An Introduction to Blockchain and Cryptocurrencies

A message from the BMO Nesbitt Burns Portfolio Advisory Team: This article is designed to provide awareness about virtual currencies, also referred to as "cryptocurrencies." We are not specifically recommending cryptocurrencies or derivative investments at *this* point given their extremely high volatility and massive increase in values (before the recent correction), which puts them in the company of historical investment "bubbles". This being said, we do believe it is valuable to remain knowledgeable as market dynamics continue to be affected by technological change and emerging tech investment themes.

What is Blockchain?

Blockchain technology is the foundation behind cryptocurrencies. A blockchain is a publicly distributed ledger that is shared among a network of nodes (computers). The name "blockchain" is derived from the format in which the database stores data. A block collects information, such as transactions, and the block is closed once the capacity limit is reached. The block is then linked to the previously closed block and a new block is formed. Blockchains are immutable—meaning that once data is entered it is irreversible. In the case of Bitcoin, all transactions are permanently recorded and viewable to anyone. This database structure provides inherent security due to its' decentralized and immutable nature. For example, even if it is possible to tamper with one ledger, it is infeasible to tamper with every distributed ledger at the same time.

There are different variations of blockchain such as permissioned blockchains where the blockchain is privately operated by an intermediary. Cryptocurrencies predominately fall under the unpermissioned (or public) blockchain category. It is important to note that blockchain technology has uses beyond the payment realm—such as record keeping, decentralized applications (dApps), smart contracts, and decentralized exchanges.

What is a virtual currency?

All virtual currencies are also digital currencies or digital money, and do not exist in a tangible form, meaning they are accessed and transacted electronically. A virtual currency differs from a digital currency by the way in which it is issued and supported, as well as its usability. Decentralized virtual currencies utilize cryptography to secure their record of transactions, which are stored in a blockchain. An example of a blockchain is Bitcoin (capital B, Bitcoin), which is the name of both the underlying technology and the unit of virtual currency itself (lower case b, bitcoin). Bitcoin is the world's first blockchain and has existed for just over nine years. Other examples of decentralized blockchains are Ethereum and Litecoin, which share some similarities with Bitcoin.

Depending on whom you ask, virtual currencies can be considered a currency, an asset, or a commodity, similar to gold. Arguably, virtual currencies have similar characteristics to traditional fiat currencies (i.e., a store of value, a medium of exchange, and a unit of account). Unlike traditional currencies, virtual currencies are not controlled or regulated by any single authority and are, therefore, decentralized. Transactions are conducted in a peer-to-peer network without the need for intermediaries such as central banks or financial institutions.

Virtual currencies, such as bitcoin, can be used to purchase goods and services or to hold as a store of value, and transfer

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value seamlessly across international borders. At the moment, there are more than one thousand operational virtual currencies, each offering something different.

Figure 1. Top 10 Cryptocurrencies by Market Cap ($US)

Ticker	Cryptocurrency Name	Market Cap (Billions)
BTC	Bitcoin	$ 818.3
ETH	Ethereum	$ 366.0
USDT	Tether	$ 78.0
BNB	BNB	$ 67.3
USDC	USD Coin	$ 51.6
XRP	XRP	$ 39.2
ADA	Cardano	$ 38.5
SOL	Solana	$ 35.0
LUNA	Terra	$ 22.6
DOT	Polkadot	$ 21.0

Source: CoinMarketCap (Feb 8 2022)

How does supply work?

Currently there are two main models that drive cryptocurrency supply. The Proof-of-Work (PoW) consensus protocol was proposed in Satoshi Nakamoto's whitepaper for Bitcoin in 2008 and is the method of choice for the two leading cryptocurrencies (Bitcoin and Ethereum). The second model is the Proof-of-Stake (PoS) consensus protocol which was introduced in 2012. There are other consensus protocols such as Proof-of-History, Byzantine Fault Tolerance (BFT), and Delegated Proof-of-Stake (DPoS). However, the PoW and PoS consensus algorithms are the most commonly used and they are introduced below:

In PoW, the nodes (miners) that make up the network compete with one another to solve a cryptographic puzzle to win the opportunity to add the next Block and earn the blockchain's cryptocurrency as a reward. The PoW consensus protocol is effective in ensuring security and decentralization but is extremely demanding in terms of computational power, bandwidth, and storage. The PoW algorithm encourages each miner to obtain advanced equipment in order to reach higher hashrates, thus providing the miner an advantage in being the first to solve the cryptographic puzzle. Simply put, the hashrate is a metric used to measure the total computational power provided by miners to process transactions. It can be used to gauge the health and security of a cryptocurrency's network.

