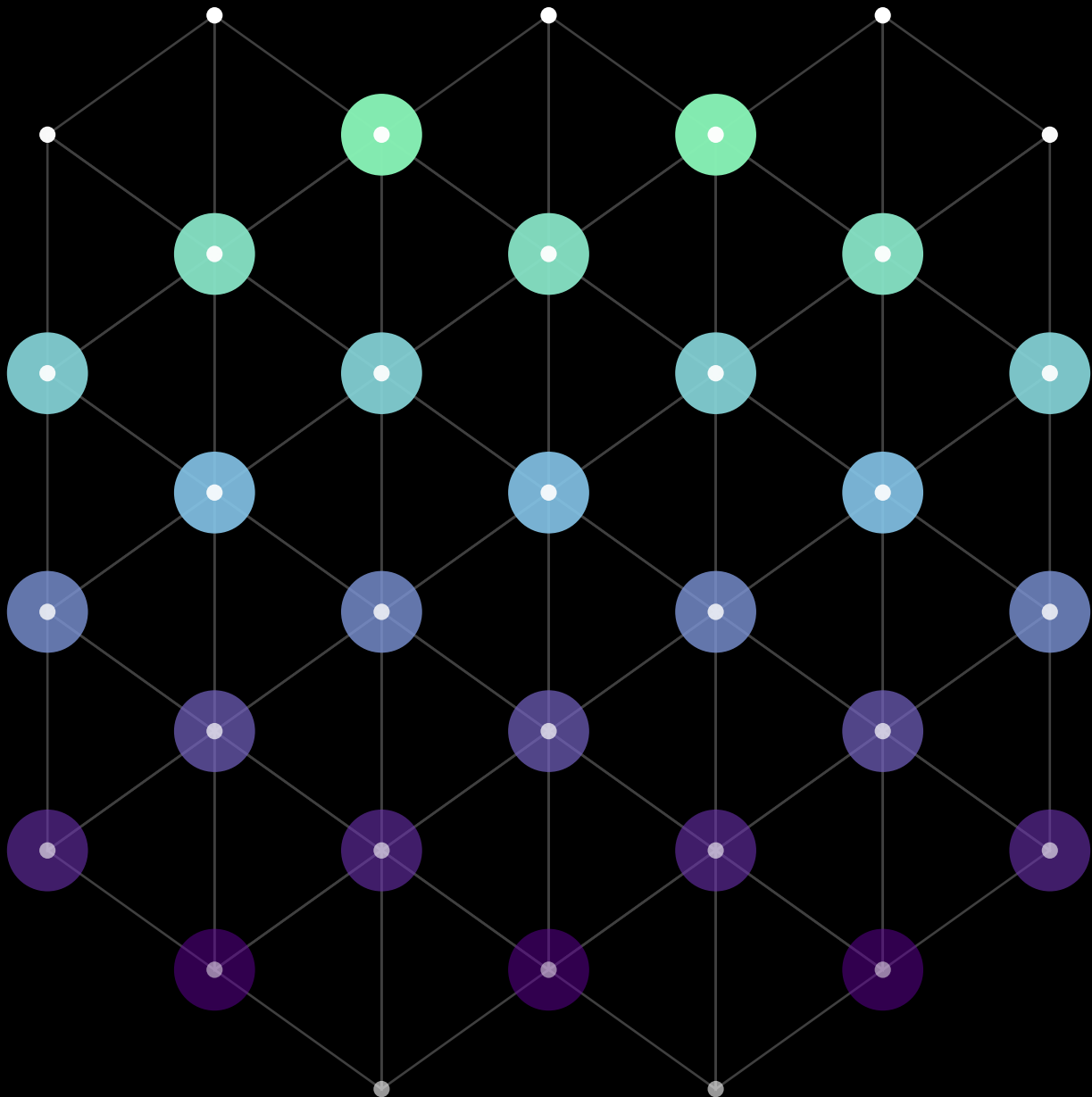AMBER

JUNIPER
PLACE

Digital Asset Investments
for UHNW Investors and Family Offices
A first look

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Contents

Abstract

In late 2021, BNY Mellon Wealth Management surveyed 200 key personnel at family office firms, including 56 single-family offices and 144 multi-family offices with at least $150 million assets under management[1].

The survey found that "77% of family offices have some level of interest in or exposure to digital assets. Among those who have already deployed capital to digital assets, 66% said they would probably increase their holdings in the next year or two".

Despite this level of interest, many wealth managers and family offices still find the topics of blockchain, cryptocurrencies, and decentralized finance opaque and difficult to tackle - especially when exploring it from the lens of asset allocation and portfolio construction. This report provides a high level overview of digital assets as an investable asset, first covering the fundamentals of blockchain, its related concepts, and why they are important for family offices and high net worth (HNW) investors.

The report then provides a quantitative framework aiding the understanding of whether digital assets have a role to play in diversified portfolios, and henceforth appropriate size for allocations (subject to each investor's risk appetite and investment return objectives).

Finally, the report showcases some of the relevant products offered by Amber Group as a specialist digital asset financial institution for interested investors to gain exposure and execute on their digital asset investment strategies.

This report should provide family offices, wealth managers and UHNW individuals with a basic understanding of digital assets as an asset class, the foundations to form their own opinion on its investability, an awareness of strategies for portfolio construction and diversification that can be utilized when considering digital assets, and tangible solutions that Amber can offer.

Generally speaking, this report does not take a stance on whether investors should own digital assets or not, nor does it provide investment advice or recommendations for specific products to deploy capital into.

Instead, the objective is to provide a foundational understanding of the merits and limitations of digital assets, a framework for thinking about their positioning relative to other traditional assets within a portfolio, and finally strategies available for managing the risk / reward for those who hold digital assets within a diversified portfolio.

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1 BNY Mellon, "Digital Assets: From Fringe to Future"

01

Digital Assets 101 – Fundamental concepts
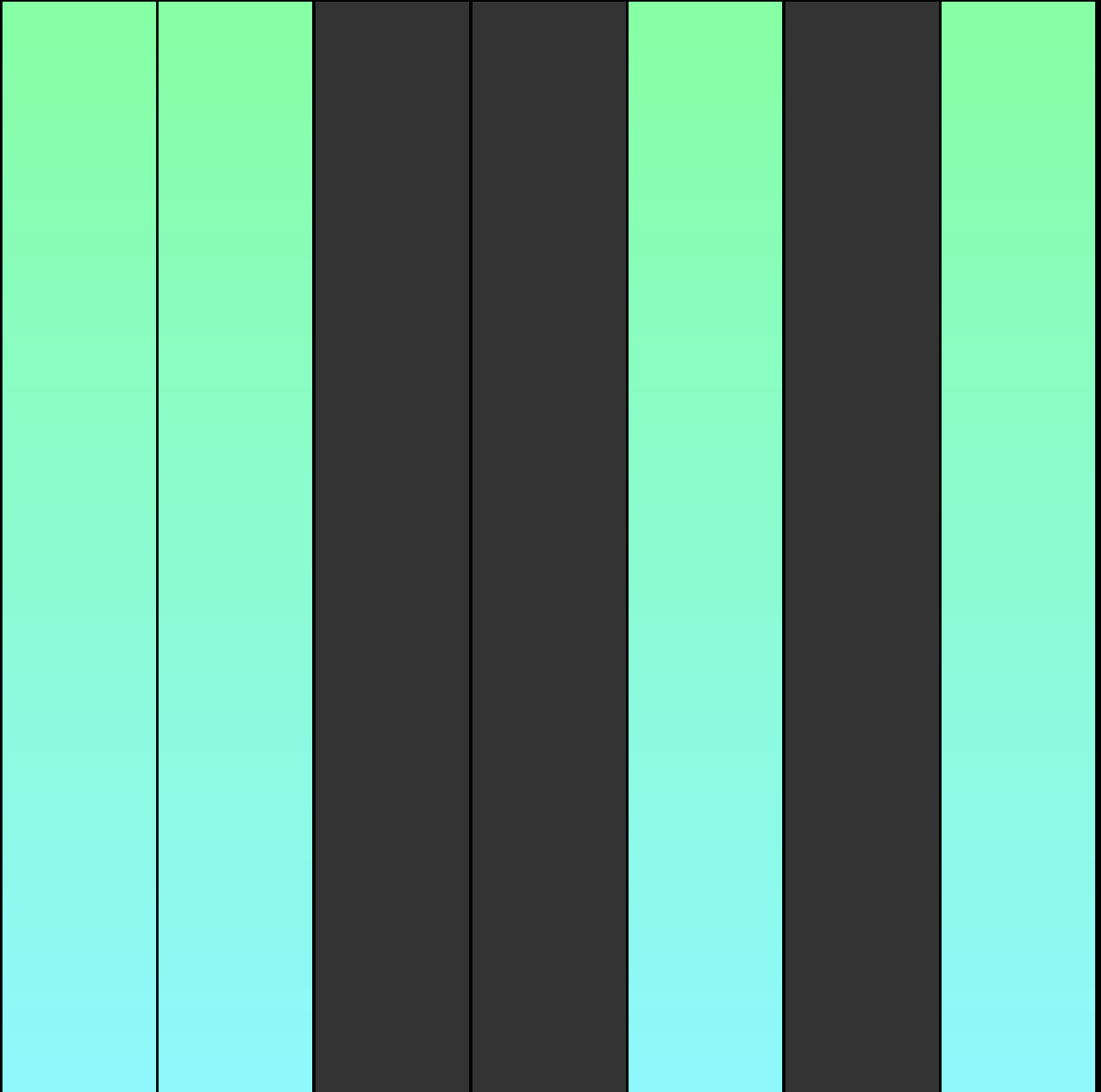
Distributed Ledger Technology (DLT)
A verifiable and trustless public database for value transfer

Generally speaking, a distributed ledger is nothing more than a database that verifies, processes, and records transactions on a network, along with their corresponding source (which can be a "wallet" or "account"). In traditional finance, this has always been done via centralized intermediaries acting as record keepers. Bitcoin, the first cryptocurrency created, was revolutionary as it replaced the traditional need for a centralized intermediary through its creation of a blockchain, the most commonly-used form of distributed ledger technology. It uses cryptography to avoid single points of failure and maintain pseudoanonymity and seizure-resistant ownership. Instead of using intermediaries, value is transferred peer-to-peer (P2P) and verified by a network of nodes as opposed to a central entity.

There are a few key defining characteristics of a blockchain network: Blockchain is formally described as a "cryptographically secure… transactional singleton machine with shared state" [2]. These complex terms can be further broken down into more simple concepts.

Cryptographically secure	Cryptographically secure	Cryptographically secure
Means that the transactions are secured by complex mathematical algorithms whose outputs effectively cannot be faked. This makes it nearly impossible to cheat the system (e.g., create fake transactions, erase transactions, and others).	Means that there is a single canonical instance of the machine responsible for all the transactions being created in the system. In other words, there is a single "global truth" everyone believes in.	Means that the state stored on this machine is shared and open to everyone; effectively, the ledger is public and readily accessible[3].

The quintessential usage of this technology (and the one that brought it to the mainstream) is Bitcoin (BTC), a digital currency that functions without the need of any financial intermediary or centralized technology. Transaction data on the Bitcoin network are cryptographically stored and immutable. This data cannot be altered and a pseudonymous transaction log is visible to all, providing an absolute level of transparency for users. Users who are interested in viewing data for the latest transactions on a blockchain, most recent historical prices, or more complex information, can easily do so using publicly available tools such as www.blockchain.com/explorer.
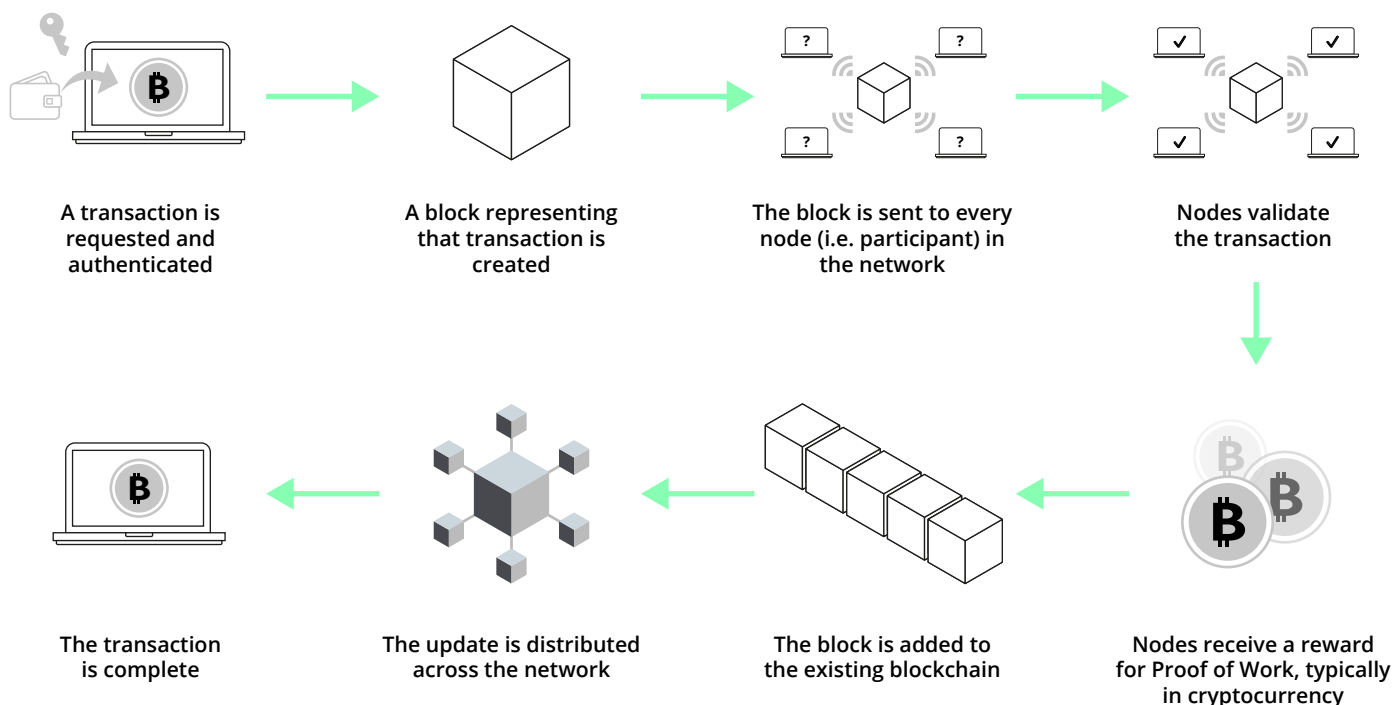
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2 Dr Gavin Wood, "Ethereum Yellow Paper"
3 Dapp Club

