Global Cryptocurrencies and Digital Assets

Digital Assets Primer: Only the first inning

Primer

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Alkesh Shah
Crypto&Digital Assets Strategy
BofAS

Andrew Moss
Crypto&Digital Assets Strategy
BofAS

SEC: United States Securities and Exchange Commission

CBDC: Central Bank Digital Currency

Digital asset sector too large to ignore; not just bitcoin, so much more

With a $2tn+ market value and 200mn+ users, the digital asset universe is too large to ignore. We believe crypto-based digital assets could form an entirely new asset class. Bitcoin is important with a market value of ~$900bn, but the digital asset ecosystem is so much more: tokens that act like operating systems, decentralized applications (DApps) without middlemen, stablecoins pegged to fiat currencies, central bank digital currencies (CBDCs) to replace national currencies, and non-fungible tokens (NFTs) enabling connections between creators and fans. Venture Capital digital asset/blockchain investments were $17bn+ in 1H/2021, dwarfing last year's $5.5bn. This creates a new generation of companies for digital assets trading, offerings and new applications across industries, including finance, supply chain, gaming and social media.

Welcome to the token economy

Bitcoin was designed as money, but is increasingly viewed as “digital gold.” Ethereum created a generalized platform powered by smart contracts, enabling the development of hundreds of applications that could transform finance, insurance, legal, real estate and many other industries. Digital assets that enable applications to be built, like the Apple iPhone did with its App Store, are gaining the most value. Our view is that there could be more opportunity than skeptics expect. In the near future, you may use blockchain technology to unlock your phone; buy a stock, house or fraction of a Ferrari; receive a dividend; borrow, loan or save money; or even pay for gas or pizza.

DApps and NFTs: the most innovation

Decentralized Finance (DeFi) is an ecosystem that allows users to utilize financial products and services, such as lending, borrowing, insurance and trading, without relying on a traditional financial institution. DApps may bring financial services to many of the 1.7bn unbanked globally through a simple smartphone app. NFTs are changing the way creators connect with fans and receive compensation (and Gen Y & Z along with a few boomers are snapping them up). NFT sales were $3bn+ in August, up from $250mn in all of 2020, led by demand from celebrities, corporations and individuals (Beeple’s digital artwork NFT sale at Christie’s for $69mn was a catalyst, for example).

Risk: regulation coming to the Crypto Wild West

Increased adoption of cryptocurrencies, new blockchain-based applications and stablecoins that could be used as money are drawing attention globally. Some governments, such China’s and India’s, have banned bitcoin trading. Governments are working to develop policies and, as the SEC said recently, the digital asset industry’s future lies “in the public policy framework.” CBDCs appear inevitable, but fiat digital assets, such as bitcoin, may be targeted if central banks see risk to the payments system or credit flow disruption. DeFi applications with security-like features may draw SEC attention, likely pressuring near-term usage. Regulatory uncertainty is the largest near-term risk in our view, but regulation may drive increased investor participation over the long term once the “rules of the road” for digital assets are established.

Refer to important disclosures on page 9 to 10.

Executive Summary & Key Conclusions

Digital asset ecosystem value surged in 2021

At $2.1tn, the digital asset ecosystem aggregate market value is now larger than the gross domestic product (GDP) of Italy or Canada.[1] We expect further value creation as bitcoin is increasingly adopted, alternative coins/tokens enable new applications and a pipeline of Venture Capital-backed private companies reach public markets.

Bullish on long-term prospects

Despite potential regulatory headwinds (maybe tailwinds ultimately), we are bullish on the long-term prospects for the digital asset ecosystem as it enters the mainstream. We anticipate significant growth as digital asset use cases move beyond bitcoin's store of value thesis to an industry characterized by product innovation, regulatory clarity, increased institutional participation and mainstream adoption.

> It's difficult to overstate how transformative blockchain technology, digital assets and the thousands of decentralized apps that have yet to be created could potentially be. We expect rapid changes to the current market structure – new use cases will be discovered and others will be discarded.

