealing to users seeking quality discourse and a community-oriented environment. In contrast, Lens currently experiences less interactive engagement despite a rich feature set for creators. Tailored more towards creators and artists, Lens provides tools like the Collect module for monetizing content and Follow NFTs for innovative social engagement. This makes it an attractive platform for both content creators and artists looking to leverage blockchain technology for broader audience reach and engagement. The allure of platforms like Farcaster and Lens lies in their ability to offer a clear, elegant representation of social connections by not only facilitating ease of access and content discovery but also ensuring the portability and resistance to censorship inherent in blockchain technology.



However, the journey of decentralized social networks is not without challenges. The success of platforms like Farcaster largely depends on the ability of developers and entrepreneurs to build social primitives (such as the recently launched Warpcast by the Farcaster team) on top of the protocol, as it is unlikely that users will come to these platforms for the guarantees provided by decentralization alone.



The issue of data storage, often reliant on peer-to-peer networks, introduces cost considerations that could deter widespread adoption. Moreover, the absence of well-established models for content discovery and algorithmic targeting in a completely on-chain environment remains a significant hurdle. Farcaster's reliance on an off-chain solution raises questions about data storage and scalability. Conversely, Lens Protocol's on-chain storage method prompts discussions about compliance and the permanence of blockchain records. User experience also largely differs between the two; Farcaster is known for fostering insightful, civil conversations, a welcome change from the often noisy nature of traditional social media. In contrast, Lens currently experiences less interactive engagement despite a rich feature set for creators.

Creators and artists now have the potential to distribute their content while simultaneously engaging with a dedicated group of users. These users, akin to collectors, play a pivotal role in amplifying the reach and impact of the content, akin to the role of decentralized autonomous organizations (DAOs). This model creates a positive feedback loop, incentivizing community members who actively contribute and engage with the content. Such dynamics enable the formation of micro-communities centered around creators, allowing them to benefit economically from the activities of the communities they help build. This marks a

significant departure from the traditional revenue streams of creators, which were primarily limited to their artwork or direct content. Additionally, the evolution of the creator economy is evident in the diversification of revenue streams by modern creators.

However, not every creator possesses the skills or resources to navigate this expansion successfully, further underscoring the need for robust platforms that can support creators in broadening their reach and influence in a decentralized ecosystem. Decentralized social networks like Farcaster and Lens, by facilitating an Ethereum-native social graph and seamless access to a variety of applications, are setting the stage for a new era of social interaction and community building. As these platforms evolve, they promise to unlock unprecedented possibilities for human interaction, content distribution, and creator empowerment in the digital world. Although we've witnessed its successful application in areas like NFTs (Seaport) and DeFi (Uniswap/Aave), the idea of leveraging these decentralized social media protocols to share human attention across multiple applications is still largely untested. The integration of blockchain technology in social networking is not just a technical advancement; it is a fundamental shift towards a more interconnected, transparent, and user-empowered digital landscape.

# DISCLOSURES

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