

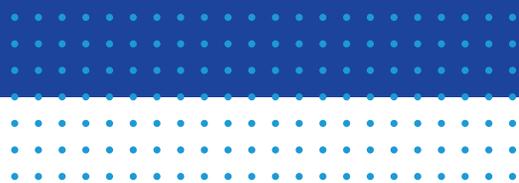


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Cryptoassets: Beyond the Hype

An Investment Management Perspective
on the Development of Digital Finance

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Abstract

This research paper is a practitioner analysis of the manner in which investment professionals have considered cryptoassets and cryptocurrencies for integration purposes into their investment decision process or asset allocation portfolios.

It is based on a series of interviews held with industry experts and investment practitioners over the course of 2022.

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1. EXECUTIVE SUMMARY

Since March 2022, we have conducted a series of interviews on crypto investing with a variety of investment professionals and crypto experts—some enthusiastic proponents, some skeptical, and many cautious though curious. Our primary goal has been to go beyond the hype and understand what investment professionals believe and are actually doing regarding cryptoassets. This paper seeks to distill what we have learned. It thereby seeks to inform investment professionals on the current state of crypto investing and draws observations and recommendations to support positive investor outcomes.

Because the world of crypto is still very much in flux—with new developments in markets and technology and a still-evolving legal and regulatory framework—fundamental questions remain open. Before plunging into crypto investing, we believe that investment professionals generally should take a careful, studied approach. That is the approach we have adopted in this paper. Rather than taking definitive black-and-white positions, we believe it will be more valuable to our audience—which includes investors, policymakers, the media, and others curious about crypto—to present the key themes that emerged from our interviews and also to convey the mix of insightful, yet at times contradictory, ideas expressed to us.

To make that mix more manageable for readers, we begin with two concise sets of recommendations, one for policymakers and the other for investors. For the former, we suggest that policies should be technology-neutral. Laws and regulations should not entrench incumbents but, instead, should allow for startups with innovative technologies to challenge and compete with established firms and infrastructure providers in traditional finance. But policies should also not compromise investor and consumer protections in the name of innovation or technological novelty.

For investors, we emphasize the critical importance of grounding investments in rigorous investment analysis. Mere novelty, let alone hype and speculation, cannot justify any investment, whether in cryptoassets or more traditional assets.

As an introduction to the practitioner's view of the crypto market, we review major types of cryptoassets and trading platforms while presenting a sense of size and scale. Notwithstanding their meteoric rise, cryptoassets remain dwarfed by traditional assets.

Three key themes resonated with many of our interlocutors. First is the question of how to value cryptoassets, which frequently defy traditional discounted cash flow analysis. Valuation questions, in turn, lead to an examination of crypto use cases that can suggest nascent demand and potential scale. The second fundamental theme examines whether crypto investing is compatible with fiduciary duty, a question much on the minds of pension fund investment professionals and regulators, in particular. We trace specific characteristics of cryptoassets to specific elements of fiduciary duty to illustrate the challenges of meeting a fiduciary test of a prudent investment process. Our third theme revolves around the challenge of providing safe custody of cryptoassets in light of their novel underlying technology.

Next, we paraphrase some of the most pertinent comments that our interlocutors made to us. The picture that emerges may appear to some as something of a gallimaufry, to use an apt if rather quaint word. Nonetheless, we believe that it will best serve our readers to present a mosaic of ideas, rather than a logical or linear narrative that embraces one point of view while relegating or discarding others.

Finally, we conclude with a short set of key messages—some of the most fundamental themes to emerge from our research and interviews, including

- the need for crypto investors to ground their decisions in a sound investment case,
- the need, therefore, to examine crypto use cases, especially in the absence of cash flows,
- the need to look beyond the hype and to distinguish the disruptive potential of crypto technology from the value of individual cryptoassets,
- the need to ask what decentralization means in the crypto ecosystem and the conundrum this presents for accountability and regulation, and
- the need to establish a strong regulatory framework, for the benefit of crypto providers and users alike.

These questions, challenges, and conundrums continue to vex crypto practitioners, investors, and policymakers alike, but they also make the study of crypto investing fascinating.

An Update on the FTX Situation and How It Is Relevant for This Research Report

This paper was researched and substantially written before FTX's sudden demise in November 2022. While the facts behind FTX's collapse remain to be established, what we know already highlights key themes and raises fundamental questions.

For investors and regulators alike, FTX's failure reinforces the central importance of custody and protection of investor assets. Investors in cryptoassets and participants on crypto platforms must be particularly diligent in understanding how their deposits and assets will be protected and segregated.

Legislators and regulators will need to establish and enforce strong laws and regulations to protect customer and investor assets from misuse by crypto platforms. Existing laws and rules are meant to prevent brokerage firms and stock exchanges from using customer resources to fund their own or affiliated businesses. The rules involve, among other things, segregation of assets and requirements to place customer funds with qualified custodians. Although the system is not perfect—witness, for example, the past failure at MF Global—the rules have proven useful in protecting customer assets. Crypto currently lacks similar rules to protect customer assets. That is a particularly risky regulatory gap, since crypto platforms combine many of the functions that are separate in mainstream finance, such as the roles

of brokerages, exchanges, market makers, custodians, and clearing agencies.

The events surrounding FTX have also raised issues related to run risks in the cryptoassets sector. It is not yet clear what risk-mitigating mechanisms would be put in place to limit the transmission to traditional finance channels if traditional banks and other mainstream financial institutions were significantly more entwined with crypto and exposed to its risks. Likewise, there is no expectation that central banks will bail out failing crypto platforms. It would be an altogether different story if crypto firms had access to central bank financing or if collapses of major crypto firms triggered central bank bailouts.

FTX's failure also pokes holes in another crypto myth—the myth about its disintermediating nature—or at least demonstrates that the reality is far more complex than is often portrayed.

In the pages that follow, you will find historical data that precede FTX's collapse. We have not attempted to update such data. The larger point, however, is that, in our view, FTX's failure reinforces key themes in this paper, including the importance of custody issues and the responsibility of investors to base their decisions on the investment case rather than speculation.

1.1. Summary of Conclusions for Policymakers and Regulators

Here, we summarize our key conclusions intended primarily for policymakers and regulators.

- **Regulation needs to be harmonized.**

Given the inherently cross-border and decentralized nature of blockchain processes, regulators must find ways to harmonize regulatory frameworks at an international level and agree on definitions and supervisory programs that take account of the specific nature of cryptoasset services. The objective should

be to minimize regulatory uncertainty due to potential market fragmentation.

- **Whether cryptoassets are securities needs to be determined.**

It will be critical to definitively state whether cryptoassets qualify as securities, other forms of financial instruments, commodities, or currencies and to harmonize this definition at an international level. CFA Institute believes that several cryptoassets would meet the definition of securities under US securities laws, for example, while this debate is also taking place in the European Union in regard to MiFID II. There is a risk that confusion on this point will cause regulatory and legal uncertainty across jurisdictions. We would also argue against designing new extensive

regulation as a simplistic response to the challenge of classifying cryptoassets as securities (or commodities), which is the primary question that should be answered as a priority.

- **Regulation should be technology neutral.**

Regulation on cryptoassets and digital finance should remain technology neutral. Regulators should not adjudicate which technological developments or orientations offer markets, investors, and consumers the most benefit. Nor, however, should regulators lower the bar on investor protections just because a technology is new.

- **Stablecoins should be regulated for systemic risk potential.**

Stablecoins, one subset of cryptoassets, should be properly regulated both from a prudential standpoint and a business conduct or investor protection standpoint because they bear properties that are similar in some respects to money market instruments. The method used to maintain the peg should be scrutinized and their collateral verified independently. These instruments create ties with and ramifications for traditional financial markets in ways that suggest they may represent systemic risk to financial stability if left improperly supervised.

- **Cryptoasset services need to be categorized and their business conduct regulated.**

Cryptoasset-related services should be identified and properly regulated according to the risks they represent to investors and participants. This means clarifying the activity scope of crypto exchanges and determining which regulatory framework they fall under, taking into consideration the discretionary or nondiscretionary nature of their operations. It also means defining a proper regulatory framework for decentralized finance (DeFi) activities related to lending and borrowing activities. One litmus test for regulation should be the intention of participants when they enter the market. If they expect a return from their engagement, in whatever form, this should be sufficient to assume that a principal-agent relationship is involved, which requires proper regulation.

- **The competition level needs to be monitored to avoid undue consolidation.**

Regulators should monitor the cryptoasset market to ensure that it remains driven by sound competition forces. The inherent technical nature of cryptoassets suggests that specific firms may benefit from a technology and information advantage. Regulators should establish monitoring programs with a specific focus on costs, fees, and business practices related to investor or consumer protection. The potential for consolidation should not result in the establishment of a new value chain working essentially in the interest of a selection of technologically advanced companies.

