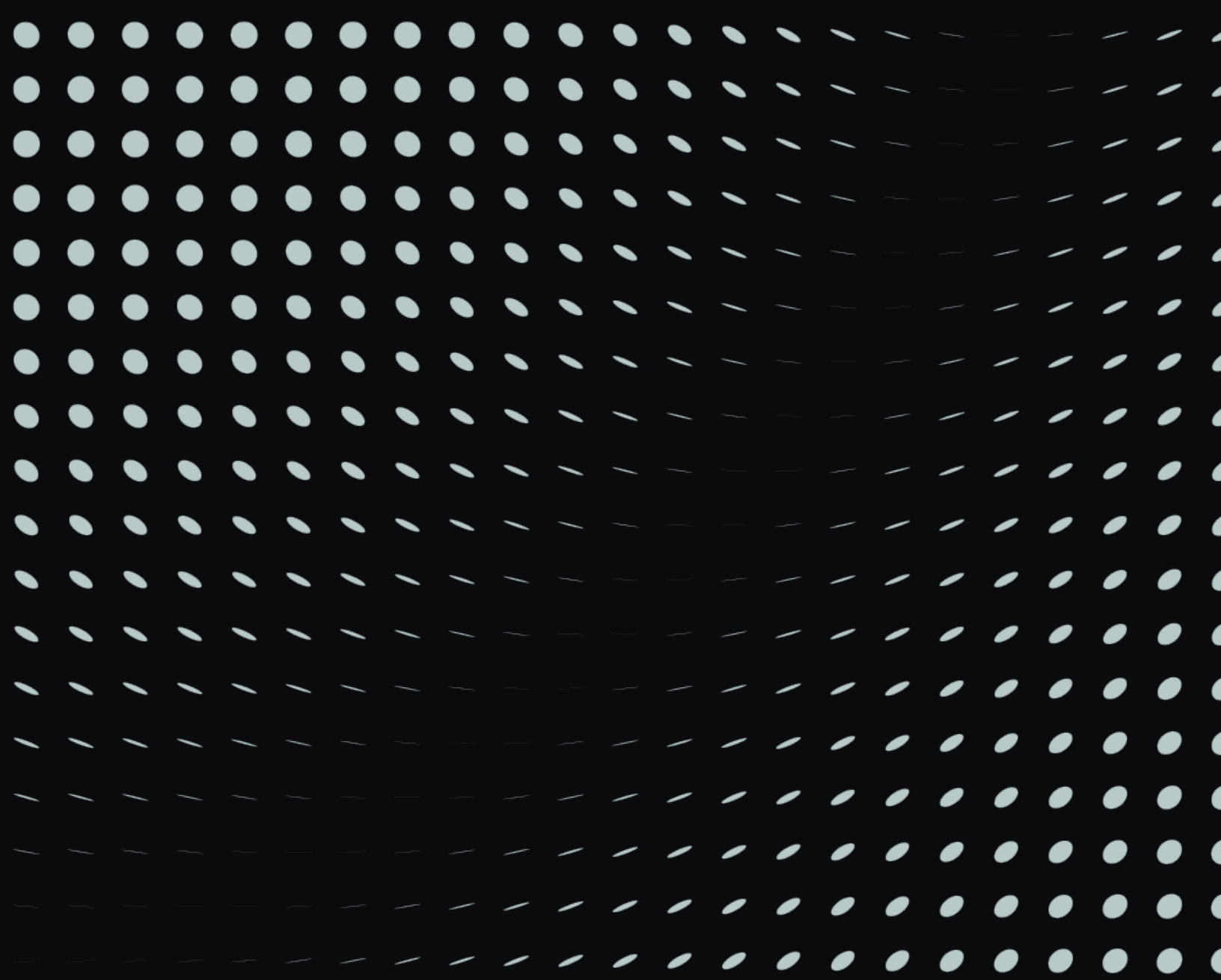


2024 Crypto Market Outlook



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2024 Crypto Market Outlook

This report is part of our efforts to provide applicable market intelligence to our institutional clients, highlighting updates on our institutional practice in long-form format. Note that all the data and charts included in this report reflect information up to and including November 30, 2023.

Authors and contributors

David Duong, CFA - *Head of Institutional Research*

David Han - *Research Analyst*

Mark Meadows - *Senior Product Marketing Manager*

Special thanks to:

Andrew Allen

Scott Bauguess

Anthony Bassili

Viktor Bunin

Robin Cook

Ben Floyd

Neil Gallagher

Tom Duff Gordon

Katie Harries

Jaydip Mahida

Katie Mitchell

Brandon Myint

McKenna Otterstedt

Jordan Salberg

Ben Rodriguez

Shaida Safai

Jaclyn Sales

Andrew B Samuel

Lukas Staniszewski

Greg Sutton

Hoolie Tejwani

John Turner

Mike Urciuoli

Ning Wei

Claire Wells

Crystal Yang

Alex Zosos

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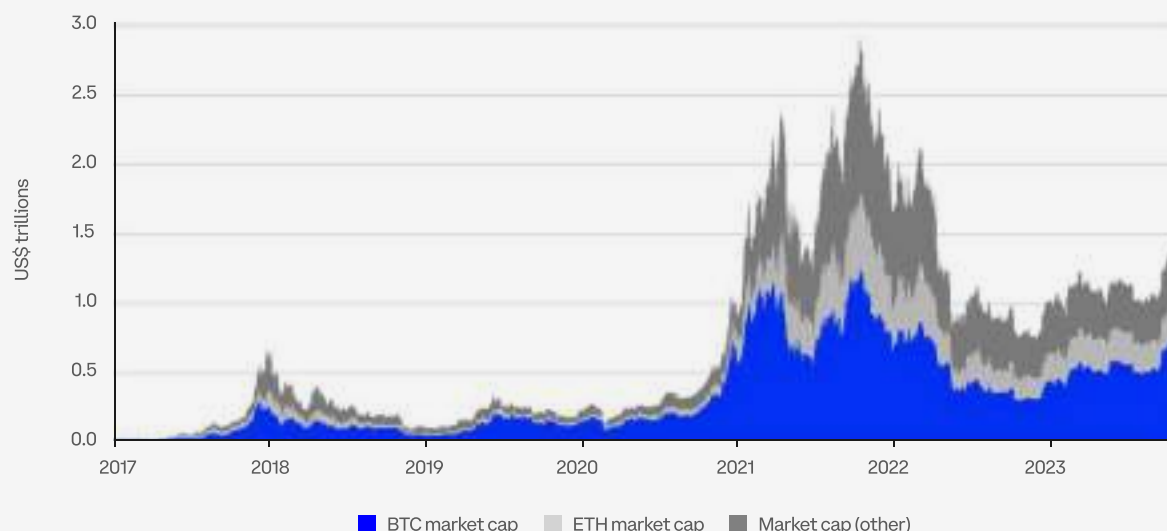
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A note from the author.

DAVID DUONG, CFA
HEAD OF INSTITUTIONAL RESEARCH

The total crypto market cap doubled in 2023, which suggests that the asset class has already exited its “winter” and is now in the midst of a transition. Still, we think it'd be premature to put labels on this or see the positive performance as vindication against the cynics who reveled in crypto’s greatly exaggerated demise. What’s clear, however, is that in spite of the hurdles directed towards the asset class, the developments we witnessed over the past year have defied expectations. They are evidence that crypto is here to stay. The challenge now is to seize the moment and build something better.

Chart 1. Total crypto market capitalization at US\$1.5T



Sources: Coin Metrics and Coinbase.

The catalysts for crypto's recovery in 2023 have at times been extrinsic to the innovations that typically characterize its value. Both the US regional banking crisis and the proliferation of geopolitical conflict, among other things, reinforced bitcoin's status as a safe haven alternative. Moreover, spot bitcoin ETF applications from some of the top US financial institutions have been an implicit acknowledgement of crypto's potential to disrupt. This may be the precursor to greater regulatory clarity, removing the frictions that would otherwise prevent capital from flowing into this asset class.

But progress rarely moves in a straight line. To create a more resilient market, developers will need to continue building towards real world use cases that help us cross the chasm from early adopters to mainstream users.

The foundations of what this might entail are already evident – from web2 analogues like payments, gaming, and social media to crypto-specific advancements like decentralized identity and decentralized physical infrastructure networks. The former are easier to understand for investors, but these projects face an uphill battle against well-established web2 giants. The latter could transform the technological landscape, but the development timelines are longer while meaningful user adoption is further out on the horizon. However, blockchain infrastructure has come a long way in the last two years, enabling the necessary conditions for these applications to experiment and innovate – and putting us far closer to an inflection point.

Tokenization is another vital use case, which is currently attracting traditional financial players into this space. Full implementation may take another 1-2 years, but the resurgence of the tokenization theme reflects the economic reality that opportunity costs are higher today than they were immediately after the pandemic. That makes the capital efficiency of having instantaneous settlement on repos, bonds, and other capital market instruments much more relevant.

Against this backdrop, we think the secular trend for institutional crypto adoption will accelerate. In fact, anecdotally, the later stages of the 2023 rally have started to attract a broader set of institutional clients into the crypto space, from traditional macro funds to ultra high net worth individuals. We expect the availability of spot bitcoin ETFs in the US to advance this trend, potentially leading to the creation of more complex derivative products that rely on compliance-friendly spot ETFs as the underlying. Ultimately, this should improve liquidity and price discovery for all market participants.

In our view, all of these represent some fundamental themes for cryptocurrency markets in 2024, which we discuss in this report. If you have questions about our work or want to understand how Coinbase's institutional practice can help your firm engage with the crypto markets, please contact us at institutional.coinbase.com.

Chapter 1

Key Themes for 2024

01. THE NEXT CYCLE

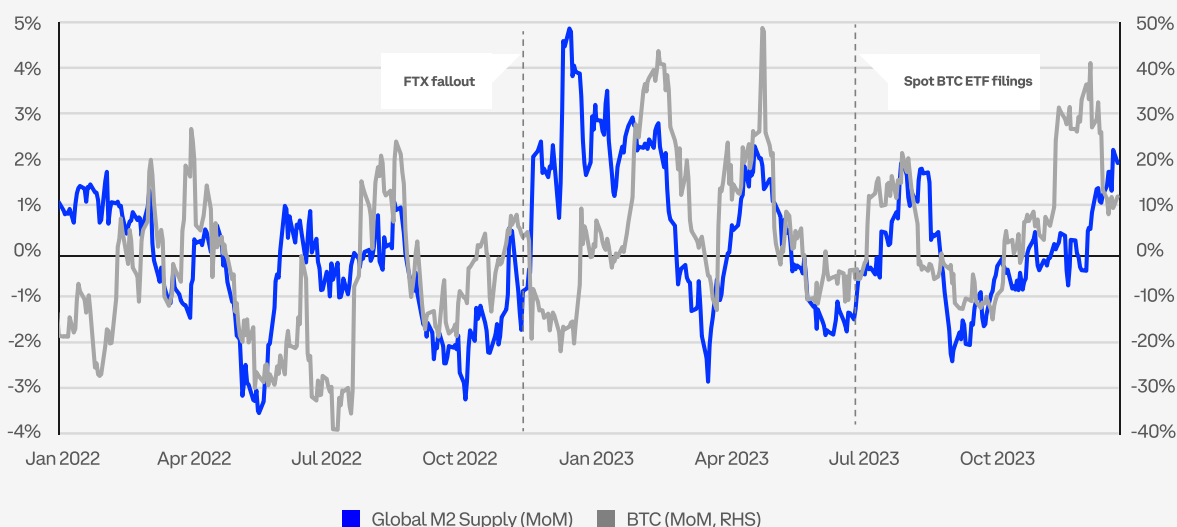
Bitcoin hegemony

Flows in 2023 played out largely as we expected in our *Crypto Market Outlook 2023*. Digital asset selection transitioned towards higher quality names, leading bitcoin dominance to steadily increase above 50% for the first time since April 2021. This was driven in large part by multiple well-known and established financial stalwarts applying for spot bitcoin ETFs in the US, as their participation in the space has helped to validate and enhance crypto's prospects as an emerging asset class. Although there may be some capital rotation into riskier parts of the asset class next year, we believe institutional flows will remain firmly anchored on bitcoin at least through the first half of 2024. Moreover, pent-up demand from traditional investors seeking to enter this market will make it harder to supplant bitcoin hegemony anytime soon.

We believe institutional flows will remain anchored on bitcoin at least through the first half of 2024.

Bitcoin’s idiosyncratic narrative has helped it outperform traditional assets through 2H23, and we expect that to continue next year. Barring a widespread risk-off environment that begets a clamor for liquidity, we think bitcoin may perform well even against a more challenging macroeconomic backdrop. Fiscal dominance in the US and other countries may curtail the restrictive monetary policies keeping capital sidelined, for instance. The commercial real estate sector in the US looks vulnerable and may contribute to renewed pressure on US regional banks. Both developments should extend the secular trend towards bitcoin adoption as an alternative to the traditional financial system. All of this could strengthen the narrative around the disinflationary supply schedule associated with the Bitcoin halving in April 2024.

Chart 2. Rolling global M2 money supply (MoM) vs BTC performance



Sources: Bloomberg and Coinbase.

A new trading regime

The previous crypto winter (2018-19) ended with the advent of decentralized finance (DeFi) and the rise of multiple alternative layer-1 networks (L1s), ostensibly built to satisfy the anticipated demand for onchain blockspace. Experimentation with the protocols on these platforms brought crypto further into the mainstream before overall activity stagnated in late 2021. Consequently, it turned out that there wasn’t necessarily a need for more blockspace. Out of the depressed expectations that ensued, developers decided to use the crypto winter to build. They dedicated their time to confronting the technological hurdles that hinder new blockchain use cases from developing.

The first stage of that progress has been to build the infrastructure necessary to enable a web3 future, such as scaling solutions (layer-2s), security services (restaking), and hardware (accelerators for zero-knowledge proofs) to name a few. These remain important investment opportunities for the crypto space, but arguably, a lot of infrastructure has now been built over the last two years. As this enables more decentralized applications (dapps) to emerge, we think the trading regime for crypto will transition alongside these endeavors. That is, we expect more market players to focus on finding the potential web3 apps that can help crypto bridge the gap between early adoption and mainstream use.

The trading regime for crypto may pivot towards web3 apps in 2024, as market players focus more on use cases.

Many market players rely on web2 analogues for their investment ideas in this space, like payments, gaming, and social media. Other use cases have emerged that have a more distinct crypto native flavor, including decentralized identity, decentralized physical infrastructure networks, and decentralized compute. We think the challenge isn't just identifying the sectors but picking the winners. Achieving dominance in any given sector isn't just about having the first-mover advantage (although it helps); it's also about achieving and monetizing the right network effects. Before early 2004, there were at least six other social media platforms, including Friendster and MySpace, that had made their mark but which didn't achieve the same network size or prominence as Facebook, for example. Given the nascency of the digital asset class, we expect many market participants to rely more on proxies and platform plays to capture the opportunities we'll see in the next cycle.

The layer-1 equilibrium

In our view, the moderation in onchain activity over the last two years has reduced demand for "general purpose" alternative layer-1s. Ethereum's dominance among smart contract platforms has remained steadfast, leaving only narrow room for direct competition. Around 57% of the total value locked in the crypto ecosystem sits on Ethereum, while ETH dominance of 18% of the total crypto market cap remains larger than any other token except BTC.¹ As market players increasingly focus on applications, we expect more alt L1s to repurpose their networks in a way that better aligns with the shifting narrative. More sector-specific platforms, for example, are already being propagated in the ecosystem.

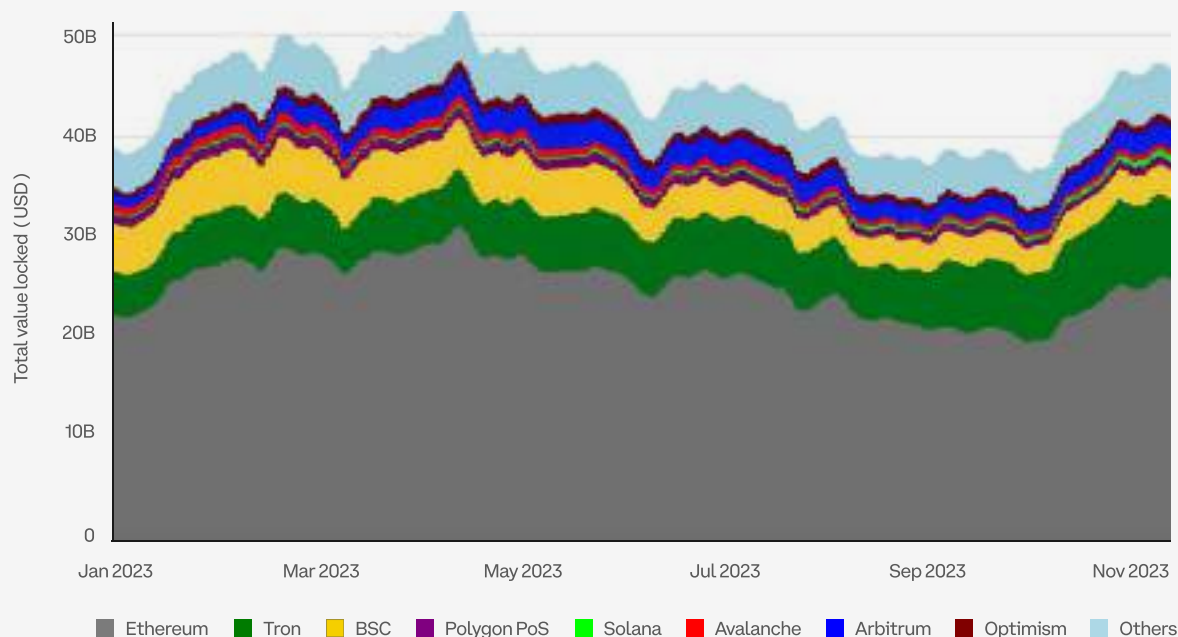
¹ See DefiLlama. [Ethereum](#).

Some are focused on gaming or NFTs (Beam, Blast, Immutable X, e.g.) while others are focused on DeFi (dYdX, Osmosis) and/or institutional participants (Avalanche’s Evergreen subnet, Kinto).

At the same time, the concept of modular blockchains is gaining more traction within the crypto community, with many L1s stepping in to fulfill one or more core blockchain components including data availability, consensus, settlement, and execution. In particular, the launch of Celestia on mainnet in late-2023 reanimated the conversation around modular blockchain design by providing a readily-accessible, plug-in data availability layer.² That is, other networks and rollups can use Celestia to post transaction data and guarantee that that data is available onchain for anyone to check. Other Ethereum Virtual Machine (EVM) compatible L1s are opting to focus on smart contract execution by transitioning to Ethereum L2s, like Celo.³

The debate between the modular vs integrated (monolithic) blockchain theses is unlikely to be resolved anytime soon.

Chart 3. DeFi total value locked



Sources: DefiLlama and Coinbase. Values are taken on a 5 day rolling basis

² See Coinbase Cloud. “Unpacking Celestia: An Introduction to Modular Blockchains” published August 21, 2023.

³ See cLabs. “cLabs Proposal for Celo to transition to an Ethereum L2” published July 15, 2023.

That said, integrated (or monolithic) chains like Solana continue to have an important place in the crypto ecosystem, meaning the debate between the modular vs integrated theses may not be resolved anytime soon. Nevertheless, we think the trend towards increasingly differentiated chains – whether by sector or function – will continue through 2024. However, the value of these blockchains ultimately still comes down to which projects are building on top of them and how much usage they attract.

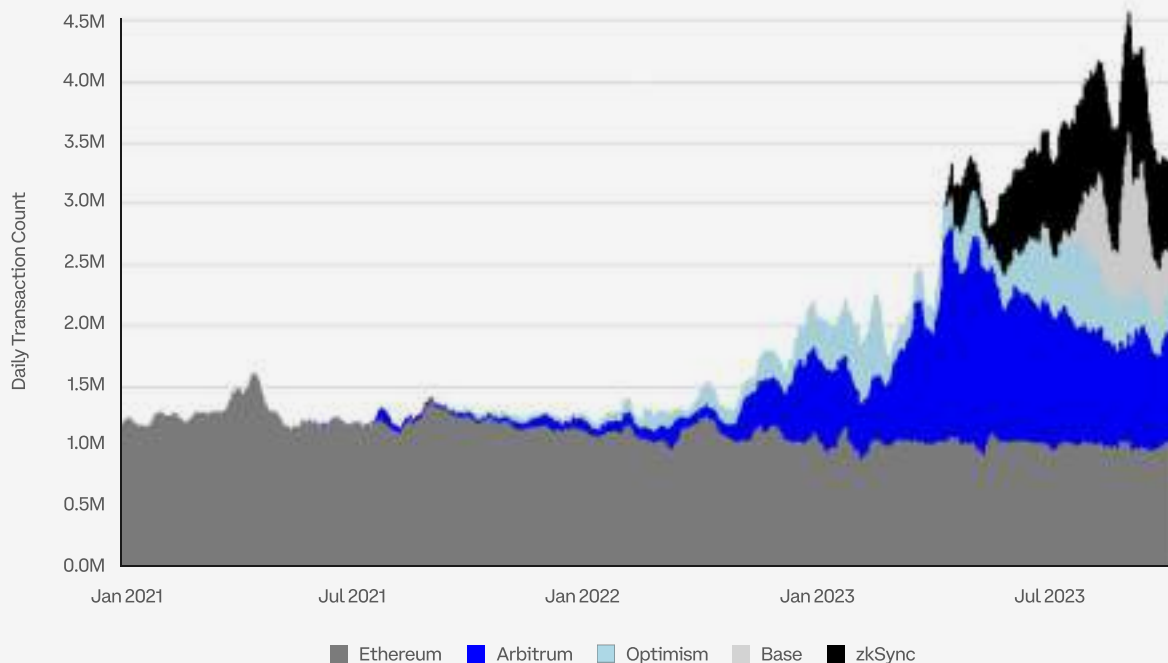
The proliferation of L2s has diverted very little activity away from Ethereum, instead cannibalizing the activity of alt L1s.