In the PoS consensus protocol, validators are randomly chosen to validate the transactions in the block. Validators stake their cryptocurrency as collateral for a chance to be chosen. PoS and its potential to replace PoW is explained further in the "Scalability, Proof-of-Work, Proof-of-Stake" section on page 8.

Bitcoin is one such virtual currency that requires the mining process; however, the total number of units that can be created is limited, much like the total available supply of gold. In the case of Bitcoin, the total supply is capped at 21 million, with each bitcoin being divisible by 100 million and its smallest divisible unit is referred to as a "Satoshi." The last bitcoins are anticipated to be mined in 2140 with incentive then moving solely to the monetization of the verification process, as opposed to the creation of new units.

How does demand work?

Once created, virtual currencies can be used to trade or conduct transactions in the global economy, with more and more retailers and businesses accepting virtual currencies by the day. Typically, virtual currencies are accessed through a user's virtual currency wallet held on a virtual exchange or hard wallet device (similar to a USB stick.) These are accessible via mobile phone or laptop computer. Each wallet contains the user's public and private keys. The public key is similar to an email address and the private key is effectively the password.

In using the Bitcoin blockchain as an example, a transaction will state, "John gives 'X number' of bitcoin to Sarah." This transaction is signed (approved) by John's private key and sent to Sarah's public key (wallet address). After verification by the miners, the transaction is completed and added as part of a block to the Bitcoin blockchain. This block will house certain information confirming the transaction took place alongside other transactions bundled together with it. Not all transactional information is stored in the block; however, the approximate time stamp of when the transaction took place

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and the wallet addresses of those involved (not the names of the individuals) are included.

Buying and selling bitcoin and other virtual currencies

Individuals currently cannot purchase or sell bitcoin and other virtual currencies from their local bank branch or through their financial professionals. Generally, virtual currencies are purchased and sold via a third-party exchange, such as Coinbase, foreign brokerage, Bitcoin ATM, or peer-to-peer website such as Local Bitcoins. Typically, users will create a wallet linked to their bank account or credit card to purchase and sell virtual currencies. Some exchanges and brokerages will accept wires, e-mail money transfers, and other payment methods, and the rates between buyers and sellers can differ significantly. Bitcoin ATMs ("BTMs"), generally only accept cash and charge higher fees for their convenience. However, BTMs typically have limits on the amount of virtual currency units that can be purchased. While there are many ways to purchase and sell, the use of blockchain technology ensures there is only one ledger, per virtual currency, recording all of the transactions.

The use of virtual currencies continues to grow as the emerging digital economy gains prominence in Canada and worldwide. We encourage investors to stay informed as technological advances that marry currency and the online sphere become more accessible.

Key Concepts

According to JPMorgan, there are three important concepts to understand the value of cryptocurrencies:

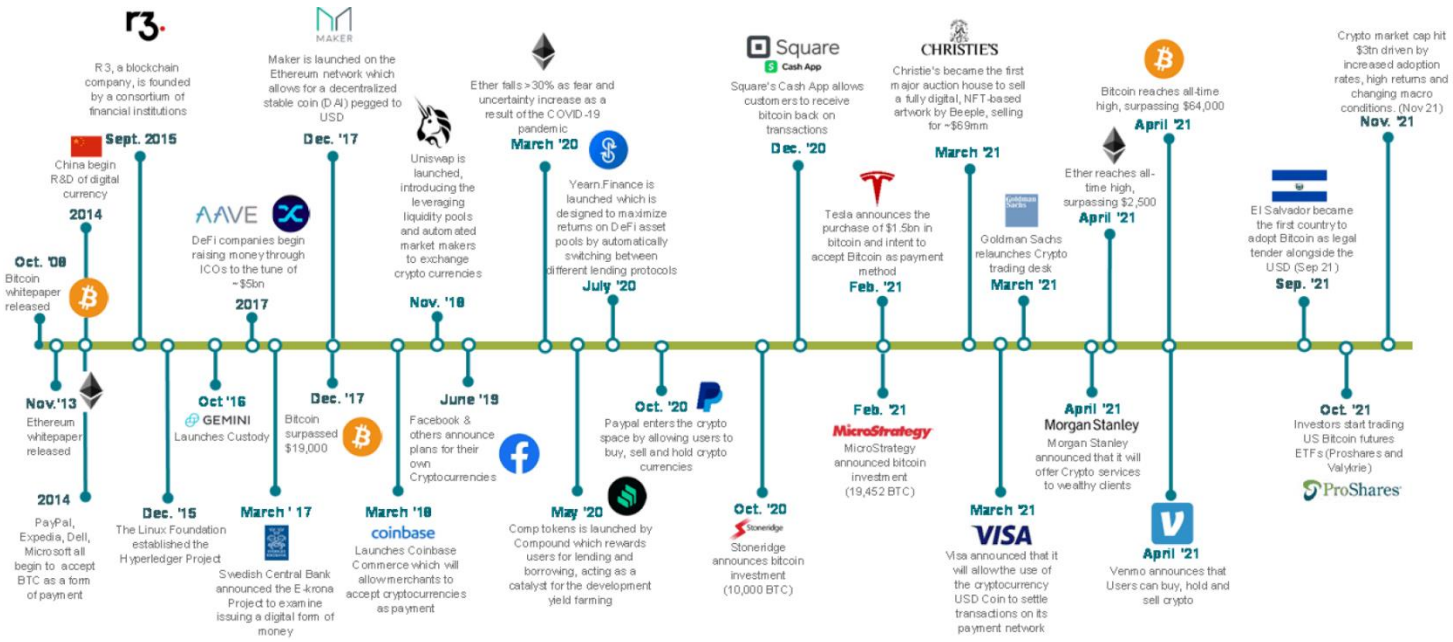
1) Cryptocurrencies are technology. While investors trade tokens like assets, cryptomarkets are technology and the underlying use cases are a big driver of their value. This technology is also the basis for communities that develop around cryptocurrency projects, but in JPM's view the technology comes first and is more important to the initial value creation.

2) The tokens are linked to blockchains. Investors with whom JPM have spoken to are far more willing to ascribe value to blockchains than they are to cryptocurrencies. There is a more easily accepted belief that blockchain technology has value, while the digital tokens are a retail driven pyramid scheme. However, the tokens and the blockchains are linked. Decentralized blockchains need a token with value to incentivize the validation of the blockchain – there needs to be a token and that token needs to have value in both proof-of-stake and proof-of-work. While this token value will fluctuate with supply and demand and thus the tokens can get overvalued, a token with value is nonetheless a necessary component of a decentralized blockchain.

3) Token value is based on the use cases for the blockchain. The value of the token is set by the market, based on supply and demand. Transactions on a blockchain are paid in the native token and thus one needs to purchase the underlying token to transact. For example, ERC-721 tokens (also referred to as NFTs) are bought and sold with Eth (Ether) and gas prices (transaction prices) are also paid in Eth. Acquiring Eth to transact in Ethereum based projects drives up the value of the Ether token.

(Source: JPM)

Figure 2: Timeline of Key CryptoEcosystem Milestones in Recent Years



Source: Onyx by JPMorgan

Bitcoin vs. Ethereum

Before moving on to non-payment uses of blockchain technology, it is important to note the distinction between Bitcoin and Ethereum. These two cryptocurrencies are the two largest cryptocurrencies in the world when categorized by market capitalization.

Bitcoin can be best understood as a digital currency and its uses are one-dimensional as with other non-digital currencies. Bitcoin's scarcity provides owners with value that they can use to purchase goods/services.