- **Market abuse risks need to be monitored and controlled.**

The same technology and information advantages can also result in potential market abuse (e.g., front running, insider dealing). Regulators should harness advanced forms of data science to monitor such activity to maintain market integrity. The inherently fragmented nature of the cryptoasset market will require the regulatory community to establish information-sharing mechanisms to ensure a coherent and comprehensive understanding of transactions in this market.

- **Financial risk buildup in the DeFi sector needs to be monitored and measured.**

Depending on the pace of the development of DeFi services based on lending and borrowing, regulators should develop appropriate metrics to measure and quantify the buildup of risk in this sector of the economy. It is possible this activity will require prudential measures similar to those related to financial institutions for their securities lending business dealings.

- **Custody of cryptoassets needs to be regulated and secure.**

Policymakers should place a high priority on enacting a framework of laws and regulations to ensure the safe custody and safekeeping of customers' cryptoassets. The key principle should be that crypto platforms and firms should not be allowed to use customer assets to fund their own businesses. Customer assets should be segregated and protected even if the platform or firm becomes bankrupt. These principles are consistent with that developed by the International Organization of Securities Commissions (IOSCO) and the Committee on Payments and Market Infrastructures (CPMI) on central securities depositories. To achieve the right solutions, policymakers and regulators will need to consider the specific nature of digital assets, including questions related to IT security, access control, and the various forms of storage that are possible.

1.2. Practical Recommendations for Fiduciaries and Institutional Investors

In this section, we summarize our key practical conclusions for entities acting as fiduciaries and institutional investors.

- **Recommendation 1: Hype is not a sound basis for an investment case.**

We recommend that fiduciaries continue to apply the principles of prudence, loyalty, and care in their work as an agent of their clients. From this perspective, the mere potential prospect attached to cryptoassets or

to the related ecosystem is not in and of itself sufficient as a rationale to invest clients' money into these instruments or projects. Unsubstantiated promises and aspirations do not make for a reasonable investment case. Proper analysis of value, merits, and risks remains necessary for fiduciaries to discharge their role as it is intended. We urge fiduciaries to guard against their clients' fear of missing out (also known as "FOMO").

- **Recommendation 2: Basic principles of portfolio construction continue to apply.**

We recommend, in line with the teachings of the CFA Program curriculum, that investors continue to take a holistic and strategic portfolio construction view on their investments by balancing short-, medium-, and long-term objectives. This approach is the soundest basis for investment decisions.

- **Recommendation 3: Careful analysis of value and portfolio benefits is necessary.**

We recommend that fiduciaries provide sufficiently grounded analysis of intrinsic value, volatility, correlation effects, momentum, or technical features of their proposed investment within the overall portfolio context, whether directly into tokens or indirectly through the equity of an enterprise, before they claim that such an investment satisfies their usual standard of care.

- **Recommendation 4: Intrinsic value should be related to an in-depth understanding of use cases.**

We recommend that fiduciaries who are interested in the fundamental value of cryptoassets conduct an in-depth and rational analysis of the use cases for the tokens, project, or enterprise. Our view at this stage of cryptoasset development is that intrinsic value of cryptoassets has to be related to an analysis of use cases, which is a driver of demand for these instruments. This will require an application of a dispassionate analysis of the business model in question and the economics that are being proposed.

- **Recommendation 5: Careful analysis of the sustainability of the business model and client acquisition strategy is necessary.**

We recommend that fiduciaries pay particular attention to the potentially circular nature of the cryptoasset project being analyzed, focusing on the intrinsic and distinguishing qualities of the project along with the client acquisition model. The business model should be sufficiently sustainable organically or on a course to sustainability, as opposed to relying on

unsustainable subsidies or unrealistic economics to attract the user base. Otherwise, risks in this area can be very high.

- **Recommendation 6: Investors need to investigate decentralization claims and the third parties in the value chain.**

We recommend that a reasonable investor investigate the notion of decentralization in relation to the business model of a proposed investment in a cryptoasset project. A fiduciary or investor should have a clear understanding of the value chain in place and the series of third parties involved in the transactions pertaining to these tokens or coins. Such an analysis should lead to a sufficient understanding of the economics of a project and its distribution of benefits.

- **Recommendation 7: Fiduciaries need to ascertain the custody chain and safekeeping of client assets.**

We recommend that fiduciaries conduct a thorough analysis of the custody aspects related to any cryptoasset project, as safekeeping of client assets is of fundamental importance. The proper approach should be to require the same standard of quality or care as the agent applies to all other assets or to contract with a third party that can provide this quality standard. Asset segregation, ownership rights, IT security, cybersecurity, access, and legal certainty are all points that should factor into this analysis. A good starting point would be to consider the Principles for Financial Market Infrastructures developed by IOSCO and the CPMI in 2012, especially regarding central securities depositories, as we discuss later in this research paper.

- **Recommendation 8: Fiduciaries need to have a good grasp of the regulatory context and anticipate possible developments.**

We recommend fiduciaries keep a close eye on the evolving regulatory context concerning cryptoasset markets. Regulatory frameworks for this market are only emerging, and it will take time before they are harmonized at an international level. Fiduciaries should conduct their own analysis of whether cryptoassets they are considering qualify as securities or not, depending on local legislation and currently available regulatory guidance. We advise prudence and the adoption of a conservative take on this question for as long as regulatory certainty is not established. In such a context, fiduciaries should make sure they can justify such investments for different client types, whether professional or retail investors.

2. INTRODUCTION

2.1. Methodology

The core purpose of this research was to question and learn from professionals in various fields of work who have interacted one way or another with cryptoassets and digital finance. We conducted a series of interviews with these professionals, collated key observations from our conversations, and organized them in overarching themes.

The primary perspective of our inquiry was to take the point of view of investors and investment practitioners as they adapt to what may become an entirely new asset class. In so doing, we were concerned with relating these observations to the principles taught in the CFA Program curriculum with respect to financial analysis, portfolio management, and fiduciary duty.

This research paper therefore constitutes our own analysis of these observations and presents the views of CFA Institute on the developments of digital finance. We do not attribute any comment or observation made by the interviewees.

The acknowledgments section sets forth those interlocutors who have given us permission to list their names. CFA Institute thanks all our interlocutors. Their thoughts and range of perspectives have informed our understanding of digital assets.

2.2. Why We Are Performing This Research

CFA Institute believes there is still a considerable amount of hype and unsubstantiated claims in public comments and analyses of cryptoasset market developments. In particular, we believe there is a need to provide an objective viewpoint in terms of the merits and risks this market poses to a typical investor, taking the fiduciary perspective of an institution or an adviser who has duties of care, loyalty, and prudence.

2.3. Terminology and Glossary

Throughout this document, we make use of certain terms that, essentially, refer to the same idea. We view cryptoassets or digital assets as referring to the same concept. At times, we mention specific subcategories, such as cryptocurrencies or stablecoins, but we do recognize there is a large degree of overlap between these terms and no truly definitive industry consensus has yet emerged.

The same goes for general industry terms, such as blockchain or distributed ledger technology (DLT). We use these terms interchangeably as they refer to the same underlying process.

A glossary is available at the end of this paper for terms that are in bold font in the body of the text.

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4. PREAMBLE

4.1. A Historical Context That Matters

In this preamble, we provide a historical context to the development of **cryptoassets**. We believe that analyzing—even if only briefly here—the progress made in economic theory and the rise of political economy in the eighteenth century provides useful background that may help explain why individuals showed interest in blockchain technology.

As we discuss, economists have long debated the merits of the monopoly over money enjoyed by governments and central authorities as this power can be abused, thus resulting in economic inefficiencies. It is possible to view the development of cryptoassets and blockchain-enabled applications as a response to—or in the context of—the search for a more efficient system.

The view we propose in this paper is a point-in-time assessment of a burgeoning industry that is changing fast. At its core, digital finance proposes to transform the traditional mechanisms of commercial transactions intermediated by financial institutions. The sought result is a system permitting peer-to-peer transactions, which it is hoped will free economic creativity and distribute wealth creation across a wider spectrum of economic agents. Our purpose in this paper is to explain that this proposition cannot simply be taken at face value and that investment practitioners need to understand the reality, merits, and risks of a system where traditional intermediaries would no longer be responsible for guaranteeing and securing transactions, facilitating price formation, or raising capital.

Digital finance will continue to change as it stabilizes and as rules that govern the sector are clarified. CFA Institute will continue to analyze this development from the perspective of investor protection, market integrity, and professionalism.

4.2. From Nakamoto Back to Adam Smith and F. A. Hayek

4.2.1. Early Developments

When Satoshi Nakamoto produced the now famous white paper on bitcoin in 2008, it is hard to imagine if he (or the group of people under this name or pseudonym) could have foreseen the magnitude of the ecosystem that has since developed in the coin's footsteps.

Nakamoto (2008) criticized the incumbent system because he felt it generated excessive frictions caused by the important number of intermediaries whose role is precisely to create trust in transactions. His original idea was, therefore, that "a purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution."