Blockchain is also described as a "trustless" system. Blockchain does not completely eliminate trust, it simply minimizes the amount of trust required from any single actor in the system. This is done by distributing trust among different actors in the system via economic incentives for them to cooperate within the rules defined by the protocol. In modern day "centralized" transactional systems, trustworthy intermediaries (such as banks, remittance companies, payment providers, and others) facilitate the transfer of value between parties and verify that the specific transfer is authentic and involves "no double spending" (validity). In a "decentralized" system like Bitcoin, the trust is placed elsewhere, namely in **"public-key cryptography"** and a **"consensus mechanism"** that allows each party to determine the truth:

Fig. 1

How does a transaction get into the blockchain?

A transaction is requested and authenticated

A block representing that transaction is created

The block is sent to every node (i.e. participant) in the network

Nodes validate the transaction

The transaction is complete

The update is distributed across the network

The block is added to the existing blockchain

Nodes receive a reward for Proof of Work, typically in cryptocurrency
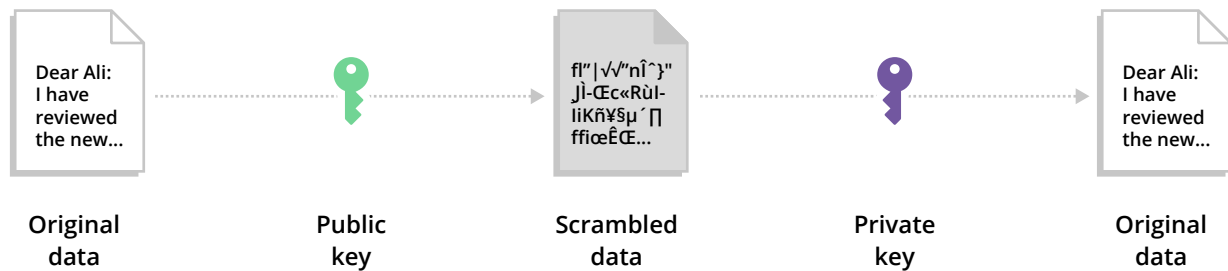
Taking the less technical route, **"public-key cryptography"** allows for the generation of a digital signature for each blockchain transaction that a user sends out. Public keys can be thought of as email addresses, whereas private keys, which are secret strings of characters used for access to a given address, are akin to email passwords. If you want to receive a transaction, you share your public key but not your private key. In this way, public-key cryptography helps authenticate and identify individual users within the P2P protocol. Note that here, we highlight the importance of protecting private keys: a leak of your private keys would allow anyone to access your cryptocurrency, enabling a malicious actor to take control of your digital assets.

Most users do not directly interact with the public-key cryptography protocols involved in signing and verifying messages; instead, wallets, which are user-friendly applications that interact with the blockchain (for storage and transfer of assets), store users' private keys. Protecting one's private keys requires selection of a secure wallet. Some wallets are "hot wallets", which store private keys on devices that are connected to the internet, whereas others are "cold wallets", which store private keys on devices that are not connected to the internet (e.g. a USB stick) and offer an additional layer of security.

Fig. 2

Public-Key Cryptography

| Original data | Public key | Scrambled data | Private key | Original data |

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To ensure transaction validity, there also needs to be a record of account balances so each party can know how much an account can spend. The "consensus mechanism" allows users to preserve a digitally shared truth. Blockchain has a shared ledger that gives users the absolute truth of the state of the system. It uses mathematics, economics, and game theory to incentivize all parties in the system to reach a "consensus", or an agreement on a single state of the ledger.

The Bitcoin protocol uses a consensus system called "Proof-of-Work" (PoW) [4]. Within PoW, there are computers running the BTC protocol (called nodes), and a subset of these nodes compete against each other to be the first to solve complex puzzles. This process is commonly referred to as mining because the energy and resources required to complete the puzzle are often considered the digital equivalent to the real-world process of mining metals. For a transaction to be settled between two parties, the subset of nodes solving these puzzles (called "miners") are required to compete to validate transactions by solving a complex algorithmic problem. Because Bitcoin's protocol specifies that a new block of transactions should be produced approximately every ten minutes and because each new block has a maximum amount of memory it can store, Bitcoin's maximum processing capacity is estimated (using a median transaction size) to be between 3.3 and 7.0 transactions per second (tps). By comparison, Visa processes an average of 1,700tps, up to a high of 24,000tps. Other distributed ledgers, such as Solana, boast a theoretical maximum of 65,000 tps with near zero fees (in practice, Solana has historically delivered between 2,000tps-3,000tps, on average).This is accomplished through innovations in the mechanisms used by the protocol, including optimizations to ordering transactions, sending transactions to nodes, arriving at consensus, and executing the computation required by the transactions themselves, among other things.

Bitcoin economically incentivizes miners to use their computational power to solve complex problems. These economic incentives include earning a transaction fee that users pay for carrying out a transaction and earning new bitcoins for successfully solving the puzzle. Because of these economic incentives, miners are constantly monitoring the network so that they can gather a new set of transactions to fit into a new "block" on the chain. The first miner to solve the algorithmic puzzle is allowed to create a new block (a grouping of transactions) and broadcast it to the network of nodes, which will then perform audits of the existing ledger and the new block. Should everything check out, the new block is "chained" onto the previous block, creating a chronological chain of transactions. The miner is then rewarded via the incentives mentioned above for supplying their resources.

Mining requires a large amount of resources, including specialized computers, a robust source of electricity, and related infrastructure. This secures the network by ensuring that only those that can prove they have expended resources are granted the right to append a new set of transactions to the blockchain. Because of this feature, it is difficult, time-consuming, and expensive to attack a PoW consensus system. Even nefarious miners that have adequate resources would still need to compete to solve the puzzle faster than everyone else and attempt to add a block of transactions containing counterfeit bitcoins to the chain. In the event that a nefarious miner successfully solves the puzzle first, they would try to broadcast a new block of transactions out to the rest of the network. However, as the nodes audit the new block against the previous version of the ledger, they would notice the counterfeit BTC. The block would be considered invalid based on consensus rules.

Fig. 3

Mining in slow motion

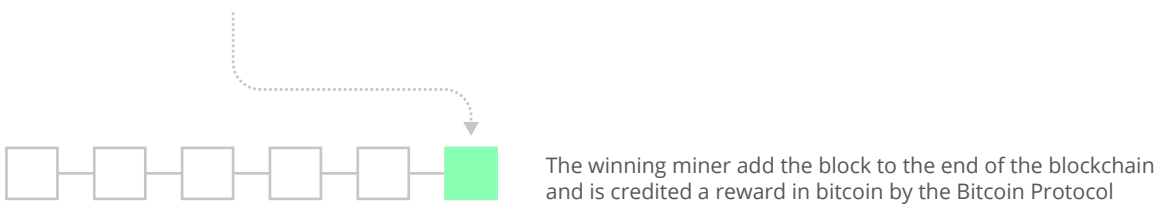Bitcoin Protocol says: the resulting hash of the next block must have 8 zeros at the beginning and be less than x

The winning miner add the block to the end of the blockchain and is credited a reward in bitcoin by the Bitcoin Protocol

With every new block that is added to the blockchain, the system becomes more secure. A hypothetical plan to counterfeit bitcoin would require a miner to control over 50% of the cumulative computing power of the network. In this scenario, they could broadcast a bad block to the network and have their own nodes accept the block to the chain. Given how large Bitcoin's network has grown (a fully diluted market cap of roughly $0.5 trillion, at time of writing) and how much energy miners contribute to the PoW system, such an attack would be nearly impossible today. PoW has been a proven way to maintain consensus and security within a distributed public ledger. Since launch, Bitcoin has had an over 99.98% uptime [5].

Why is this important?

Distributed ledger technology (in conjunction with Bitcoin) has brought to the world the ability to trustlessly transfer value without relying on intermediaries. This has far-ranging implications, from the creation of a new way to store value that cannot easily be impinged on by any entity to the possibility of new financial infrastructure outside of traditional financial rails. In the next few sections, we explore innovations that have occurred in the DLT space, their real-world implications and why these are relevant for investors today.

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5 Blockworks, "Proof-of-work vs. Proof-of-stake: Which is Better?"

Smart Contracts - self-executing software programs built on top of a distributed ledger

Smart contracts are software programs hosted on a distributed ledger used to exchange on-chain assets without the need for any intermediates. It is an automated or self-executing contract that performs some function or functions when a transaction is sent to the smart contract's address. A simple non-blockchain related example is the vending machine, which has inherent logic built-in to ensure that with the right inputs, a specific output is produced [6].

Once published to the ledger, smart contracts are distributed, decentralized, and transparent, as they run on DLT. Contract execution over a distributed ledger provides advantages compared to running centralized software: smart contracts inherit features such as immutability, transparency, and security.

When Bitcoin was released, it only allowed the creation and execution of simple smart contracts. It was Ethereum that introduced a far more capable way of using smart contracts in a distributed ledger. Vitalik Buterin, Ethereum's founder, succinctly described smart contracts as a way to transfer assets or currency in a program. Smart contracts work by following simple "if/when...then..." statements that are written into code on a distributed ledger. A network of computers executes the actions when predetermined conditions have been met and verified. There are several advantages smart contracts have over traditional systems [7]:

1 Speed, efficiency, and accuracy

Once a condition is met, the contract is executed immediately. Because smart contracts are digital and automated, there is no paperwork to process and no time spent reconciling errors that often result from manually filling in documents. The combination of accuracy, speed, and automation completes the entire contract process efficiently.

2 Trust and transparency

Because there is no third party involved, and because encrypted records of transactions are shared across participants, there is no need to question whether information has been altered for personal benefit.

3 Security

Transaction records are encrypted, which makes them very hard to hack. Moreover, because each record is connected to the previous and subsequent records on a distributed ledger, hackers would have to alter the entire chain to change a single record.

4 Savings

Smart contracts remove the need for intermediaries to handle transactions and, by extension, their associated time delays, labor, and fees.

Why is this important?

Smart contracts open up a range of applications leveraging DLT; while we will explore their use cases in the context of financial infrastructure, it is important to note that they are already being utilized by traditional non-financial businesses, taking advantage of the benefits of active DLT solutions today. Some examples include:

Digital art and collectibles – In the past two years, NFTs have created a new medium through which artists and creators can share their work, while also allowing collectors to more easily connect with and trade the pieces they enjoy. Importantly, NFTs have also provided a more accessible way for new audiences to engage with crypto protocols and associated tools.

Gaming – Recently, we have seen a large number of new gaming studios looking to integrate crypto mechanics into their titles, allowing the trading of in-game items, making it possible to place friendly wagers with other players, or implementing other game mechanics uniquely enabled by operating on crypto rails. Many of the teams currently entering the space have extensive game development experience from publishers including Riot Games, Blizzard, and others.

Online community building – Much like subreddits or Facebook groups, certain NFT collections and decentralized autonomous organizations (DAOs) have successfully created membership-based online communities with people from around the world who share the same interests and online culture.