The evolution of layer-2s

The rapid growth of layer-2 scaling solutions has been accelerated by the emergence of new rollup stacks like OP Stack, Polygon CDK, and Arbitrum Orbit as well as the abstraction of functionality into specialized layers. As a result, developers are able to build and customize their own rollups more easily. Yet, despite the proliferation of L2s, they've diverted very little activity away from Ethereum mainnet and have instead been cannibalizing the activity of alt L1s.

For example, if we compare the canonical bridges linking Ethereum with L2s versus alt L1s, the share of ETH locked on rollup-linked bridges has grown from 25% of all bridged ETH at the start of 2022 to 85% by end-November 2023. Meanwhile, despite the growth in rollup usage, transaction counts on Ethereum have remained relatively stable averaging around 1M per day. Comparatively, the aggregate activity across Arbitrum, Base, Optimism, and zkSync currently average more than 2M transactions per day. **(See Chart 4.)**

Chart 4. Transaction counts on Ethereum have remained stable despite L2 growth



Sources: Coinbase and Dune. Transaction counts taken on a 10 day rolling basis

Moreover, the modularity thesis is manifesting in the L2 sector in altogether unique ways. Eclipse captured significant attention in 2023 for challenging existing conventions by being a “universal” scaling solution that relies on a modular architecture. Notably, Eclipse relies on (1) the Solana Virtual Machine (SVM) for transaction execution, (2) Celestia for data availability, (3) Ethereum for settlement (security), and (4) RISC Zero for zero-knowledge fraud proofs. This is just one example of how we are starting to see some experimentation with different (non-EVM) virtual machines on the execution layer, although it remains to be seen what the influence of this will be on the ecosystem. With the Cancun (Dencun) Fork also on the horizon in 1Q24, we may also see transaction fees coming down for L2s settling to Ethereum.

02. RESETTING THE MACRO FRAMEWORK

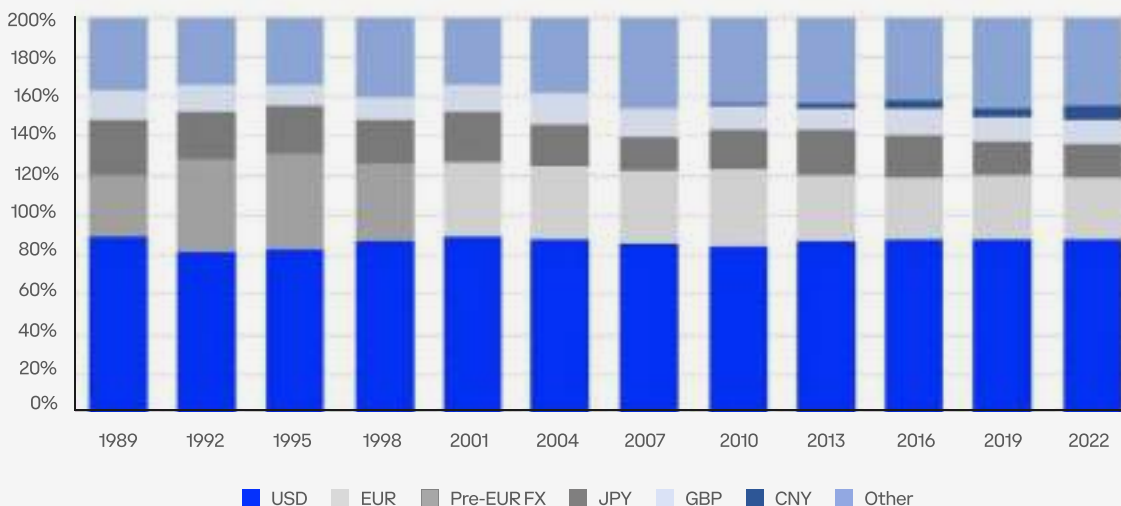
The long road to de-dollarization

De-dollarization may continue to be a perennial topic of conversation in 2024, particularly as it’s an election year. However, the reality is that the USD isn’t under any threat of losing its global supremacy (or “privilège exorbitant” per former French President Valery Giscard d’Estaing) anytime soon.

What is clear is that the USD is at an inflection point. Although de-dollarization may take many, many generations to unfold, the global monetary regime has already started to shift away from USD dominance – and for good reason. Macroeconomic imbalances in the US are growing as the cost of servicing America’s debt burden is projected by the Congressional Budget Office (CBO) to rise to \$1T or 3.1% of GDP by 2028. The CBO expects the federal deficit to expand from an average 3.5% of GDP to 6.1% in the next decade.

On the other hand, the de-dollarization theme has been a topic of discussion since at least the early 1980s, and despite that, the USD still remains the world’s reserve currency. Indeed, the USD’s outsized role in global finance and trade means the USD’s share of all international transactions has hovered around 85-90% for the last four decades. **(See Chart 5.)** What has changed is the weaponization of global finance that began with increased US sanctions on Russia as a direct result of the war in Ukraine. This has accelerated interest in developing new cross border payment solutions as more countries are striking bilateral agreements to reduce their dependence on the USD. Both France and Brazil (among others) have started to settle commodity trades in Chinese renminbi, for example.⁴ More trials are being conducted with central bank digital currencies to avoid today’s cumbersome system of correspondent banks.

Chart 5. Share of global FX transactions (turnover) by currency



Because every transaction involves two currencies, the sum of foreign exchange turnover each year is 200%.
Source: BIS Triennial Survey 2022.

⁴ See Bloomberg, [Brazil Takes Steps to Transact in Yuan as China Ties Grow](#), published March 30, 2023 and Reuters, [China's CNOOC, French energy firm Engie complete yuan-settled LNG trade](#), published October 17, 2023

Crypto advocates argue that bitcoin and other digital stores of value have an important role in this emerging shift from a unipolar to multipolar world, as the value of having a supranational asset that is not owned or controlled by any single country seems evident. Monetary transformations often take place in periods of socioeconomic upheaval that are only understood well after they happen, like paper money in 11th century China, promissory notes in 13th century Europe, or credit cards in mid-20th century America.

On the other hand, while digital cash and distributed ledgers will likely form a major part of the next transformation, displacing the USD in the global financial system is no small task. For one thing, the entire crypto market cap is only a fraction of the \$13T in USD-denominated bonds available to non-banks outside the US.⁵ The USD's share of foreign exchange reserves has declined over the last 30 years, but it still comprises the overall majority at 58%.⁶ But bitcoin doesn't necessarily need to disintermediate the USD to play a valuable function as an attractive alternative in unstable conditions, which could potentially help it find a place as part of more countries' reserve assets. Nor is the structural adoption of bitcoin and crypto contingent on the collapse of the USD, which explains why we saw bitcoin strengthening in tandem with the USD in early 2H23. Over the long haul, the monetary regime change that's happening and crypto's part in that will likely be momentous, even if we may not be around long enough to see the toppling of the old order.

The economic outlook for 2024

The chances that the US may avoid an economic recession in 2024 have increased sharply in recent months, although the probability of recession is not zero – as highlighted by a still deeply inverted US Treasury yield curve. The US' particular brand of economic resiliency this year has been driven by high levels of government spending as well as near-shoring efforts to strengthen the domestic manufacturing sector, among other things. However, we expect these effects to wear off in 1Q24, leaving the economy much softer amid comparatively tighter financial conditions. But this doesn't need to result in a recession, in our view. Rather, a recession will be contingent on endogenous factors like the potential for renewed weakness in the US banking system or the overall pace of disinflation.

A softer US economy and Fed cuts in 1H24 should translate to a weaker USD trend next year, which presents an opportunity for crypto.

⁵ See BIS. "BIS global liquidity indicators at end-June 2023" published August 2023.

⁶ See IMF. [World Currency Composition of Official Foreign Exchange Reserves](#).

On the latter, we've argued since March 2023 that inflation had already peaked and that moderating aggregate demand should cyclically support a stronger disinflationary trend going forward.⁷ In large part, that has already materialized, while structural forces like artificial intelligence can lead to greater automation and lower input costs. That said, shifting demographics – such as the departure of baby-boomers from the workforce – may act as a counterbalance to that. Taken together, we think the combination of an economic slowdown and a moderation in price pressures should pave the way for the Federal Reserve to cut rates by mid-2024, if not sooner.

In our view, lower capital costs could support risk assets in 2Q24, but 1Q24 may present some challenges depending on how entrenched the Fed's position is. Crypto may not be entirely immune in that scenario. But our economic outlook also translates to a weaker USD trend next year, which would be an opportunity for cryptocurrencies, as these assets tend to be priced in USD. Although the correlations between changes in many macro variables and bitcoin (and ether) returns have come down over the last year, an amenable macro backdrop still forms a core part of our overall constructive market thesis for 2024.

Chart 6. Correlation matrix (data from January 1 to November 30, 2023)

	BTC/USD	Copper	CRY	DXY	ETH/USD	Gold	MOVE	S&P 500	US 10Y	US 2Y	US Bond	VIX
BTC/USD	1.00	0.07	0.12	-0.12	0.04	-0.05	-0.02	0.20	0.07	0.09	0.08	-0.19
Copper	0.07	1.00	0.26	-0.40	0.11	0.40	-0.17	0.25	-0.03	-0.01	0.01	-0.21
CRY	0.12	0.25	1.00	-0.50	0.12	0.11	0.02	-0.02	0.48	0.53	0.45	0.15
DXY	-0.12	-0.40	-0.50	1.00	-0.12	-0.17	0.17	-0.25	-0.43	-0.40	-0.46	0.10
ETH/USD	0.04	0.11	0.12	-0.12	1.00	0.01	-0.08	0.10	0.02	0.02	0.04	-0.19
Gold	-0.05	0.40	0.11	-0.17	0.01	1.00	-0.07	0.15	-0.09	-0.13	-0.07	-0.13
MOVE	-0.02	-0.17	0.02	0.17	-0.09	-0.07	1.00	-0.25	-0.21	0.08	-0.27	0.40
S&P 500	0.20	0.25	-0.02	-0.25	0.10	0.15	-0.25	1.00	0.03	-0.15	0.15	-0.74
US 10Y	0.07	-0.03	0.48	-0.43	0.02	-0.09	-0.21	0.03	1.00	0.79	0.98	0.00
US 2Y	0.09	-0.01	0.53	-0.40	0.02	-0.13	0.08	-0.15	0.79	1.00	0.76	0.28
US Bond	0.08	0.01	0.40	-0.40	0.04	-0.07	-0.27	0.15	0.98	0.76	1.00	-0.04
VIX	-0.19	-0.20	0.15	0.10	-0.19	-0.10	0.40	-0.74	0.03	0.28	-0.06	1.00

Based on daily changes. Sources: Bloomberg and Coinbase.

⁷ See Coinbase Research. "Reflections of the Past" published March 9, 2023.

Reading the regulatory tea leaves

In a recent *Institutional Investor* survey, commissioned by Coinbase, around 59% of participants said they expect their firm's allocations to the digital asset class to increase over the next three years, while a third said they've already boosted their allocations over the past 12 months. This affirms that crypto remains a globally important asset class with widespread commercial and investor appeal. However, while many jurisdictions around the world are taking decisive action on crypto regulations, uncertainty in the US is contributing to an environment of missed opportunities and enforcement-centric market constraints. Indeed, 76% of survey respondents agree that the lack of sensible and well-defined crypto regulations in the US has threatened the country's position as a leader in financial services.

"I don't own any bitcoin, to be frank, but I should."

- Stan Druckenmiller, *CNBC Delivering Alpha conference interview*
(October 30, 2023)

Moreover, irrespective of the specific language used in guidance and other public statements in 2023, the perception in the market is that US banking supervisors' attitude toward the digital asset ecosystem is at minimum unfavorable, while some view it as being outright hostile. The result is that all but the largest and most reputable crypto companies may experience difficulty in establishing banking relationships. Whether intended or not, the regulatory gates being erected in the US through non-objection letters and other permission-seeking requirements has chilled the incentive for banks to invest in digital asset technology or take on clients that actively engage in these activities.

On the upside, we think more legislators in the US recognize the rising risk of global regulatory arbitrage with several US House Committees advancing the Clarity for Payment Stablecoins Act and the Financial Innovation and Technology for the 21st Century Act (FIT 21 Act) in 2023.

Separately, the potential approval of spot bitcoin ETFs in the US could widen crypto access to new classes of investors and reshape the market in unprecedented ways. Compliance-friendly ETFs could become the underlying for a new set of financial instruments (lending and derivatives, for example) that could be traded among institutional counterparties. We believe the foundations for crypto regulation will continue to be built in 2024, leading to more incremental regulatory clarity and greater institutional participation in this space in the future.

03. CONNECTING TO THE REAL WORLD

Tokenization, redux

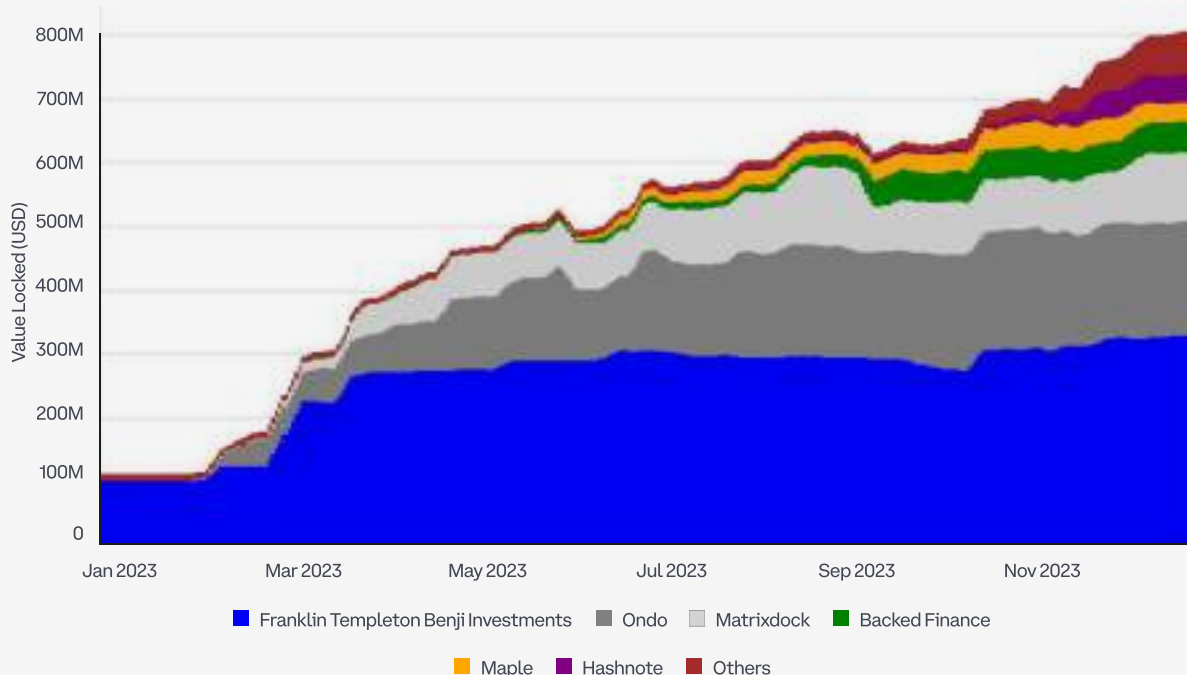
Tokenization is a vital use case for traditional financial institutions and we expect it to be a major part of the new crypto market cycle, as it is a critical part of “updating the financial system.” This primarily involves automating workflows and eliminating certain intermediaries that are no longer needed in the asset issuance, trading, and record keeping process. Not only does tokenization have strong product-market fit for distributed ledger technology (DLT), but the current high yield environment makes the capital efficiency offered by tokenization much more relevant than it was even two years ago. That is, for institutions, tying up capital for even a few days in higher interest rate environments is much costlier than doing so in lower rate environments.⁸

Over the course of 2023, we witnessed dozens of new entrants on public permissionless networks begin to offer access to tokenized US Treasury exposure directly onchain. Total assets held in US Treasury-like exposure onchain has increased 6x to over US\$786M as digitally native users have sought to gain exposure to yields that have no connection to traditional crypto yield sources. **(See Chart 7.)** In 2024, we may see tokenization expand to other market instruments including equities, private market funds, insurance, and carbon credits, given the client demand for higher yielding products and the need for diversified sources of return.

Over time, we believe that even more business and financial sectors will incorporate aspects of tokenization, though regulatory ambiguity and the complexities of managing different jurisdictions continue to pose significant challenges for market participants – alongside the integration of new technologies into legacy processes. This has driven most institutions thus far to rely on private blockchains, due to the risks associated with public networks such as smart contract exploits, oracle manipulation, and network outages.

⁸ See Coinbase Research. “Tokenization and the New Market Cycle” published October 30, 2023.

Chart 7. Tokenized US Treasuries on public networks have increased 6x over 2023



Sources: RWA.xyz and Coinbase. Does not include US Treasury tokens minted for the usage in a single protocol like those in Maker Vaults. Value taken on a 5 day rolling average.

While private blockchains may continue to grow alongside public permissionless chains, this can potentially fragment liquidity due to interoperability hurdles, which would make it harder to realize the full benefits of tokenization.

An important theme to watch around tokenization is the regulatory progress being made in jurisdictions like Singapore, the EU, and the UK. The Monetary Authority of Singapore has sponsored “Project Guardian” which has produced dozens of proof-of-concept tokenized projects on public and private blockchains from tier 1 global financial institutions. The EU DLT Pilot regime has developed a framework for enabling multilateral trading facilities to utilize a blockchain for both trade execution and settlement, rather than through a Central Securities Depository. The UK has also launched a pilot regime seeking an even more advanced framework for issuing tokenized assets on public networks.

While many are now looking past “proof-of-concepts” towards possible commercialization, we still expect that full implementation will continue to take place over multiple years given this theme requires regulatory alignment, progress with onchain identity solutions, and critical infrastructure within major institutions to operate at scale.

Can we play a game?

Web3 gaming has had a resurgence of interest in 2H23 after a steep drop in transaction activity in the early stages of the most recent crypto winter. At the moment, this sector is mainly concentrated on capturing the attention of mainstream gamers that sit outside of many “crypto first” communities. Altogether, the gaming industry represents a total addressable market of around US\$250B at the moment, which is projected to grow to \$390B over the next five years.⁹ Meanwhile, while the opportunities for investment may be massive, users have broadly spurned existing web3 “play-to-earn” models that were exemplified by early projects such as Axie Infinity. In fact, such models may have led to greater skepticism from many mainstream gamers regarding web3 integrations.

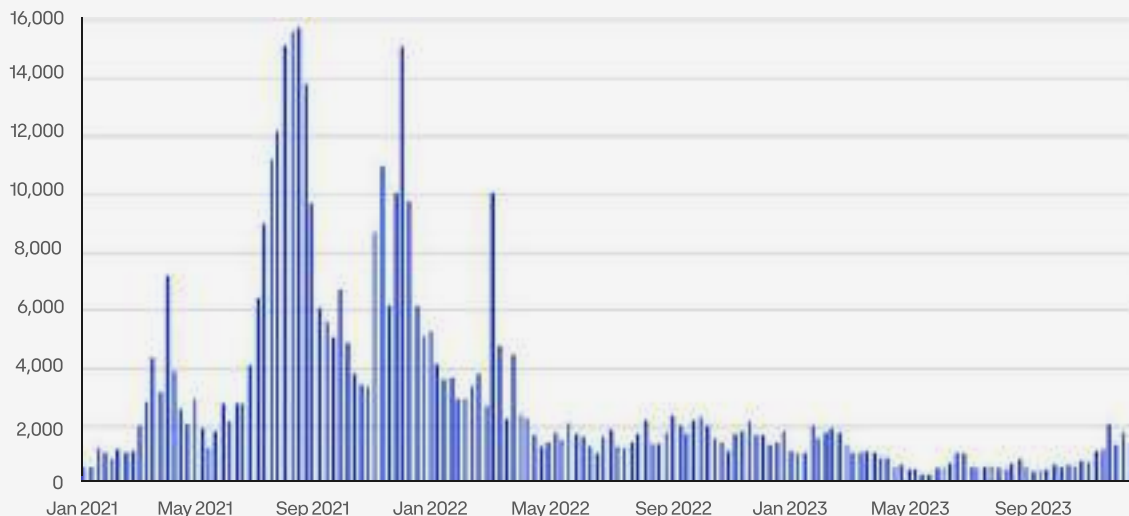
The gaming industry represents a total addressable market of \$250B at the moment, which is projected to grow to \$390B in the next five years.