Frictions in the financial system materialize in various forms, including transaction costs, time delays, uncertainty, lack of irreversibility, and fraud. The novelty of Nakamoto (2008), therefore, resides in his proposal for a system that would not need to be based on trust: "What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party."

Based on our reading of Nakamoto's white paper, he did not intend for bitcoin to become anything more (or less) than a means of exchange that would be essentially decentralized and independent of intermediaries to enforce transactions. This is an important notion given how the principles of cryptography and distributed ledger technology (DLT)—also known as the blockchain—which underpin crypto instruments, have developed into potentially an entirely new class of financial assets for investment or speculation purposes. This was arguably not the intended purpose of bitcoin.

4.2.2. The Link with the Development of Political Economy

To gain an eventually useful perspective on the development of digital assets in their various forms and ecosystems, we also consider the work of such historical figures as economists Adam Smith (1723–1790) and Friedrich August von Hayek (1899–1992). Our aim is to trace important intellectual thought that helps contextualize the development of digital finance.

In some circles, bitcoin is considered to be digital gold, mainly because it represents systematized digital scarcity, the growth of which can follow a predictable pattern. The question then would be why individuals and governments would want to hoard gold, and we can extend the question to bitcoin. The answer could be perhaps that gold and bitcoin serve as an inflation hedge or a store of value. In other words, it is possible to assume that the logic for hoarding gold or bitcoin is that it represents a measure of accumulated and protected wealth. This assumption is precisely

where Adam Smith would beg to differ. In his famous 1776 opus, *The Wealth of Nations*, Smith criticizes this mercantilist view of political economy. Gold, or bitcoin for that matter, is nothing more than a commodity, which you can purchase with goods or use to purchase other goods. The perspective here is that wealth creation has nothing to do with hoarding currency but, rather, corresponds to the quantity of goods and services that is rendered possible to produce and exchange thanks to the circulation of such currency in a free market economy. Economist Irving Fisher (1867–1947) would later further develop this idea with his quantity theory of money (Fisher 1911), as he discussed how the concept of money illusion (Fisher 1928)—a cognitive bias—blurs people's impression and understanding of wealth accumulation, largely because they ignore the effects of inflation over time.

This then takes us to F. A. Hayek because the logical continuation of this train of thought is to interrogate whether bitcoin would be a good money or currency to use when engaging in these exchanges. There is no reference in Nakamoto's white paper to the effect that bitcoin should be a stable means of exchange by virtue of its constitution or its administration, which is precisely the problem that Hayek (1976) discusses in his book *The Denationalization of Money*. For Hayek, inflation was a perverse and harmful effect of governments' monopoly over money (or legal tender), which historically has often led to their abusing this power of coinage to engage in debasement through seigniorage, or quantitative easing, to use a modern expression. In practice, inflation is the decline of a currency's purchasing power.

Hayek's view is therefore that governments should be stripped of their monopoly over money in favor of a multitude of private currencies competing for business.¹ The essential part of this proposition is that for a currency to be competitive and, therefore, for it to attract consumer interest in holding it or borrowing it, the main characteristic of such currency should be its stability measured in terms of the commodities you can purchase with it. People and businesses will want to use a currency whose value remains stable and therefore provides both creditors and debtors equal protection against inflation. In such a system, competition is what guarantees that the parties proposing their private currencies will have an interest in maintaining their value stable (and therefore will have to adjust the quantity of money in circulation to effect stability), since people will have the choice of switching to alternative currencies. This alignment of interest between providers and users of currency is at the core of Hayek's proposal.

4.2.3. Cryptocurrencies Have Emerged as a Response to Fiat Money's Weaknesses

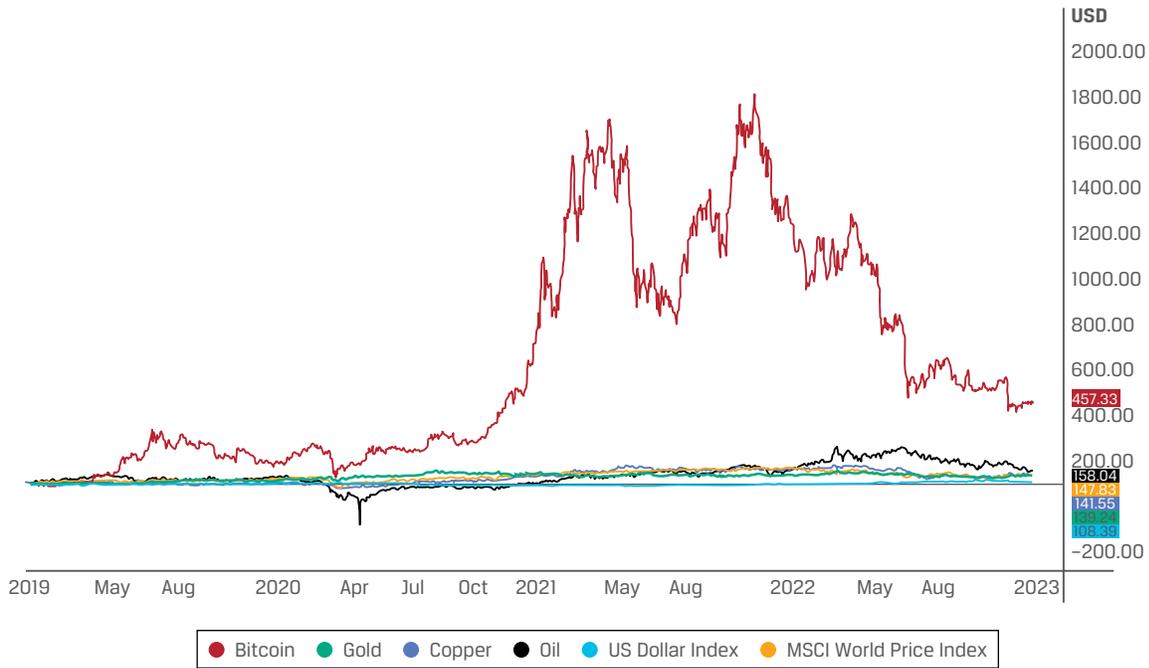
It is possible to consider bitcoin and the development of crypto currencies in general as a derivative or indirect effect of the failure of governments in providing a currency (whether fiat or based on gold) that corresponds to consumers' and businesses' needs (see Tebble 2021). A corollary argument is related to the failure of the traditional banking system and the centralized intermediation of money and credit as evidenced by the 2008 Global Financial Crisis (GFC). It is possible the GFC provided a degree of impetus to the interest in and development of alternative forms of money. However, there is a major difference between the free market monetary system advocated by Hayek and bitcoin's fundamental constitution in that bitcoin has no incentive structure in place to keep its value constant. The quantity of bitcoin in circulation does not depend on a mechanism to keep its value stable as compared to an underlying list of goods or commodities. The result has been the high volatility of bitcoin against, for example, the US dollar. From this perspective, bitcoin cannot become a valid currency in the sense that Hayek meant it—that is, that it needs to satisfy three conditions: a medium of exchange, a unit of account, and a store of value. Bitcoin probably fails on one or two of these conditions because of its inherent instability.

Exhibit 1 shows a comparative table of bitcoin's market price (BTC, measured in US dollars) against gold (XAU spot), oil (WTC spot), the U.S. Dollar Index (DXY), the MSCI World Price Index, and copper (BRHG spot).

These constitutional shortcomings of bitcoin did not prevent cryptocurrencies and digital assets from spawning an entire ecosystem of services based on cryptography and blockchain. The extent to which this ecosystem will translate into accelerated real economic growth and wealth creation in the sense that Smith and Hayek had envisaged remains to be seen. The promise of the third internet generation (**Web 3.0**) is precisely that it will enable people to own portions of the online world and use it for micro-economic and commercial purposes in a decentralized manner. Scaling up through acceptance will be essential for this development to take hold and become mainstream. Blockchain and its underpinning principle of cryptographically secured exchanges will need to demonstrate that they provide a more efficient way (user friendliness, recognition, less friction, lower costs, better stability) to conduct exchanges between individuals and businesses. As we will show later, it will also depend in large part on the willingness of governments to support such developments

¹Other economists and financial scholars have come to the opposite conclusion, arguing that attempts at private money have failed before and, in their latest incarnation as cryptocurrencies, will fail again. See, for example, Gorton and Zhang (2021, 2022).

Exhibit 1. Bitcoin Price vs. Gold, USD Index, MSCI World, Copper, and Oil, January 2019–December 2022 (all denominated in USD; rebased 100)



Source: Refinitiv, an LSEG business (www.refinitiv.com/en).

and, to a degree, accept that part of their sovereignty over money be diluted. After all, Hayek did not preclude a situation where the government's money continues to exist yet only as one competing money among others.

In the next section, we briefly describe this ecosystem, including the variations of blockchain uses and the size that they represent.