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6 The integral components of a smart contract are termed as objects. There are essentially three objects in a smart contract – the signatories, who are the parties involved in the smart contracts that use digital signatures to approve or disapprove the contractual terms; the subject of the contract; and the contract's specific terms.
7 Visual Capitalist, "The Power of Smart Contracts on the Blockchain"

Decentralized Finance - financial infrastructure built on top of compatible distributed ledgers

Decentralized finance (DeFi) is a DLT-based financial infrastructure that has recently gained a lot of traction. The term generally refers to a collection of decentralized applications (dapps) built on public smart contract platforms, such as the Ethereum blockchain. They remain different from centralized finance (CeFi) platforms in that they are fully open and permissionless; whereas a CeFi exchange such as Coinbase may restrict certain users' activities, DeFi architecture remains open to everyone.

Smart contracts are the backbone of all DeFi applications and protocols. By deploying immutable smart contracts on Ethereum, DeFi developers can launch financial protocols that run exactly as programmed and that are available to anyone with an internet connection. The breakthrough of DeFi is that digital assets can now be used in ways not possible with fiat or "real world" assets. Decentralized exchanges, synthetic assets, and lending and borrowing using flash loans are some of the completely novel applications that can only exist on distributed ledgers and are discussed in further detail below.

The Federal Reserve of St. Louis published a paper on financial markets and covered DeFi's use of a multi-layered architecture, with each layer having its own distinct purpose [8]. These layers build on each other and create an open and highly composable infrastructure that allows everyone to build on, rehash, or use other parts of the stack:

1 The Settlement Layer

Consists of the ledger and its native asset (e.g. ETH on the Ethereum blockchain). It allows the network to store ownership information securely and ensures that any state changes adhere to its ruleset. Distributed ledgers can be seen as the foundation for trustless execution and serve as a settlement and dispute resolution layer.

2 The Assets

Consists of all assets that are issued on top of the settlement layer. This includes the native settlement layer asset as well as any additional assets that are issued on this ledger, commonly referred to as tokens (to be discussed in more detail below). As an example, NFTs are issued as ERC-721 standard tokens on the Ethereum blockchain.

3 The Smart Contracts

A smart contract is software which is deployed on the settlement layer and which is built for specific use-cases of value transfer. These are usually implemented as a set of addresses on the settlement layer that can be interacted with by any user (or DeFi application). As such, these smart contracts are often highly interoperable. An example could be "Compound", a money-market smart contract built on the Ethereum blockchain, or Uniswap's decentralized exchange (DEX) smart contract also built on the Ethereum blockchain. Protocols typically issue a token associated with their use.

4 The Applications

User-oriented applications, such as websites or mobile apps, that connect to smart contracts (protocols) hosted on the settlement layer. The smart contract interaction is usually abstracted by a web browser-based or mobile-based front end, making the protocols easier to use. An example of this is Compound.finance, a website which hosts a user interface through which end users can interact more easily with the Compound money-market smart contract built on the Ethereum blockchain.

5 The Aggregators

Is an extension of the application layer. Aggregators create user-centric platforms that connect to several applications and protocols. They usually provide tools to compare and rate services, allow users to perform otherwise complex tasks by connecting to several protocols simultaneously, and combine relevant information in a clear and concise manner. An example of this is "1inch", a DEX aggregator that connects to multiple decentralized exchanges within a given chain to give users the best possible price on their on-chain swaps.

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[8] Federal Reserve Bank of St. Louis, "Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets"

These components are hierarchical and are only as secure as the components below. If, for example, the blockchain used as the settlement layer is compromised, all subsequent components would not be secure. Similarly, if we were to use a permissioned ledger as the foundation, any decentralization efforts on subsequent smart contracts, applications, or aggregators would be ineffective. We highlight a range of DeFi applications and their different use-cases:

Decentralized Exchange (DEX)

Uniswap is a fully decentralized on-chain protocol for token exchange, generally referred to as a DEX. Because it would be too costly to post and cancel individual trade orders to Ethereum's v, Uniswap replaces the need for a traditional central limit order book with an algorithm known as an Automated Market Maker (AMM). An AMM is a smart contract that will hold (at least) two tokens in a reserve known as a "liquidity pool" and allows anyone to deposit tokens of one type and to withdraw tokens of the other type. To determine the exchange rate of a particular trade, smart contract-based liquidity pools typically use a variation of the "constant product" model, where the relative price is a function of the relative quantities of each token in the liquidity pool. In its simplest form, the constant product model can be expressed as $xy = k$, where x and y correspond to the quantities of each token in the pool (e.g. 50 ETH and 100,000 USDC) and k is a constant (in this example, $k = 5,000,000$ because $50 * 100,000 = 5,000,000$). As-of August 2022, Uniswap had a total value locked (TVL) of over $6.5 billion [9], representing the dollar value of all tokens which are held by Uniswap smart contracts for the purposes of running the AMM.
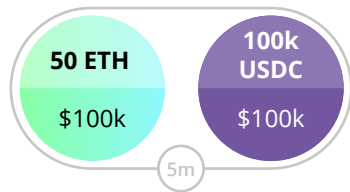
Fig. 4

Uniswap
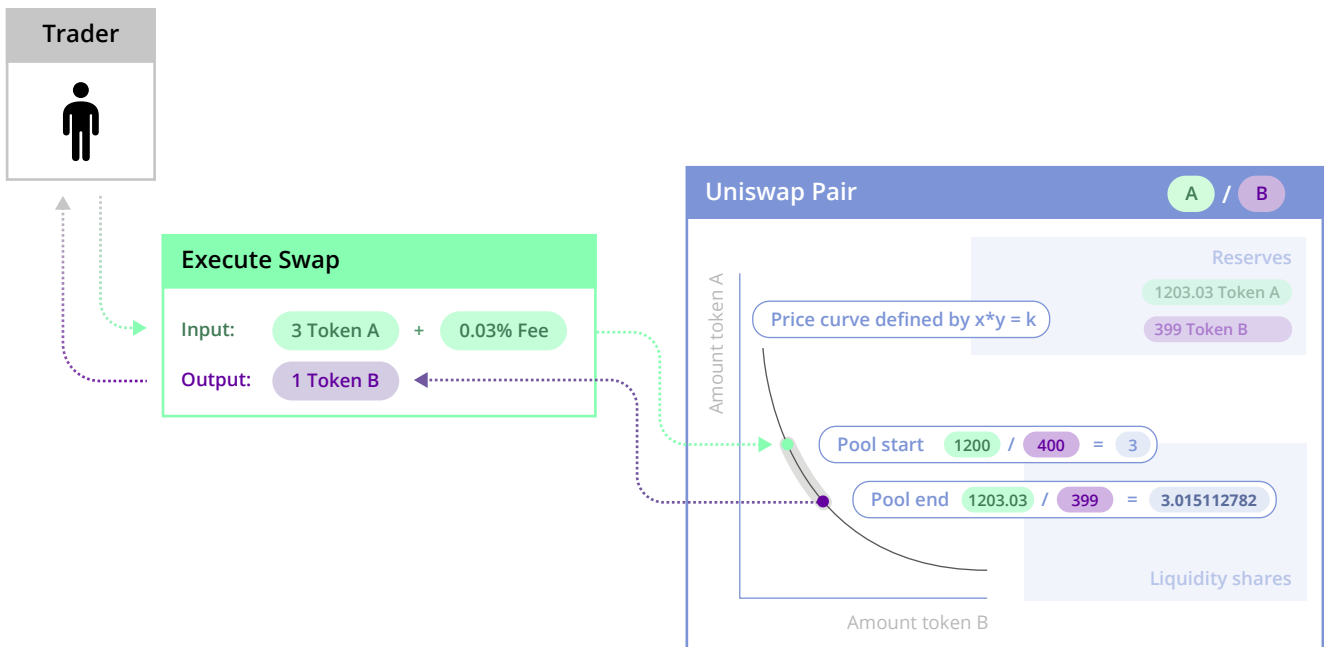
Trades change the balance of reserves, resulting in a new price.

Fig. 5

How decentralized exchanges use pricing algorithms to stay balanced

50 X 100,000 = 5,000,000

Different AMMs use different pricing algorithms, but they typically use some version of a "constant-product" algorithm to price assets in the liquidity pool.

The AMM will 'price' each asset such that the product of the quantities of each token is constant.

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1 ETH ($2k)

< $2K USDC (1,960.78)

51 ETH — ~98k USDC
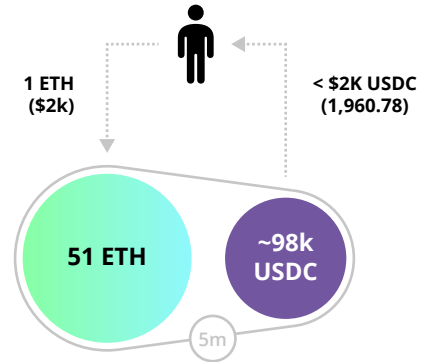
5,000,000 / 51 = 98,039.22

A trader looking to sell 1 ETH for USDC will send it to the liquidity pool.

The AMM will use the constant-product rule to calculate how much USDC the trader will receive for his 1 ETH:

5,000,000 / 51 = 98,039.22

So, the trader receives 1,960.78 USDC (minus a fee which is paid to Liquidity providers).


20 ETH ($40k)

< $40K USDC (28,571.43)

70 ETH — ~71k USDC
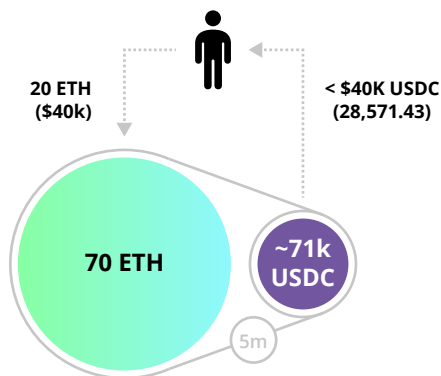
5,000,000 / 70 = 71,428.57

A larger trade which uses up a larger portion of available liquidity will receive a worse execution price.

E.g. if the trader wanted to sell 20 ETH instead of 1 ETH, he would only receive 28,571.43 USDC (minus a fee) because:

5,000,000 / 70 = 71,428.57

This is materially lower than the 'correct' price of $40k

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20 ETH ($40k)

28,571.43 USDC

50 ETH — 100k USDC
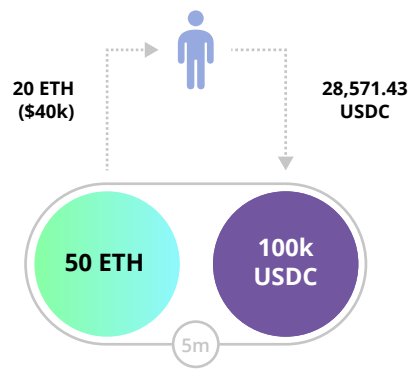
5,000,000 / 100,000 = 50

The resulting imbalance from a large trade creates an instant opportunity for another trader willing to 'rebalance' the pool by supplying USDC.

A seller of 28,571.43 USDC would receive 20 ETH from the AMM because:

5,000,000 / 100,000 = 50

This keeps pools close to balanced.

Synthetic Assets

Synthetix is a decentralized platform facilitating the creation of "Synths", on-chain synthetic assets that track the value of real-world assets. Common assets tracked include fiat currencies, commodities (such as gold), other digital assets, and even some leading tech stocks. Users are able to issue or "mint" these synthetic assets by locking in a sufficient amount of collateral denominated in Synthetix's native token, SNX. For example, if a user wanted to mint $100 worth of a synthetic gold token, the user would need to post greater than $100 worth of SNX. The synthetic tokens are freely tradable ERC-20 tokens, meaning they can be transferred to any other user via the ETH blockchain. SNX tokens accrue value via trading fees on Synths which are distributed to those who post SNX as collateral. Synthetix had a TVL of over $430 million as of August 2022.

Lending and Borrowing

Aave) is a non-custodial lending and borrowing protocol built on the Ethereum blockchain. Through Aave, users are able to supply and borrow digital assets, earning yield on any tokens supplied to the protocol. Yields are determined algorithmically based on supply and demand in the protocol. The Aave protocol allows for both collateralized borrowing and 'flash loans', which allow one to borrow any amount of assets without putting up any collateral as long as the liquidity is returned within the same block written to the chain (i.e. from the perspective of the protocol, the loan proceeds were disbursed and repaid in a single instant). Arbitrageurs commonly use flash loans to quickly capitalize on arbitrage opportunities in crypto markets.

Why is this important?

The significance of core financial infrastructure elements (e.g. lending and borrowing, exchanges, etc.) on top of entirely new financial rails unreliant on centralized intermediaries has rapidly increased the adoption and institutionalization of digital assets. Leveraging the functionality of smart contracts on a distributed ledger has enabled the creation of a permissionless financial infrastructure, which has not only eliminated many of the inefficiencies of the traditional financial system (through the reduction of intermediaries and redundancy errors) but also enabled novel functionalities and value propositions (such as flash loans).

Tokenization - the process of representing digital assets on a distributed ledger

Asset tokenization is important for multiple facets of DeFi's architecture mentioned above. The process of adding new assets to a distributed ledger is called tokenization, and the ledger's representation of the asset is referred to as a token. Simply put, a token offers a digital representation for a unit of value and implies transferring real-world assets to the ledger or transforming the items of value into tokens that reflect those values.