We are bullish on the digital asset theme for the following reasons:

1. We are only in the first innings of a major change in applications across most industries that will take place over the next 30 years, in our view. Estimates indicate about 221mn users globally as of Jun'21 have traded a cryptocurrency or used a blockchain-based application, up from 66mn at the end of May'20.[2]

2. Due to technological advances in decentralized software that is native to the internet, a new medium – with distributed ledgers and blockchain at its core – is emerging rapidly. The applications built on this new software architecture appear to be growing more quickly than past technologies. New companies are likely to emerge and poorly positioned companies will exit, creating significant upside potential for some and downside for others.

> While we acknowledge concerns about the speculative digital asset trading that takes place currently, we believe it's the underlying blockchain technology driving this speculation that could be revolutionary.

Diverse and thriving

Hundreds of companies are now within the digital asset ecosystem providing infrastructure support, marketplaces and applications (such as decentralized finance, digital identity, supply chain, gaming and social media). Many are just 2 quants in a garage, though Venture Capital funding jumped to $17bn+ in 1H/2021 from $5.5bn in all of 2020. Digital asset public companies' aggregated market caps are $130bn+ (boosted by COIN's listing in 2021; market cap $54.6bn as of August 31).[3]

Digital asset-related M&A ytd jumped to $4.2bn, up from $940mn in 2020 and $2.5bn in 2019, indicating a dynamic and maturing industry.[4] We're still in the early innings and we see the potential for value creation over the next 5 years but, as in prior tech cycles (PCs, software, internet…), only a handful of well-run, focused companies will likely succeed.

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[1] *All ytd data as of the end of August 2021 unless noted otherwise. $2.1tn market value from CoinMarketCap.com*

[2] *Crypto.com's Measuring Global Crypto Users*

[3] *Pitchbook.com*

[4] *Pitchbook.com*

Governments & regulators are noticing

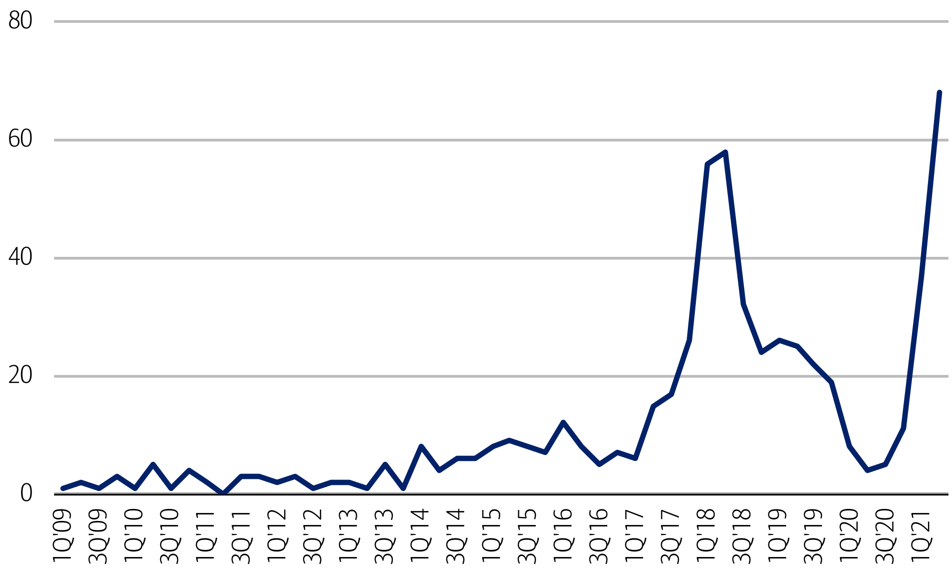
Increased adoption, new token-enabled blockchain-based applications and stablecoins that may act like money are drawing attention globally. Some governments, such as China's and India's, have banned bitcoin trading, while they try to figure it out. Others, such as the US, are attempting to bring digital assets into a defined regulatory framework. Digital asset bulls expect strong performance once governments and regulators introduce the rules of the road but, in our view, there's likely to be plenty of volatility along the way.