5. STATUS UPDATE ON THE DEVELOPMENT OF DIGITAL FINANCE

5.1. The Digital Asset Ecosystem

From a macro standpoint, economic exchanges currently have two models:

- The first model—what we call the traditional model—operates according to historical mechanisms to effectuate economic or financial transactions, intermediated by financial institutions and making use of fiat money as a unit of account and means of exchange. This is still by and large how the world functions. These mechanisms have also improved over the years through financial technology, automation, and streamlining of processes.

In this world, participants get to own shares or portions of financial or physical assets administered by intermediaries. The government is in charge of enforcing property rights.

- The second model involves the blockchain (also known as DLT). This is the model in which digital assets live. The diversity of such assets, platforms, and means of exchange is vast and heterogeneous. Collectively, this economic model is routinely referred to as **decentralized finance (DeFi)**. An additional complexity in depicting this environment is that not all uses and applications are truly decentralized.

In this world, participants own specific blocks of data on a distributed ledger that is not centrally administered by third parties. Enforcement of ownership rights is unclear.

Nakamoto's original concept focused on the simple idea of providing a new means of exchange, which would be electronic and free of the necessary intermediation of traditional financial institutions, thereby reducing frictions. Although bitcoin remains the figurehead of the digital asset world, it is somewhat ironic that its importance probably rests foremost on the series of derivative applications of the blockchain algorithmic principle (the **consensus mechanism** for validating new blocks) rather than itself as one very narrow form of **cryptocurrency**.

In the next section, we present a non-exhaustive list of the various economic forms that have been made possible using a blockchain. The focus of this paper is on presenting an overview of the penetration of digital assets and solutions in the investment industry from a practitioner perspective. We did not set out to present a complete picture of the digital asset sector.²

5.2. Cryptocurrencies and Stablecoins

A cryptocurrency is a digital version of a private currency understood as a means of exchange. Transactions effectuated using this cryptocurrency are recorded and verified on a decentralized ledger using cryptographic algorithms by a community of users incentivized to maintain the integrity of the ledger by being rewarded with new units of the currency through this consensus mechanism. In this sense, these instruments are decentralized because they do not require the intervention of a centralized authority to validate and authenticate transactions.

To acquire a cryptocurrency, one must first part with some form of fiat currency or another cryptocurrency and exchange it for a digital token of the desired cryptocurrency. This token's value will vary over time depending on the supply/demand equilibrium, in the same way as any other commodity or currency. The token can also be used to effect transactions in the real economy where it is an accepted form of payment.

Cryptocurrencies can either be free floating (e.g., bitcoin, ether) or be kept at a stable value by the operator. The latter form is known as stablecoins, which can take three forms:

- *Fiat- or asset-collateralized.* Examples: TrueUSD (TUSD), USD Tether (USDT), USD Coin. The coins or tokens issued are supposed to be backed by an equal amount of reserves in a fiat currency of any choice or other forms of assets or commodities, such as gold. The operator of the coin maintains the peg, which is the basis of the interest in using the coins to effectuate transactions, benefiting from the ease of use and lack of transactional frictions.

²For a detailed and comprehensive overview of the digital asset landscape and its technicalities, we recommend Matt Hougan and David Lawant's (2021) guide on the subject published by CFA Institute Research Foundation. CFA Institute also provides a learning experience on the subject of decentralized finance and its impact on the asset management industry, including a review of how blockchain works in practice (Online Course: "Decentralized Finance for Investment Professionals"; <https://store.cfainstitute.org/defi--introduction-to-blockchain-and-cryptocurrency/>).

- *Crypto-collateralized*. Examples: Havven (HAV), DAI, Wrapped Bitcoin (WBTC). These types of coins are backed by another cryptocurrency in the form of a loan using **smart contracts** on the blockchain. The peg is maintained and regulated on-chain via the smart contracts.
- *Algorithmic stablecoins*. Examples: TerraUSD (UST), Tron, Frax (FRAX), Neutrino (USDN). The idea or proposition with these types of coins is that they do not hold actual reserves as a basis for pegging their value to another asset or currency. Their value is kept stable by controlling the supply of the currency via an algorithm. These instruments are, in theory, the closest to the current form of fiat sovereign currency, with one major exception being that they do not benefit from a central bank controlling monetary policy and issuing the only legal tender in its jurisdiction.

To a large extent, these categories are not as clear cut in reality and stablecoin mechanisms do overlap with each other, given how immature the sector still is, from a technology standpoint as well as considering the underlying economics at play.

The reason why we single out stablecoins in this paper is because they are probably the closest digital and private equivalent to our current system of fiat money and money market instruments. Yet, any wholesale acceptance of stablecoins (moving away from the current monopolistic legal tender system) is unlikely to occur smoothly. An example of this point was the TerraUSD crash of May 2022 (Rosenberg 2022), which showed that the framework for unbacked stablecoins will take time to mature, especially in a context where the central government chooses to maintain its control over legal tender. Individuals and businesses will naturally gravitate towards the stablecoins that offer the most stability (inflation protection) while granting them the digital benefits promised by cryptocurrencies—that is, fewer transactional frictions, lower transaction costs, immediacy, certainty of execution, and lower levels of intermediation.

We also focus on stablecoins because they have characteristics similar to those of money market funds, in particular the coins that use a backing or collateralization setup. This is where these instruments may create systemic risk; they are by definition tied to the rest of the financial system through their collateral chain. As we discuss later,

the CFA Institute Systemic Risk Council has called for regulating these instruments as "systemically important payment, clearing, and settlement activities."

In the following exhibits, we aim to provide a notion of market size and significance for cryptocurrencies and stablecoins. For these instruments to be considered potentially systemic, one way or another, their market footprint needs to be established using metrics such as market capitalization or trade volumes, compared with other markets or economic values. The systemic risk potential of any instrument or market is determined by compounding the following variables: size, trading volumes, leverage, connectivity, and transmission channels. Whereas money market funds would clearly qualify as a potential source of market instability in stressed market conditions, at this current moment in time, the data on cryptocurrencies (shown below) hardly point to a similar level of significance or concern. The goal is rather to monitor their development and determine the right metrics to obtain so as to preempt future disruption as—or if—these instruments grow in importance. Issues of contagion and financial stability risks also arise if cryptoassets become integrated into the financial mainstream.

Exhibit 2 shows the largest cryptocurrencies in terms of market capitalization and trading volumes (measured in US dollars) as of 24 August 2022.

On 24 August 2022, the total global cryptocurrency market capitalization reported by CoinMarketCap was USD1.02 trillion, after a historical high of USD2.83 trillion reached on 12 November 2021. See **Exhibit 3** for a historical representation of the market capitalization of the largest cryptocurrencies over time, since 2013.

Data provider Chainalysis provides an interesting analysis showing how stablecoins and smart contract tokens have rapidly progressed as a share of the total transaction volume in cryptoassets. **Exhibit 4** illustrates how DeFi in general is gaining in diversity in terms of the services it can offer.

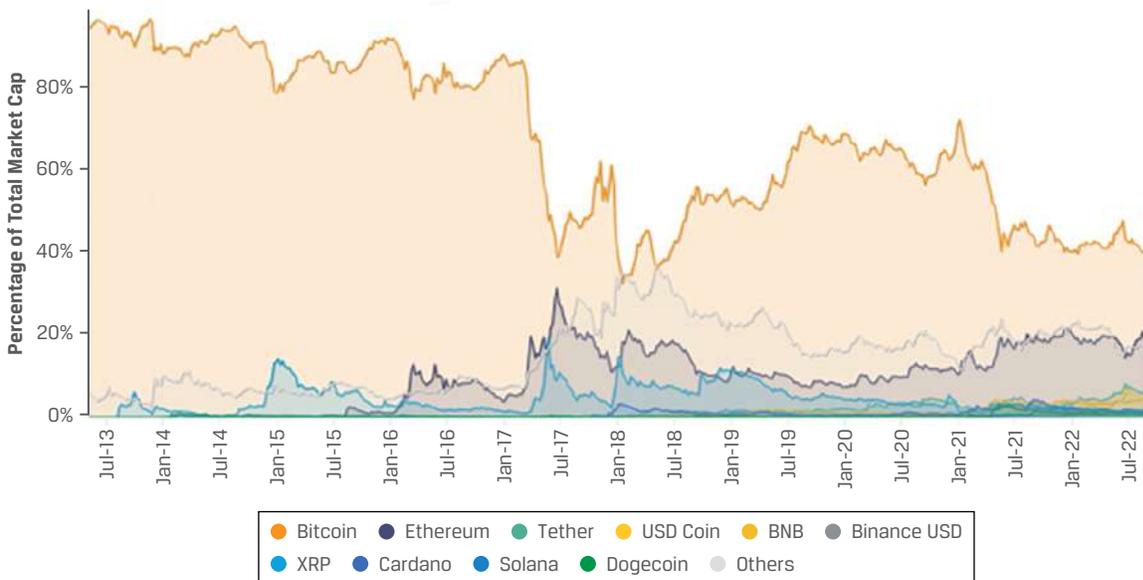
From a proportional perspective, **Exhibit 5** and **Exhibit 6** present a comparison of cryptocurrencies with other markets in terms of their size and trading volumes. The two main cryptocurrencies, bitcoin and ether (Ethereum), still represent small aggregates in comparison with other asset classes or economic interests.