Why is this important?

The general idea of tokenization is to make assets more accessible and transactions more efficient. Tokenized assets can be transferred easily and within seconds from and to anyone in the world. Tokenization enables a formidable reduction in barriers to investment, thereby encouraging retail investors to trade assets that were traditionally expensive and featured lower liquidity, such as art. Tokenization also fosters asset liquidity by reducing the threshold for market entry alongside the minimum amount of capital required for transactions. However, one of the obstacles for tokenization comes in the form of regulatory uncertainty. Without adequate preparation of legal frameworks in many jurisdictions, regulatory uncertainty may slow the development and adoption of tokenized digital assets.

Fig. 6

How Does Tokenization Work?
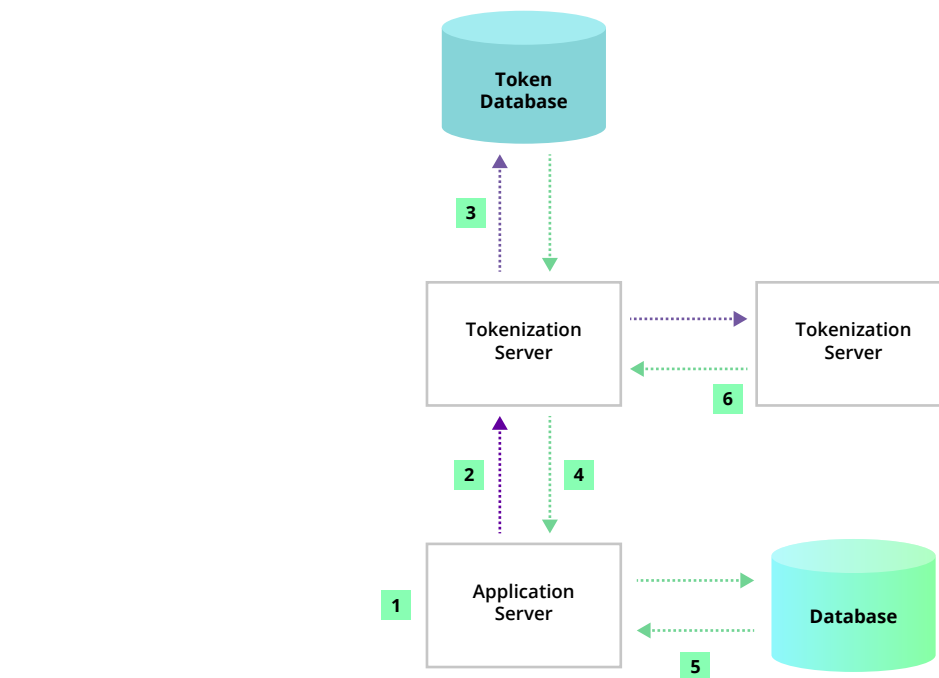
�:::::▶	Sensitive Data
�▶	Token

Tokenization has already begun to affect various industries:

Art

The art industry is seeing huge disruption in the form of non-fungible tokens (NFTs). According to a report released by UBS in early 2022 [10], global sales of art and antiques in 2021 reached an estimated $65.1 billion. The report also quantifies the art market's relatively recent digital pivot - online sales more than doubled as a share of all sales by value in 2020 compared to 2019, and continued to increase moderately in absolute sales by 10% in 2021.

One factor that has played a big role in the continued digitization of the art market is undoubtedly NFTs. NFTs are unique tokens that can be minted on a distributed ledger, and are suitable for tokenization of assets that cannot be divided into smaller units or exchanged with a similar item. The most common use-case of NFTs so far has been to represent metadata for digital art; the fact that it is a token on a public blockchain means users can seamlessly buy, sell, and transfer NFTs among one another, unlike traditional art assets. This lends itself to greater price discovery and transparency in what historically has been an opaque and illiquid market. NFTs can also be encoded to collect royalty fees upon each transaction throughout the life of the asset, meaning that artists and creators can be compensated for their work in perpetuity. Contrast this with the traditional art market, in which an artist can sell a piece for a few thousand dollars only to see it later re-sell for millions and not participate in its price appreciation. According to UBS, NFT sales increased over a hundredfold to $2.6 billion in 2021; interest is also on the rise, with 19% of dealers and auction houses planning to sell NFTs within the next two years, up from 6% the previous year.

Bored Ape Yacht Club (BAYC) is arguably the most popular series of NFTs, consisting of 10,000 pixelated profile pictures of apes created (minted) on the Ethereum blockchain. BAYC is marketed as an exclusive membership community whereby owning one of the coveted NFTs unlocks associations with high-profile celebrities, top-tier access to private events, premium merchandise, and even first looks at other NFT projects. BAYC NFTs have now generated more than $750 million worth of trading volume [11], with Sotheby's announcing that it auctioned 101 of their NFTs for $24.4 million in September [12].

(Georgiev, 2022)

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10   UBS - Art Basel and UBS Global Art Market Report
11   Cryptoslam, "NFT Collection Rankings by Sales Volume (All-time)"
12   Sotheby's, "101 Bored Ape Yacht Club"

Corporate Debt Markets
Recently, a number of protocols have been developed to facilitate the raising of debt financing by traditional private corporations. One of these protocols, Turnpool, allows fintech companies to raise capital from investors who fund loans on-chain using stablecoins. The resulting debt assets are split into tokens which can be bought or sold by a range of market participants in any size. Other on-chain institutional debt protocols include Maple Finance and Clearpool.

Protocol Revenues
A large number of digital assets accrue value via demand for their token as a commodity. However, an increasing number of protocols are now generating revenue from providing on-chain services, and in many cases, protocols have implemented mechanisms to deliver this revenue to token holders. This "tokenization" of protocol revenues is directly analogous to the function of equity in a traditional corporation. One protocol with a revenue accrual mechanism is 1inch, a DEX aggregator which routes trade orders across multiple DEXs in order to achieve the best price execution for traders. 1inch earns revenue via its "spread surplus" mechanism: 1inch quotes an estimated price to a trader based on available liquidity across DEXs, and the trader agrees to settle the trade at this quoted price. If 1inch is able to execute the trade at a better price, the 1inch protocol keeps the additional tokens purchased and deposits them into the 1inch treasury. The 1inch treasury can then be used to buy back 1inch tokens, accruing the value of its services directly to token holders. This is economically identical to share repurchases in traditional finance, and it is becoming more popular among crypto protocols. Many protocols have the potential to implement similar mechanisms but have held off on doing so in order to avoid being classified as securities.

Why is this important?

These industries are seeing the beginning of transformational shifts, and are primed to become new sources of innovation for DLT. We are at the forefront of a new wave of technological disruption, similar to when the internet first emerged in the early 2000s. For UHNW investors, family offices and broader market participants, even simply having an understanding of the underlying mechanics and economics of DLT will ensure that they and their portfolios are future-ready.

Stablecoins - digital assets whose value is pegged to a major currency

Coindesk defines stablecoins as a "type of cryptocurrency whose value is pegged to an outside asset class, such as USD… to stabilize its price" . Stablecoins such as USDT (USD Tether) and USDC (USD Coin) aim to exactly match the value of a target asset (in this case, USD). The underlying currency does not necessarily have to be USD; EUROC is a stablecoin which is pegged to the Euro, for example. By pegging their value to an outside asset, stablecoins help eliminate the volatility commonly seen in other digital assets.

The mechanism by which stablecoins ensure their peg (and therefore, the associated level of confidence in their corresponding value) varies. A few ways USD-stablecoins ensure their peg include:

Centralized audited
USDC, with a market cap of $51 billion , is the second largest stablecoin today. USDC is issued by a consortium called Centre, which was founded by the fintech company Circle. USDC reserves, which are composed almost entirely of cash and cash equivalents that, at a minimum, match the market cap of USDC 1:1, are regularly attested by Grant Thorton LLP. Monthly attestations can be found on the Centre consortium's website.

Centralized unaudited
USDT, with a market cap of $76 billion, is the largest stable coin today. It owes its popularity due to its early creation (Jan 2012) and adoption, however faces increasing scrutiny due to its failure to regularly release detailed attestations about its backing . In the past, some of its holdings included digital assets and commercial paper, including from Chinese corporate issuers. That said, Tether recently announced that they had reduced their commercial paper exposure to less than $8.5B and completely eliminated all exposure to Chinese commercial paper. Furthermore, they announced plans to phase out remaining commercial paper exposure in favor of US Treasuries. Perhaps the most important measure of Tether's creditworthiness is that they have never failed to redeem USDT for its face value of $1, even during periods of extreme stress. During the most recent crypto drawdown

Decentralized collateralized
DAI (Dai stable coin), with a market cap of $9 billion, is the fourth largest stable coin today. Unlike centralized stablecoins, DAI is issued on the decentralized protocol MakerDAO. The peg of DAI is based on other collateralized digital assets: users must deposit other tokens into the protocol in order to mint new DAI tokens, with the current collateral ratio set at 150%. In this way, the value of the stablecoin is backed by the collateral reserve. Because a large portion of the assets backing DAI are not US dollar-denominated, there could theoretically be a scenario in which a large proportion of DAI holders look to redeem their DAI for the underlying collateral, and as collateral is sold to meet these redemptions, the collateral's value could fall below the face value of issued DAI. That said, this has not yet occurred, even during times of stress.
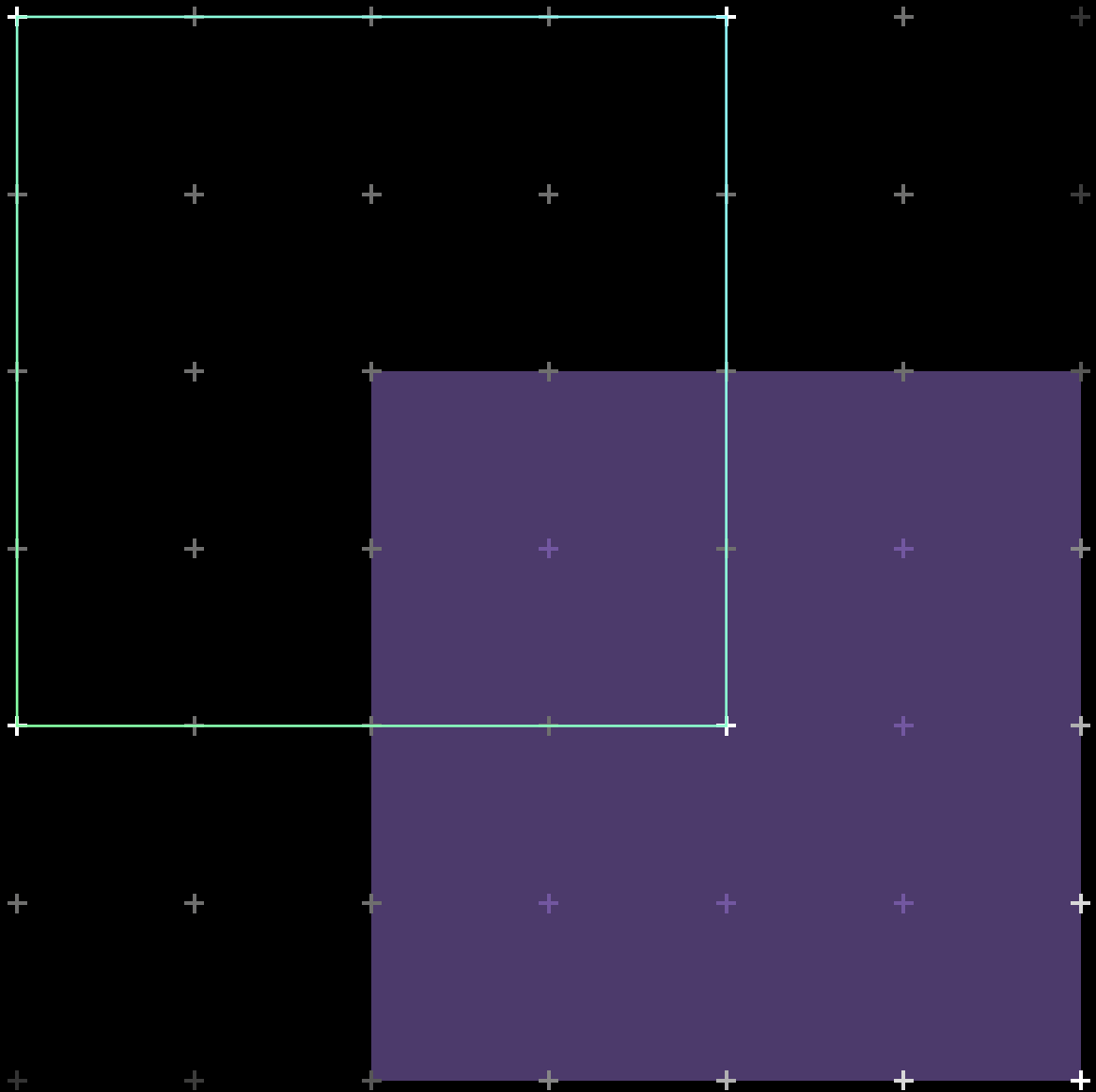
Why is this important?