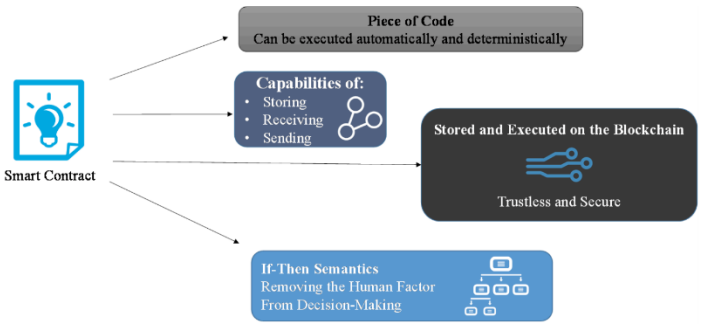
Ethereum is similar to Bitcoin in that it can be used as a digital currency, but a significant advancement is that the Ethereum network is essentially a decentralized software platform. Ethereum can be best understood as a programmable blockchain. It utilizes blockchain technology to allow developers to store computer code that can be used to create new cryptocurrencies, smart contracts, and decentralized applications.

Smart Contracts

The term "smart contract" was pioneered by computer scientist, law scholar, and cryptographer, Nick Szabo in 1997. The original term "smart contract" coined by Nick Szabo was defined as "a set of promises, specified in digital form, including protocols within the parties perform on these promises." A simple example of a smart contract is a vending machine. The vending machine is programmed so that you are guaranteed an authentic product if you input a certain amount of money into the machine. This removes the need for a human (intermediary) to process the sale of the good. Another example of a smart contract is the popular crowdfunding website Kickstarter. If a project on Kickstarter reaches fully funded status, the code on Kickstarter self-executes and provides the project team with the capital that was pledged. Similarly, the capital is returned to individuals if the project does not reach funded status by the deadline.

Smart contracts (in terms of blockchain) are written on the Ethereum network and are the base for decentralized applications. These contracts, like cryptocurrency, are immutable in that they cannot be changed once created and they are distributed and publicly available. These characteristics make tampering with smart contracts nearly impossible and the code is open source creating trust in a trustless system. Smart contracts execute the code defined in the agreement once the predetermined conditions are met and thus create value by eliminating the need for an intermediary. Some uses of smart contracts include borrowing and lending, insurance, and exchanges. Smart contracts are essential in decentralized applications (dApps) and Web3.0.

Figure 3. Smart Contracts



Source: Ethereum.org, JPM

Decentralized Applications (dApps)

Decentralized applications are programs that run on a blockchain network and can only be built on networks that support smart contracts (i.e. Ethereum). dApps are not owned by a single entity and run via peer-to-peer network. Each dApp will be unique in its function similar to how we currently use certain programs to accomplish different goals. Users will need to purchase the dApp's native token to interact with the program. For example, YouTube is a centralized video sharing program where users can post or watch content. It is easy to imagine the same type of program but on a decentralized network where users can post or watch videos on the blockchain while interacting with the dApp using its tokens.

There are three key benefits that dApps offer by being open-source and decentralized.

Trust. Unlike centralized applications that we are used to such as Facebook, Twitter, or Google, dApps are open-source and

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the code that make up the programs are publicly available. This creates trust as users are able to verify how the program functions.

Censorship Resistant. The immutable nature of blockchain and the decentralization of the program mean that there is no central authority. For example, unless programmed into the code, it would not be possible for a single user on a decentralized social media platform to delete a post that has already been recorded in the blockchain.

Always online. dApps are in essence being run on hundreds of thousands of computers in a network and therefore it cannot go offline. Unlike centralized programs where there are frequent maintenance breaks or bugs that crash the website, dApps are always running.

One notable disadvantage that dApps is that bugs (issues in the program's code) are harder to fix. Programs whether they are centralized or decentralized often require updates to the code to fix unforeseen problems. This is significantly more difficult to achieve in a dApp relative to their centralized counterpart.