Exhibit 2. Largest Cryptocurrencies in Circulation, 24 August 2022

Cryptocurrency	Nature	Market Capitalization (in USD billions, as of 24 August 2022)	Volume Traded Daily (3-month average, in USD billions, on 24 August 2022)
Bitcoin (BTC)	Unbacked (free floating)	411	29.79
Ether (ETH)	Unbacked (free floating)	201	17.96
Tether (USDT)	Stablecoin (ref. USD)	67	51.21
US Dollar Coin (USDC)	Stablecoin (ref. USD)	52	5.94
Binance Coin (BNB)	Unbacked (free floating)	45	1.34
Binance USD (BUSD)	Stablecoin (ref. USD)	19	5.53
XRP (XRP)	Unbacked (free floating)	18	1.28
Cardano (ADA)	Unbacked (free floating)	17	0.963
Solana (SOL)	Unbacked (free floating)	14	1.44
Dogecoin (DOGE)	Unbacked (free floating)	9	0.566
Litecoin (LTC)	Unbacked (free floating)	4	0.552
Chainlink (LINK)	Unbacked (free floating)	3	0.493
EOS (EOS)	Unbacked (free floating)	2	0.294

Sources: CoinMarketCap (<https://coinmarketcap.com>); Yahoo Finance (<https://finance.yahoo.com/>).

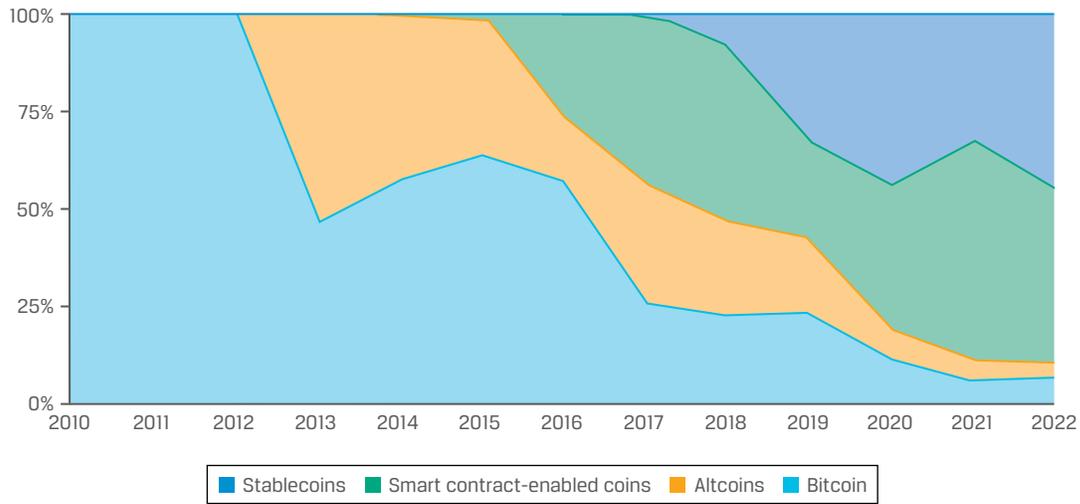
Exhibit 3. Major Cryptocurrencies by Percentage of Total Market Capitalization



Note: The key is ordered from top to bottom, with Bitcoin at the top.

Source: CoinMarketCap (<https://coinmarketcap.com>).

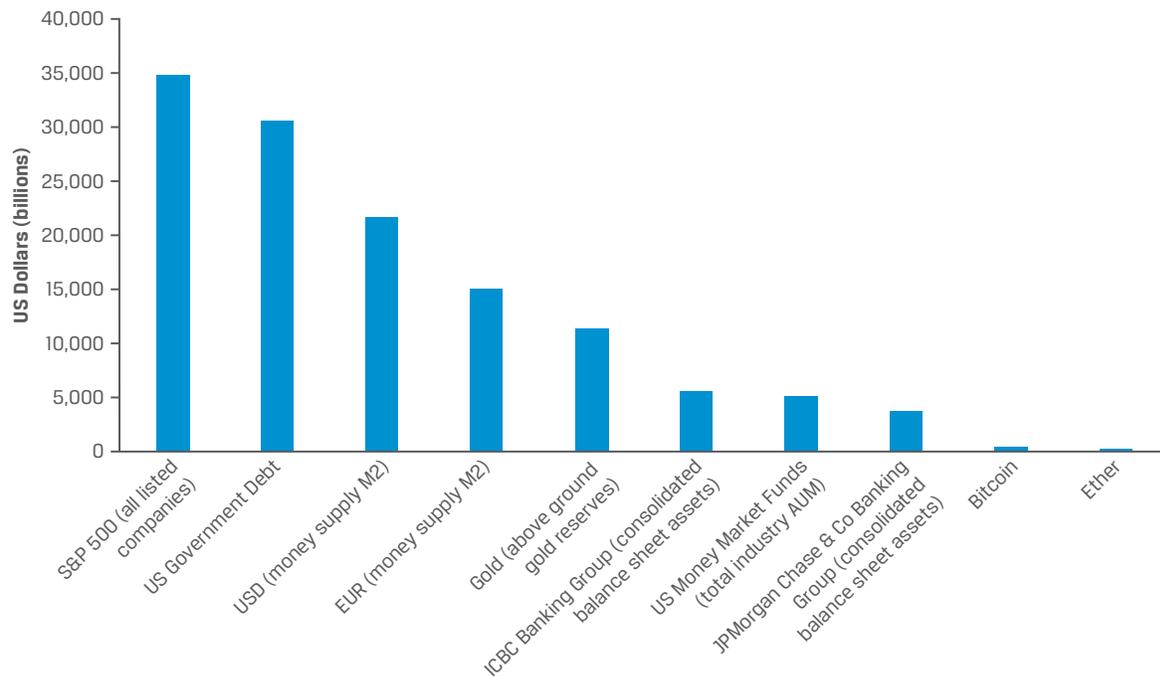
Exhibit 4. Share of Total Transaction Volume by Instrument Type, 2010–2022



Note: In general, altcoins are defined as all cryptocurrencies other than bitcoin.

Source: Chainalysis (www.chainalysis.com).

Exhibit 5. Cryptocurrencies Compared with the Size of Other Markets, 24 August 2022 (USD billions)



Sources: World Gold Council (www.gold.org); Compare Forex Brokers (www.compareforexbrokers.com/forex-trading/statistics/); CoinMarketCap (<https://coinmarketcap.com>); Statista (www.statista.com); Office of Financial Research (www.financialresearch.gov/money-market-funds/us-mmfs-investments-by-fund-category/); ICBC (<https://www.icbc.com.cn/ICBC/en/default.htm>); J.P. Morgan (www.jpmorgan.com).

Exhibit 6. Average Daily Trading Volume, 24 August 2022 (USD billions)

Asset Class or Instrument	Average Daily Trading Volumes (USD billions)
Global foreign exchange transactions	6,600.00
S&P 500 (constituent issuers)	694.00
US Treasury debt	550.00
Gold	130.90
Bitcoin	29.81
Ether	17.96

Sources: Bloomberg; World Gold Council (www.gold.org); Compare Forex Brokers (www.compareforexbrokers.com/forex-trading/statistics/); CoinMarketCap (<https://coinmarketcap.com>); Statista (www.statista.com); Office of Financial Research (www.financialresearch.gov/money-market-funds/us-mmfs-investments-by-fund-category/).

5.3. Initial Coin Offerings (ICOs)

Initial coin offerings emerged around 2014 as a novel way to raise funds in order to finance a venture or a project. While the underlying principle and objective are similar to traditional initial public offerings (IPOs), an ICO involves the offering of a cryptographic token or coin that represents the economic interest investors will obtain in the venture.

Several types of tokens can be the subject of an ICO, including the following:

- Currency tokens (a means of exchange or a store of value)
- Investment tokens (similar to securities)
- Utility tokens (access rights to future services or products)

Most ICOs to date have concerned utility tokens and, by and large, use Ethereum as the blockchain platform that administers the issuance and trading of the related tokens or coins. Utility tokens confer certain rights to the holders (access rights, future usage of services or products).

CFA Institute has published several pieces of research on ICOs, discussing their functioning as well as risks and opportunities (see, e.g., Edwards, Hanley, Litan, and

Weil 2019). In addition, we have also written a policy position paper in the form of a review of regulators' initial attempts at regulating this burgeoning sector of capital-raising activity and the issues raised in the process (Devai, Fines, Razvi, and Rosov 2019).