This is prompting greater experimentation from developers, who are trying to merge the network effects of a high-quality AAA game with sustainable financialization mechanics. For example, gaming studios have considered minting web3 primitives like non-fungible tokens (NFTs) that can be used, transferred, or sold in-game or on designated market places. However, surveys indicate that a large majority of gamers dislike NFTs, which broadly reflects their rejection of the play-to-earn or pay-to-play ethos.¹⁰ Meanwhile, for the gaming industry, the value-add of tapping into web3 architecture is that it promises to improve user acquisition and retention, but as of yet, this is still an unproven thesis. With many projects reaching the 2-3 year mark in their game development process (following an influx of fundraising in 2021-2022), we think the possible release of some web3 games in 2024 may soon give us the stats and data we need to better assess this sector.

⁹ See Statista Market Insights. [Video Games – Worldwide](#).

¹⁰ See FandomSpot. [“Study: 69% of Gamers Hate NFTs”](#) published March 21, 2022.

Chart 8. Weekly active users of top games on Ethereum



Source: Dune.

How to hardwire a decentralized future

A big theme for 2024 (and most likely beyond, depending on development timeframes) is the decentralization of real world resources. We are specifically focused on decentralized physical infrastructure networks (DePIN) and the related concept of decentralized compute (DeComp). Both DePIN and DeComp utilize token incentives to drive resource creation and consumption for real world constructs. In the case of DePIN, these projects depend on creating economic models that help incentivize participants to build physical infrastructure (from energy and telecommunications networks to data storage and mobility sensors) that sit outside the control of large corporations or centralized entities. Specific examples include Akash, Helium, Hivemapper, and Render.

DeComp is a specific extension of DePIN that relies on a distributed network of computers to meet specific tasks. The concept has been reinvigorated by the mainstream adoption of generative artificial intelligence (AI). Training AI models can be computationally expensive, and the industry is exploring whether there’s an opportunity for decentralized solutions to alleviate the problem. It’s still unclear whether the ability to express the AI theme within blockchain will be viable, but the sector is growing. For example, a separate but related field of research called zero-knowledge machine learning (ZKML) focuses on privacy and promises to revolutionize how sensitive information is handled by AI systems.¹¹ ZKML could potentially enable large language models to learn from a set of private data without ever accessing that data directly.

¹¹ See WorldCoin. “An introduction to zero-knowledge machine learning (ZKML)” published February 22, 2023.

DePIN represents a strong real-world use case for blockchain technology that can potentially disrupt the existing paradigm, but it is still relatively immature and faces a number of hurdles. These include high initial outlays, technical complexity, quality control, and economies of scale to name a few. Moreover, many DePIN projects have been focused on how to incentivize participants to supply the necessary hardware for these projects, but only a few have started to tackle the financialization models for driving demand. Although a demonstration of DePIN's value may come early, realizing the benefits could nevertheless take years. Thus, we think market players will still need to take a long duration view in order to invest in the sector.

DePIN represents a strong real-world use case for blockchain technology that can potentially disrupt the existing paradigm.

Decentralized identity

Privacy is a new frontier for blockchain developers, who are leveraging innovations like zero-knowledge (ZK) fraud proofs and fully homomorphic encryption (FHE) to enable computations on user data while still keeping that data encrypted. The applications for this are extensive, particularly as it pertains to decentralized identity – which describes an end-state where users have full control and ownership of their personal data. For example, this could enable a healthcare research organization to analyze patient data, helping them discover new trends or patterns for specific diseases but without revealing the sensitive health information of any patients. To achieve this, however, we think individuals would need to have control over their own identity data – a departure from the current status quo of having this information sit on the servers of many disparate centralized entities.

To be sure, we're still in the very early stages of tackling this problem. But ZK systems and FHE were once considered purely theoretical concepts that have recently seen more experimental implementations within the crypto industry. In the next few years, we expect to see greater advancements in this field that may get us to the point of having end-to-end encryption in our web3 applications and networks. If so, then we believe decentralized identity could have a strong product-market fit in the future.

04. FUTURE OF BLOCKCHAIN

A better user experience

One of the big themes to emerge from the recent bear market cycle is a focus on how to make crypto technology more user friendly and accessible. The added responsibility of managing crypto and all that entails (wallets, private keys, gas fees, etc.) is not for everyone, which makes it hard for the industry to mature unless it can overcome some key user experience-related challenges. Progress around account abstraction appears to be yielding meaningful results on this front. The concept of account abstraction dates back to at least 2016 and refers to the idea of treating both externally owned accounts (like wallets) and smart contract accounts similarly, thereby simplifying the user experience. Ethereum advanced account abstraction in March 2023 with the introduction of the ERC-4337 standard, opening up new opportunities for users.

The crypto user experience needs to improve if the industry wants to cross the chasm from early adopters to mainstream users.

For example, in the case of Ethereum, it could allow application owners to act as “paymasters” and pay for users’ gas fees or enable users to fund transactions with non-ETH tokens. This functionality can be of particular importance to institutional entities who do not want to hold gas tokens on their balance sheets due to price variability or other reasons. J.P. Morgan’s proof-of-concept report as part of Project Guardian highlights this, with all gas payments handled via Biconomy’s Paymaster service.¹²

With the Dencun upgrade set to potentially reduce rollup transaction fees by 2-10x, we think more decentralized applications (dapps) may pursue a “gasless transactions” path, effectively allowing users to focus only on high-level interactions.¹³ This may also enable new non-financial use cases to develop. Account abstraction can also facilitate robust wallet recovery mechanisms to create failsafes against simple human error (like losing a private key, for example). The goal is for the crypto ecosystem to attract new users as well as encourage existing users to become more active participants.

¹² See J.P. Morgan. [“The Future of Wealth Management”](#) published November 2023.

¹³ Not only will Proto-Danksharding reduce the costs of putting rollup data on the layer-1 mainnet as part of Ethereum Improvement Proposal (EIP) 4844, but EIP-1153 will also optimize gas fees for the network.

Validator middleware and customizability

Developments like restaking and distributed validator technology (DVT) are giving validators the ability to customize key parameters in new ways – to better accommodate changing economic conditions, network demands, and other preferences over time. The growth of validator middleware solutions has already been a major theme in 2023 from an innovation perspective, but their full potential – for enhancing customizability and unlocking new business models – has yet to be fully realized, in our view.

In the case of restaking, currently being pioneered by EigenLayer, this could be a way for validators to secure data availability layers, oracles, sequencers, consensus networks, and other services on Ethereum. The potential rewards earned from this process will likely represent a new income stream for validators in the form of “security-as-a-service.” EigenLayer officially launched phase 1 on Ethereum mainnet in June 2023 and will begin registering operators to actively validated services (AVS) in 2024, after which restakers will be able to delegate their staked positions to those operators.¹⁴ We think these developments will be worth watching to see what percentage of staked ETH will be allocated towards additional security provisions, when EigenLayer is fully open to the public.

Meanwhile, distributed validator technology (DVT) for proof-of-stake networks can offer stakers more design choices as far as setting up and managing their validator operations. DVT splits the responsibilities (and private key) of a single validator among multiple node operators, thereby limiting single points of failure.¹⁵ This can reduce the risk of slashing penalties and enhance security because a single node operator being compromised does not leave an entire validator compromised. Moreover, for solo stakers, DVT gives participants the ability to run a validator and earn rewards without putting up as much collateral (assuming they partner with others via platforms like Obol, SSV Network, or Diva Protocol to meet staking thresholds), thus lowering barriers to entry and promoting greater decentralization.¹⁶ We may also see DVT enable validators to distribute themselves geographically to mitigate liveness and slashing risks.

¹⁴ See EigenLayer Blog. “[Launch of the Stage 2 Testnet](#)” published November 16, 2023.

¹⁵ See Ethereum.org. “[Distributed validator technology](#)” published June 1, 2023.

¹⁶ Note: Coinbase Ventures is an investor in Obol and SSV Network.

Chapter 2

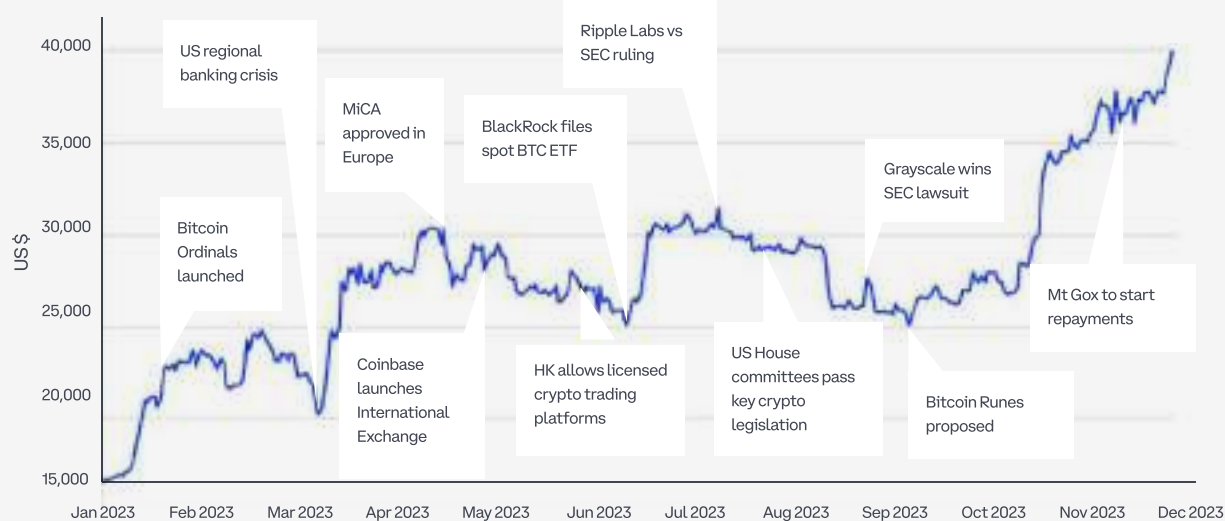
Bitcoin

MARKET OUTLOOK

Bitcoin's (BTC) rally in 2023 has been a function of three key factors. First, the token had already been heavily oversold in late 2022, following FTX's collapse. Second, the US debt ceiling showdown (in January 2023) and US regional bank failures (in March) helped burnish bitcoin's flight to quality credentials. Third, a further catalyst then emerged in 2H23 when multiple financial institutions including BlackRock, Invesco, and Franklin Templeton filed spot bitcoin ETF applications, accelerating bitcoin's "store of value" narrative. The result is that bitcoin has outperformed both crypto peers as well as traditional assets like US technology stocks, not only in absolute terms but on a risk-adjusted basis this year.

Bitcoin strength in 2024 should be well supported by themes like spot ETFs, the halving, and a fall in real rates.

Chart 9. Bitcoin (BTC) 2023 events/milestones



Sources: Coin Metrics and Coinbase.

Although there will be a temptation to see bitcoin profits rolled into tokens further out the risk curve, we think bitcoin will continue to be the anchor for the digital asset class in 2024, particularly as spot ETFs (if approved) represent a bitcoin-specific conduit for capital from new segments of the population. Moreover, the bitcoin halving (which will reduce rewards for mining bitcoin) is expected to drive BTC prices higher as it enhances the token’s prospective scarcity and improves its supply-demand technicals. (More on this in the next section.) Together, these factors may continue to drive the secular adoption trend for bitcoin.

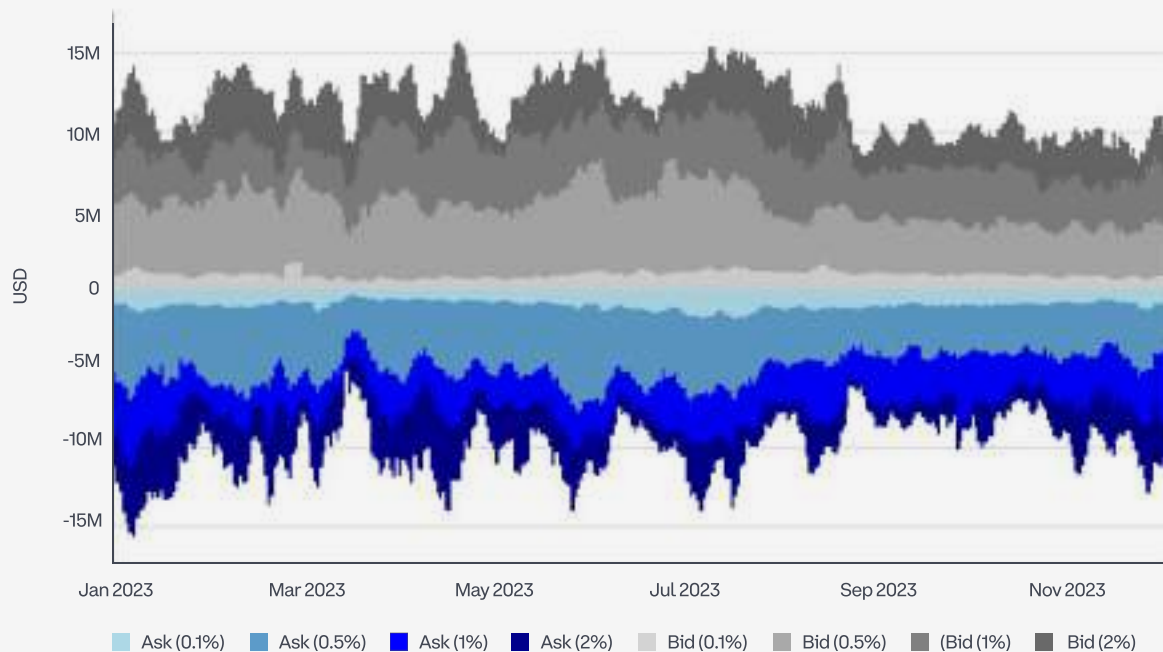
Spot ETFs can help meet the demand coming from the investors and institutions that want access to crypto but don’t have recourse to buying and holding such assets directly.

However, there are also a few sources of anticipated selling pressure for bitcoin in the months ahead. These include 141,686 BTC (alongside 142,846 BCH and JPY69.7B in cash) held by the Mt. Gox Rehabilitation Trust that needs to be repaid to creditors by October 31, 2024 (delayed from October 31, 2023). As of November 30, 2023, this represents around \$5.2B in crypto assets that may be distributed in the months ahead, although the Trustee has already started making the cash component of the repayments (JPY200k per person) to creditors this year. Creditors may choose to sell some or all of the crypto distributions they eventually receive, so the precise impact on the bitcoin price is hard to estimate. Additionally, the trustee may need to sell some crypto to satisfy any creditors who elected to be repaid entirely in cash.

Meanwhile, FTX is in the process of liquidating around \$3.4B in digital assets, alongside \$2.6B in (debtor and non-debtor) cash and \$1.3B in brokerage and government recovered assets, valued as of August 31, 2023. (Note that given the market rally in 4Q23, we value the digital asset position at closer to \$6.6B as of November 30, 2023.) Based on the court filing, we estimate that the firm held around 58M SOL, 22.1k BTC, and 134.4k ETH at the start of this process.¹⁷ That said, it’s unlikely these tokens will flood the market because liquidations are bound by weekly sell limits of \$100M per week. There are also strict controls in place for selling certain “insider-affiliated” tokens that require 10 days advance notice to two committees representing FTX debtors. Due to the weekly sell limits and recent selling start date of September 13, 2023, we conservatively estimate at least \$4.6B of digital assets still pending liquidation in 2024 if assets were sold evenly across their holdings.

There are a few sources of anticipated selling pressure for bitcoin in the months ahead, such as Mt. Gox creditor repayments and liquidations by FTX.

Chart 10. Bitcoin market depth on Coinbase platform



Sources: Coin Metrics and Coinbase. Rolling 5 day average.

¹⁷ See US Bankruptcy Court for the District of Delaware. Case No. 22-11068 (JTD). Re: FTX Trading Ltd, et al. “Stakeholder Update Materials” prepared for creditor meeting on September 11-13, 2023.

BITCOIN HALVING

Cause and effect

The Bitcoin halving (which will lower bitcoin issuance rewards from 6.25 BTC to 3.125 BTC in late April 2024) has often been cast as a direct catalyst for driving bull runs in the crypto space, but we think that causality is less precise than some may believe. In our view, the halving's underlying significance lies in its ability to raise media attention around what makes bitcoin unique: a fixed, disinflationary supply schedule that culminates in a maximum supply limit of 21M bitcoin.¹⁸

This point often goes underappreciated. For physical commodities, additional resources can theoretically be applied to mine and extract more gold or copper (for example), helping to meet demand when prices rise, even if the thresholds may be high. But the same can't necessarily be said of bitcoin due to the preset block rewards and the difficulty-adjustment mechanism. Moreover, bitcoin is a growth story. The utility of the Bitcoin network expands in relation to the number of users on the network, which directly contributes to the value of the token. That is, investors may buy bitcoin because they believe the network could grow. Comparatively, there are often no growth aspirations for buying precious metals like gold. These characteristics distinguish bitcoin from other financial assets and are important for market participants when formulating their investment strategies.¹⁹

One of the things that makes bitcoin unique is its inelastic supply: you can't mine more bitcoin when prices rise, due to preset block rewards and the difficulty-adjustment mechanism.

All of this is to say that we think the next halving could indeed have a positive impact on bitcoin performance, but the context does matter. In May 2020 for example, the last Bitcoin halving coincided with unprecedented levels of global central bank quantitative easing and pandemic-related fiscal stimulus, dramatically increasing the world's money supply. This raised bitcoin's "supply scarcity" profile at precisely the right time.²⁰ The backdrop for the upcoming 2024 halving may be similarly amenable to bitcoin, as we expect global growth to slow and many central banks including the Federal Reserve to cut interest rates in 1H24. This narrative converges nicely with potential spot bitcoin ETFs in the US, which will provide a wider audience with a previously unavailable hedging vehicle to defend against rising economic and geopolitical uncertainty.

¹⁸ Note that we distinguish bitcoin the token in lowercase and Bitcoin the network in uppercase.

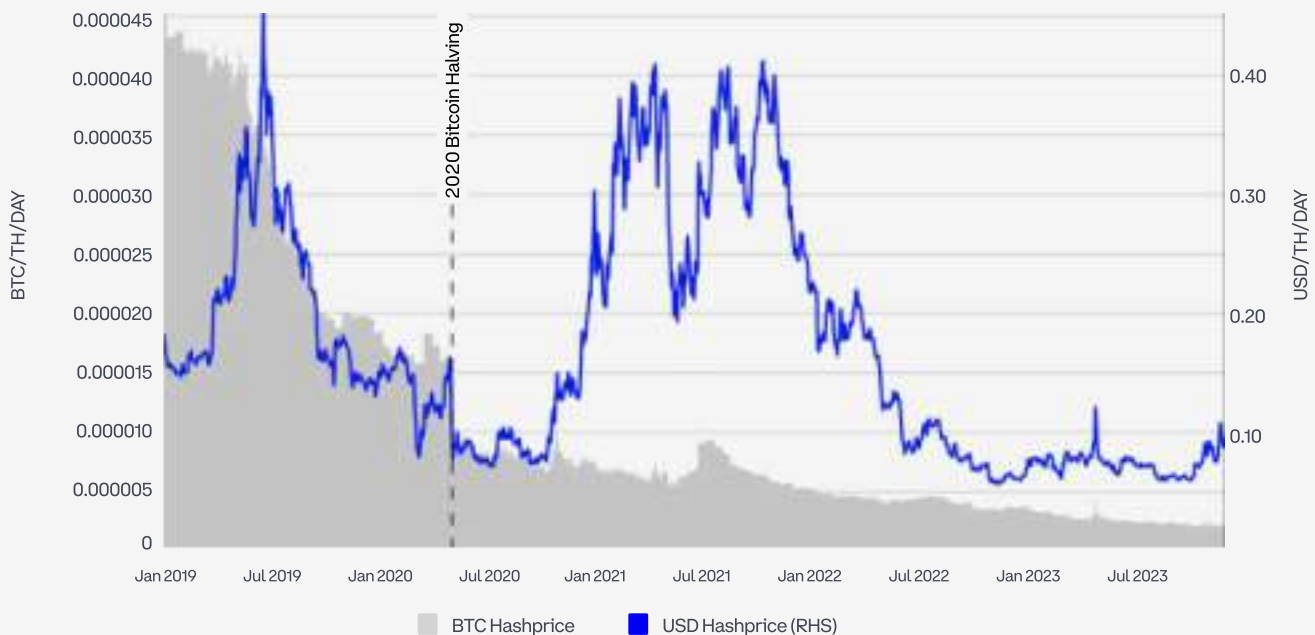
¹⁹ See Coinbase Research, "Monthly Outlook: Why an ETF Matters" published November 13, 2023.

²⁰ See Coinbase Research, "Bitcoin Halvings and the Liquidity Problem" published June 14, 2023.