Corp interest growing; earnings call mentions increasing

Recent and increasing regulatory scrutiny as the digital asset ecosystem grows, and more individuals participate, may mean digital assets are a step closer to the end of their Wild West days. If so, corporations may in the future be more willing to consider adding digital assets to their balance sheets for diversification or to participate in the digital asset ecosystem by leveraging blockchain technologies to make their businesses more efficient (Exhibit 1). Partnering with our BofA Predictive Analytics team, we used Natural Language Processing (NLP) to analyze 161,322 earnings call transcripts from 1Q'09 through August 2, 2021, which found corporate interest in digital assets is at an all-time high.

Exhibit 1: Number of US companies that mentioned a digital asset keyword* on an earnings call rose to 147 from 17 a year ago

NLP analysis of earnings call transcripts of the S&P 500; avg 3,174 transcripts reviewed per quarter



Source: FactSet, BofA Global Research

*Keywords include: altcoin, bitcoin, blockchain, crypto, cryptocurrency, decentralized finance, defi, ether, ethereum, NFT, non-fungible-token

Year-over-year calculation period: 1Q'20 – 3Q'20 and 1Q'21 – 3Q'21 through 8/1/21. Note 3Q'21 not shown on chart.

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Holders getting younger; corporates want to keep up

Generational change

Development and adoption of digital assets will likely be led by Gen Y, Millennials and Gen Z. These generations grew up with the internet and expect native internet transactions to be frictionless and digital – without multiple steps and middlemen. Digital asset growth is likely to continue as it enables people to simply and easily transfer value and make payments. It is also real-time and eliminates the middleman (or at least makes the transaction less cumbersome if using a digital asset exchange.

Going mainstream

It's estimated that 14% (21.2mn) of US adults own digital assets and an additional 13% (19.3mn) plan to buy digital assets in 2021. Notably, the average age of these potential buyers is 44 and 53% of the potential buyers are female.[5]

Corporations aren't risking being left behind

Companies aren't taking the risk of ignoring digital assets and applications and are actively exploring this new technology and its use cases. Leading tech companies, banks and others are adjusting their approach.

Bitcoin leading the way

Bitcoin is up over 2x its 2017 high at ~$47,000, as adoption by individuals increased, corporate managements begin due diligence and regulators work to provide a framework that could bring digital assets into the mainstream. Bitcoin remains the most valuable digital asset at an aggregate value of $887bn. Value drivers include supply/demand dynamics, scarcity (only 21mn coins total; ~19mn already mined) and potential exchange-traded fund (ETF) approval timing.[6]

But it's not just bitcoin; value of altcoins is rising

Coins other than bitcoin are known as alternative coins or altcoins. There are now 11,500+ altcoins (or tokens), although many do not have a clear use case. Digital assets that enable a platform to be built, like the Apple iPhone did for applications, are gaining the most value; the top 3: ether (365% ytd to $403bn value), cardano (1427% ytd to $89bn value) and binance coin (1142% ytd to $78bn value).[7] Applications built on these blockchains that are gaining the most momentum are Decentralized Finance, Digital Identity and Supply Chain tracking. Key value drivers are increases in developers' building applications on these tokens and user adoption of the applications – tokens without this engagement are not likely to survive except as novelties.

Individual interest in Alternate Coins is rising as our Twitter analysis (Exhibit 2) and Reddit analysis (Exhibit 3) indicate.