The pace of ICO issuance and the amount of capital raised has gradually slowed, after its peak in 2018. Regulators, including the SEC (2017a) in the United States and the European Securities and Markets Authority (ESMA 2017) in the EU, have warned investors about the risks ICOs may represent, mentioning in particular that they may be circumventing securities laws and are vulnerable to fraud.

In the United States, issuance of ICOs has fallen precipitously since the SEC and its previous chair, Jay Clayton, insisted that ICOs were really IPOs and that the coins were in fact securities. Since then, it appears that this segment of capital raising has shifted from ICOs to exempt offerings under Regulation D and Regulation A+.

Exhibit 7 shows the number of ICOs published and funds raised per year since 2014.

A particular issue concerning ICOs is the availability and reliability of data. In 2018, a report by consultancy and advisory firm Satis Group (2018), also mentioned by CoinDesk (Kim 2018), concluded that over 80% of ICO projects in 2017 had been identified as scams. Another interesting datapoint concerned the share of Ethereum as the platform issuers chose for ICO operations: 86%.

In comparison, traditional IPOs raised globally USD271 billion in 2018 and USD453.3 billion in 2021.

Exhibit 7. Initial Coin Offerings Statistics, 2014–2021

	ICOs Published	Funds Raised (USD millions)
2014	2	16
2015	3	6
2016	29	90
2017	252	5,718.38
2018	1,602	13,558.67
2019	474	168 (H1 2019)
2020	121	Uncertain (data unreliable)
2021	136	Uncertain (data unreliable)

Sources: Coin Insider (www.coininsider.com); Statista (www.statista.com).

5.4. Non-Fungible Tokens (NFTs)

A **non-fungible token** represents an interest in a particular digital or physical asset recorded on a blockchain. It can be sold and traded. Their particularity is that, contrary to traditional cryptocurrencies, they are unique instruments and cannot be interchanged with other NFTs.

The primary challenge with NFTs is the absence of enforceable rights on the legal ownership they confer, which is an issue that has been raised multiple times by regulators. Specifically, there is currently no obvious mechanism to technically differentiate or reconcile tokens issued on different blockchains even if they relate to the same underlying digital or physical asset, which raises the risk of fraud or, in any case, renders the verification and enforcement of ownership complex or impossible.

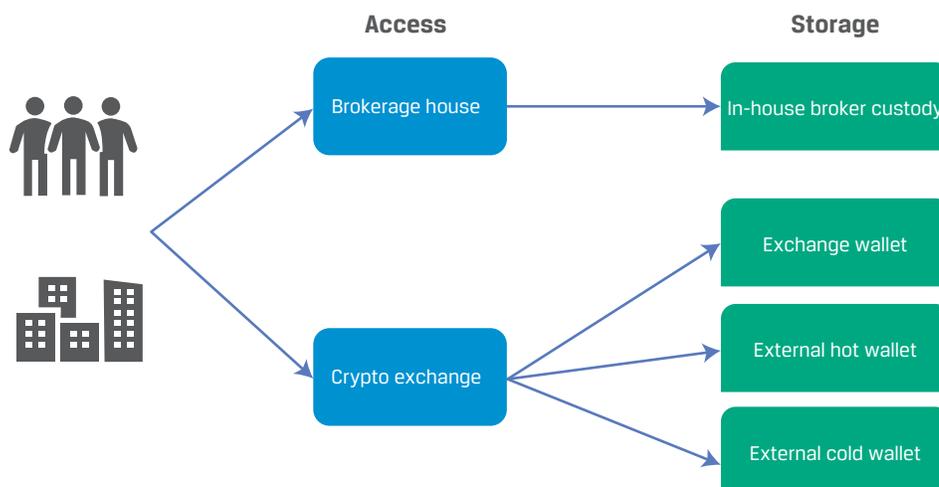
The capital raised through NFTs has experienced rapid growth, from USD94.9 million in sales volume in 2020 to USD44.2 billion in 2021, according to data provider Chainalysis (2022a).

In terms of sector, the following is a list of primary sources of interest, by order of importance:

1. Sports goods and collector items
2. Art piece rights
3. Movie avatars
4. Gaming features and items (in-app purchases)
5. Music rights
6. Metaverse



Exhibit 8. Architectural Logic of Investing in Cryptocurrencies, Considering Access and Storage



5.5. Market Infrastructure and Crypto Exchanges

The manner in which investors and individuals trade in cryptocurrencies depends on two dimensions—not entirely dissimilar to traditional trading in financial assets:

- Access for trading
- Storage

Access is provided by a range of service providers, in general:

- Brokerage houses (e.g., Robinhood, SoFi, eToro)
- Crypto exchanges (centralized or decentralized)

The business model of these entities is simple and based on fees charged per transaction.

Storage also varies in forms and depends on the method investors choose to access the market and purchase the cryptocurrencies:

- In-house broker storage and custody
- Exchange-attached wallet
- Hot wallets—online facility (internet-connected apps and devices) allowing real-time access
- Cold wallets—offline hard drives where the private crypto keys are held

Exhibit 8 summarizes the architectural logic of how investors will typically access the market for cryptocurrencies.

Given this framework, several important issues arise:

- Fees will vary widely depending on the chosen solution, and they currently are high in general (see Exhibit 19 in Morningstar 2022).
- In-house broker custody will generally prevent users from moving their cryptocurrencies to an external wallet.
- If investors maintain their assets on an exchange, they will lose control over these assets because the custody chain of crypto exchanges does not benefit yet from typical banking and custody safekeeping rules and insurance backing. The risk of fraud is also a challenge.
- Hot wallets allow better control and interoperability but are still exposed to the risk of theft or fraud.
- Cold wallets are more secure, yet as hardware systems, they can malfunction or users may lose the access codes.

From a fiduciary perspective, the issue of custody and safekeeping of assets is paramount and the subject of strict regulation in traditional investment management activity. We provide a more in-depth analysis of this problem for cryptoassets in Section 9.

The notion of centralization or disintermediation deserves some examination. While the principle of DLT or blockchain is the operational foundation of crypto services and products, not all these services are truly decentralized as they are often purported to be.

We consider a transaction-related service as being intermediated or centralized through a third party when it involves the following characteristics:

- Custody
- Discretionary decisions on behalf of third parties
- Maturity transformation (or some form of asset transformation)

Together, these characteristics constitute a typical principal-agent relationship, which is a key component of how financial services function.

From this perspective, a crypto exchange is considered decentralized when it does not involve a third party between a buyer and a seller as part of a transaction. Centralized exchanges involve some degree of custody to effectuate transactions, with the associated issues this situation may generate as discussed earlier:

Owners of crypto on those exchanges in practice own a claim against a pool of cryptoassets in the custody of the exchange. However, only centralized exchanges therefore allow for transactions to take place using fiat currencies. Decentralized exchanges permit truly peer-to-peer transactions involving solely cryptocurrencies, which are stored exclusively on external wallets. Examples of decentralized exchanges include Uniswap, Tokenlon, Ox Protocol, and Venus. Most operate using the Ethereum blockchain.

Cryptoasset exchange and custodian Gemini (2021) estimated in April 2021 that a vast majority of crypto transactions (95%) were facilitated by centralized crypto exchanges.

As of 24 August 2022, the largest cryptocurrency exchanges in the world, measured in terms of the score calculated by data provider CoinMarketCap (aggregate of volumes, traffic, and reliability of data), were as shown in **Exhibit 9**.

For comparison, **Exhibit 10** shows the largest stock exchanges in the world as of June 2022, ranked by the value of their electronic order book for share trading.

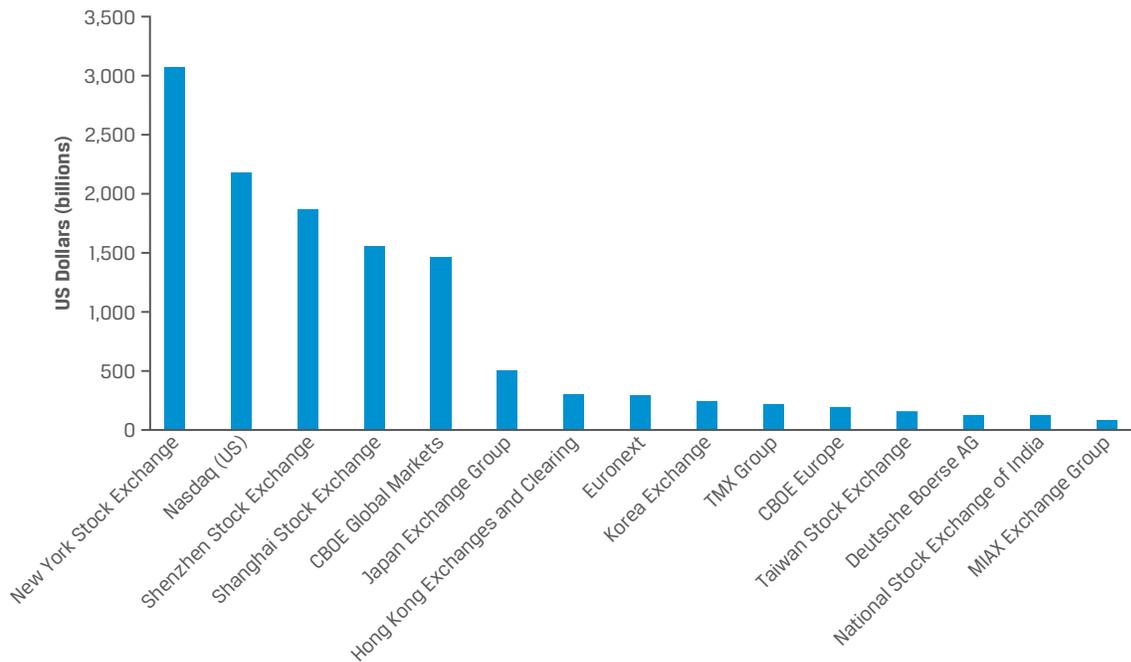
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Exhibit 9. Largest Crypto Exchanges in the World, 24 August 2022