Network impacts

Separately, we think the halving will have a two-pronged impact on the Bitcoin network’s fundamentals. It will likely (1) affect supply side dynamics among bitcoin miners as well as (2) act as a litmus test for the viability of sustaining a proof-of-work (PoW) network in the face of significant drops in block rewards. The decline in rewards amidst an overall increase in network hash rate means a portion of bitcoin miners may no longer be productive enough to continue mining in the absence of significant increases to price or transaction fees. In our view, this could lead to further consolidation among select miners who are able to reduce their operational costs amidst narrowing profit margins. **Chart 11** depicts the Hashprice Index, a measurement pioneered by Luxor of the expected revenue per terahash of compute power each day.²⁰ The Hashprice Index in USD indicates whether a fleet of miners can be profitable given their overall efficiency and cost of energy, while the Hashprice Index in BTC is inversely correlated to network hash rate and signals increasing mining competition in the space as the Hashprice Index falls.

Chart 11. Bitcoin profitability per terahash of mining power is likely to hit new lows post-halving



Sources: Hashrate Index and Coinbase.

²¹ See Luxor, [Hashrate Index](#).

Following the 2020 halving, the Hashprice Index dropped from \$0.15 to \$0.07. A similarly aggressive drop will likely follow the 2024 halving, possibly decreasing the Hashprice Index to below \$0.04 for the first time – unless there is significant bitcoin price appreciation. The newest Bitmain Antminer S21 rig released in August 2023 operates with an efficiency of 17.5 joules per terahash (J/TH) at a maximum 200 terahashes per second (TH/s). Based on the bitcoin price and network hashrate as of November 1, 2023, 1 TH/s earns approximately \$0.07 per day in revenue. To break even on the approximately \$4800 upfront cost of the S21 at those economics requires nearly one year of mining sans any operational and energy costs. This could be even longer in a post halving environment. In light of these economics, we believe that bitcoin prices have to rise for the network hash rate to continue growing post-halving, lest the network experiences a slowdown in 2H24. Miners need to pay their energy costs in fiat currency and may not be able to do so with the smaller distributions of bitcoin rewards.

Note that while electricity costs are normally significant for independent miners, institutional miners are often able to have negligible or even negative net costs for energy due to power curtailment credits, independent energy infrastructure, or other agreements with local power grids to consume excess energy supply. According to Riot's 8-K filed on November 8, 2023, the firm has a 2023 YTD cost of \$0.0137 per kilowatt hour (kWh),²² less than 10% the average cost of \$0.15/kWh in the US West South Central region.²³ During Q3 2023, Riot's net energy costs were even negative. Thus, in the short-term, we believe that the upfront cost of mining machines is more important to overall miner economics than the cost of energy for institutional miners – barring any exogenous shocks to energy markets themselves.

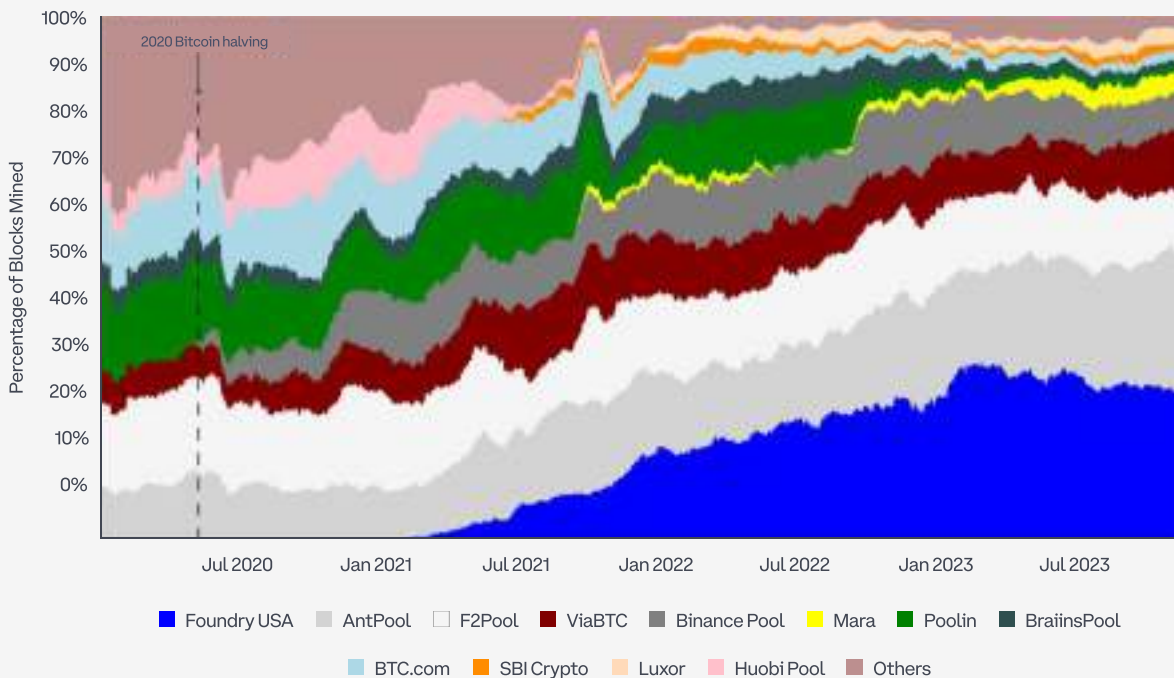
However, cheap energy costs (in the US) are subject to regulations and energy agreements. Riot's raw cost of energy without credits and special agreements hovered above \$0.03/kWh throughout 1H23. If block rewards were halved at today's hash rate, this cost could significantly eat into mining profitability. At the same time, a number of public mining companies, including Riot and Marathon, have the capacity to increase their hash rate by as much as 40% going into the halving in a move that we believe could further diminish margins.

²² See Riot. SEC 8-K filing published November 8, 2023.

²³ See BLS. [Midwest Information Office](#).

In our view, if a hash rate slowdown scenario materializes, it would be accompanied by a further consolidation in hash rate to miners located in regions with low energy costs as well as to well-capitalized miners with the ability to purchase distressed competitor ASICs (custom-built bitcoin mining computers) at discount. Already the top three mining pools – Foundry USA, AntPool, and F2Pool – control more than two-thirds of the total network hash rate. **(See Chart 12.)** While this consolidation may not pose risks in the near future, we think it is worth tracking to guard against transaction censorship and overall network stability (similar reasons to the validator centralization concerns on Ethereum and other networks).

Chart 12. A handful of Bitcoin mining pools currently dominate the network hash rate



Sources: Coinbase and Blockchain.com. Labels were assigned by looking at the top 20 miner addresses per 3 month period and looking either at their label in Blockchain.com or at their block's coinbase message. Note that the wallet labeling is not exhaustive due to the top 20 cap, but it does set a minimum floor on consolidation (i.e. some blocks mined by "Others" could have been mined by one of the labeled pools). Figures are taken on a rolling 20 day average.

TECHNICAL UPGRADES

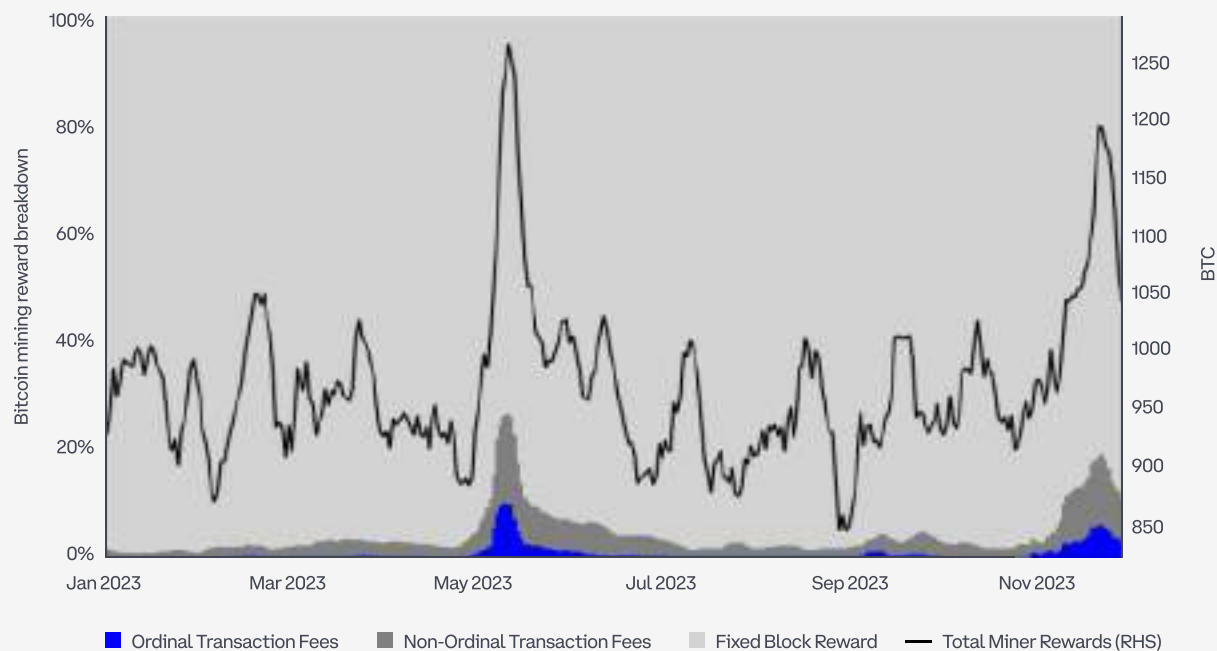
In light of decreasing fixed block rewards for miners, our view is that catalysts for raising the variable block rewards from transaction fees will be increasingly important. The core Bitcoin protocol is in a largely stable state, with the Taproot upgrade in November 2021 being the only major protocol upgrade in the past 5 years -- at least with regards to changes that have required a soft fork.

Thus, we believe usage catalysts will originate from technological innovation mostly within the confines of the existing network protocol such as increased usage of blob data like Ordinals and Atomicals, elevated activity on secondary layer 2s like the Lightning Network (LN), or general smart contract environments built on top of the Bitcoin network like Rootstock, Stacks, RGB, or future implementations of BitVM.

Technical progress on the lightning network - perhaps the most well-known Bitcoin scaling solution - has continued this year.

The surge in transaction fees paid to Ordinals, in particular, have at times represented a meaningful proportion of block rewards – nearly 10% of all bitcoin paid to miners at its peak in May 2023. **(See Chart 13.)** The increase in Ordinals activity has a knock-on effect in driving up overall demand for blockspace and increasing non-Ordinals transaction fees as well, pushing total transaction fees to over 20% of mining rewards at times. However, the spikes in transaction fees have been intermittent, with Ordinal related fees falling to less than 1% of block rewards during the months of June and August 2023. Still, it shows promise in a future where Bitcoin transaction fees may supplement or possibly supplant block rewards as payment for miners to secure the network.

Chart 13. Bitcoin miner rewards breakdown



Source: Coinbase. Transaction fees and rewards are taken on a rolling 7 day average.

That said, we think that a future where secondary layers contribute significant revenues to the protocol may be several more years away, primarily due to the challenges of acquiring developer mindshare and attention. Stacks requires developers to learn a new programming language and execution environment.²⁴ Rootstock is EVM-compatible, but raises the question of its advantages over Ethereum or its rollups. Meanwhile, RGB is still in its nascency and BitVM's journey from an idea to a fully-fledged environment is one that will take years of research and development. (For example, see zero-knowledge technology as a prime example of implementations being a multi-year endeavor). The recently unveiled Babylon network, which enables "staking" bitcoin to secure alternative networks, could see adoption among passive bitcoin holders, although, in our view, it is unlikely to generate meaningful volumes of onchain fees due to the infrequency of transactions. Furthermore, its staking protocol is still in the very early stages, after only unveiling its minimally viable product (MVP) on November 9, 2023.

The lightning network (LN), perhaps the most well-known Bitcoin scaling solution, saw a plateau in the amount of bitcoin locked in lightning channels in 2023, slightly down from 5130 BTC at the start of the year to 5052 BTC as of end-November – in line with a drop in nodes (3% reduction) and channels (22% reduction).²⁵ That said, there have been observations of increased usage within LN itself, such as that by River Lightning whose nodes have more than tripled monthly transaction counts in 2023 YTD.²⁶ Technical progress on LN has continued with over \$400M of venture capital funding into LN-based startups throughout 2022 as well as growing support by exchanges, like Coinbase, announcing plans to support LN. Notably, Lightning Lab's release of Taproot Assets introduces a means to issue and transfer tokens (like stablecoins) on the Bitcoin network.²⁷ That said, the lightning network does not yet provide much revenue to miners since transactions are only settled at the base layer when channels are opened and closed. Thus, while we are optimistic for transformative innovation around Bitcoin in the longer term, we believe idiosyncratic factors like the halving, a potential ETF approval, and the broader macro backdrop will be the primary drivers of the Bitcoin narrative in the coming year.

²⁴ See Stacks. [Clarity Overview](#).

²⁵ See DefiLlama. [Lightning Network](#).

²⁶ See River. ["2023 Lightning Report"](#) published October 2023.

²⁷ See Lightning Labs. ["Taproot Assets on Mainnet: A New Era for Bitcoin and Beyond"](#) published October 18, 2023.

Chapter 3

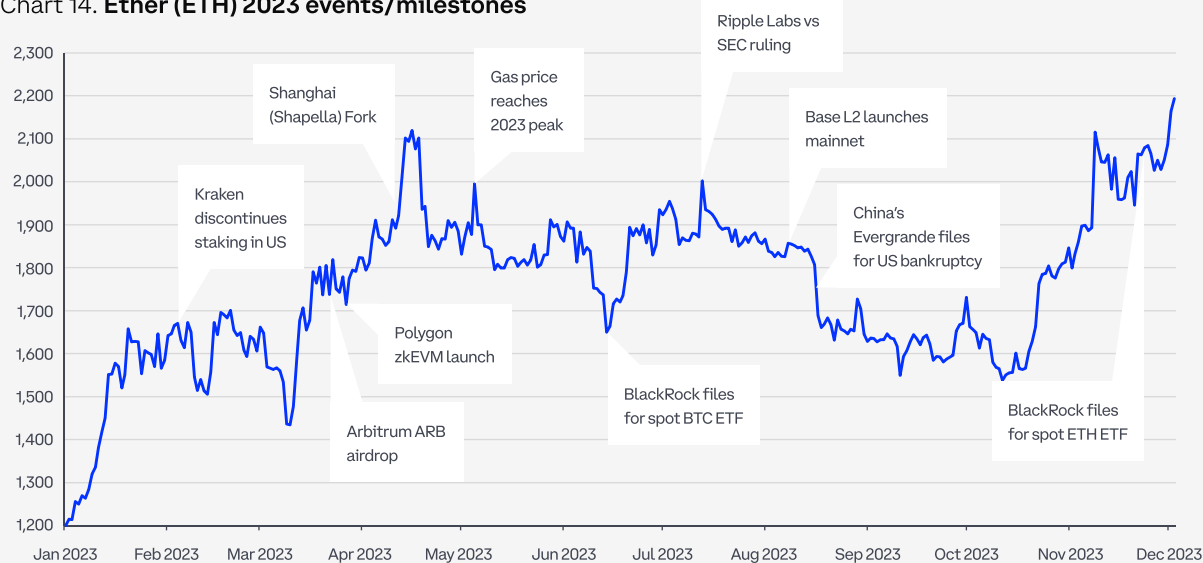
Ethereum

MARKET OUTLOOK

Ether (ETH) underperformed bitcoin through most of 2023 despite appreciating in absolute terms, with its dominance of the total crypto market cap falling from 20.4% at the beginning of the year to 17.9% as of November 30, 2023. Although we think ETH's relative discount could be the precursor to some mean reversion in 2024, the network's softer fundamentals have so far been a constraint to a meaningful correction, even if the prospects for ETH are on stable ground with one or more US-based spot ETH ETFs potentially on the horizon.

Ethereum remains one of crypto's most important smart contract platforms. But the focus on bitcoin in 2023 has led ether dominance to fall to 18% of the total crypto market cap.

Chart 14. **Ether (ETH) 2023 events/milestones**



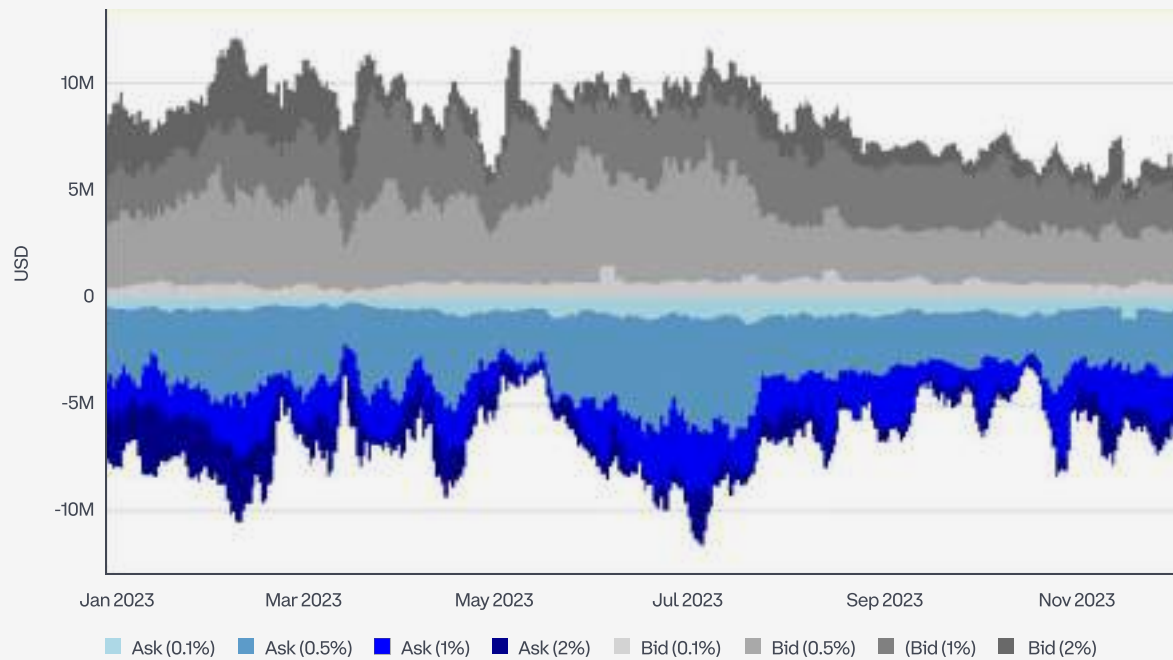
Sources: Coin Metrics and Coinbase

For example, total transaction revenues on Ethereum year-to-date (up to end-November) declined by 29% compared to the same 11-month period in 2022. The inconsistency in onchain activity is also making monthly ETH supply deflation inconsistent as well. On the other hand, total value locked (TVL) on the network is set to end 2023 higher than it started at \$25.8B – above the \$22.3B at the end of 2022, albeit still far below the late-2021 peak of \$108.1B. Note that onchain activity on Ethereum aligns with the overall trend observed across the broader smart contract space, based on multiple metrics.

Nevertheless, despite the preponderance of other layer-1 and layer-2 networks, Ethereum remains crypto’s most important smart contract platform, and so far, the evidence in 2023 suggests this role may not be displaced anytime soon. Ethereum has continued to process an average of around 1M transactions per day – relatively unchanged since late 2020, with a consistent daily average transfer volume between \$1B to \$3B²⁸ – despite rollup adoption. While the transaction count on L2s is outpacing Ethereum in aggregate, ETH burn continues to be driven primarily by base fees from mainnet activity. That said, the total execution transaction fees paid on rollups have increased from 3% (of all transaction fees) at the start of the year to an average of 9-10% in 2H23, suggesting users are in fact using L2s to transact in the Ethereum ecosystem.

²⁸ See Glassnode. [Ethereum: Total Transfer Volume \[USD\]](#).

Chart 15. **Ethereum market depth on Coinbase platform**



Sources: Coin Metrics and Coinbase. Rolling 5 day average.