Stablecoins generally have two key uses within the digital asset world today:

On-chain non-volatile asset- Since their value is pegged to an external asset, users can be more confident in its value within the digital asset ecosystem. Stablecoins are commonly used as a trading pair with other tokens; the most commonly traded pair across major spot exchanges is BTC/USDT. In the last 12 months, despite BTC's fluctuations between $18,000 and $69,000, USDT (issued by Tether) has maintained a price range between $0.993 and $1.015.

Fiat on/off ramp - Since the value of stablecoins are pegged to an external asset, many fiat on/off ramps (the conversion of fiat in traditional markets into digital in the crypto world) are based on stablecoins. As an example, one common way for Coinbase users to gain exposure to the crypto market is to exchange their fiat USD for USDC, 1:1, and then moving this USDC to their own custodial wallet without being exposed to price movements. The stable peg provides security for investors when bringing their fiat currency on-chain prior to trading other digital assets.

13   Coindesk, "What is a Stablecoin"
14   CoinMarketCap
15   Fortune, "Cryptocurrency Tether is fined $41 million for lying about reserves"

02

**Crypto as
an asset class**

Crypto as an Asset Class

Historically, many of the largest opportunities for investors have come in the form of either the growth of new technologies or the market inefficiencies of new or poorly-understood asset classes.

Digital assets represent a historical anomaly because they are simultaneously a new technology as well as a new asset class, and as such, offer opportunities to profit from its growth as well as from its market inefficiencies. Amber's history and culture is rooted in traditional finance, and as former practitioners in well-established asset classes, we recognize the potential to profit from both of these important characteristics of digital assets. Below, we discuss why investors should be interested in digital assets from both a technological and trading perspective.

1   Crypto - an open computational platform for value transfer

The potential for digital assets as a new technology centers around their potential to serve as the next evolution of our financial system.

Throughout history, the methods through which we transfer and assign value have always been adapted to meet the demands of an increasingly connected society. In ancient Mesopotamia, almost 2,000 years BCE, the invention of clay tokens stored in sealed cylinders allowed individuals and institutions to record debts and contracts with those outside of their villages (these clay tokens eventually evolved into cuneiform, one of the earliest forms of writing). As society achieved larger scale, new financial technologies emerged, such as the publican societies of Rome, which allowed the Roman Empire to employ tax collectors across thousands of miles on behalf of the government. Over 1,000 years later, the Dutch East India expanded the concept of common ownership of an enterprise by allowing for public trading of its ownership through physical shares. In the 20th century, as trading volumes and the number of publicly traded companies increased, these physical shares were consolidated in central clearinghouses and eventually digitized. Today, trillions of dollars of value change hands via a convoluted network of payment systems, clearinghouses, and settlement teams communicating via email and phone to settle trades.

Currently, most view digital assets as a completely distinct realm from traditional finance. However, the reality is that it is conceptually similar to previous natural evolutions of our financial infrastructure. In the 21st century, and especially post-COVID, the internet has enabled global economic collaboration on a level not seen before. However, our financial system is still heavily restricted by borders, centralized institutions, and other forms of gatekeeping. Anyone who has invested in an early-stage company or participated in an IPO process knows that these opportunities are typically only available to a small number of well-connected participants who live in the right jurisdictions. Although these restrictions may aim to protect certain investors, they are still highly limiting

to both individuals looking to grow their wealth as well as to enterprises looking to raise capital. Furthermore, the recent price implosion of newly-issued SPACs which published overly-optimistic growth projections suggests that a restrictive set of regulations does not necessarily insulate individual investors from being taken advantage of.

The technological promise of crypto is that by allowing anyone on Earth with an internet connection to access its markets, it enables a far more egalitarian system of capital allocation and participation. That is not to say that there is no need to protect small investors – rather, crypto has the potential to ensure that the rules which protect investors do not simultaneously prevent them from realizing the benefits of participating in capital markets.

The ways in which crypto can unlock the power of truly open capital markets are already to beginning to take shape. Talented developers have already invented methods of exchanging assets, creating on-chain derivatives, representing US dollars and Euros on a distributed ledger, and extending certain types of loans to borrowers in a permissionless way. Currently, our industry is seeing the development of undercollateralized lending markets with the technical capability to allow anyone with internet access to provide credit to a private enterprise. A growing number of protocols are generating revenue from providing on-chain services and delivering this revenue back to token-holders via token buybacks, emulating the mechanics of traditional equity ownership. All of these aforementioned products have been built on what is still a nascent and admittedly unscaled infrastructure. Multiple teams within crypto are currently architecting software which will enable far more computational throughput to be achieved in a permissionless way and without trusting any intermediary. These include improved versions of existing types of distributed ledgers, such as directed acyclic graphs (DAGs), as well as off-chain computational environments whose outputs are verifiable via zero-knowledge proofs. As these tools are built and released, protocols with a new level of complexity and utility will be made possible, including in non-financial applications such

as gaming and art. Combined with enhancements in user interfaces and user experience, crypto-based products and their associated digital assets are well-positioned to accelerate their value creation for users and owners in the coming years.

Given the increasing capabilities of digital ledgers and the growth of digital assets as an asset class, it is prudent for UHNW investors and family offices to understand the mechanics of distributed ledgers along with the applications built on top of them in order to capture the accelerating amount of value being created by these products.

2 Cryptocurrency – a highly inefficient market in which informed investors can achieve outsized performance

Although we at Amber have conviction in the value creation potential of DLT and its related applications, we also recognize that not all investors share this conviction. Fortunately, crypto markets are notoriously inefficient and often provide profitable opportunities even for investor who remain unsold on the technological bull case for DLT. Many of these inefficiencies are directly analogous to ones found in traditional asset classes and can be exploited using systematic strategies commonly used to trade equities, bonds, and currencies. While inefficient behaviors in crypto markets are logically very similar to those in traditional markets, the size and frequency at which they occur are greatly amplified. Some examples are discussed below.

There are two facts about the historical returns of equities which make them an attractive asset class to investors, both of which appear to be true in crypto markets as well. Both of these facts are the result of irrational investor behavior and represent market inefficiencies from which it is possible to earn outsized returns. The first fact is that equity returns exhibit "excess volatility", given their underlying fundamentals.

The chart below comes from a Nobel Prize winning paper written by Robert Shiller in 1981, and it shows the price of the S&P 500 over time (solid line), as well as a measure of the real value of S&P 500 dividends over the same period (dashed line). As the chart demonstrates, the price of the S&P 500 is far more volatile than the real value of its dividends. We call this "excess volatility" because ff investors were perfectly rational, the price of the S&P 500 would move almost identically to the real value of its dividends (that is, an asset's price should move with its fundamental value); any excess movement implies that irrational investors sometimes over- or under-value the S&P 500 with respect to its fundamental value, and that the price of the S&P 500 at any given time is predictive of future returns. Indeed, this paper demonstrated there was excess volatility in equity markets and that this implied that future equity returns are predictable. In general, excess volatility in any asset class is a strong indicator of return predictability.

Fig. 7

The price of the S&P 500 (solid line) vs. the real value of its dividends (dashed line)
Shiller 1981

Cryptocurrency – a highly inefficient market in which informed investors can achieve outsized performance

We can perform a similar analysis on digital assets to determine if their historical returns exhibit excess volatility. As an example, we compare the historical price of ETH, the native currency of the Ethereum blockchain, against the number of daily transactions executed on Ethereum's chain as well as the number of daily active addresses on Ethereum's chain. We use these two measures because ETH's fundamental value comes from the demand to use it as a commodity to execute transactions, and these two metrics serve as a proxy for this demand.

Fig. 8

ETH Daily Transactions, Daily Active Addresses and Price
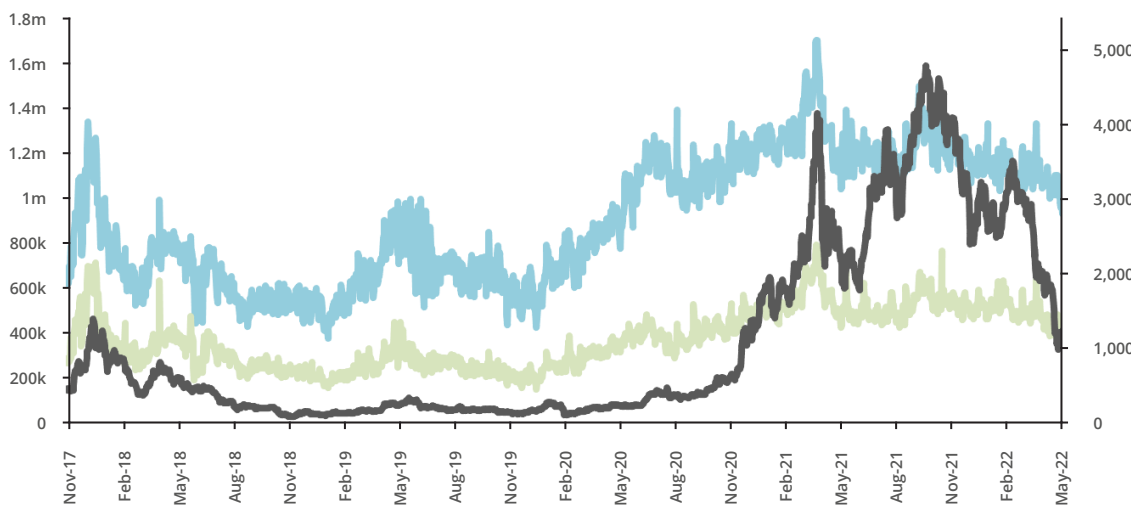
	Monthly Std. Dev.
Avg. Daily Active Addresses	**18.5%**
Avg. Daily Transactions	**14.0%**
Monthly Return	**32.0%**

Sure enough, the data suggests that the price of ETH exhibits excess volatility relative to proxies of its fundamental value. Since 2017, the monthly standard deviation of returns for ETH is 32.0%, while daily active addresses and daily transactions only have monthly standard deviations of 18.5% and 14.0%, respectively. In fairness, due to the young age of crypto markets, we do not have enough historical data to definitively prove from a statistical perspective that crypto returns are predictable. However, the data we do have suggests that the same logic underlying systematic market timing strategies in equities can also be applied to crypto markets.

The second fact about the historical returns of equities is that they exhibit unusually high "excess returns" over the risk-free rate. In plain English, this means that equities earn a significantly higher average return above the risk-free rate (US Treasurys) than we would expect, given the volatility of equities vs. the volatility of the risk-free rate. In fact, the average excess stock market return over the risk-free rate between 1889-2005 was 6.4% per year and has been even higher over the past decade. If investors were perfectly rational and priced volatility equally across asset classes, equities would have a significantly lower average excess return than what is observed in the historical data. This "excess return" is generally attributed to the fact that irrational investors under-allocate to equities due to loss aversion bias. Basically, equity returns exhibit negative skewness – their prices occasionally fall by 30%-40% or more in a short period of time but rarely rise by these amounts so quickly. This negative skewness scares investors and causes them to systematically under-allocate to equities. Because loss aversion affects investors across asset classes, any market which exhibit negative skewness can lead to systematic under-allocation.

Cryptocurrency – a highly inefficient market in which informed investors can achieve outsized performance

Crypto markets are of course known for their extreme historical returns, both positive and negative. Digital assets are unique in that they undergo periods of negatively skewed returns as well as periods of positively-skewed returns. Said differently, crypto prices sometimes fall by 70% or more in a short period of time, but other times they rise by multiples in a matter of months. Following the logic of excess returns from equities, we should expect the periods of negatively skewed returns in crypto to result in systematic under-allocation in their aftermath (and therefore unusually high excess returns, relative to volatility). Again, as a caveat, crypto as an asset class is too young to measure its average excess return in a statistically robust way, but the economic rationale of loss aversion resulting in excess returns in equities is applicable to crypto markets as well.

The crypto market inefficiencies highlighted so far are most useful in a long-only or long-biased strategy. However, there are multiple market inefficiencies which can be exploited using market-neutral strategies as well. Once again, these strategies are conceptually identical to strategies employed in traditional asset classes and can generally be categorized as either carry trades or systematic quant strategies.

There are two common forms of carry trades within crypto: basis trades and interest rate spread trades.

As is the case in traditional asset classes, basis trades in crypto involve selling futures whose price is above the spot price of the underlying asset (i.e. the futures are in contango) and buying the underlying asset in the spot market to hedge the exposure created by the futures. The extent to which the futures price of a given digital asset exceeds its spot price is a function of the demand for leveraged exposure to the underlying asset. During times of price appreciation, this demand tends to increase, widening the spread and increasing the profitability of the basis trade.