Figure 4. Current Web Apps Versus Future dApps

	Web 2.0	Web 3.0 (powered by blockchain)
Storage	Dropbox, Google Drive, OneDrive	Storj, Filecoin, Sia, MaidSafe
Video and audio calls	Skype	Experty
Operating System	Android, IOS	Elastos, Essentia one
Social Network	Facebook, Twitter, LinkedIn	Steemit, Ono, SoMee, Mithril
Messaging	Wechat, Whatsapp, Messenger	Status, Dust, Cryptviser
Video Streaming	YouTube, Netflix	Flixxo, Dtube, Videocoin
Music	Spotify	Mycelia
Cloud Compute	AWS, Azure, GCP	Golem, SONM, Dfinity, iExec

Source: Hackermoon, JPM Research

Record Keeping

Record keeping is another promising area as blockchain technology can provide data security and transparency. Centralized databases are prone to single point of failure issues. Using the blockchain system, governments or corporations can utilize private distributed ledgers and smart contracts to enhance transparency thereby reducing the risk of manipulation. For example, growing concerns regarding election security and integrity can be remedied by using the decentralized and immutable aspects of blockchain. The immutable nature of blockchain means that it creates an audit trail that cannot be deleted.

Non-Fungible Token (NFT)

Non-fungible tokens are digital assets that are stored on blockchain. "Non-fungible" means that one digital asset (an NFT) is unique and there is no other NFT like it. For example, cryptocurrencies like bitcoin and Ethereum are fungible tokens in that one token is equal in value to another token of the same kind.

The Ethereum Foundation describes NFTs as the following: "an NFT has one owner at a time, which is managed through the uniqueID and metadata that no other token can replicate. NFTs are minted through smart contracts that assign ownership and manage the transferability. When an NFT is created, the creator executes code stored in smart contracts that conform to a certain standard, and this information is added to the blockchain where the NFT is being managed" (Source: Ethereum). An NFT can be artwork, photos, videos, or any other type of digital asset. They are analogous to sports trading cards in that scarcity creates value. A couple examples out of a long list of notable public companies that have ventured into NFTs include the NBA (Top Shot) and Adidas (Into the Metaverse).

The Evolution of the Internet So Far

The first iteration of the internet (Web1.0) lasted from 1991 to 2004. The internet during this period were mostly static pages of information via text and images. Users could not enter their own data and they were strictly consumers of information.

The evolution into Web2.0 began in 2004 and is the current state of the worldwide web that we use. The main difference that Web2.0 offers is the interactivity between users and webpages. Companies that own specific domains began collecting data on their users and using this data to provide users with content that we might be interested in. The advancement in machine learning and artificial intelligence has allowed centralized companies to gather extensive amounts of information on their users to sell this information to advertisers. This lack of privacy is a key issue that the next iteration of internet aims to solve.

Web3.0

Web3.0 is an idea of the new iteration of the World Wide Web. Proponents of Web3.0 believe that issues resulting from monopolistic centralized data will be remedied via decentralization. The decentralized version of the internet will result in higher levels of privacy where users can control what information they share with the internet.

Web3.0 applications will likely utilize dApps as the main form of applications due to Ethereum's inherent decentralized network. The progression from Web2.0 to Web3.0 will likely occur in stages and we should see new decentralized versions of programs that we are familiar with. For example, Storj is the decentralized counterpart to Google Drive. Data on the Storj DCS (decentralized cloud storage) are encrypted and distributed on a global cloud network. Storj offers users privacy via encryption and 24/7 availability due to decentralization.

Unlike Web2.0, domains or dApps will be owned by the users. It will be a creator economy where users are rewarded with the application's tokens for content creation. Instead of a single entity receiving the profit, the profit is spread amongst participants that create content and verify the content on the blockchain.

It is important to note that Web3.0 is still in its infancy stage and there has not been any concrete developments in a Web3.0 platform. The decentralized web that Web3.0 aspires to be is still in its research and development phase by organizations such as the "Web3 Foundation."

Metaverse

Metaverse has been a huge buzz word as of late since Mark Zuckerberg announced Facebook's rebranding into Meta Platforms Inc. on October 28, 2021. So, what is the metaverse? The metaverse can be best understood as a virtual universe that acts as an overlay of the world that we live in and supporters of the metaverse are calling it the next iteration of the Internet. It is a virtual world where you can work, play, and stay connected with users. Users can make transactions online to own digital assets (NFTs) that they can share virtually through the metaverse. It will not be a single product from Facebook (or Meta Platforms Inc.) but something that will be adopted by many companies across various sectors as a way to remain competitive.