Note that the Cancun/Deneb (Dencun) Fork is planned for sometime in 1Q24 and may reduce fees on L2s by another 2-10x with the implementation of Proto-Danksharding, which creates new data space on blocks called blobs. But we believe that Proto-Danksharding is unlikely to fundamentally alter ETH’s tokenomics, especially when compared to The Merge or the Shanghai/Capella (Shapella) Fork. For example, after the Shanghai Fork formally enabled staked ETH withdrawals, demand for staking far outpaced the demand for exits, contributing to a net inflow of almost 9M ETH between April and November 2023. That has consequently lowered the ETH reward rate by 80bps from the start of the year to around 4.00% as of end-November.²⁹

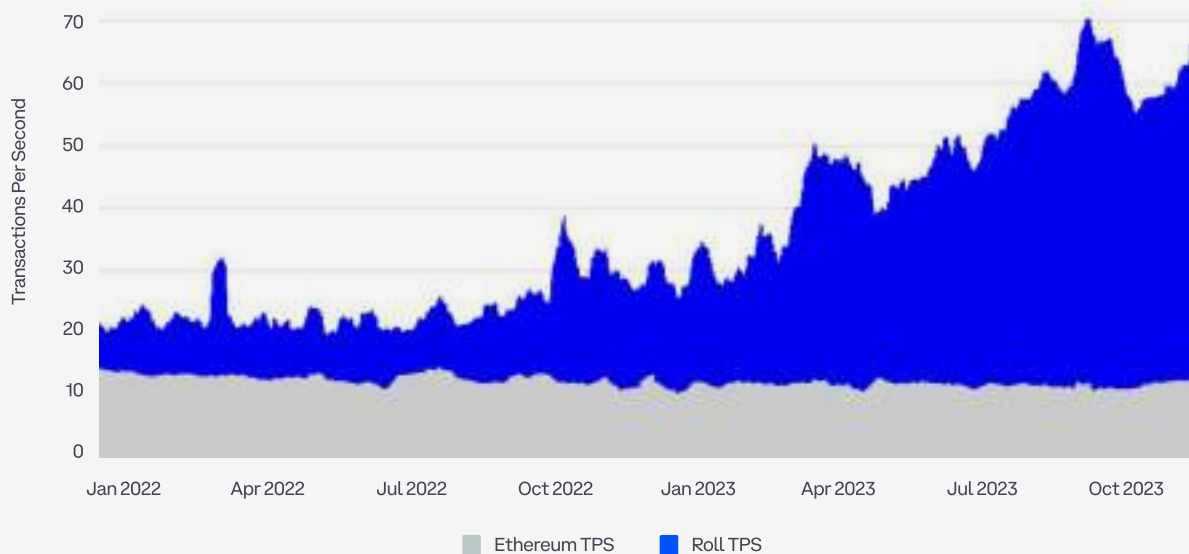
Where Cancun may directly affect ETH tokenomics is in proposal EIP-7514 (see “Future upgrades” section), which introduces a cap on the maximum churn limit for new validators per epoch. Because Ethereum has hundreds of thousands of validators, significantly more than most networks, there's a burden on the network to support such a large active set. So if too much ETH is staked, it risks destabilizing the network. EIP-7514 is a step towards finding a permanent solution to constraining the ultimate validator set size. Restricting the pace at which validators can enter the network can theoretically slow the amount of ETH that gets locked up by lengthening the entry queue but also potentially keep staking yields stable for longer.

²⁹ Based on [Composite Ether Staking Rate \(CESR\)](#) developed by Coinfund and CoinDesk.

After the Shanghai Fork, demand for staking far outpaced the demand for exits, leading to a net inflow of ~9M ETH between April and November 2023.

This proposal may take on added significance ahead of spot ETH ETFs being reviewed in the US next year. This is because these products have the potential to attract a new institutional audience, who may have an interest in staking their ETH holdings to earn passive income.

Chart 16. Realized transactions per second for Ethereum and rollups

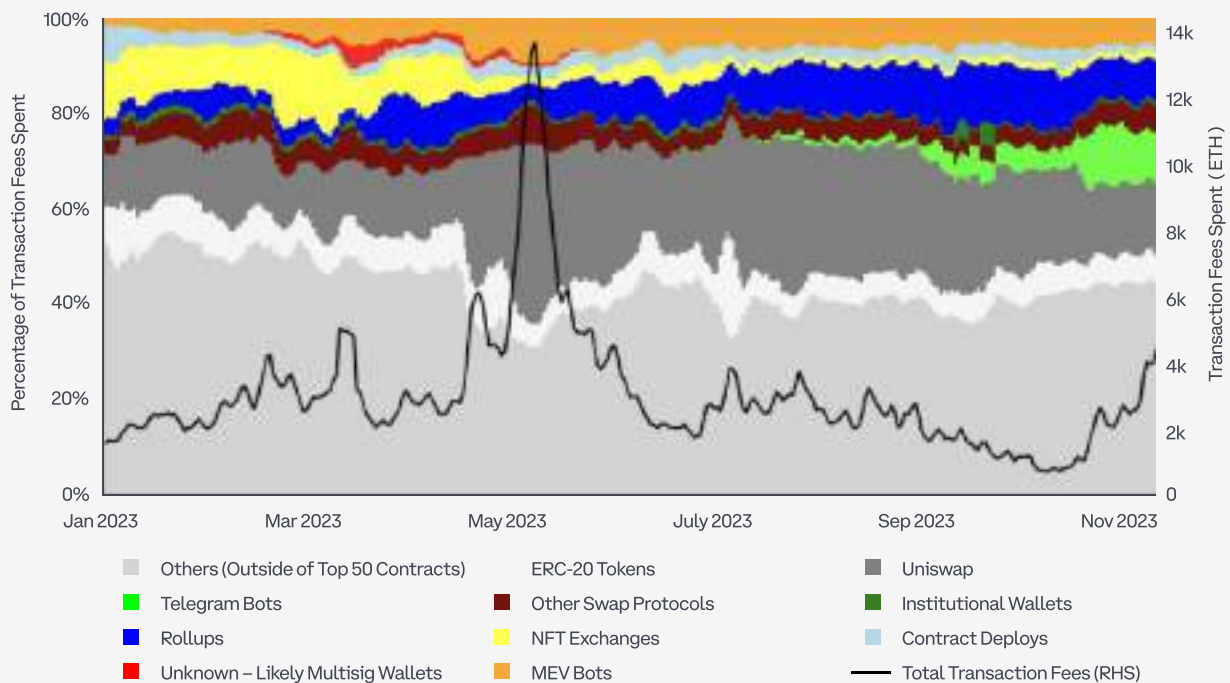


Sources: L2Beat and Coinbase. Transactions per second are taken on a rolling 10 day average.

NETWORK ACTIVITY

Demand for Ethereum blockspace has shifted increasingly towards DeFi and other financial related activity in 2023, accounting for more than 40% of all transaction fees on the network as of the end of November. **(See Chart 17.)** The rise of Telegram bots such as Maestro, Banana Gun, and Unibot (otherwise known as “sniping tools”) this year, for example, highlights the shift towards consumer-focused interfaces for tracking and trading crypto markets. In particular, the sudden tripling of Telegram bot transaction fees occurred at the same time that Uniswap’s interface fees went live on October 17, 2023, showing a rise in competition for convenient, low-fee interfaces. Comparatively, rollup demand for Ethereum blockspace has remained relatively steady throughout 2H23.

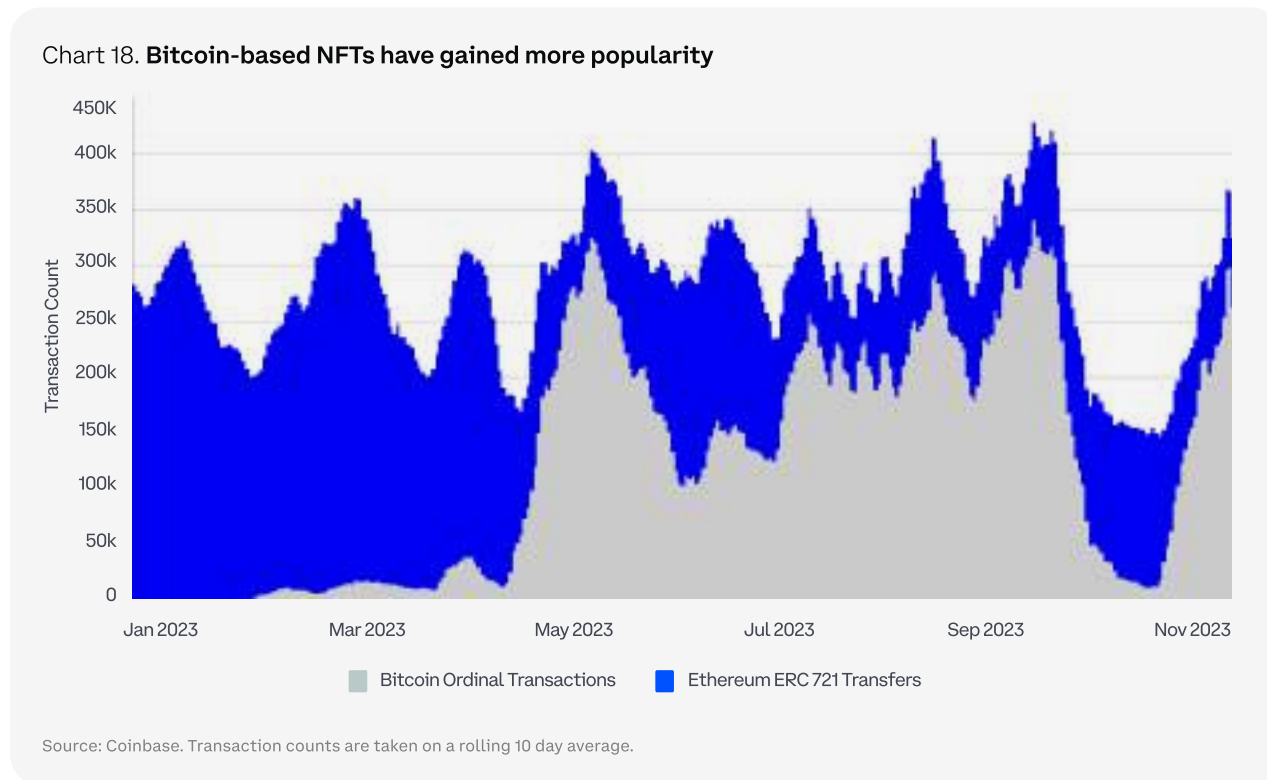
Chart 17. The top 50 contracts on Ethereum account for more than half of all transaction fees spent



Sources: Coinbase and Etherscan. Chart is produced by taking the top 50 gas consuming contracts from January 1, 2023 to November 14, 2023 and categorizing them. Transaction fees are taken on a rolling 5 day basis. Note that this only measures transaction fees consumed by the contract called and does not account for subsequent internal transaction calls.

There also has been a notable drop in blockspace demand for NFT-related transactions throughout 2Q23, which the sector has not yet recovered from. While this was caused in part by a decrease in overall NFT activity, we also believe that a large portion of NFT activity has shifted to bitcoin Ordinals which saw its initial surge in volume over April and May 2023, around the same time Ethereum NFT gas demand dropped. **(See Chart 18.)**

During the drop in Ordinals activity in early October following debates on deprecating Ordinals in favor of Runes, NFT activity on Ethereum somewhat recovered.³⁰ However, Ethereum-based NFT activities fell again with the recovery of Ordinals activity in late October.



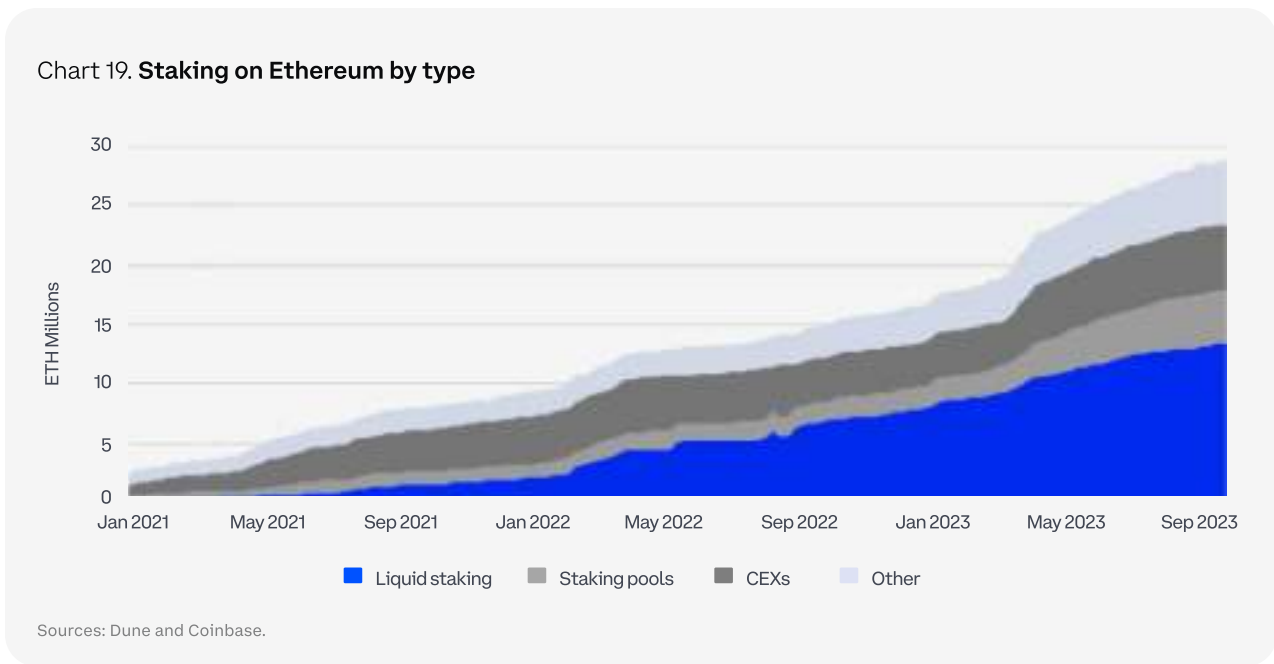
STAKING

Staking on Ethereum has increased by over 57% following the Shanghai Fork in April 2023, which formally enabled withdrawals of staked ETH and effectively signaled the completion of The Merge – the blockchain’s transition to the proof-of-stake (PoS) consensus mechanism. As of end-November 2023, there are 882k active validators that have locked up 28.2M ETH, which is around 23.5% of the total 120.3M ETH supply in circulation – up from 12.9% at the end of 2022. At the moment, there appears to be very little congestion in the validator entry and exit queues, signaling that we’ve potentially reached a short-term equilibrium as far as investor demand for Ethereum staking is concerned.

³⁰ See Coinbase Research. [“Weekly: Constructive for Q4”](#) published September 29, 2023.

Indeed, immediately following the Shanghai Fork, validator entry queues were at peak capacity for several months, leading staking yields to drop from 4.75-5.00% to 3.75-4.00%, as the base reward is inversely proportional to the square root of the total balance of all validators. This suggests that current rates may be the provisional threshold for new entrants given the risks involved, such as opportunity costs, lock-up periods, and slashing. This is important as the base rate on staked ETH provides a floor for the crypto ecosystem, in our view, providing a benchmark for alternative crypto investments.

However, we believe there is room for the staking ratio to grow, even if it remains below the 50-75% (of token supply) observed in other alternative layer-1 networks. The prospect of spot ETH ETFs in the US, for example, is spurring more discussions about whether these could result in more demand for ETH staking. That said, there are still outstanding impediments to incorporating staking into ETF workflows, such as concerns surrounding withdrawal periods, legal ambiguity, custody, and tax accounting.³¹ But we think this may be an opportunity for liquid staking in particular as this service can help mitigate the potential issues that may arise around redemptions and liquidity risk. Currently, the total market cap of liquid staked ETH tokens equals 13.5M ETH, representing 47% of all ETH staked on Ethereum.



³¹ We've previously covered some of the regulatory concerns surrounding staking in our report "Growth of the Liquid Staking Market" published November 7, 2022.

FUTURE UPGRADES

Cancun (Dencun) Fork

Ethereum remains a work in progress, where one or more annual upgrades can be expected in the years ahead to scale the network and address potential centralization issues, among other things. The next big upgrade is the Cancun/Deneb (Dencun) Fork, which focuses heavily on Proto-Danksharding as part of Ethereum Improvement Proposal (EIP) 4844. While this upgrade was expected to be activated in 2H23, implementation has been pushed back to 1Q24 to give developers more time to sufficiently test new features. Indeed, upgrades following The Merge have become more complex because the protocol has itself become more complex, so it's possible that delays may become more common going forward.

Proto-Danksharding is the precursor to full Danksharding, whose ultimate vision is to enable massive rollup scaling by increasing the storage capacity on Ethereum for compressed transaction data. Proto-Danksharding lays the groundwork for this by introducing most of the scaffolding logic for the full Danksharding specifications including (1) a new binary large objects (blob) transaction type, (2) uplifted execution-layer and execution/consensus cross-verification logic, (3) updated beacon block logic, and (4) an independently adjusting gas price for blobs.

The introduction of blobs is expected to increase the average block size more than three-fold from ~150 kB to ~0.5 MB (assuming the target 3 blobs per block out of the 6 maximum), enabling more rollup data to be compressed into each block at cheaper costs.³² Furthermore, the separation of blob gas pricing from calldata transactions minimizes the impact that congested L1 executions will have on L2 transaction prices.

In order to minimize excessive disk usage, blobs are deleted after approximately 2 weeks – long enough for L2s to retrieve and verify the data, but short enough to keep usage manageable. This enables blobs to be priced cheaper than typical transaction calldata, which is stored indefinitely. Dencun is likely to lower rollup transaction costs by 2-10x depending on blob space demand, although the impact requires rollup upgrades in addition to the mainnet release. But optimizing rollups to integrate EIP-4844 blob storage is a non-trivial task, and while we expect these developments to be completed in time for a 1Q24 Dencun release, the upgrades may not be released in tandem with the mainnet release.

³² See Etherscan. [Ethereum Average Block Size](#).

Further optimizations for blob data sharing strategies between rollups are also undergoing research, which could theoretically lead to further gas cost reductions.³³ Still, we anticipate realized benefits for reduced rollup fees sometime in 1H24.

Depending on the result of these fee reductions, we believe this could materially increase onchain activity and unlock new use cases. A significant reduction in fees would make it more economically viable for L2 projects to improve user experience by paying for user funds via account abstraction. (Currently the majority of ERC-4337 smart account transactions occur on Polygon PoS, which is about 10x cheaper to use than existing rollups.³⁴) An uptick in L2 activity, however, is unlikely to result in a meaningfully increased burn rate of ETH in our view. Rollup sequencers currently contribute less than 10% of the total gas fees on the Ethereum mainnet, and it is unlikely for this ratio to push higher following the Dencun upgrade without a corresponding increase in transaction activity.

The Cancun (Dencun) Fork is expected in 1Q24 and could lead to 2-10x declines in rollup transaction costs.

Validator churn limit. In addition to EIP-4844, EIP-7514 also changes the network dynamics by reducing the max validator churn limit to 8. Currently, the maximum number of validators that can enter or exit per epoch (a period of 32 slots, approximately 6.4 minutes at 12 seconds per slot) is 13, but this number is dynamic based on the size of the active validator set – for every 65,536 additional validators, the churn limit is increased by 1 to accommodate demand. However, if the active validator set becomes too large, the network could become destabilized from the load. That is, with more validators, it becomes harder to send P2P messages on the network. There may also be more BLS signatures that need to be aggregated to each block, thus potentially increasing the Beacon Chain memory footprint. So reducing the validator set size can help mitigate these issues. While EIP-7514 does not directly solve the problem of active validator counts, it does slow down the growth of validators while long-term solutions are discussed.

That said, in our view, a max limit churn of 8 is unlikely to have any realized impact on the effective pace of validator activation in the very near term – barring any significant catalysts that drive up staking demand. Potential drivers that could cause this, such as significant restaking yields or a spot ETH ETF with staked ETH, are still in relatively early phases. A churn rate of 8 still enables 57,600 ETH to be staked each day – accommodating more than \$115M of daily staking demand at a price of \$2000 ETH.

³³ See Arxiv, “EIP-4844 Economics and Rollup Strategies” published October 2, 2023.

³⁴ See Dune, [ERC-4337 Smart Accounts](#).

Since the validator entry queue first emptied out in mid-October 2023, the effective churn rate has been approximately 2.9 on average between October 15 and November 15. Thus, while EIP-7514 is a precautionary measure, we do not think it will constrain validator onboarding significantly.

Restaking (security-as-a-service)

In our *2023 Crypto Market Outlook*, we alluded to the growth of middleware solutions that could introduce a new revenue stream for ETH validators in the form of “security-as-a-service”.³⁵ Effectively, the concept of “restaking” by EigenLayer could be a way for validators to secure new features in Ethereum – like data availability networks, rollups, bridges, oracles, etc – or even secure other networks, possibly earning additional rewards in the process.³⁶ Developers would benefit by having their middleware run and be secured by Ethereum’s validators, avoiding the more time-intensive alternatives of either changing the Ethereum network or launching their own new protocol.³⁷

EigenLayer’s release occurs in 3 phases: (1) stakers onboard liquid staking tokens, namely stETH, rETH, and cbETH, (2) node operators receive delegation from restakers, and (3) services onboard to become actively validated services (AVS).³⁸ Stage 1 was completed in June 2023 and hit three rounds of increased staking limits for a current TVL of approximately \$205M. Stage 2 is currently in testnet along with EigenDA, the first AVS for data availability. Both stage 2 and stage 3 are expected to be completed in 2024.

A number of protocols have made plans to incorporate EigenDA as their data availability layer including established networks like Celo and Mantle as well as upcoming rollups like Fluent, a zkWASM rollup. We believe that EigenDA could be a strong competitor to Celestia for rollups seeking a scalable and cheap data availability layer due to its tight integration with Ethereum and the economic security that brings.

Yet despite these promising developments, there have been concerns raised around the threat restaking could pose to Ethereum, most notably by Vitalik Buterin (the co-founder of Ethereum) who notes that overloading Ethereum consensus could lead to forks in certain scenarios, particularly when the economic value secured by restaking passes a certain threshold.³⁹

³⁵ See Coinbase Research, “[Crypto Market Outlook 2023](#)” published December 20, 2023.

³⁶ Note: Coinbase Ventures provided Series A funding to EigenLayer in March 2023.