Interest rate spread trades in crypto rely on the same economic rationale of FX carry trades in traditional currency markets. In traditional currency markets, certain currencies offer higher interest rates to their holders, depending on their respective monetary policies. An FX carry trade simply buys currencies with a higher interest rate and sells (borrows) currencies with a lower interest rate. The hope is that the depreciation of the currency with the higher rate does not exceed the difference in interest rates, allowing the trader to realize a profit when both positions are eventually closed. Historically, this assumption has held up well. In fact, currencies with higher interest rates actually tend to appreciate against those with lower interest rates, on average, making the FX carry trade particularly attractive to systematic investors.

Just like traditional currencies, many digital assets use inflationary issuance policies to offer interest payments to their holders, typically in exchange for staking or locking up their tokens for a given period of time. Investors can buy (and stake/lock up) tokens with high interest rates and sell tokens with low interest rates to capture the spread. The long and short positions of this trade can be sized to give the investor a market-neutral exposure. Furthermore, the position can be structured with leverage if the short token position can be used to finance the long token position.

The next group of crypto market inefficiencies we will discuss can be exploited using quantitative strategies. As in equities, returns in crypto markets exhibit momentum: small positive returns over the prior week(s) are predictive of positive returns in the following week(s), on average. At the same time, returns in crypto are prone to reversals: large positive returns over the prior week(s) are predictive of negative returns in the following week(s), on average. Both momentum and reversal effects can be identified and measured using statistical methods.

Another quantitative strategy used in crypto markets is statistical arbitrage, in which traders identify historically steady return relationships between similar assets and bet that these relationships will continue in the future. To identify potential return relationships between different digital assets, tokens can be categorized into different subsectors depending on their function (e.g. layer 1s, layer 2s, DEXs, lending/borrowing protocols, "memecoins", etc.). For example, a trader may statistically determine that DEX tokens generally have very similar returns, on average. If the price of Uniswap (a popular DEX) rises by 10% in a month while the prices of other DEXs such as SushiSwap or TraderJoe rise by only 2%, this would be predictive of relative underperformance by Uniswap in the near future, on average. A statistical arbitrage trader would short Uniswap tokens and long SushiSwap and TraderJoe to create a market-neutral position which profits if the tokens converge to their historical return relationship. Amber employs both momentum/reversal and statistical arbitrage strategies within its quantitative trading arm to generate returns for clients while offering a market-neutral exposure.

Perhaps the most distinctive inefficiency within crypto markets is that its participants use an unusually high amount of leverage. During times of volatility and/or declining prices, the amount of leverage used by large market participants results in high levels of forced selling and even "liquidation cascades", in which the selling of collateral causes further price declines which result in additional forced sales of collateral and further price declines. The most recent example of this phenomenon

Cryptocurrency – a highly inefficient market in which informed investors can achieve outsized performance

was in June 2022, when a multi-billion dollar crypto hedge fund, Three Arrows Capital (3AC), defaulted on its loans from creditors. The collapse of 3AC led multiple large crypto lenders to seek emergency financing or declare bankruptcy, including Celsius, Voyager, and others. Although high levels of leverage and associated forced selling add to the volatility of crypto markets, they also generate short-term buying opportunities for participants with available liquidity. In traditional markets, many of the best investment opportunities can be found in distressed assets during times of market stress, and the same is true in crypto. The difference is that widespread forced sales occur far more frequently in crypto than they do in traditional markets. This scares many investors from ever participating in crypto markets, but for those with the ability to wait for these moments and deploy an appropriate amount of capital when they occur, the volatility can serve as a source of edge and outsized returns.

All of these inefficient market behaviors in crypto allow for the profitable execution of a multitude of strategies with varying levels of market exposure and leverage. Long-only is not the only way to successfully participate in this emerging asset class. In the next section, we focus on how digital assets might be integrated into broader traditional investment portfolios, including what cash-alternative and lower risk investments in digital assets could look like.

03

**Asset Allocation –
A Quantitative Framework**
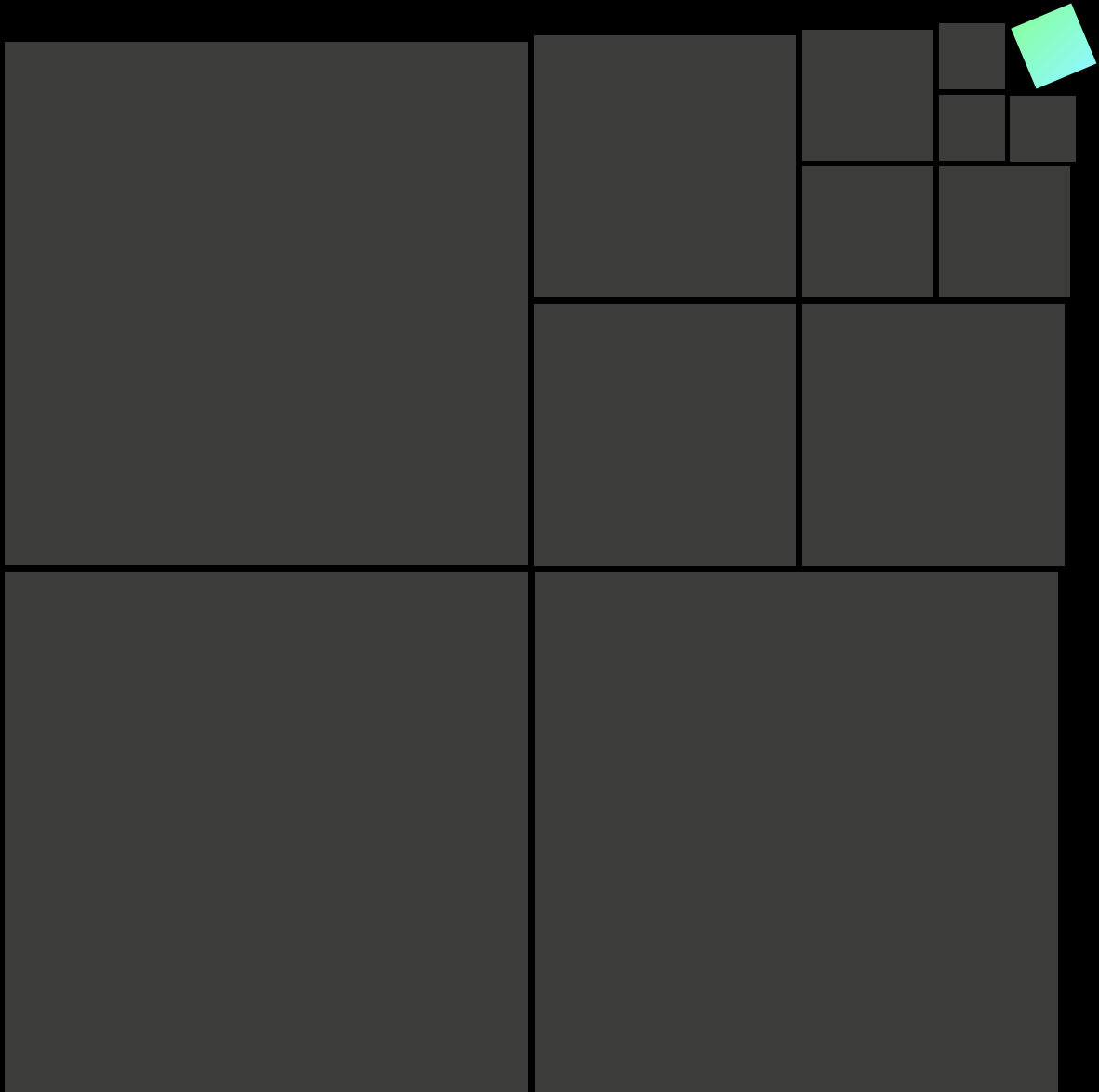
How to Size a Passive Long Digital Asset Allocation

Portfolio management models tend to be rooted in modern portfolio theory shaped by Nobel Prize-winning research from the likes of economists including Harry Markowitz, William Sharpe and Eugene Fama.

So far, most traditional asset allocators have not yet incorporated digital assets into their portfolio construction due to concerns around its lack of market history, unproven technology, and significant price volatility. However, despite the volatility of the asset class, independent analyses performed by multiple research groups using different methodologies have found that the optimal passive long allocation to digital assets in a balanced portfolio is greater than zero. as early as 2019, Aleh Tsyvinski, a professor of economics from Yale University, found a traditional balanced portfolio should include a 4% to 6% allocation to digital assets [16]. The study examined multiple digital assets at the time, including Bitcoin (BTC), Ripple (XRP), and Ethereum (ETH).

When considering a traditional balanced portfolio allocation, the Black-Litterman model provides a good starting point to determine the role digital assets can

play [17]. The model begins with a neutral "equilibrium" portfolio and provides a mathematical formula for increasing your holdings, based on your view of the world, by incorporating not just your estimate about how one investment might perform compared to other investments in a portfolio, but also your confidence in that estimate.

The Black-Litterman model uses global market asset values as its starting point for building a portfolio. The main inputs to the model are (i) global market capitalizations across asset classes, (ii) asset class volatilities, and (iii) the correlation between these asset classes. In early 2021, the global market for stocks totalled $95 trillion and the global market for bonds reached $105 trillion. Using this as a neutral starting point, the model's equilibrium allocation for traditional assets is 47.5% global equities and 52.5% global bonds. At the same time, the digital asset market as a whole was valued at roughly $1 trillion. This means that digital assets represented 0.5% of global market asset value. Given this, the model follows a neutral standpoint of 0.5% for digital assets and notes that as the start of an investor's allocation.

Fig. 8

The Black-Litterman allocation model

Crypto
0.5%

Bonds
52.5%

Stocks
52.5%
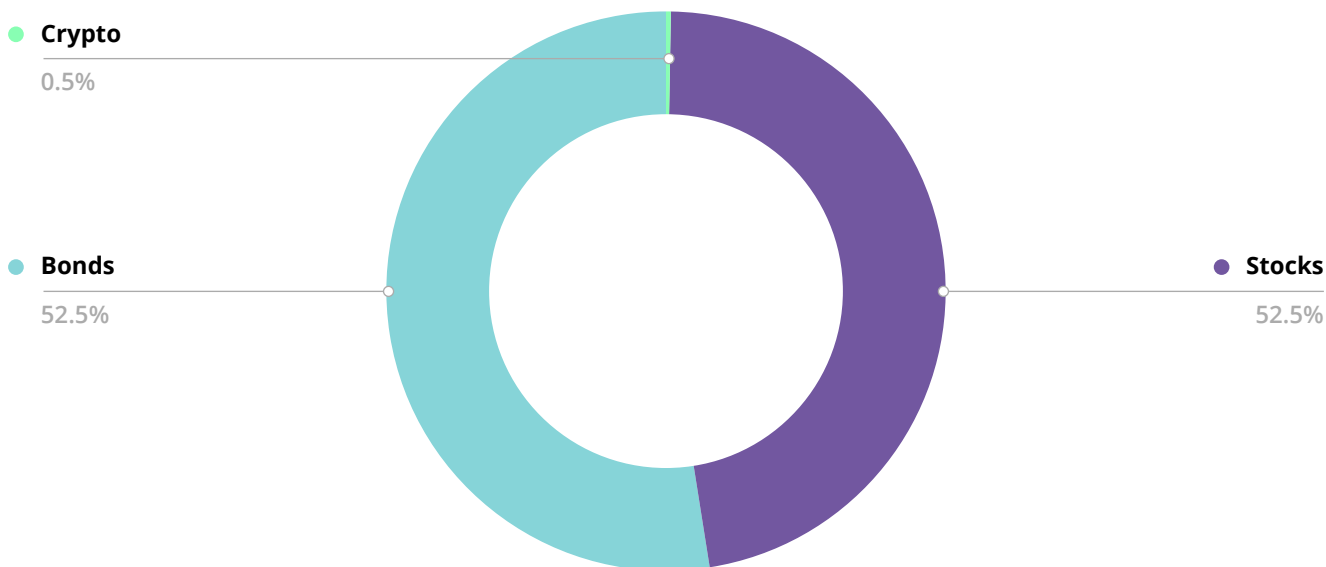
16   Yukun Liu and Aleh Tsyvinski, "Risks and Returns of Cryptocurrency"
17   Thomas M. Idozrek, "A Step-by-Step Guide to the Black-Litterman Model"

The second step is to consider return expectations and the confidence around these. For any given growth rate in digital assets (or any investment for that matter), the Black-Litterman model will return the optimal allocation amount for an investor's portfolio. The model used only BTC as a proxy for digital asset investment but can also be adopted to consider a wider basket of digital assets.

The investor starts by deciding how much they think BTC will outperform equities and also how confident they are in that view.