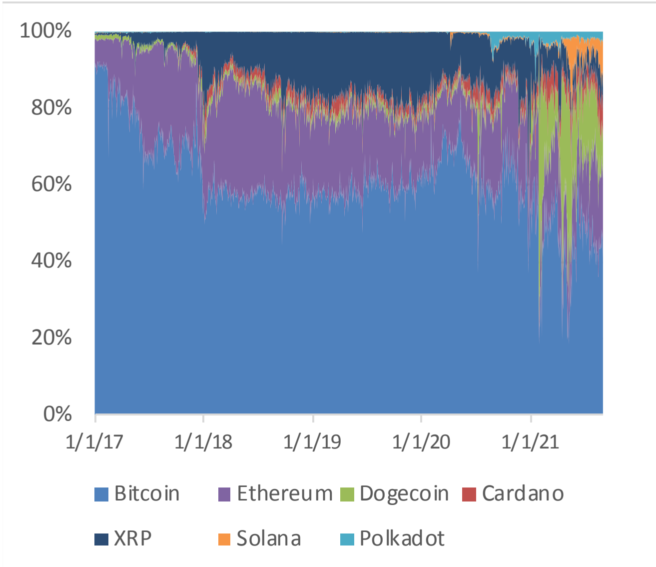
[5] *Gemini's 2021 State of the U.S. Crypto Report*

[6] *CryptoCompare.com*

[7] *CoinMarketCap.com*

Exhibit 2: Twitter digital asset mentions

Twitter mentions of bitcoin fell to 44% of all mentions ytd through August across the 7 coins listed from 63% in 2020



Source: ListenFirst, BofA Global Research
Data: 1/1/17 – 8/31/21. Note that searches for mentions also included tickers, i.e., BTC.

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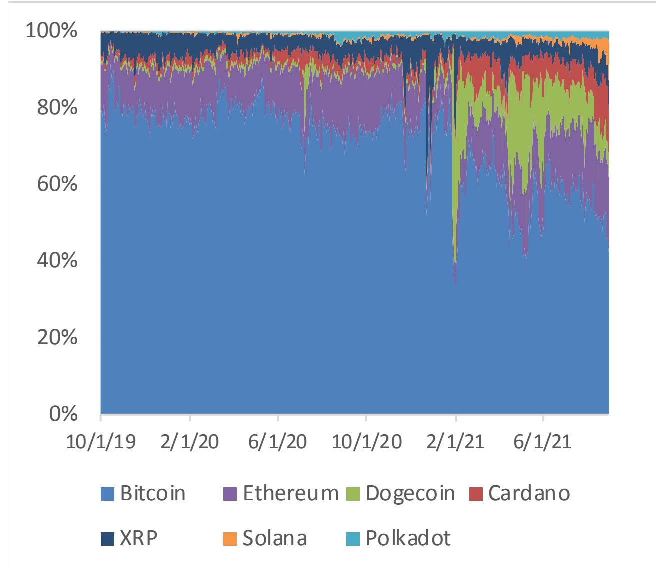
Exhibit 3: Reddit digital asset mentions

Altcoins mentions increasing across both Twitter and Reddit with Reddit mentions of dogecoin jumping 3032% in Jan'21 m/m



Source: ListenFirst, BofA Global Research
Data: 10/1/19 – 8/31/21

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Digital assets & ESG – plans to shift to greener energy

Mining digital assets uses a lot of resources. Many digital assets plan to shift to less energy-intensive forms of mining and to move to greener/renewable energy. For example, the current process of creating bitcoin consumes ~91 terawatt-hours of electricity annually, up 10x in the past 5 years. This represents ~0.5% of global electricity consumption, which causes critics who believe that Bitcoin adds no value to argue that using as much electricity as Finland or the state of Washington is wasteful.[8] Bitcoin supporters counter that the energy use will get better and is worth the consumption for the future value it will provide against the devaluation of fiat currencies. Supporters also point out that homes in the US use ~1,375 terawatt-hours of electricity annually and that Christmas lights in the US use ~6.6 terawatt-hours of electricity annually – more than the annual electricity consumption of El Salvador or Ethiopia.[9]

Stablecoins critical for digital asset applications, but bring risk

Stablecoins (tokens pegged to a fiat currency such as the US dollar and backed by fiat currencies/assets) established a firm foothold in the digital asset ecosystem this year, with the top 6 by market value rising to $115bn and 1H/2021 transaction volume of $2.8tn+.[10] Stablecoins are designed to eliminate volatility and act as a store of value and a medium of exchange (act as money). We view stablecoins as a waiting zone between fiat currencies and digital currencies, which could further accelerate adoption of the latter. The top 3 by market value are tether, USD coin and binance USD.