³⁷ See EigenLayer Team, “[EigenLayer: The Restaking Collective](#)”

³⁸ Note: Coinbase Cloud is part of EigenLayer’s Operation Work Group and is participating in the testnet. See [announcement](#) on X.

³⁹ Vitalik Buterin’s Blog, “[Don’t overload Ethereum’s consensus](#)” published May 21, 2023.

While these scenarios are a concern, the competition of protocols in the middleware space makes it unlikely any one of them will voluntarily reduce their activity. In our view, this danger can largely be avoided as long as (1) restakers carefully evaluate new AVSs and (2) AVSs do not control large amounts of value relative to that staked on the Ethereum network.

The next big thing: in addition to selling blockspace, security-as-a-service could be a new revenue stream for Ethereum validators.

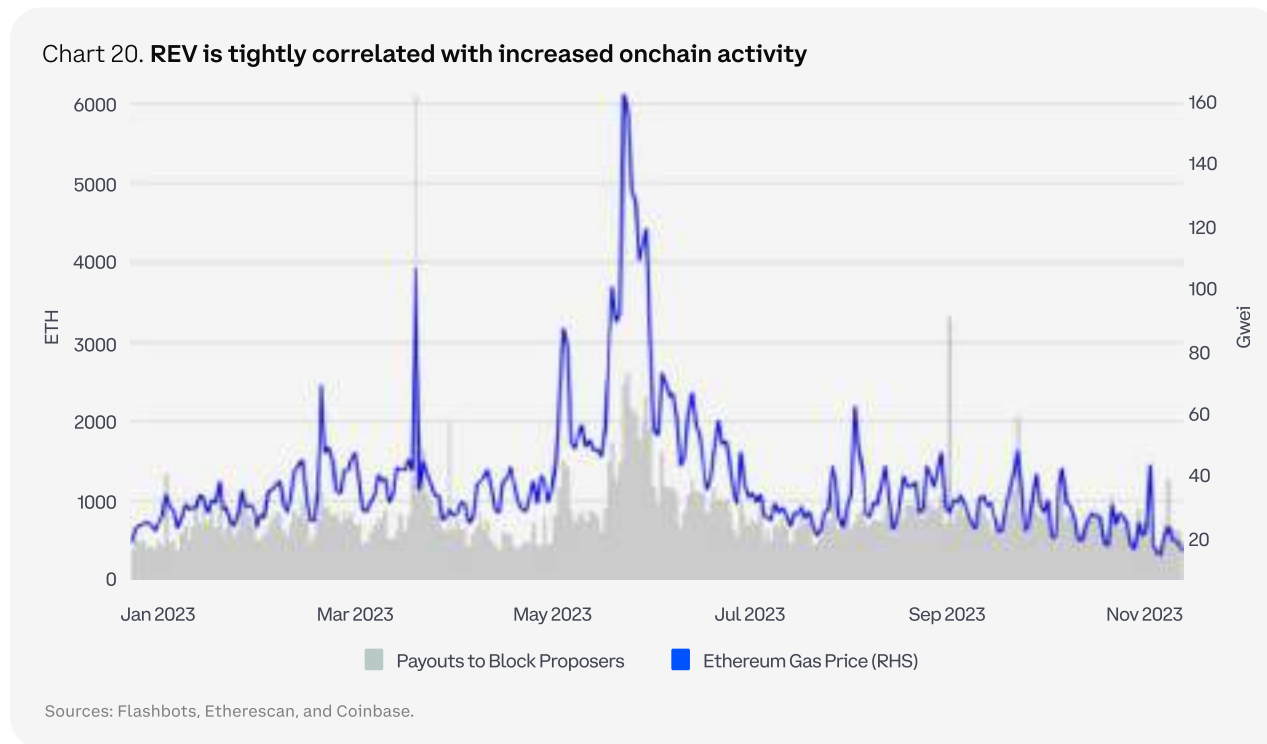
Proposals on the Frontier

Restricting validator growth. Above, we discussed why having an infinitely increasing validator set can harm the network through centralization and increased reorgs. Perhaps the most discussed long-term solution for this is EIP-7251, which would economically incentivize a contraction in the active validator set by increasing the maximum stake of a validator to 2048 ETH while retaining a 32 ETH lower bound. Large validators would be able to consolidate to fewer validators and thus fewer beacon nodes, while smaller validators would be able to compound their rewards with more flexibility in staking increments. This does not guarantee consolidation, but may lower operational costs and – as the authors of EIP-7251 point out – is a prosocial behavior that aligns with the Ethereum roadmap. Alternative proposals such as creating a hard limit on the validator count are also being discussed, though there has been no consensus at this time on the path forward.

Updates to MEV. Maximal extractable value (MEV) refers to the profit that validators can earn via their ability to order (and re-order) transactions in a block. Some forms of MEV are neutral or even relatively benign like buying and reselling discounted ETH during liquidations of margin-called loan positions. This can help ensure price stability in the market. MEV can also take advantage of arbitrage opportunities between exchanges, which can help improve price discovery. However, other forms of MEV can be seen as malicious, like front-running trades or “sandwich attacks.” The latter is a more aggressive form of front-running that levers users’ market orders to artificially inflate prices for designated sellers, causing price slippage for the network’s users.

One of the issues with MEV is that it can create negative externalities. For example, from the validator perspective, MEV rewards depend on the level of network activity at any given time, meaning extraction opportunities may vary.

A validator proposing blocks in one epoch may be able to earn a lot of MEV, while in another epoch, a different validator may only earn a negligible amount. Larger validator sets may benefit because they can smooth MEV rewards among all stakers, but solo stakers could either be very lucky or unlucky with regards to the uneven distribution of their MEV rewards.



At least 366,000 ETH of value has been extracted from the ecosystem since The Merge, translating to a daily payout to block proposers of approximately \$1M in realized extractable value (REV) – a term coined by Flashbots to quantify the observed value extracted from the blockchain from REV opportunities.⁴⁰ As onchain activity (measured by gas price) increases, so too does REV.⁴¹ **(See Chart 20.)** Measuring payouts to block proposers is generally a conservative floor for estimating the amount of REV capture in a system, as other creative ways to capture value are difficult to measure consistently.

Solutions for minimizing the negative externalities of MEV are being developed at various levels ranging from the base Ethereum protocol to application design changes. At the base protocol level, there is an active and ongoing discussion on incorporating MEV-burn dynamics into the enshrined proposal builder separation (ePBS) proposal, which may obviate the need for a separate MEV-Boost system, but may still require out-of-protocol relays.

⁴⁰ See Flashbots. "Quantifying Realized Extractable Value" published May 15, 2021.

⁴¹ See Flashbots. "Modelling Realised Extractable Value in Proof of Stake Ethereum" published September 2022.

Other MEV protection products like Protect by Flashbots and MEV-Blocker by CowSwap aim to protect users from certain forms of MEV like sandwiching, while also enabling users to receive a payout from any MEV generated by searchers backrunning their transactions. At the application level, intent driven architecture, such as that in Uniswap X, can also minimize the negative impacts of MEV on user experience by pitting MEV searchers against each other for the benefit of the user.

In our view, one of the largest open problems exposed by MEV is the centralization of sophisticated block builders and relays. Centralization of block builders could lead to transaction censorship, and Blocknative's shutdown of their MEV-boost relays and other research suggests that the economic role of relays may have been somewhat overlooked.⁴² While it is unlikely that an upgrade to address these issues will go live in 2024, a future upgrade introducing a carefully designed ePBS implementation and possibly MEV-burn could alleviate some of these issues. In the meantime, to combat builder centralization, Flashbots is developing its Single Unifying Auctions for Value Expression (SUAVE) protocol to decentralize the block builder role. SUAVE is an adapted EVM chain that can act as a plug-and-play mempool and decentralized block builder for any blockchain, and is slated for release in 1H24.

⁴² See Arxiv, "[Ethereum's Proposer-Builder Separation: Promises and Realities](#)" published September 24, 2023.

Chapter 4

The L1/L2 Landscape

There were some major developments in the layer-2 (L2) landscape in 2023 including an increase in rollup adoption as well as variations on the modular blockchain theme such as Celestia's launch and Eclipse's announcement to glue together Ethereum, Celestia, RISC Zero, and the Solana Virtual Machine (SVM). At the same time, however, highly performant integrated (or monolithic)* blockchains have also made significant strides towards scalability. The unveiling of Solana's Firedancer client (which may go live in mid-2024) demonstrated the feasibility of massive scaling via hardware optimizations, for example.

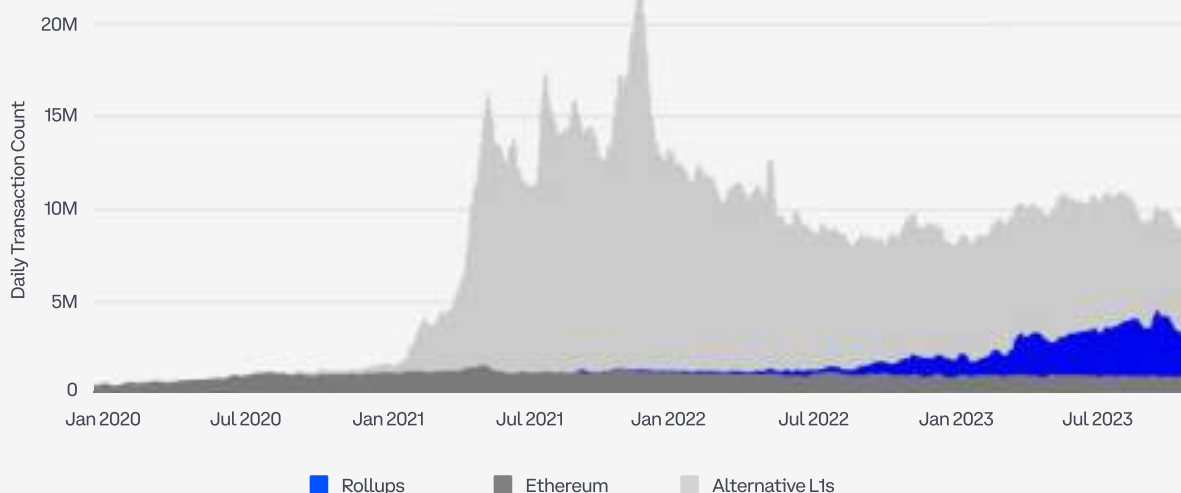
Where do developers want to build? The landscape for L1s and L2s has changed dramatically over the last two years.

We doubt the multi-year debate between the modular vs integrated approach to scalability will have any explicit resolution in the near term, but our view is that the more important question is where do developers believe it will be easiest to support their application requirements – ranging from developer tooling and asset availability to transaction fees and throughput. We believe developer mindshare is a key leading indicator for building products and interfaces, which compounds network adoption in a flywheel effect around liquidity and cross-protocol interoperability.

ROLLUP DOMINANCE

Despite a number of newer alternatives, the Ethereum Virtual Machine (EVM) remains by far the largest developer ecosystem within crypto. Within networks running the EVM, we have seen a continued shift in activity from alternative layer-1s (L1s) to layer-2 rollups. At the same time, activity on the Ethereum mainnet measured by daily transaction count has remained steady at roughly 1M per day. **(See Chart 21.)** As mentioned earlier, we believe that the fear of L2s cannibalizing Ethereum mainnet activity has not yet been realized – this cannibalization has instead occurred predominantly against alternative L1s.

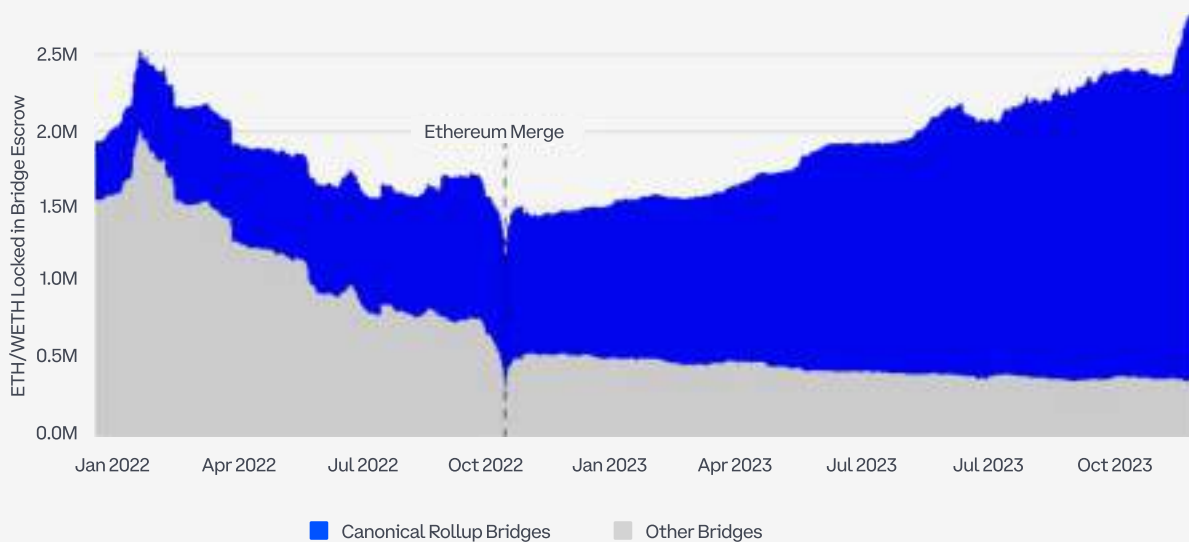
Chart 21. Onchain activity has been gradually shifting from alternative EVM L1s to L2s



Sources: Dune and Coinbase. Rollups tracked are Arbitrum, Optimism, zkSync, and Base. Alternative L1s tracked are Polygon PoS, Avalanche C-Chain, Binance Smart Chain, and Fantom. Transaction counts are taken on a rolling 10 day basis.

While the transfer of activity (measured by transaction counts) seems gradual, the transfer of liquidity paints a much more aggressive shift. The amount of ETH bridged to rollups has nearly doubled in 2023 from 1.1M ETH to 2M ETH, while the quantity of ETH locked in other bridge contracts dropped 20% YTD from 490k to 390k ETH. **(See Chart 22.)** In our view, tracking bridged ETH more accurately reflects shifts in long term adoption because the network effects of liquidity, particularly in DeFi applications, are extremely sticky. We also think that the outsized growth of bridged ETH to rollups in 2023 suggests that users are increasingly comfortable with the security guarantees of canonical rollup bridges.

Chart 22. The amount of ETH locked into rollups continues to increase



Source: Coinbase. Canonical rollup bridges tracked are Arbitrum, Optimism, Base, zkSync Era, StarkNet, immutableX, Linea, Mantle, PolygonZk, and Scroll. Other bridges tracked are Polynetwork, Multichain, Nomad, Harmony, Polygon PoS, Avalanche, Wormhole, Stargate, Omnibridge, Mantle, Rainbow Bridge, Gravity, Hop, Across, Connex, Symbiosis, Axelar, Ronin, and Celer.

As mentioned previously (see Ethereum section), this uptick in L2 activity has not resulted in a significant increase in Ethereum transaction fees due to the cost saving nature of rollup transactions. Rollups in aggregate constituted more transaction volume than Ethereum, yet typically account for less than 10% of the daily transaction fees paid to the network. To put this into perspective, the transaction fees paid to the Arbitrum Sequencer over 2023 was similar to that spent on the Metamask Swap Router (19.3k ETH vs 18k ETH), though Arbitrum had more than 100 times the number of transactions settled on it compared to the number of transactions interacting with Metamask’s router (329M transactions vs 2.7M transactions in 2023).⁴³

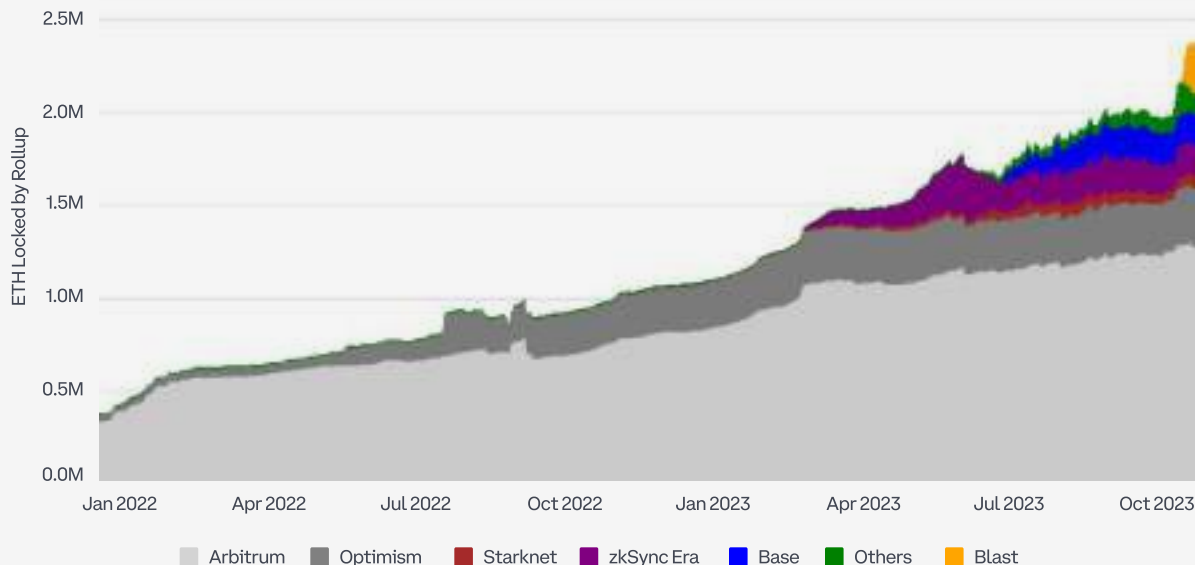
⁴³ See Etherscan. [Arbitrum Sequencer](#) data and [Metamask Swap Router](#) data.

ROLLUP CONSOLIDATION

The launch of more than a dozen EVM-compatible rollups puts into question the unique value proposition of each new rollup. The advent of rollup technology stacks (such as OP Stack, Polygon CDK, or Arbitrum Orbit) and rollup-as-a-service providers (such as Caldera and Conduit) – designed to facilitate the development of customized L2 networks – is only accelerating this trend. In our view, this is reminiscent of the L1 EVM launches in 2020-21, each purporting to have its own solutions to scalability. Most activity ultimately consolidated across a handful of chains, driven by their unique premises and developer outreach. Strategies for rollup differentiation have been similar and range from creating different execution environments such as StarkNet’s CairoVM to attracting developers and launching unique protocols such as friend.tech on Base.

In our view, the EVM-based rollup space is becoming congested with most new entrants finding it difficult to attract significant market share. **(See Chart 23.)** Take zero-knowledge (ZK) rollups for example. These have not yet been able to take significant market share from Optimistic rollups because their transaction fees and realized transactions per second (TPS) are not meaningfully lower compared to optimistic rollups, although this may change in the future. For now, what differentiates native ZK bridges from optimistic bridges is mainly instant withdrawals, and it doesn’t yet seem like that’s a significant enough improvement, given that third party bridges unlock similar functionality for optimistic rollups. The rapid expansion of ETH locked into the not-yet-released Blast L2 also represents user demand for earning yield and may signal a new opportunity for the more than \$2B ETH locked in bridges to become productive assets.

Chart 23. Liquidity is concentrated within a small number of rollups



Source: Coinbase. Other rollups tracked are ImmutableX, Linea, Mantle, Polygon ZK, and Scroll

More than half of all rollup bridged ETH is currently attributed to Arbitrum. In our view, this concentration of activity is primarily driven by its first mover advantage as well as its enhanced security with live fraud proofs. Fast second movers like Optimism, institutionally backed chains like Base, and the first-mover zkEVM rollup, zkSync, have also seen substantial adoption. Starknet has seen increasing traction as well, although it had a slow start partially due to the overhead of its new CairoVM developer environment, which extended application development timelines. As the leading rollups continue with their plans for improved security and decentralization, we foresee this consolidation pattern generally continuing throughout 2024.

DEVELOPER ACTIVITY AND EVM RELATIONSHIPS

In the crypto space, we often see developer activity on L1s and L2s measured by the number of commits, active developers, or lines of code added on Github. For example, Electric Capital maintains an Open Source Crypto Taxonomy that covers over 226k crypto repositories.⁴⁴ Their latest developer update from October 2023 suggests that there are currently around 19.3k monthly active open source developers, which is a 27% decline from last year but still 66% up from the previous bear market three years ago.⁴⁵

⁴⁴ See Electric Capital. [Open-Source Crypto Taxonomy in GitHub](#).

⁴⁵ See Electric Capital. ["October 2023 Developer Update"](#) published October 18, 2023.

Nevertheless, collecting this data can be time consuming and labor intensive, while there are several limitations of such heuristics –

- determining how to associate project repositories with specific chains can be very difficult, as projects may build on private repositories or without clear labels,
- commits may only reflect routine changes and not necessarily new functionality or meaningful progress,
- developer counts do not reveal whether projects involve “10x engineers” who do disproportionately more work than others, and
- more lines of code could be a sign of poor code structure rather than new features.