Fig. 9

Allocation to bitcoin in your portfolio

Confidence in your estimate of bitcoin's return over stocks
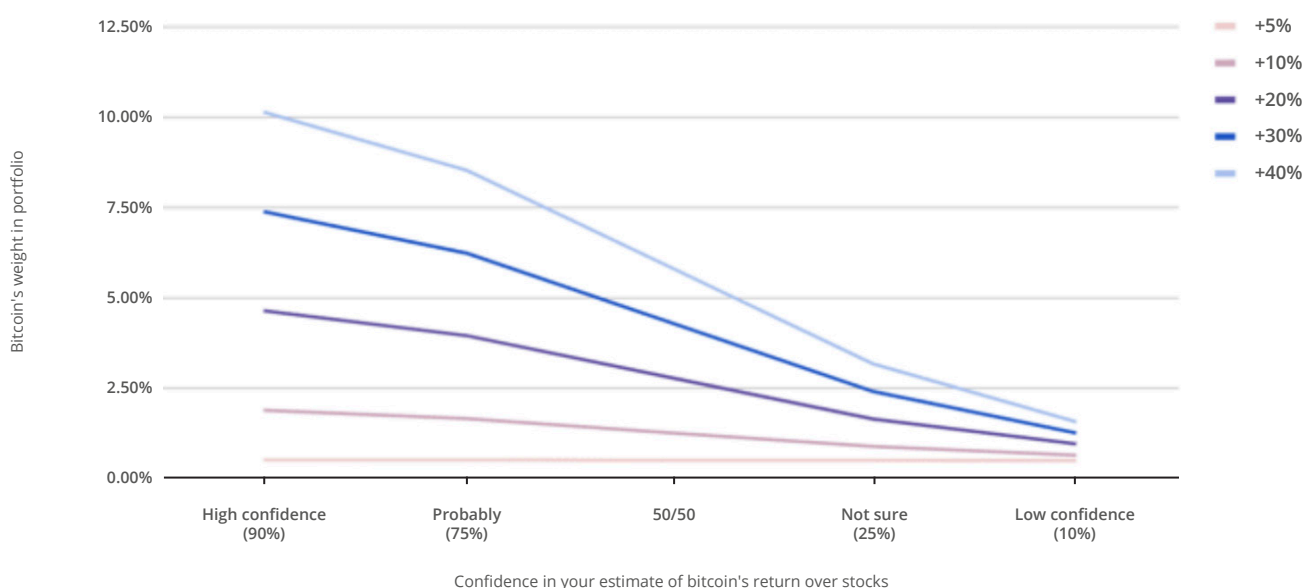
The chart above shows the range of optimal portfolio allocations dependent on the investor's outperformance expectation and confidence level. The main thesis of the model is that crypto-curious investors who believe BTC will not materially outperform equities should only begin with an allocation of 0.5%, moving up to 2.0% depending on their level of confidence. On the other hand, investors who believe BTC will far outperform equities with a high degree of confidence can consider digital asset allocations up to 10.0%.

Importantly, the model also highlights that any investor needs to believe that Bitcoin will outperform equities to have any crypto allocation at all. Otherwise, the optimal model allocation to BTC would be 0%. Another interesting result is that regardless of how high your confidence level is, a 40.0% outperformance expectation of digital assets vs. equities results in a maximum allocation of only 10.0%. Reasons for this are further explored below.

Asset managers and wealth professionals are now moving in line with the findings of the Black-Litterman model. The approach for many investment managers so far has been to look at digital assets as having higher average returns, and fit them within their portfolio given their unusually high volatility. This is typically done by replacing a part of their alternate investments or equities allocation with an allocation to digital assets, with the purpose of ultimately increasing a portfolio's Sharpe ratio. A good rule of thumb is that digital assets are 4 times more volatile than equities, so a 5% allocation to digital assets will contribute as much dollar volatility to a portfolio as a 20% allocation to equities, assuming the investor passively holds a basket of digital assets.

The Chartered Alternative Investment Analyst (CAIA) Association notes that including between 1.0% and 2.5% of BTC to a portfolio of 60% equities and 40% bonds from January 2014 to March 2020 added 1.0% to 2.3% of annual returns without a significant increase in portfolio volatility or drawdown [18]. It is important to note that they found an allocation of over 5.0% allows the high volatility of BTC to substantially increase overall portfolio volatility and drawdown statistics.
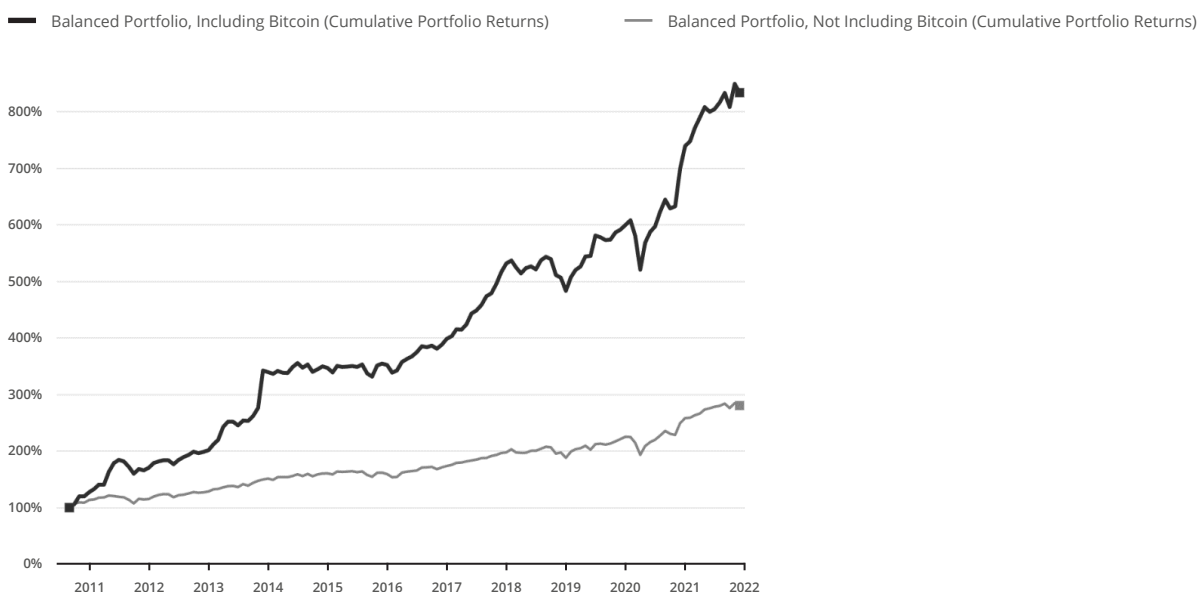
Fig. 9

CAIA Analysis

Priod between January 1, 2014 and March 31, 2020 (assuming quarterly rebalancing)

Portfolio	Cumulative Return	Annualized Return	Volatility (Annualalized Std. Dev.)	Sharpe Ratio	Maximum Drawdown
Traditional Portfolio	26.22%	3.80%	9.86%	0.31	21.07%
Traditional Portfolio + 1.0% Bitcoin	33.52%	4.74%	9.87%	0.41%	21.32%
Traditional Portfolio + 2.5% Bitcoin	44.91%	6.13%	10.07%	0.54	21.80%

The Institutional Investor found that reducing U.S. equities by 5.0% and allocating those funds to BTC generated significantly higher risk-adjusted returns [19]. The portfolio was constructed taking a balanced portfolio allocation of S&P 500, Russell 2000 (for small cap equity allocation), MSCI EAFE, Barclays U.S. Aggregate (for US Bonds) and the Barclays Global ex-U.S. Aggregate (for international bonds). Annualized returns since July 2010 were much higher for the BTC-inclusive portfolio (20.7% versus 9.5%). Although the standard deviation of the BTC-inclusive portfolio was meaningfully higher (14.1% versus 9.1%), the Sharpe ratio (risk-adjusted return) was still much higher for the BTC-present portfolio.

Fig. 10

Institutional Investor Analysis

— Balanced Portfolio, Including Bitcoin (Cumulative Portfolio Returns)   — Balanced Portfolio, Not Including Bitcoin (Cumulative Portfolio Returns)

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18   CAIA, "What Happens If you Add Crypto to a 60/40 Portfolio"
19   Institutional Investor Group, "The Case for Making Bitcoin 5 Percent of Allocators' Portfolios"

How to Size a Passive Long Digital Asset Allocation

Barron's notes that up to a 2.0% portfolio allocation (substituting digital assets as part of the allocation to alternative investments) keeps the nature of portfolios broadly unchanged [20]. They note that higher allocations (over 5.0%) increase portfolio risks materially and alter the nature of the entire portfolio, a view that seems to be common across a range of research.

Finally, Edelman found that a 1.0% allocation to digital assets is something of a sweet spot [21]. They note that it was small enough that a market crash would be almost undetectable within a diversified portfolio while still exposing the investors to potentially double the returns they would see without it. Edelman plugged this pattern into a hypothetical scenario involving what they describe as a typical portfolio containing a 60/40 asset mix. A portfolio with no BTC would see returns of around 7.0% in one year (estimated conservatively) and 14.5% in two years. Changing that asset allocation slightly to 59/40/1 – a 1.0% addition of digital assets – the potential gains jumped to 22% in year 1 and 15.4% in year 2 (even with an 85% dip in digital asset prices within that time period). Even in the event that digital assets crash entirely, the 59/40/1 allocation would have still resulted in a 6.0% return in year 1 and 13.4% in two years. This shows that even a small allocation to digital assets can materially improve returns while generating limited downside risk..

Looking at other aspects beyond return, digital assets have also been attractive due to its low correlation to other asset classes. This is desirable because uncorrelated sources of return are necessary to increase the Sharpe ratio of a portfolio. It is important to make two points here. First, when the market rallies hard or falls, correlations rise. In a steep market sell-off such as what was seen in March 2020 or spring 2022, digital assets also saw significant downside moves. Second, the more digital assets are included within institutional portfolio allocations and traded like other traditional assets, the faster correlations are expected to rise. Still, digital assets offer at least some level of diversification, and research based in portfolio theory shows that institutional investors can improve their risk-adjusted returns by "getting off of zero" with their allocation to digital assets.

20   Barron's, "Crypto Returns Are Appealing. The Volatility May Not Be"
21   Edelman Financial

Digital Asset Portfolio Construction and Product Suite

For UHNW investors and Family Offices that already think digital assets deserve an allocation in a well-diversified portfolio, the next step is to think about digital asset allocation and diversification strategies in a similar way as they would with a traditional portfolio. In doing so, defining the volatility and return expectations of the digital asset portion of their portfolio is crucial. Following a growth-tilted asset allocation (50.0% equities, 40.0% bonds and 10.0% alternatives for a traditional investment portfolio), a potential 5.0% exposure to digital assets (replacing a part of the alternatives allocation) can follow a similar structure and be narrowed down further into separate segments as below:

1 40.0% stablecoin yield generation and market-neutral strategies (analogous to a bond allocation in a traditional portfolio):

This part of a digital asset portfolio is closest to the bond portion of a traditional asset portfolio. In the past, investors would simply purchase stablecoins for the sole purpose of converting these into other tokens that they wanted to purchase, such as BTC or ETH. Today, investors can hold stablecoins in wallets and receive a yield on their stablecoin balance. Unlike cash yields in the traditional market (currently 1%-2% for USD), stablecoin yields in the digital asset market start around 6.0% APY with providers such as WhaleFin generating yield primarily through market-neutral systematic trading strategies. Higher yields are possible for investors willing to take on additional risk, such as credit risk or directional market risk..

One important point to note is that these funding rates tend to rise during market rallies when demand for leverage is high and fall when the overall market sells off. During the recent BTC price decline, funding rates for stablecoins on many platforms fell back towards 7.0% APY.

Investors who decide to take advantage of these enhanced yields also need to understand the risk factors surrounding it. The first is the counterparty risk of the exchange, lender, or DeFi protocol. Exchanges have seen nefarious actors succeed in infiltrating their systems – names such as Mt Gox, Bitfinex, and others have lost millions due to hacking, although exchange hacks have grown far less common in recent years. Another critical risk is code vulnerability. DeFi protocols that use algorithms to determine pricing may be taken advantage of, such as Venus which saw hackers manipulate its algorithms in order to take millions of dollars of tokens. Smart contract exploits highlight the risks of storing stablecoins in these protocols without the assistance of larger service providers.

Market-neutral strategies also have a role to play within this portion of a digital asset portfolio. As discussed previously, investors can employ "cash and carry" arbitrage, a market-neutral strategy aimed to profit from buying an asset in the spot market whilst simultaneously having a short position in the futures market when the futures are at a significant premium relative to the spot price.

In the early days, there were only a few providers of futures contracts which meant that the basis premium between spot and futures hit as high as 200.0% p.a. on major digital assets such as BTC. Prior to the June 2021 market selloff, this return profile had been around 20.0%-30.0% p.a. for BTC, highlighting the increasing maturity of the market and willingness of arbitrageurs to provide liquidity to speculators, yet still over 10x of the returns seen for similarly structured trades in equities.

For other digital assets, investors were able to generate a yield as high as 70% p.a. These yields exist because speculators are willing to pay a positive interest rate to get leverage, on the belief that price appreciation for digital assets will at least outpace the premiums they pay over a specific time horizon. Following the recent selloff, the basis trade premium had fallen significantly as leverage demand fell. Overall, although delta-neutral strategies such as the cash and carry arbitrage offer yield enhancement opportunities, many investors may experience difficulties in deploying these without the help of larger digital asset specialists that offer expertise in the space.