Some stablecoins aren't backed 1:1 with US dollars and, instead, partially use reserves such as commercial paper and/or corporate debt to provide extra yield to the stablecoin creator, which creates the risk of forced liquidation if market conditions become illiquid or if there's a broader market correction. In response, the leading stablecoins have

[8] *The New York Times*

[9] *Natural Resources Defense Council (NRDC), Center for Global Development*

[10] *CoinMarketCap.com, Messari*

issued public statements that their reserves are composed of dollars or Treasury Bonds, but increased regulatory scrutiny is likely.

Central Bank Digital Currencies (CBDCs) – when, not if

Inspired by digital assets and stablecoins, Central Bank Digital Currency activity increased significantly in 2021 in an effort to create the next evolution of money – Cash 2.0. Central banks from countries that represent over 90% of global GDP are reported to be exploring CBDCs.[11] Three of the world's major currencies – the dollar, euro and renminbi – are actively moving to the introduction of a CBDC. China's e-Renminbi is in the lead with a potential 2022 launch coincident with the Beijing Winter Olympics.

Governments and regulators globally have stepped up efforts to limit usage of digital assets, as adoption and use have increased. Some of the key issues that governments and regulators appear to be focused on revolve around anti-money-laundering and know your customer (AML/KYC), mitigating potential bank runs, taxation and liability. A central bank-issued/managed CBDC would address these issues, while maintaining central bank monetary policy control.

Non-fungible tokens (NFTs) – a surprise for all

The rise of NFTs caught even old-time digital asset players by surprise. NFT sales increased to $3bn+ in August 2021 (although the market has cooled a bit since), up from $250mn in 2020 driven by corporate, celebrity and individual demand.[12] NFTs are unique digital files created on the blockchain (immutable, transparent record) that usually contain data that point to an online version of art or a physical asset and usually confer ownership or certain rights. NFTs can be used instead of deeds, titles or anything currently needed to demonstrate ownership – and all without a middleman charging a fee.

Collectors view the current generation of NFTs as the firsts of a new digital art form. The NFT wave was kick-started earlier this year by Beeple's digital artwork NFT sale at Christie's for $69mn (3rd highest auction price for a living artist). Yes, the image could be copied, but the blockchain establishes the true ownership (provenance) and any associated rights.

NFTs are evolving with artificial intelligence (AI) and smart contracts being added to the code. With an embedded smart contract, the NFT can act as a perpetual royalty stream for the original creator; every time the NFT is sold, a percentage of the sale price can be sent back to the creator.

Recent NFT sales (with strong demand) of CryptoPunks (CryptoPunk #3100 sold for $7.6mn on March 11 and is now on sale for $111.2mn) or of simple images like a black background with a few words of text make us concerned that there are heightened risks in this segment that need to be fully understood before NFTs can achieve true adoption.[13]

Decentralized finance/applications & regulatory trends

Tokens such as ether, cardano, solana and others with blockchains that can do more than securely record payments (Bitcoin's strength) can execute automated programs (smart contracts) such as making a payment after an event. This is Decentralized Finance (DeFi) where smart contracts automate manual processes of traditional finance, such as loans without a middleman (trusted intermediary). DeFi applications are a fast-growth segment of the digital asset ecosystem with Total Value Locked (measure of token value used for decentralized finance applications) increasing to $90bn in August 2021 from $17bn in August 2020.[14]

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[11] *Atlantic Council*
[12] *Dune Analytics (https://dune.xyz/rchen8/opensea), NonFungible.com*
[13] *Larvalabs.com*
[14] *Defipulse.com*

DeFi is an area that regulators are reviewing because applications may be viewed as securities once they provide traditional financial services as per Securities & Exchange Commission (SEC) Chair Gary Gensler's recent comments. The SEC is investigating DeFi applications and companies to determine if and how they should bring them into the current regulatory framework. We are optimistic about the long-term growth of this segment as it matures and regulatory uncertainty is clarified.