Thus, ascertaining a transparent picture of developer activity has continued to be a challenge in this space. Instead, we think that an alternate heuristic for developer activity could be combining two key onchain metrics: (1) the number of unique addresses that have deployed contracts with at least one interaction post-deployment, and (2) the percentage of total gas demand that these deployments consume. Note that we only include contracts that have at least 1 interaction post deployment to eschew contracts that might be deployed in error.

We introduce a new measure of onchain developer activity that may offer a different perspective from Github repository statistics.

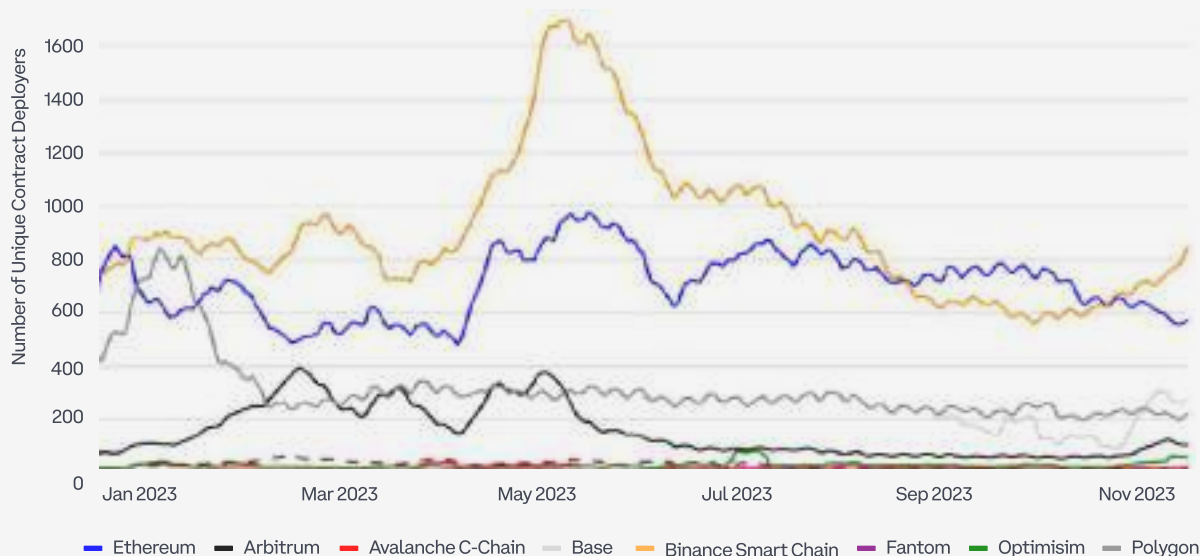
We believe that this measure is a more neutral standard and one that more accurately shows developer trends in an ecosystem because every application needs to be deployed onchain amidst existing network activity. Ethereum provides a strong baseline measurement of developer activity as it consistently has over 500 unique addresses deploying contracts each day, taking up around 1.5% of blockspace demand. We believe this signals that a large amount of innovation and activity within the EVM space still primarily takes place on the Ethereum mainnet, likely due to its liquidity advantages and high protocol composability. Indeed, with the exception of Base's outperformance, we see greater developer activity trend towards chains with higher TVL.

As an example, the meme coin frenzy during May 2023 saw a notable increase in both the number of unique contract deployers and the proportion of gas spent on contract deployments on Ethereum, Binance Smart Chain, and Arbitrum. In our view, this surge was reflective of a collective increase in creating new ERC-20 tokens, initializing liquidity pool contracts, and deploying more onchain bots during that time. These three chains had the deepest liquidity and most active trading venues at the time, which explains why similar upticks in activity were not seen on other EVM chains.

Following the May peak, however, we saw a heavy decline in developer activity in both Arbitrum and Binance Smart Chain, while Ethereum developer activity has been comparatively tenacious despite having the highest transaction fees.

In our view, this is reflective of the sustained innovation on and interest in the Ethereum mainnet. Among rollups, Base is a notable outperformer and has continued to retain outsized developer activity throughout several months after its launch. Despite having overall lower TVL and DeFi activity, we believe this outperformance arises from its efforts in attracting developers to create novel applications.

Chart 24. Number of unique contract deployers



Source: Coinbase. Deployer address counts are taken on a rolling 5 day basis. Only includes contracts that have at least 1 interaction post deployment. Base stats only begin on 1 September to normalize for an overweighting of contract deployments in its first month post-launch.

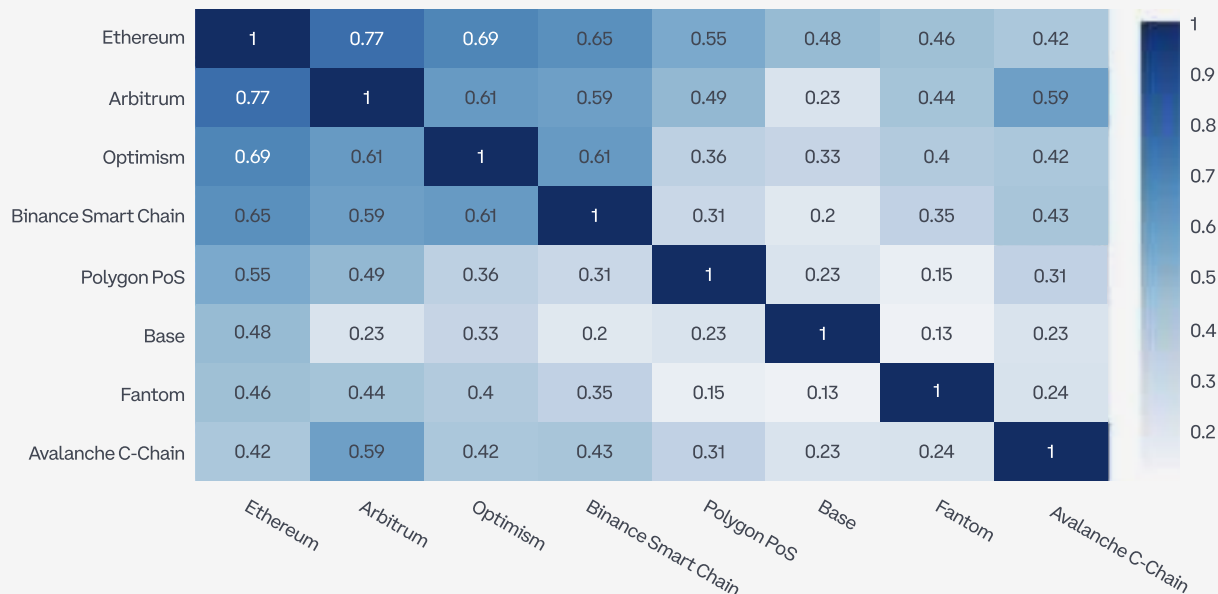
Chart 25. Percentage of transactions fees spent on creating contracts with at least one interaction



Source: Coinbase. Transaction fee percentages are taken on a rolling 5 day basis. Only includes contracts that have at least 1 interaction post deployment. Base stats only begin on 1 September to normalize for an **overweighting** of contract deployments in its first **month** post-launch.

While rollup adoption continues to increase, we’ve also seen differentiation between other major EVM chains and Ethereum regarding usage and demand as measured by transaction fee variability. **(See Chart 26.)** The high correlations between transaction fee usage on Ethereum and transaction fee usage on Arbitrum/Optimism should be expected as there is a base fee cost for rollups to post data to mainnet. However, the relatively lower correlation between Base and Arbitrum/Optimism fees suggest that blockspace demand is driven by applications of different natures as fees spike at different times (i.e. DeFi vs SocialFi). Avalanche C-Chain and Arbitrum’s relatively higher correlation also highlights the heavily DeFi oriented nature of top protocols on these chains (TraderJoe and GMX).

Chart 26. Correlation in Transaction Fee Variability for between EVM Chains



Source: Coinbase. Correlations are computed from August 1, 2023 to November 12, 2023 to include Base launch. A correlation heatmap taken from January 1 shows a near identical correlation pattern, but with Fantom less correlated to the rest due to a massive spike in transaction fees on Fantom in mid-June.

Despite this diversification, we still foresee most EVM L1 chains either pivoting towards rollups as evidenced by Polygon 2.0’s focus on zkEVM rollups, or towards non-EVM differentiation as seen with Avalanche’s HyperSDK for building custom VMs on distinct chains. The migration of dYdX to its own chain in late 2023 via the Cosmos SDK also paves a path for scaling via application-specific chains that are custom tailored to meet niche requirements. In our view, while this direction may be suitable for some large projects with highly tailored needs, the vast majority of new applications have neither the requirements nor resources to implement application-specific chain infrastructure. We believe that most development teams will continue to focus heavily on app-specific programming rather than tackle fundamental issues around infrastructure and scalability.

OUTSIDE THE EVM

Hence, the narrative and outperformance of Solana throughout 2023 is of particular note as it has been claiming an increasingly large amount of developer mindshare. It is differentiated from Ethereum with regards to both its fundamental design philosophy of scaling via hardware and its realized transaction execution environment with sub-cent fees and localized fee markets. Solana also has a Rust-based smart contract development environment that benefits from the broader Rust developer community. Though this may cause some friction for existing smart contract developers familiar with Solidity, tools like Solang and NeonEVM ease this gap.

Solana's approach to protocol development tends towards enshrining features and complexities at the protocol level as exemplified by the native SPL token standard and massive hardware scalability. This enables application developers to spend fewer resources on infrastructure and execution optimization and also reduces the proliferation of L2 chains and their associated complexities of managing cross-chain liquidity. However, this complexity has partially contributed to its network instability throughout 2022 with more than 14 days recording partial downtime.⁴⁶ That said, Solana's network has seen major improvements to its stability with only one outage in 2023 on February 25.

Solana has claimed an increasing amount of developer mindshare in 2023 with its differentiated fundamental design philosophy.

Future Solana clients like Firedancer and Sig could further improve stability and decentralization to the network because a bug in one client is less likely to halt all processing. Solana's approach stands in stark contrast to Ethereum, whose stance has historically been to keep the protocol simple to maximize decentralization and minimize risks of systemic failure. As a result, Ethereum's network has not had any major downtime for several years, although it did experience issues with block finality several times over 2023.⁴⁷ However, more recent discussions have been hinting at a partial reversal of this trend going forward, per Vitalik Buterin's writing about the possibility of moving towards the "minimal viable enshrinement" of some complexities into the protocol.⁴⁸

⁴⁶ See Solana Status. [Update History](#).

⁴⁷ See Coindesk. ["Ethereum Resumes Finalizing Blocks after Second Performance Hiccup in 24 Hours"](#) published May 12, 2023.

⁴⁸ See Vitalik Buterin's Blog. ["Should Ethereum be okay with enshrining more things in the protocol?"](#) published September 30, 2023.

Investors have been heavily allocating to Solana throughout 2023, with net fund inflows to Solana second only to Bitcoin, surpassing Ethereum and other multi-asset funds flows.⁴⁹ In our view, this reflects a view of Solana as the technological platform of choice for a new wave of highly performant applications that cannot currently be supported on Ethereum or its rollups (though this may change in the future). Indeed, we believe that improved transaction throughput and lower fees are necessary to improve UX to onboard a series of new use cases, and Solana has an early lead in that regard.

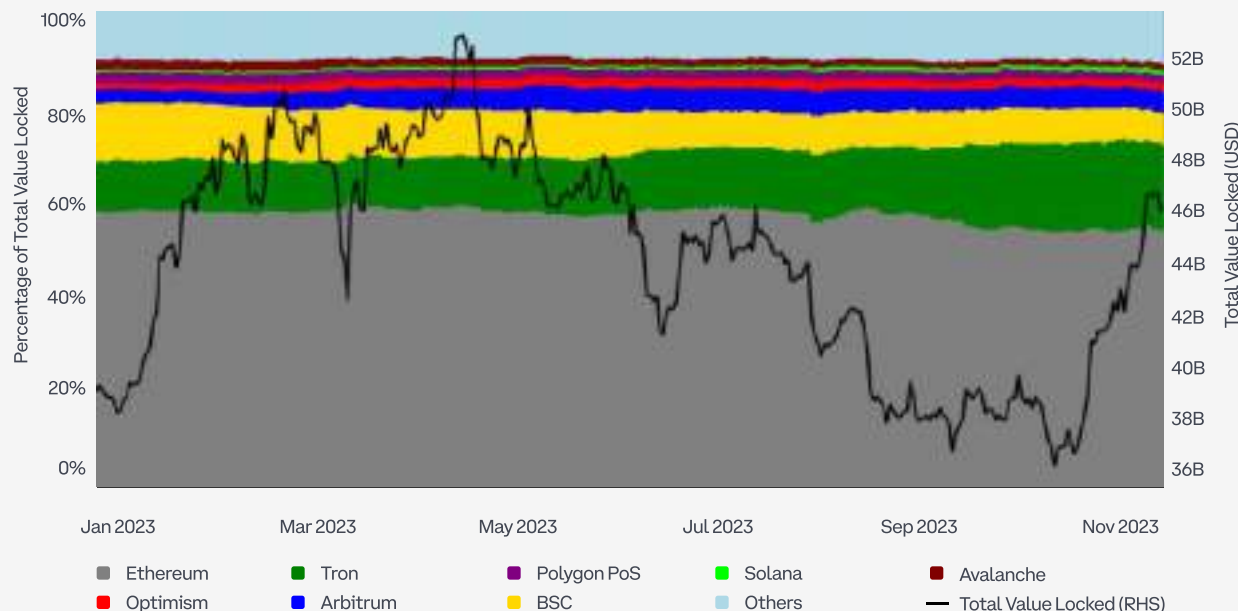
In addition to Solana, a number of recently (or soon-to-be) launched L1s including Aptos, Sui, Sei, and Monad, aim to handle scalability demands at the base layer, following an integrated approach and parallel execution processing. On the other hand, a number of highly scalable chains are opting to follow a modular approach with a designated data availability layer such as Celestia or EigenDA. This includes some existing L1s like Celo, which plans to become an Ethereum rollup, or new chains like Eclipse, Fluent, or Offshore which bring alternative virtual machine execution environments to Ethereum.

THE BROAD PICTURE

The total value locked (TVL) across DeFi applications oscillated in 2023 from a peak of \$52B in April 2023 to a low of \$36B in October, before ending November at \$48B. **(See Chart 27.)** This 4Q23 rebound has been driven both by price appreciation of the underlying assets as well as by a recovery in fundamental DeFi usage. Borrowing and lending rates as well as decentralized exchange (DEX) trading volumes have all seen substantial increases with Uniswap's aggregated trading volume increasing from \$3.3B in October to \$8.8B in November.

⁴⁹ See Coinshares. "[Digital Assets Fund Flows Weekly](#)" published November 13, 2023.

Chart 27. Change in Total Value Locked



Sources: DefiLlama and Coinbase. Excludes staking, borrows, and double-counting of tokens.

Notably, only eight chains (of the 235 analyzed by DefiLlama) have a TVL of more than \$500M, and seven out of these eight chains (except for Solana) are EVM-compatible. These are the chains depicted in **Chart 27**. In aggregate, these eight chains constitute approximately 90% of all TVL in the crypto environment. Half of the eight chains sit directly within the Ethereum ecosystem and include two rollups (Arbitrum and Optimism) and one commit-chain (Polygon PoS) in addition to Ethereum mainnet. In our view, the concentration of TVL in EVM-based networks is due in large part to its tested security and to longer development timelines for alternative ecosystems.

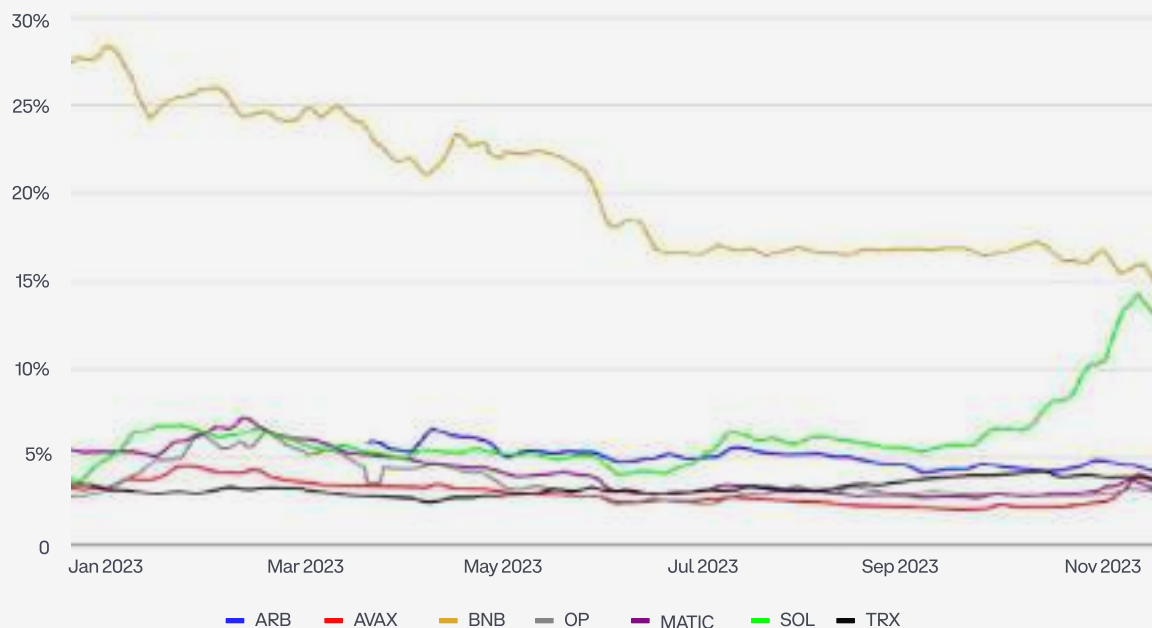
Thus, despite Solana's impressive relative growth and increased attention of developer mindshare this year, it is not surprising the vast majority of value locked still sits within EVM chains. In fact, Ethereum's TVL did not surpass \$500M until 2019, nearly 4 years after its launch. In the coming year, however, it's possible that a growing proportion of liquidity could be drawn into non-EVM environments as developer tooling improves and non-EVM systems become better tested, increasingly decentralized, and overall more robust.

Ethereum's TVL increased from \$22B to \$26B from the start of 2023 to end-November, growing slower than the market as a whole. However, Arbitrum's doubling of TVL from \$1B to \$2B perhaps indicates that Ethereum's growth is beginning to move to rollups in a testament to their increased trust and adoption.

Meanwhile, Binance Smart Chain’s TVL has dropped both on an absolute scale (from \$4.6B to \$3B) as well as relative to other chains (from 12% to 6.5% of TVL). Tron far outperformed the market, increasing its TVL share from 10% to 17%, following a growth from 2% to 10% over 2022. In large part, this has been fueled by a 50% growth of USDT issued on the chain from \$31.7B to \$45B. Tron has more circulating USDT than Ethereum (\$45B vs \$39B), and its leading protocol, JustLend, has more than 30% of its collateral stored in the form of stUSDT, a yield bearing form of staked USDT.

With two exceptions, most of the primary tokens of the aforementioned top TVL chains have largely traded in line with ETH, reflecting their tight relationships with Ethereum. **(See Chart 28.)** BNB, the native gas token of Binance Smart Chain, dropped from a 2023 high of 28% of ETH’s market capitalization to less than 15% as of end November. On the other hand, SOL (Solana’s token) greatly outperformed, trending from 4% to 14% of ETH’s market cap. Most of these gains accrued in Q4 starting after Solana Labs’ v1.16 client release on September 23 and sustaining its rally through the Firedancer announcement at the Breakpoint conference in early November.

Chart 28. Market cap of select tokens as a percentage of ETH



Sources: Amberdata and Coinbase. Arbitrum data only begin on March 23, 2023 following its airdrop. Market capitalizations are taken on a 5 day rolling basis.