Rank	Exchange	Volumes Traded over Last 24 Hours (USD billions)	Number of Coins Offered for Trading
1	Binance	12.00	387
2	Coinbase Exchange	1.76	213
3	FTX	1.37	286
4	Kraken	0.49	199
5	Binance.US	0.39	129
6	KuCoin	0.72	730
7	Gate.io	0.66	1,467
8	Bitfinex	0.41	171
9	Gemini	0.05	109
10	Huobi Global	0.52	591

Source: CoinMarketCap (www.coinmarketcap.com).

Exhibit 10. Largest Stock Exchanges in the World Based on Share Trading Electronic Order Book, June 2022 (USD billions)



Source: Statista (www.statista.com).

5.6. Crypto Investment Funds

Investment funds focusing on cryptoassets can be classified in two categories:

- Venture capital funds investing in companies (equity) that are developing economic activity or applications in the crypto sector
- Investment funds investing directly in coins and tokens

In general, these funds are structured as offshore alternative investment vehicles, often domiciled in the Cayman Islands or specific states in the United States, offered to a client base of professional investors, accredited investors, high-net-worth individuals, or family offices.

According to consulting firm PwC, in Q1 2021, between 150 and 200 active investment funds invested directly in coins and tokens as their main investment strategy (excluding venture capital funds), and 81% of these vehicles were launched in 2017 and 2018. The total assets under management (AUM) of these crypto funds reached USD3.8 billion globally in Q1 2021, as compared to USD2.0 billion a year prior (PwC 2021). Interestingly, PwC indicated that 21% of traditional non-crypto-focused hedge funds had reported they also invested in digital assets, with the average percentage exposure reaching 3% of fund assets.

According to Investing.com (2022), venture capital funds focused on crypto projects, blockchain startups, Web 3.0, or DeFi solutions had deployed USD25.2 billion in capital in 2021, as compared to USD3.1 billion in 2020.

For comparison purposes, note that cryptoassets still represent a small portion of global assets under management. According to consulting firm BCG, global assets professionally managed had reached USD103 trillion at the end of 2020 (Heredia, Bartletta, Carrubba, Frankle, McIntyre, Palmisani, Panagiotou, Pardasani, Reeves, Schulte, and Sheridan 2021).

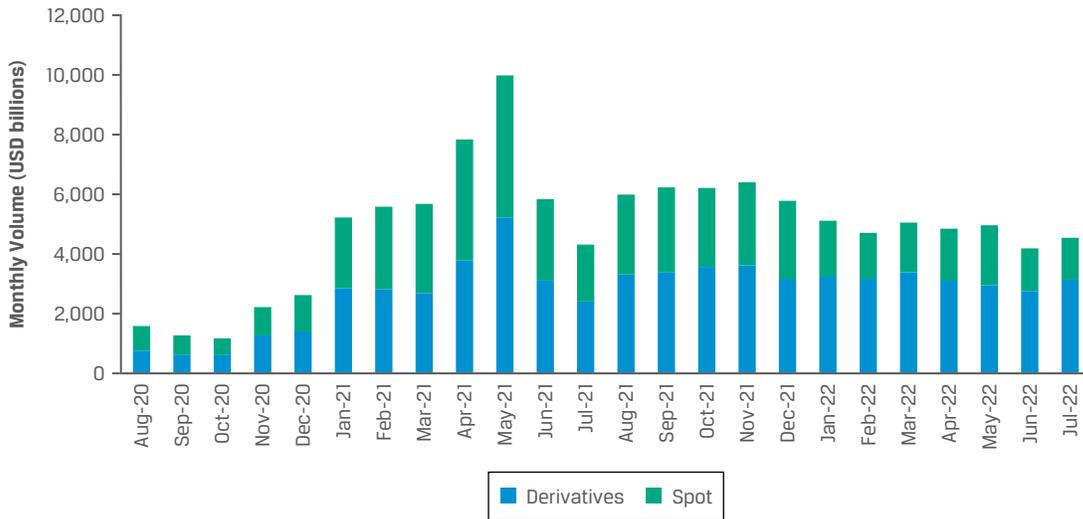
At this stage of the development of cryptoasset markets, our view is that investors should consider the merits and risks of crypto investment funds in a similar way as they consider an investment in typical alternative investment funds, hedge funds, or private equity funds. This paradigm may shift over time as the regulatory context clarifies.

5.7. Derivatives Activity in Cryptoassets

An active derivatives market exists for cryptoassets.

Cboe (Chicago Board Options Exchange) was the first US company to launch a bitcoin futures contract, in 2017, but in 2019, it stopped offering the instrument. The Chicago

Exhibit 11. Monthly Spot vs. Derivatives Trading Volumes in Crypto Assets, August 2020–July 2022 (USD billions)



Source: CryptoCompare.

Mercantile Exchange (CME) bitcoin futures contracts, also launched in 2017, are still active, and the CME started offering options on those contracts later in 2020.

Most of the derivatives activity in connection with cryptoassets takes place on centralized crypto exchanges, as opposed to traditional exchanges. Derivatives trading activity already is multiple times greater than spot trading volumes in cryptoassets (these data need to be considered with caution, though, since derivatives activity is measured using notional value, which may blur the picture). Indeed, according to London-based data provider CryptoCompare (2022), contracts worth a total of USD3.12 trillion (notional) were exchanged globally in July 2022, while the turnover in the spot market reached USD1.39 trillion in the same month.

Exhibit 11 compares spot and derivatives monthly trading volume in cryptoassets since 2020.

The top centralized crypto exchanges for derivatives trades on cryptoassets as of 24 August 2022, according to CoinMarketCap, are shown in **Exhibit 12**.

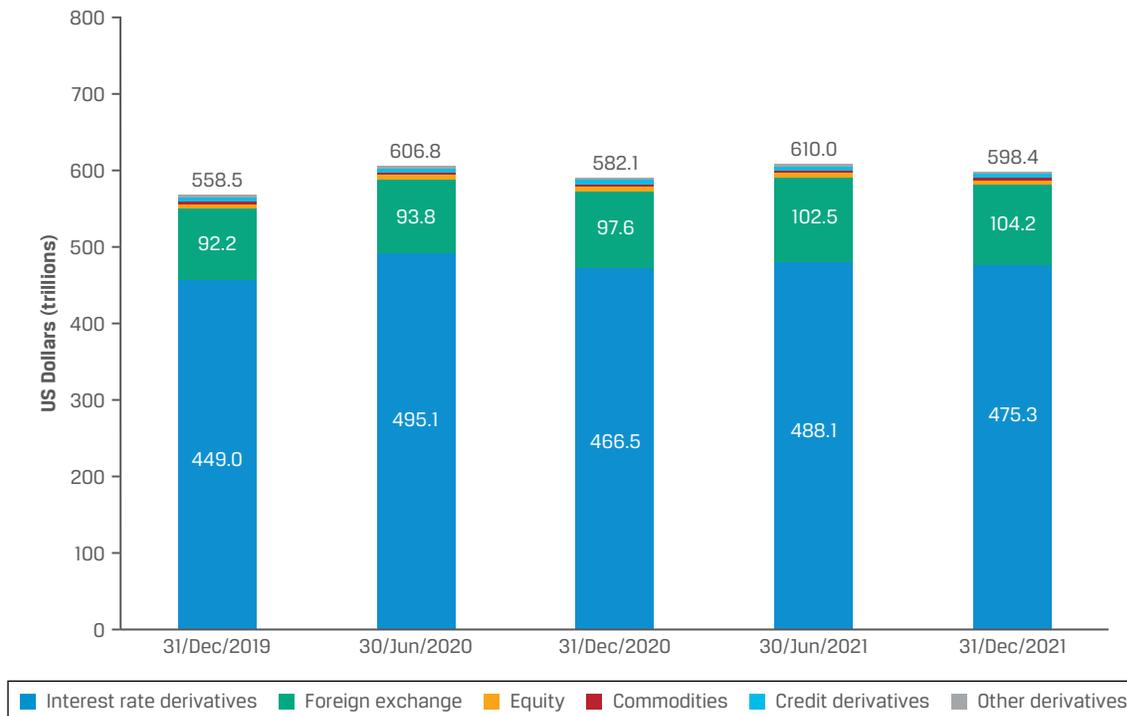
For (loose) comparison purposes and for a sense of proportion, **Exhibit 13** shows data on the outstanding notional value of traditional OTC financial derivatives markets over time, using Bank for International Settlements (BIS) and International Swaps and Derivatives Association (ISDA) data. At the end of December 2021, this total notional value had reached USD598.4.0 trillion (ISDA 2022), demonstrating again that cryptoasset trading activity (considering open interest or volumes in Exhibit 12) remains small compared with traditional finance.