According to Roundhill Investments, the first metaverse ETF (Ticker: META) issuer, the metaverse is enabled by seven key categories. Computing, networking, virtual platforms, interchange standards (tools & formats for the digital world), payments, content, and hardware. From socialization to gaming to advertisements- the metaverse has huge implications that will impact many sectors. These categories can be broadly defined as software (programs, apps, tools), hardware (AR/VR devices & components), infrastructure (internet and systems), and virtual platforms (engines and environments). The following figure is a list of companies that are likely to play a big role in the metaverse. (Source: Roundhill Investments)

An important distinction to make is that the metaverse does not necessarily have to run on a decentralized network such as blockchain. Centralized single entities such as Meta Inc and Roblox are examples of non-decentralized platforms where the metaverse will coexist with decentralized platforms such as blockchain.

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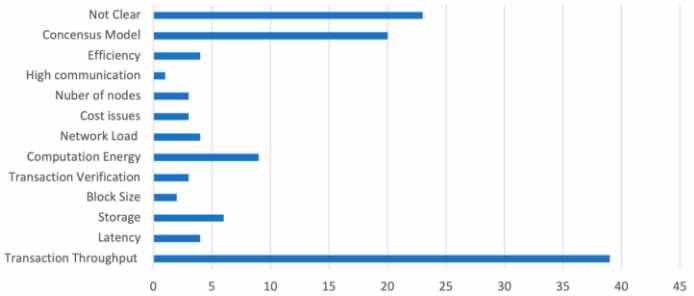
Scalability, Proof-of-Work, Proof-of-Stake

The three core blockchain properties are decentralization, security, and scalability. Decentralization and security are core/essential properties which cannot be compromised and thus creates the problem of scalability. This is referred to as the scalability trilemma.

Scalability in terms of blockchain is defined as the capability of the system to process large amounts of transactions. According to MDPI (Source: MDPI), the scalability issue arises with the increasing number of nodes and the need to verify every transaction in the blockchain. The most important performance metric in the scalability issue is transaction throughput. Transaction throughput is the total number of transactions that the protocol may handle in one second. Scalability is currently the major hurdle for popular public blockchains such as Bitcoin and Ethereum. The problem is three-fold: scalability with the PoW consensus format which is the most frequently used consensus protocol suffers from slow verification speed and requires massive amounts of energy and bandwidth.

Figure 5: Factors Causing Scalability Issues



Source: Applied Sciences MDPI

Potential solutions to the scalability issue can be broadly defined by on-chain solutions and off-chain solutions. On-chain solutions attempt to solve the scalability problem by working on the blockchain system itself. Examples of on-chain solutions can be further classified as block-data-related approaches and consensus-protocol-related approaches. Off-chain solutions attempt to solve the scalability problem by decreasing the transaction validation limitation by executing transactions outside of the main blockchain. (Source: MDPI)

The issue with scalability has a strong connection with the PoW consensus model that most cryptocurrencies currently use. There are three main problems with the PoW consensus protocol:

1) Scalability issues are concerns regarding efficiency such as transaction-per-second and this issue is discussed in the "Concerns regarding blockchain" section below.

2) The PoW algorithm provides an inherent advantage to those who have sophisticated equipment which has resulted unfair competition and semiconductor shortages.

3) The PoW algorithm consumes enormous amounts of energy and this critical issue has been gaining traction as the world combats the effects of global warming.

A promising potential solution for the scalability issue is the transition from a PoW consensus algorithm to a PoS consensus protocol:

In a PoW model, miners use hardware and electricity to solve cryptographic puzzles to create the next block in order to be rewarded the digital currency. This has led to Bitcoin miners creating mining farms that use enormous amounts of electricity. Furthermore, miners with advanced equipment are rewarded more in a PoW system.

In a PoS model, one node is almost randomly chosen to validate the next block. In order to be a "validator" rather than a "miner", a node must deposit cryptocurrency into the network as stake (or better understood as collateral). Once the validator confirms the transactions in the block, the validator receives the fees that associated with the transactions, then the block is closed and added to the blockchain. Proof-of-stake uses considerably less energy as not everyone can mine/validate the blockchain and validators do not need advanced hardware in order to execute the process. This creates a faster and more decentralized network as there are more nodes in the network.