Chapter 5

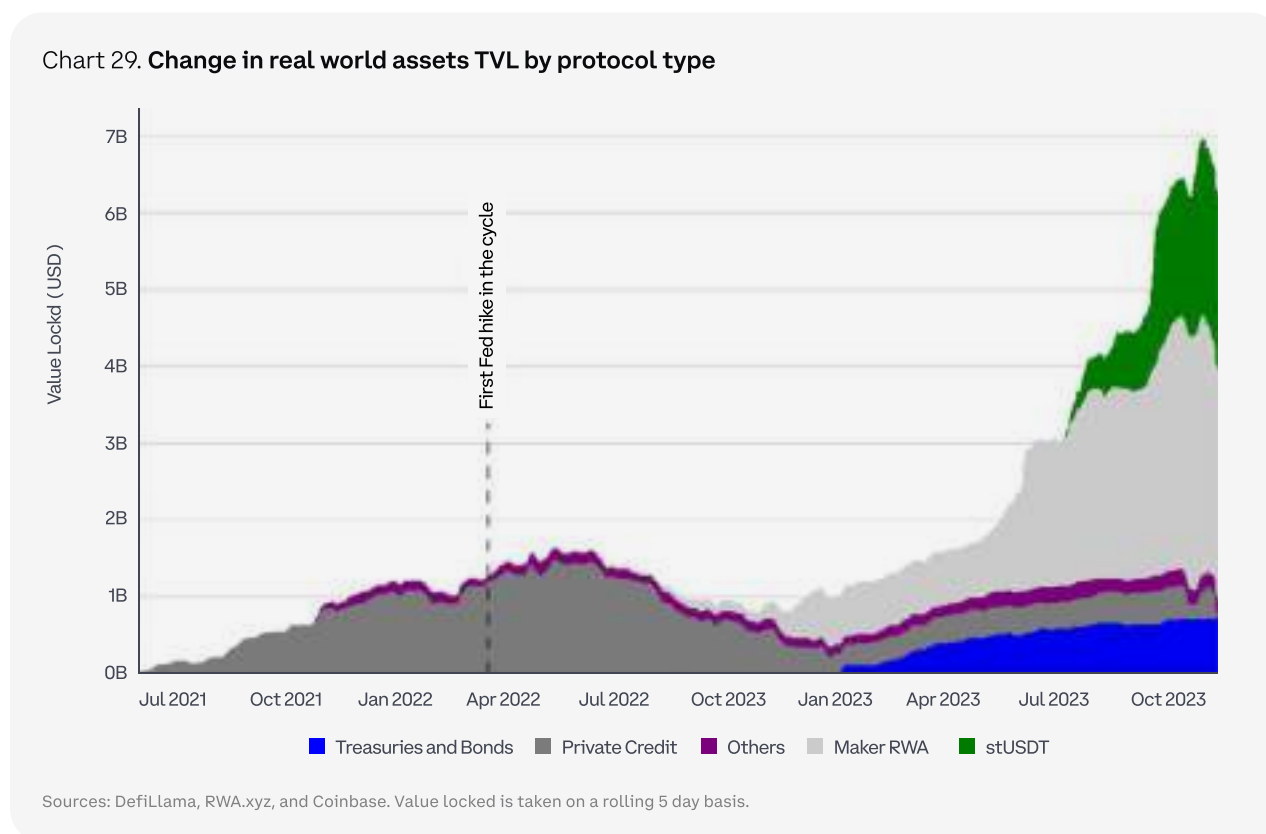
Tokenization

BECOMING MORE MATURE

The tokenization of real world assets (RWA) – that is, creating digital tokens that represent the ownership of traditional (offchain) assets like real estate, art, equities, and bonds – is not a new theme. But it gained significant traction in 2023, in part due to a realignment of tokenization’s business use cases following an accelerated pace of interest rate hikes in the US and elsewhere. In the current environment, tokenization captures an opportunity to increase the availability of illiquid assets or to provide access to assets that may be uncorrelated with other instruments in a well-diversified portfolio.

The resurgence of the tokenization theme in 2023 has been driven in part by a higher interest rate environment. The efforts have gained momentum and usage among large institutions.

From the consumer perspective, higher front-end bond yields have contributed to a surge in yield-seeking behavior from retail investors, which has funneled demand into more protocols tokenizing US Treasuries while reducing interest in private credit protocols with higher risks for default and/or less liquidity.⁵⁰ (See Chart 29.) It's also led a large number of traditional institutions to expand their tokenization efforts this year, although a large portion of these efforts have centered around permissioned blockchains.



With that in mind, the growth of Maker RWA collateral to more than \$3B is particularly noteworthy. We think this highlights one playbook for institutions to interact with public chains because it minimizes the number of entities on the blockchain that require direct interaction, and it also unlocks the liquidity and interoperability of DAI within the broader DeFi ecosystem. Throughout 2024, we anticipate a continuation of this trend with institutions primarily partnering with protocols and teams that have long-standing track records in order to minimize their counterparty and smart contract risks, while gaining access to the liquidity offered onchain.

⁵⁰ See Coinbase Research, [“Tokenization and the New Market Cycle”](#) published October 30, 2023.

We also expect to see a continued rise in the adoption of tokenization that incorporates know-your-customer (KYC) checks to meet regulatory guidelines. The introduction of a number of tools has drastically reduced the overhead costs for individual protocols to do independent KYC onboarding and address whitelisting. These include Uniswap V4's hook-driven architecture (with the open-source directory including a sample KYC integration) as well as decentralized identity tooling such as Coinbase's "Verified by Coinbase" attestations. All onchain tokenized US Treasuries currently either block US persons or require KYC verification. In light of this, we foresee the launch of more whitelisted tokenized RWAs in conjunction with the continued growth of core tooling around public chain tokenization in the coming year.

THE INSTITUTIONS ARE HERE

Meanwhile, the institutional use case for tokenization is now largely focused on capital market instruments – like bank deposits, money market funds and repurchase agreements (repos) – in our view. In large part, that's because tying up capital in higher interest rate environments is much costlier than doing so in lower rate environments, making the capital efficiency of instantaneous settlement much clearer to financial institutions.

The majority of traditional securities currently settle in two business days (T+2), during which time funds being transferred from buyers to sellers are locked up and underutilized. (That said, the US Securities and Exchange Commission has finalized a rule change that will shorten the settlement period to one business day after the trade date or T+1, which should be effective on May 28, 2024.⁵¹) For markets that can transact anywhere from hundreds of billions to over a trillion US dollars per day, lowering settlement times to minutes versus days is more crucial now with nominal yields above 5%.

However, these efforts have largely been on permissioned chains and with closed source smart contracts. Technology providers in the private blockchain space appear to be consolidating around four primary solutions: (1) Hyperledger's platform suite, (2) Consensys' Quorum, (3) Digital Asset's Canton, and (4) R3's Corda. Each platform has its own distinct ecosystems, but different projects built on the same technology stack are not automatically interoperable due to the physical separation of networks.

⁵¹ See US SEC, "SEC Finalizes Rules to Reduce Risks in Clearance and Settlement" published February 15, 2023.

Thus, the issue with the proliferation of permissioned chains and protocols for tokenization is that it can lead to the fragmentation of liquidity among chains, diluting key tokenization benefits including atomic settlement and cross-product interoperability. Such limitations are driving a number of initiatives in the tokenization space. For example, in November 2023, J.P. Morgan leveraged multiple bridging technologies to enable cross-chain liquidity for tokens issued on three different chains in a permissioned manner, as part of a demonstration for the Monetary Authority of Singapore's Project Guardian.⁵² In our view, this issue of liquidity constraints will continue throughout 2024, such that most tokenized assets will not see a particularly active secondary market due to market access challenges.

Tokenization's benefits include the ability to run operations 24/7, automate intermediary functions, and maintain transparent audit and compliance records as well as minimize counterparty risk via atomic settlements.

Additionally, most tokenization efforts still face large regulatory hurdles as laws governing this space are still new, and a number of key jurisdictions continue to lack clear legal frameworks for tokenization. Due to the nascency of the market, well-known legal precedents and templates do not yet exist and therefore require significant investments of both time and money to establish. Still, the increasing regulatory clarity throughout 2023 for blockchain's role in tokenization, spearheaded by the EU's DLT Pilot Regime, has paved the way for both legal and technical advancements in 2024. As a result, we expect institutional interest in tokenization to persist into the next crypto market cycle as the benefits (capital efficiency, faster settlement, increased liquidity, reduced transaction costs, improved risk management) have become abundantly clear.

That said, given that most tokenization efforts are currently either locked behind permissioned chains or whitelisted protocols, we do not think most tokenization efforts will have an immediate impact on the broader crypto markets. However, we believe there will be improvements in onboarding flows and processes, while additional standardized regulatory-compliant tooling will become more widespread next year, laying the foundations for long-term sustained growth of the sector.

⁵² See J.P. Morgan, "The Future of Wealth Management" published November 2023.

Chapter 6

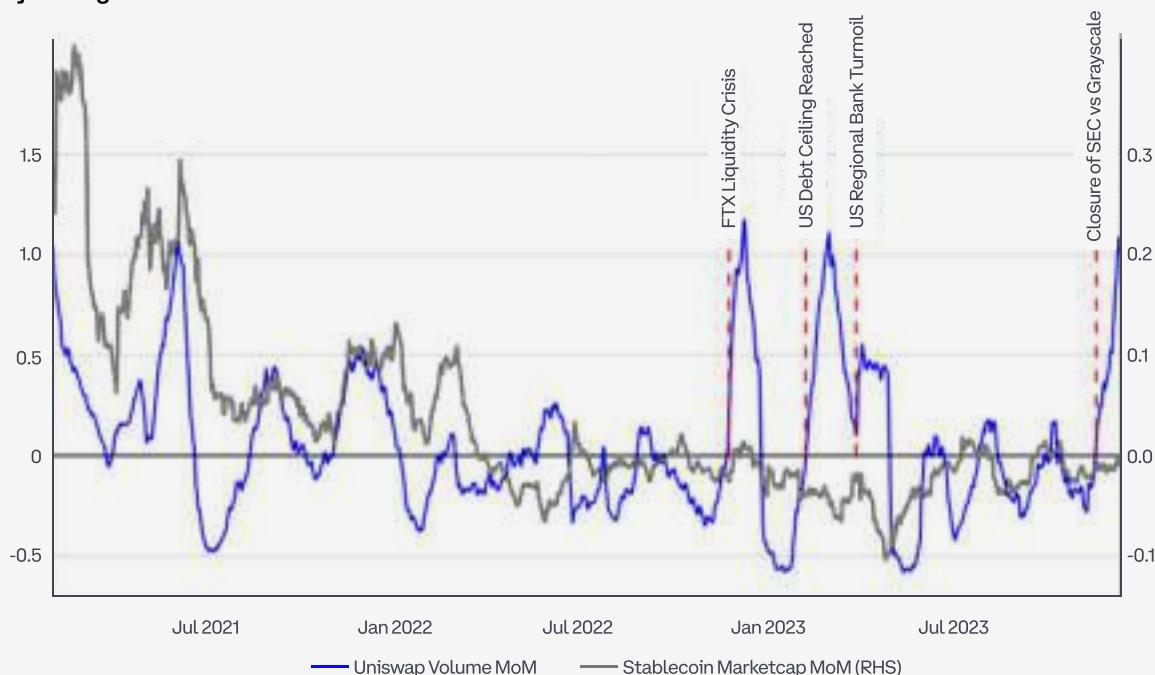
Stablecoins

YEAR IN REVIEW

Approximately US\$127B stablecoins are currently in circulation, down 9% from \$137B at the start of 2023. At the same time, the total market capitalization of crypto has grown, resulting in stablecoin dominance dropping from nearly 16% of the total crypto market capitalization to 8-9%. In our view, the drop in the stablecoin market cap mirrors the widespread drop in liquidity of the overall digital asset class as many non-US centralized exchanges as well as DEXs price their assets in USD stablecoins. Stablecoin supply changes are also tightly coupled with onchain trading volumes, though major exogenous events such as the FTX fallout of November 2022 and the US regional banking crisis in March 2023 have had temporary outsized impacts on total volume. **(See Chart 30.)**

The 2023 decline in the stablecoin market cap reflects the fall in overall global liquidity, a rise in regulatory crackdowns in the crypto industry, and a high interest rate environment in the US.

Chart 30. **Ethereum stablecoin supply changes trends with Uniswap volume changes in the absence of major exogenous events**



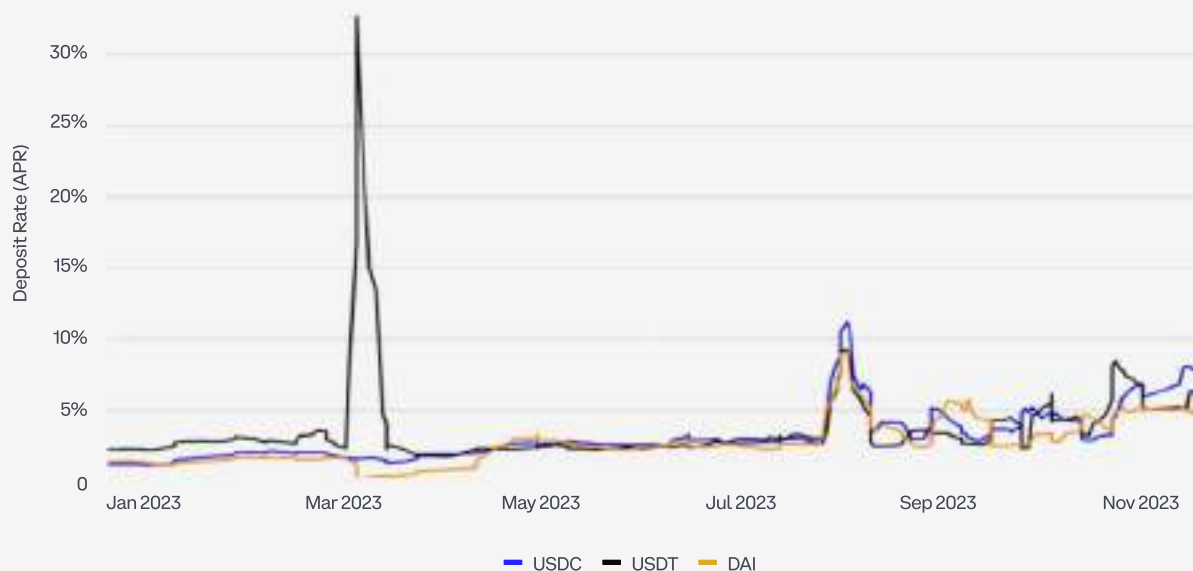
Sources: DefiLlama and Coinbase. Uniswap volume is taken on a rolling 30-day average.

We believe this relative decline in stablecoin market cap reflects a number of factors, including a broader decline in overall global liquidity, a rise in regulatory crackdowns in the crypto industry, and the high yield environment in multiple places including the US. Stablecoin volumes moderated in 2Q23 and 3Q23 to an average of \$9B per day, as global central bank balance sheets tightened, though this has since recovered to around \$12-14B per day in 4Q23. (Incidentally, this parallels what happened to crypto volumes more broadly, which is why stablecoins tend to be a good proxy for the whole market.) In a market environment where short-term US bond yields are offering approximately 5% “risk-free”, we think investors have been incentivized to shift their holdings offchain. Indeed, the top two stablecoins by market capitalization – USDC (issued by Circle) and USDT (issued by Tether), both fiat-backed – do not provide native yield to holders.

Stablecoins are a big part of the future of money due to their transaction costs, efficiency, and accessibility. As their importance grows, so does the urgency for clear stablecoin regulation.

Sources of onchain stablecoin yield, driven primarily by appetite for leverage and trading, were depressed throughout much of 1H23, but began to trend upward during 2H23. In Aave V2 on Ethereum, stablecoin deposit rates, which vary based on borrowing supply and demand, have risen from the 1-2% range to the 5-6% range. **(See Chart 31.** Note that the massive spike in USDT yield on March 13 observed in the chart corresponds to a 35% price increase in bitcoin from \$20k to \$28k over the span of a week.) Increased stablecoin yields have risen not only in Aave, but also across various DeFi protocols as trading volumes and borrowing increased.

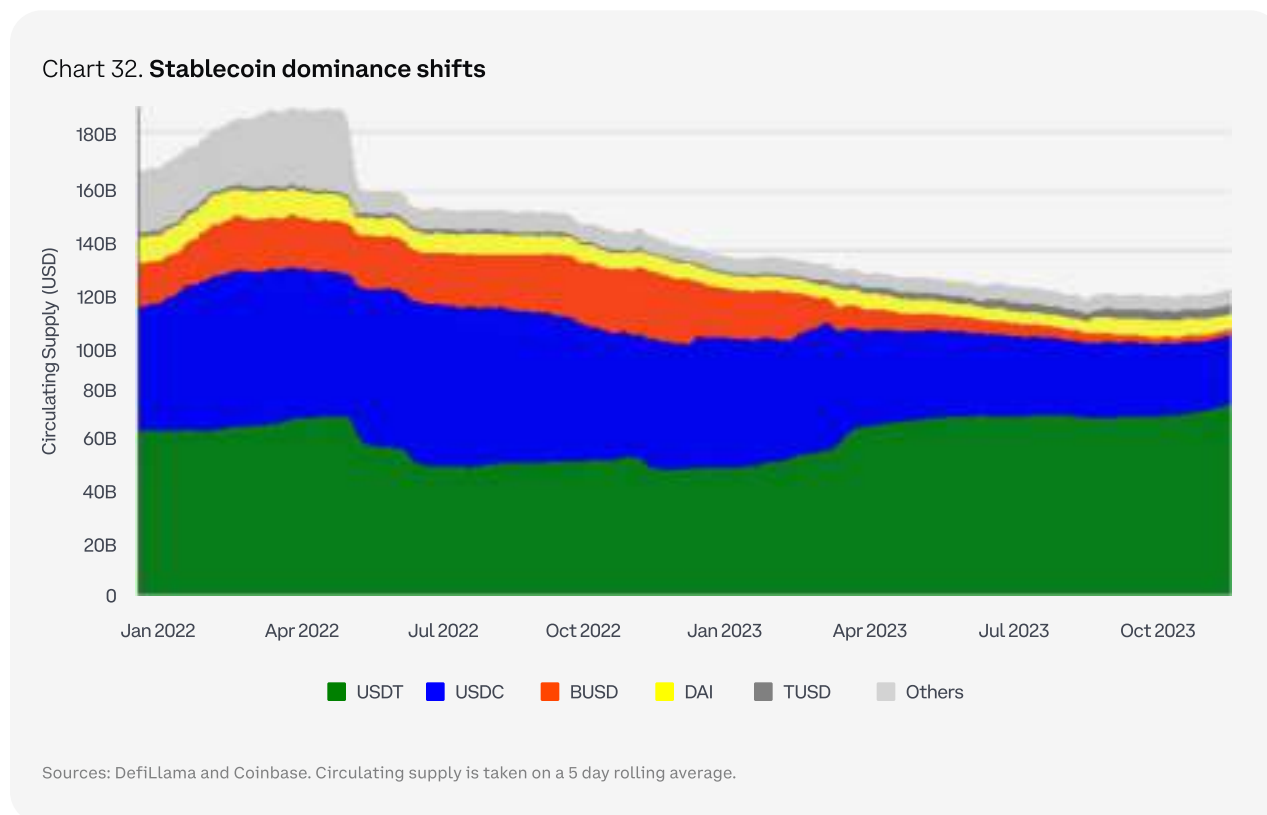
Chart 31. Aave V2 deposit interest rates have trended up throughout Q3 and Q4



Sources: Aavescan and Coinbase. Deposit rates are taken on a 10 day rolling basis. Although Aave V3 has been released since March 2022, Aave V3 TVL only caught up to Aave V2 TVL in September 2023

Within circulating stablecoins, USDT has greatly increased its share of the total supply. Its market capitalization has grown from \$66B at the start of 2023 to more than \$89B as of end-November, bringing its share of the stablecoin market up from 49% to nearly 70% currently. **(See Chart 32.)** In our view, this has been driven primarily by the shutdown of BUSD (issued by Paxos for Binance), whose market capitalization has dropped from a peak of more than \$23B to less than \$2B as of end-November. The token is set to be fully unwound in mid-December. The drop in the supply of USDC from \$44B to \$24B throughout the past year also appears to have aided the shift towards USDT supply.

TrueUSD (TUSD), whose market capitalization has risen nearly 500% from \$756M to more than \$3B this year, has also likely been another beneficiary of the BUSD shutdown as nearly 70% of its issued supply on Ethereum is held on Binance linked addresses.⁵³ DAI (a collateral-backed stablecoin maintained by MakerDAO) has also been resilient in its market capitalization (currently over \$5B) as the Dai Savings Rate (DSR) has been competitive with high end yields and currently sits at 5%.⁵⁴ The DSR was paying as much as 8% in August 2023.⁵⁵



A GROWING MARKET

Non-interest bearing stablecoins are a tested playbook for earning the yield behind customer deposits and has driven a number of new players to the market. This includes PayPal’s PYUSD, Aave’s GHO, and Curve’s crvUSD. However, adoption of these stablecoins is still limited and relatively centralized in their holder base. More than 65% of PYUSD on Ethereum is held in a single address compared to less than 3% for USDC and 7% for both DAI and USDT. GHO and crvUSD are also fairly centralized with their top holders controlling 19% and 24% of their circulating supply respectively.

⁵³ See Etherscan. [TrueUSD \(TUSD\) Token Holders](#).

⁵⁴ See Dai Stats. [Ecosystem](#).

⁵⁵ See Blockworks. [“DAI Savings Rate is at 8%, just not for Americans”](#) published August 7, 2023.

The existing deep liquidity pools of USDT, USDC, and DAI entrench liquidity in favor of existing players – as exemplified by Curve’s active 3-pool (an automated market maker or AMM specialized for stablecoin swaps containing the aforementioned three stablecoins).

We believe that as the US gains regulatory clarity on cryptocurrencies, increased momentum among US-based crypto participants will likely be the forefront driver of expanded adoption for US-domiciled stablecoins. At present, there isn't a complete federal regulatory structure for stablecoins in the US. Rather, a patchwork of state and federal legislation and guidelines cover various facets of the stablecoin sector, depending on the specific activities and unique characteristics of each stablecoin. The Clarity for Payment Stablecoins Act of 2023 received bipartisan approval from the House Financial Services Committee in July but has not yet been considered by the full House of Representatives. While full regulatory clarity will depend on Congress and significant policy action may be challenging in an election year, we anticipate further incremental steps that continue to improve market confidence and fuel positive interest around US-based stablecoin issuers in 2024.