Market structure maturing

Digital asset market structure matured with bitcoin futures volume reaching $1.7tn (+304% y/y) and ether futures volume reaching $953bn (+471% y/y) in August.[15] Institutional users and platform assets increased by 67% and 589%, respectively, on Coinbase in 2020[16]

Illicit activity concerns

Digital assets have a mixed reputation not least due to high-profile ransomware cases and their underlying foundation of anonymity. What we think is underappreciated is that the blockchain is permissionless and transparent, enabling on-chain analytics to track digital asset fund flows through multiple wallets and provide law enforcement with the ability to track criminals and other bad actors, as was done with the recent Colonial Pipeline ransomware event. Illicit digital asset transactions dropped to under 1% of total transactions in 2020 from over 2% in 2019 (and over 35% in 2012).[17]

Risks: what could go wrong?

We summarize the key risks that could slow the adoption of blockchain technology and the digital assets that we discuss in our report. We categorize these key risks as technology/adoption risk – the risk that characteristics of blockchain technology prevent broad adoption or development of use cases – and legal/regulation risk – the risk that pending legal and regulatory frameworks prevent the development of use cases – as described below and discussed in detail throughout our full report

[15] *TheBlockCrypto.com*

[16] *Coinbase Form S-1*

[17] *Elliptic's Financial Crime Typologies in Cryptoassets*

Exhibit 4: Risks for digital assets and applications

Key risks that could slow the adoption of blockchain technology

Technology	Technology/Adoption Risk	Legal/Regulation Risk
Cryptocurrencies/Tokens	Energy consumption Risk of potential adopters avoiding coins/tokens because of their perceived environmental impact Too big, too fast Risk that grand ideas to transform or remake industries don't pan out, causing potential adopters to cast doubt on the digital asset ecosystem	Environmental risk Risk of regulatory action to reduce the environmental impact of PoW mining Regulatory risk Risk of the SEC implementing onerous regulations or preventing the formation of crypto ETFs Governmental risk Risk of countries banning crypto trading (China and India already have in some capacity)
Non-Fungible Tokens (NFTs)	Awareness Risk that investors may have limited understanding of what they're purchasing or may be buying into the hype phase, causing current and potential adopters to avoid in the future Underlying tech Risk that software bugs cause smart contracts to fail, leading to lack of confidence in the underlying technology	Legal risk NFTs and legal frameworks that involve assets other than images, such as physical assets or the IP for digital art/collectibles, are still developing
Decentralized Finance (DeFi)	Consumer protection Risk that hacks, fraud and rug pulls (developers abandoning failing projects) involving current adopters with limited recourse will cause both current and potential adopters to revert to traditional financial institutions	Regulatory risk Risk of greater disclosure, AML/KYC and reserve requirements creating headwinds for DeFi companies or forcing an industry intended to be decentralized into a more centralized form
Stablecoins	Disclosure Risk that limited disclosure requirements about reserves could lead current and potential adopters of stablecoins to avoid them Too big to fail Risk that stablecoins pegged to fiat currencies could fail, creating a liquidity shock and leading current and potential adopters to cast doubt on the stability of the digital asset ecosystem	Regulatory risk Risk of impending regulations requiring 1:1 currency reserves, reducing the usefulness of stablecoins, or imposing a ban due to the perceived risk of losing monetary policy control
Central Bank Digital Currencies (CBDCs)	Privacy Risk that potential adopters perceive the loss of privacy as a reason to avoid Underlying tech Risk that underlying blockchain technology will not scale effectively	Regulatory risk Risks that issuance is delayed due to concerns around AML/KYC (anti money laundering / know your customer), that benefits of a smoother payments system could be offset by creating competition with bank deposits, or that financial stability could decrease given the potential for bank runs

Source: BofA Global Research

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