Ethereum is currently in the process of upgrading from PoW to PoS. The upgrade is referred to as the "Ethereum Merge" and is expected to occur in 2022. This is likely to be a big tailwind for Ethereum as it will allow for greater scalability and lower transaction costs.

Lack of Regulation

The lack of regulation in blockchain networks is a double-edged sword that provides users with privacy benefits but poses a risk of scams and market manipulation. The pace of advancement of possibilities in blockchain technology has outpaced the regulation considerations.

Jurisdictional concern is one example regarding lack of regulation in public blockchains. Jurisdictional concerns are an important consideration regarding blockchains as nodes in a decentralized ledger are likely to span across the world. This creates concern as laws and regulations may apply different for the same application across the world.

Endpoint Vulnerability

Despite blockchain being "unhackable", there is a lack of security for endpoint users such as digital wallets. Cyber attacks to steal cryptocurrencies is an issue that has yet to be completely resolved and unlike current financial markets, there is no insurance against hacks to exploit digital wallets or a user mistake.

According to JPM, the growth, evolution, and mainstream adoption of the cryptocurrency market has presented a unique opportunity to illicit actors, including Ransomware-as-a-Service (RaaS) operators and their affiliates. These markets are decentralized and therefore beyond the control of central governments. They also offer nearly real-time cross-border gross and final settlement. This has included the development of a host of laundering tools like mixers, privacy wallets, as well as access to a range of global exchanges. A potential solution to this issue is cyber insurance which may be possible on or off the blockchain. (Source: JPM)

Selected Stocks and ETFs Related to the Theme (These Are Examples, Not Actionable Buy Recommendations)

Smart Contracts

Ticker	Company Name	Market Cap (Millions)	Revenue (Millions) FY21	Revenue (Millions) FY22E	Price / Earnings 2022E	Price / Earnings 2023E	EV / EBITDA 2022E	EV / EBITDA 2023E	EV / Sales 2022E	EV / Sales 2023E
DOCU-US	DocuSign, Inc.	$ 24,056	$ 1,453	$ 2,088	53x	41x	41x	33x	9x	7x
CSGP-US	CoStar Group, Inc.	$ 28,040	$ 1,659	$ 1,939	51x	39x	32x	25x	11x	9x
ADBE-US	Adobe Inc.	$ 251,459	$ 15,801	$ 17,938	32x	32x	28x	25x	14x	12x

Source: FactSet

Record Keeping

Ticker	Company Name	Market Cap (Millions)	Revenue (Millions) FY21	Revenue (Millions) FY22E	Price / Earnings 2022E	Price / Earnings 2023E	EV / EBITDA 2022E	EV / EBITDA 2023E	EV / Sales 2022E	EV / Sales 2023E
VRSN-US	VeriSign, Inc.	$ 24,824	$ 1,265	$ 1,328	34x	29x	26x	22x	18x	16x
VEEV-US	Veeva Systems Inc Class A	$ 32,770	$ 1,465	$ 1,846	58x	50x	41x	35x	16x	14x
DSY-FR	Dassault Systemes SA	$ 57,379	$ 4,452	$ 5,351	37x	37x	28x	26x	10x	10x
INTU-US	Intuit Inc.	$ 159,226	$ 9,633	$ 12,272	40x	40x	32x	27x	12x	10x
ADBE-US	Adobe Inc.	$ 251,459	$ 15,801	$ 17,938	32x	32x	28x	25x	14x	12x

Source: FactSet

Security

Ticker	Company Name	Market Cap (Millions)	Revenue (Millions) FY21	Revenue (Millions) FY22E	Price / Earnings 2022E	Price / Earnings 2023E	EV / EBITDA 2022E	EV / EBITDA 2023E	EV / Sales 2022E	EV / Sales 2023E
CYBR-US	CyberArk Software Ltd.	$ 5,389	$ 464	$ 496	N/A	383x	3645x	165x	9x	7x
AKAM-US	Akamai Technologies, Inc.	$ 18,818	$ 3,198	$ 3,456	19x	17x	12x	11x	5x	5x
NET-US	Cloudflare Inc Class A	$ 27,334	$ 431	$ 648	5019x	1018x	300x	188x	33x	25x
OKTA-US	Okta, Inc. Class A	$ 28,405	$ 835	$ 1,277	N/A	844x	N/A	204x	15x	11x
ZS-US	Zscaler, Inc.	$ 36,071	$ 673	$ 1,008	268x	268x	259x	162x	33x	25x
CRWD-US	CrowdStrike Holdings, Inc. Class A	$ 36,861	$ 874	$ 1,432	187x	121x	113x	77x	19x	14x
PANW-US	Palo Alto Networks, Inc.	$ 50,261	$ 4,256	$ 5,386	56x	56x	36x	31x	9x	7x
FTNT-US	Fortinet, Inc.	$ 50,665	$ 2,594	$ 3,340	65x	55x	43x	35x	12x	10x
CSCO-US	Cisco Systems, Inc.	$ 236,903	$ 49,818	$ 52,739	15x	15x	11x	11x	4x	4x