How Amber Can Help

Flexible Time Deposits
Amber offers its client base the ability to earn passive income using their cash-equivalent stablecoins, without taking directional risk. Amber's interest rate products deliver consistent yields uncorrelated to market movements, while allowing clients to retain their cash allocation in the form of stablecoins. Amber's yield offering is available in USDT and other USD-pegged stablecoins such as USDC, PAX, BUSD, HUSD, and TUSD.

On average, Amber is able to provide fixed APRs of up to 5.0%-10.0% on stablecoin deposits. These fixed income time deposits feature flexible and custom tenors between 1 to 360 days depending on investor preference, and are cancellable at any time (subject to interest rate offsets).

Basis-Capture Yield Product
Amber offers selected institutional and HNW clients (Amber premium club and 1,000 BTC club members), exclusive participation to a basis-capture yield strategy. Members of the Amber premier club benefit from fixed yields of up to 7.0% p.a. or 10.0% to 15.0% p.a. for fixed plus floating yields. 1,000 BTC club members benefit from fixed yields of up to 8.0% p.a. or 12.0% to 18.0% p.a. for fixed plus floating yields.

Amber achieves these higher yields by capturing interest rate differentials between derivatives and their underlying spot markets, a form of synthetic lending without directional market risk. In addition, Amber also generates interest income from overcollateralized lending to institutional and corporate clients. Finally, Amber is able to match capital against margin funding demand from users financing leveraged positions.

2 50% directional long-only strategy (analogous to a long-only equities allocation in a traditional portfolio)

As of April 2022, there were 18,712 digital assets with a total market capitalization of $2.16 trillion [22]. Of these, the top 5 digital assets (including stablecoins) made up over 67.0% of the total value. This highlights the need for a two-tiered approach when constructing the long-only portion of a digital asset allocation, similar to investing in large cap or blue chip equities alongside a tactical stock-picking strategy within a traditional portfolio.

30% Broad Large Cap Exposure
Investors seeking broad digital asset exposure may prefer to hold a diversified basket, with the aim for returns to mimic the overall digital asset market. To achieve this, starting with core tokens such as BTC and ETH is a natural first step. Together, they make up over 60.0% of total crypto market capitalization. Investors who are already familiar with digital assets may also decide to allocate towards other blue-chip names that feature within the top 5 or top 10 in regards to market cap. Instead of simply allocating to BTC alone, exposure through a basket of top digital assets may offer additional diversification, potentially reducing idiosyncratic risks and overall volatility. This can be compared to allocating towards an ETF or index representing a large basket of stocks, usually weighted by sector, capitalization and/or country. For digital assets, indices or ETFs are not yet widely accessible to investors, hence requiring the services of trusted specialists that allow the execution of a tailored strategy and rebalancing of investor allocations. Working with a specialized provider to construct this basket is also important because a simple market-cap weighted index will heavily overweight BTC and also expose investors to a number of top-10 digital assets which are relatively low-quality in terms of capabilities and development progress. Cardano (ADA) and Ripple (XRP), for example, were early leaders in the digital asset space but have not delivered much in terms of utility since their initial rise. They have continued to exist and maintained their market caps primarily due to inertia, not innovation – both have materially underperformed ETH and comparable settlement layers over the past 3-4 years.

Given the significantly large tail of the crypto market, diversifying beyond the top 5 or 10 market cap names would require significant time and research in order for investors to familiarize themselves with each holding. This is where a stock-picking strategy from a traditional asset allocation can be utilized.

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20% Specific Exposure
Traditional equity investors decide what stocks to invest in based on the level of risk they want to carry; sector, market cap, and style type are additional factors to consider. Within this, investors shortlist potential stock picks, then carry out more in-depth analysis on each potential purchase to determine its opportunities and risks going forward. It is a similar process for this portion of a digital asset portfolio. Investors can choose digital assets that align with their risk level (size, age, and other factors) as well as the use-cases they see as most promising or disruptive.

Investors can narrow this portion even further by considering the category each token may belong to. Examples of categories include native tokens for layer 1s (such as DOT, NEAR and TRX), DeFi ecosystem tokens (such as UNI, AAVE, 1INCH), metaverse and NFT tokens (SAND, AXS, APE), "memecoins" (DOGE, SHIB, ELON), specific use-case tokens (HNT, VET, FIL), and many others. This reflects the most time-intensive aspect for investors looking to build an allocation to digital assets and requires regular monitoring of price changes, developments, and progress across the range of holdings.

Within the overall directional and long-only allocation of a digital asset portfolio, investors can also utilize strategies to further enhance their return profile. With the institutionalization of the digital asset space discussed earlier, asset staking has grown in popularity. The TVL in staking is near all-time highs at $270 billion. Overall, there are around 262 assets with annual rewards averaging over 11.0% p.a. Platforms like WhaleFin make it easier for investors to stake their assets, earn yields on their digital assets, and earn yield on long holdings instead of just keeping these assets in their wallets. This is a particularly attractive option for investors who are medium-term bullish on their selected digital assets. In traditional markets, this is similar to collecting and re-investing dividends on stock positions.

Within some exchanges, investors can use staking pools to stake tokens at an estimated average 12.5% p.a. (with a lockup of 15 to 30 days). Staking provides a good way to monetize digital asset holdings while still benefiting from potential capital appreciation. However, investors who participate in staking would be exposed to counterparty and/or smart contract risks of the exchange or protocol providing the staking pools. While we will discuss the benefits and risks of staking within exchanges or DeFi protocols in a follow-up report, it is important to highlight that there has been a rise in DeFi protocol exploitations in the last year, increasing the risks for investors venturing into this part of the market.

Another important point is that although yields remain substantial, most are paid in tokens whose value also remains volatile. Despite this, bullish medium-term investors are increasingly staking tokens in order to monetize their holdings.

How Amber Can Help

OTC Trading and Execution Services
Handling risks via off-exchange trading has become more important to lower execution costs for larger trades and to access fiat on/off-ramps. Given this, investors must connect to alternative sources of liquidity. Amber provides depth for clients in major digital assets through a systematic and high-touch offering. Amber offers clients access via voice, electronic chats and a single-dealer platform.

Acting as a systematic internaliser, Amber operates a single-dealer platform, representing one of the fastest growing sources of off-exchange liquidity in the market, and providing access to best aggregate pricing for major digital assets. The Amber platform offers an efficient, reliable, and cost-effective way to execute large block trades, allowing family offices and UHNW investors to build a directionally long digital asset portfolio efficiently and without any hidden fees.

In addition, one of the hardest elements of trading digital assets, especially for family offices, is managing multiple accounts and exchange connections. Amber takes that pain away. Regardless of how or what investors want to trade, the Amber trade execution desk provides efficient and effective ways to access fragmented liquidity across global exchanges. With proprietary logic, Amber improves execution quality to meet customized trading objectives without requiring complex choices or setting a wide variety of parameters. Whether investors want to programmatically purchase a portfolio of specific, hard-to-source tokens, or cost average into assets such as ETH over a set time horizon, Amber is able to help.

Flexible Time Deposits

Similar to the stablecoin product offering, Amber offers its client base the ability to earn passive income using their digital assets. Amber's interest rate products deliver consistent yields for the long token holdings of an investor. Amber's yield offering is available in BTC and ETH, while custom arrangements for other tokens are also available.

Structured Products

Amber may provide investors access to "Dual Currency" products which are suitable for family offices who wish to monetize a commitment in buying dips or selling rallies against fixed maturities. Dual Currency is an investment product with embedded call or put options. Through this product, investors can earn a higher interest rate than standard lending rates, depending on the performance of the underlying tokens.

Investors may generate yield on stablecoins, BTC, or ETH, depending on which coin they hold a natural exposure in and/ or which they are comfortable to hold in the future. The products are able to generate a return higher than those provided by market deposit rates (typically around 15.0% to 100.0% APY), with customization available to fit a specific market view. Importantly, Dual Currency investments are not principal-protected, and are exposed to underlying market movements, reflecting a natural allocation within the 50% directional portion of a digital asset allocation, and not the cash-equivalent portion.

Example (Buy-Below-Market BTC Dual Currency Structured Product): BTC is currently trading at $40,000. The investor holds USD-stablecoins. If the market drops to $35,000 in 10 days, the investor is happy to buy the dip at that price (strike). Using their USD-stablecoins, the investor places a 10-day Dual Currency order against BTC with a strike at $35,000, which gives the investor a yield of 50.0% APY (as an example). In 10 days, if the market remains above $35,000, the investor receives 50.0% APY on their USD-stablecoins along with their principal in USD-stablecoins back. If the market has dropped below $35,000, the investor will have bought BTC at $35,000, hence taking delivery of BTC at that strike in addition to 50.0% APY (paid in BTC).

3 **10% private investment allocation (analogous to an illiquid alternative investment allocation via venture capital or private equity in a traditional portfolio)**

The final portion of a digital asset portfolio can be allocated towards private equity or venture capital style investments. Investors can gain specific exposures to growing themes in digital assets, such as infrastructure, gaming, and DeFi, through private access deals with liquidity horizons of 1 to 3 years. Investments in this portion of the portfolio would typically require getting access to Initial Coin Offerings (ICOs, equivalent to an IPO for traditional assets) or seed rounds for companies building products and services in the nascent blockchain ecosystem.

Private investments offer family offices and UHNW investors exposure to new, efficient, and scalable technologies and protocols. This is similar to venture capital equity, but investing in tokens (and at times equity in companies) during the private stage at a discount to the future ICO price. This provides a substantially enhanced return profile yet features additional risks given the lack of transparency and asymmetric access to information in this portion of the market. Early-stage tokens have a risk profile similar to early venture capital investments for traditional assets, requiring deep and technical market knowledge and access to successfully generate sustainable returns. Investors who are able to access early-stage investments in high-quality protocols can earn substantial profits due to the valuation spread between private markets and publicly-traded token markets.

How Amber Can Help

Private Access via Amber Eco Fund – Amber operates an early-stage venture fund on behalf of outside limited partners, investing in what we consider to be the most promising and rapidly developing areas of the crypto landscape.

Amber's long standing reputation, technical edge, experience in leading some of the industry's biggest deals, and ability to help scale projects and protocols allow the firm to be part of lucrative early-stage rounds and lead investments in companies that exhibit significant growth potential. Similarly, Amber's established track record of working with over 1,500 institutions including HFs, HFT desks, and FOs / UHNW investors attracts world-class founders and teams who are already executing on dynamic and unique projects. Our Principal Strategies Group (PSG team), which manages the Amber Eco Fund, have led high-profile fundraising rounds for top-tier crypto projects such as Near Protocol and 1inch. They also participate in early-stage rounds for high-potential crypto start-up projects and partner as a secondary market liquidity provider on many new token issuances. In addition to providing direct exposure via the Eco Fund, Amber has the potential to offer selected institutional and UHNW clients (Amber premium club and 1,000 BTC club members) a first look at early-stage token (and equity) investment opportunities in developing protocols and projects that offer large upside growth opportunities.

Collateralized Lending
Amber's lending desk also offers collateralized loans across all major digital assets and stablecoins. With the ability to lend in large sizes across flexible tenors, many market participants work with Amber to optimize their balance sheets and working capital for a variety of business purposes. With collateralized loans, investors can access quick funding without giving up their exposure (and participation in capital appreciation), in order to invest in other areas within digital assets or even in traditional markets.

> https://h5.whalefin.com/register/?referral_code=NKA2CF

About Amber

Founded in 2017, Amber Group is a leading global digital asset company which provides a full range of digital asset services spanning investing, financing, trading, and spending. Our 24/7 trading desk serves over a thousand institutional clients globally while WhaleFin, our integrated digital asset platform, serves our individual investors via mobile and desktop applications.

We are the market leader in pricing, trading and hedging complex digital assets products. On an average day, we trade between $2 to $5 billion in cash, futures, swaps, options and other derivatives. We are an active liquidity provider on all major electronic exchanges and blockchain protocols, and have traded over $1 trillion across all products and categories since inception.

Our core value is building strong relationships with our clients; helping them buy and sell digital asset products, manage risk and access liquidity. We are a team of 900+ dynamic, entrepreneurial technologists, quantitative researchers, traders and engineers on a mission to enable frictionless markets. We operate around the clock and around the globe, with a presence in Europe, Asia and the Americas

Disclaimer

About Juniper Place

Founded in 2014, Juniper Place is a class leading provider of digital asset raising solutions to the alternative asset management industry. Our award-winning investor intelligence platform profiles over 12,000 institutional investors, including 2,000 family offices. We deliver a unique blend of investor intelligence data, lead generation, domain expertise and investor relationships.

Our clients include large asset managers , hedge funds, private equity funds and increasingly digital asset firms. We see a strong parallel between the institutional adoption of digital assets and that of the hedge fund industry in the early 2000s and are positioned to provide institutional investor and family office insight and access to digital asset firms.

Disclaimer

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