Source: FactSet

Metaverse

Ticker	Company Name	Category	Market Cap (Millions)	Revenue (Millions) FY21	Revenue (Millions) FY22E	Price / Earnings 2022E	Price / Earnings 2023E	EV / EBITDA 2022E	EV / EBITDA 2023E	EV / Sales 2022E	EV / Sales 2023E
MTTR-US	Matterport, Inc. Class A	Software, Virtual Platform	$ 2,115	$ -	$ 109	N/A	N/A	N/A	N/A	N/A	N/A
FSLY-US	Fastly, Inc. Class A	Infrastructure	$ 3,217	$ 291	$ 349	N/A	N/A	N/A	4583x	8x	7x
U-US	Unity Software, Inc.	Software, Virtual Platform	$ 29,176	$ 772	$ 1,088	N/A	1477x	790x	148x	17x	13x
RBLX-US	Roblox Corp. Class A	Virtual Platform	$ 34,905	$ 924	$ 2,715	N/A	N/A	45x	35x	10x	8x
ADSK-US	Autodesk, Inc.	Software	$ 54,553	$ 3,791	$ 4,369	35x	28x	27x	22x	11x	9x
SHOP-US	Shopify, Inc. Class A	Payment Services	$ 100,903	$ 2,929	$ 4,575	136x	96x	120x	79x	16x	12x
NVDA-US	NVIDIA Corporation	Hardware, Infrastructure, Virtual Platform	$ 631,050	$ 16,675	$ 26,644	47x	39x	37x	33x	19x	17x
FB-US	Meta Platforms Inc. Class A	Hardware, Software, Virtual Platform	$ 764,308	$ 117,929	$ 134,860	15x	15x	10x	9x	5x	4x
MSFT-US	Microsoft Corporation	Hardware, Software, Virtual Platform	$ 2,349,968	$ 168,088	$ 198,745	28x	28x	23x	20x	11x	10x
AAPL-US	Apple Inc.	Hardware, Software, Virtual Platform	$ 2,869,611	$ 365,817	$ 394,469	27x	27x	23x	22x	8x	7x

Source: FactSet

Continued

Financials

Ticker	Company Name	Market Cap (Millions)	Revenue (Millions) FY21	Revenue (Millions) FY22E	Price / Earnings 2022E	Price / Earnings 2023E	EV / EBITDA 2022E	EV / EBITDA 2023E	EV / Sales 2022E	EV / Sales 2023E
GLXY-CA	Galaxy Digital Holdings Ltd.	$ 1,619	$ -	$ 1,588	19x	N/A	N/A	N/A	4x	N/A

Source: FactSet

ETFs

Ticker	Company Name	Market Cap (Millions)
ETC-CA	Evolve Cryptocurrencies ETF CAD Unhedged	$ 25
LEGR-US	First Trust Indxx Innovative Transaction & Process ETF	$ 158
BLCN-US	Siren ETF Trust Siren Nasdaq NexGen Economy ETF	$ 223
BTCC-CA	Purpose Bitcoin ETF	$ 225
BITW-US	Bitwise 10 Crypto Index Fund Units of Benef Interest	$ 469
META-US	Roundhill Ball Metaverse ETF	$ 877
BLOK-US	Amplify Transformational Data Sharing ETF	$ 957

Source: FactSet

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BMO Nesbitt Burns

BMO Wealth Management
BMO Nesbitt Burns