Exhibit 12. Largest Crypto Exchanges in the World for Derivatives Trades, Measured Using Open Interest, 24 August 2022 (notional value)

Exchange	Open Interest (USD billions)	Volume Traded over Last 24 Hours (USD billions)
CoinEx	341.09	0.52
Binance	19.34	44.80
CoinTiger	5.92	8.33
Bit.com	5.91	0.03
BTCEX	4.78	24.12
Bitget	4.65	5.79
OKX	4.38	12.85
FTX	3.71	4.59
Bybit	3.34	8.32
BTCC	3.00	4.45

Source: CoinMarketCap (<https://coinmarketcap.com/rankings/exchanges/derivatives/>).

Exhibit 13. Global OTC Derivatives Notional Outstanding (USD trillions)



Sources: ISDA (www.isda.org); BIS OTC Derivatives Statistics (www.bis.org/statistics/derstats.htm).

5.8. DeFi, Lending, Yield Farming, and Staking

At their core, activities related to DeFi on the blockchain are about locking one's tokens for third-party use using peer-to-peer networks. The economic logic is similar to that of securities lending. In the case of DeFi, the assets being used, lent, or rehypothecated consist of digital coins. The system retains its integrity at all times through the community validation process that underpins DLT (the consensus mechanism).

Lending, **yield farming**, and **staking** all involve the **locking** of cryptoassets in a liquidity pool based on a smart contract. The incentive, or reward for providing liquidity, is to earn transaction fees, interest from lenders, or tokens. Such activity is akin to securities lending in the world of institutional finance, yet without the interface of a centralizing party, such as a bank.

The decentralized or disintermediated nature of DeFi protocols and services in no way guarantees their security or stability, as demonstrated by the recent troubles experienced by lending and yield farming platform Celsius. Excessive leverage, liquidity disruptions, and sudden loss

of trust can all affect the stability of these services. Similar to the ways regulators are placing limitations and monitoring obligations on banks' and investment managers' securities lending activities (including rehypothecation) for financial stability reasons, it will be important for DeFi to find ways to regulate and control the buildup of risk in the system.

To measure the size of the DeFi market, it is possible to use an indicator called total value locked (TVL), which corresponds to the size (value) of user funds or tokens deposited in a DeFi protocol. To date and by far, the largest underlying blockchain used for DeFi purposes has been Ethereum.

Since 2017, data provider DeFi Pulse has proved to be a useful resource to track the DeFi market, its various usages, and its size according to the different active protocols.³ According to DeFi Pulse, the DeFi market reached an all-time high TVL of USD48 billion in October 2021, before retracting to about USD19 billion in August 2022. **Exhibit 14** presents a historical chart of TVL since 2017.

It is likely that the current movement away from the **proof-of-work consensus mechanism** (the algorithmic method used to confirm transactions), which was the basis for

³See www.defipulse.com/.

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Exhibit 14. Total Value Locked in DeFi Protocols, August 2017–August 2022 (USD billions)



Source: DeFi Pulse (www.defipulse.com).

Nakamoto's (2008) white paper, in favor of a **proof-of-stake consensus mechanism** will provide even more momentum to DeFi services. "Staking as a service" opportunities will probably rise, whereby the community of users will be offered the possibility of taking part in the validation

process, all the while being remunerated for providing liquidity, as noted earlier. This area is in large part where regulators will need to focus as they endeavor to provide basic regulation to a sector that, at its root, is meant to self-regulate.

6. PRACTITIONER ANALYSIS

6.1. The Interview Process

The core objective of our research on the development of the cryptoasset market was to interview professionals on the subject and synthesize the important themes those conversations brought into focus.

Professionals we interviewed worked in the following areas:

- Fintech specialists
- General IT and technology
- Regulators
- Investment professionals
- Academics
- Asset owners and institutional investors
- Crypto market infrastructures
- Law practice
- Investor associations

Our aim has been to establish a realistic view of the penetration of cryptoassets in the investment industry. As such, we asked the interviewees to explain their experience of this nascent market and how it is changing current investment practices or perceptions.

None of the themes and observations listed in the next section are attributed. They are the results of our analysis of comments received.

6.2. Important Themes Outlined by Interviewees

We have organized the main observations from our conversations according to the following topical categories:

- The technological development that underpins cryptoassets and DeFi
- The demand for cryptoassets and acceptance by the public
- Considerations of financial stability and regulation
- The investment case for cryptoassets
- Institutional investors and fiduciary duty
- Market infrastructure and decentralization
- The business and economic model of cryptoassets and DeFi

At the outset, we stress one preliminary observation. That is, in our view, the current stage of development of digital finance offers neither a clear and coherent narrative nor one that would permit a safe prediction about the direction the burgeoning industry is headed. Therefore, the observations that follow are not intended to be read in a linear way. Rather, they are a collection of informed observations, analyzed through a practical lens and organized according to the categories above.

6.3. Summary of Our Interlocutors' Observations

The following is a synthesis of our interlocutors' observations for each topical category.

- **The technological development that underpins cryptoassets and DeFi**
Most individuals we spoke with appear to agree that the principles underpinning DLT and blockchain technology are sound and could enhance the day-to-day functioning of economic exchanges through reduced friction and enhanced efficiency. They also expressed various concerns, including the notion that DLT as a technology will naturally suffer from typical issues in IT, such as retro-compatibility and scaling advantages, which may result in vulnerability of the system to targeted attacks. Technological and informational advantages may also result in specific economic agents maintaining an undue advantage over other consumers, which could dampen trust in markets.
- **The demand for cryptoassets and acceptance by the public**
From our discussions, it was evident that retail consumers are the primary driving force supporting the rise of cryptoassets and DLT services. Web 3.0 promises to unlock new economic sectors and empower individuals' microeconomic capacity through decentralization, yet concrete and practical use cases are not clearly apparent. In general, the interviewees agreed that this technology is still in its infancy and needs to mature before it penetrates the mainstream economic system.
- **Considerations of financial stability and regulation**
Most interviewees generally agree that cryptocurrencies will have some impact on traditional financial markets. In part, the progress of this class of assets or protocols is related to the search for more efficient

mechanisms to conduct economic and financial transactions, through the bypassing of traditional intermediaries. In this context, regulation of the sector is a complicated task given that traditional finance has historically been based on a layered and centralized system of intermediaries. It is not yet clear how the parallel development of central bank digital currencies (CBDCs) will develop either in opposition to or as a catalyst for the development of private cryptocurrencies. There have also been concerns expressed about the risk of creating new too-big-to-fail entities through concentration caused by technological competitive advantage and scale effects.

- **The investment case for cryptoassets**

Participants in our interviews largely agreed that finance and the economy in general are on a course to increased digitalization; thus, cryptoasset service providers and investment managers are simply proposing to embark on that trend early. On this issue, there appears to be agreement that the technology that underpins this trend should be considered a separate business or investment case from the tokens that are produced by DLT services, as these are two different investment propositions. While cryptoassets are in an early stage and will need to mature, investing in the sector can be similar to venture capital, or a promise about the future. It is also interesting to consider the possibility of exchange-traded funds (ETFs) and indexing as an entry point into the sector. To date, however, regulators in developed markets have not permitted ETFs based on physical replication in this sector because of market manipulation concerns.

- **Institutional investors and fiduciary duty**

There seems to be significant agreement on the idea that cryptoassets and the related ecosystem have not yet reached an institutional level of quality. Institutions

and advisers bound by their fiduciary duty will demand further progress on legal and regulatory certainty, valuation principles, rationale for volatility, and custody before they begin to seriously consider cryptoassets for material inclusion in a strategic portfolio. In the meantime, some institutions will venture into the sector through minimal exposures, so as to progressively improve their knowledge of these instruments.

- **Market infrastructure and decentralization**

There appears to be broad recognition by our interviewees that cryptoassets and DLT services could play a role at the back end of financial activity, including all the so-called plumbing related to clearing and settlement processes. In addition, large parts of the investment banking intermediation used by investment managers could be digitized and optimized through smart contracts, to the extent that such interactions could be standardized. However, concerns remain related to the true decentralization of such services and whether the value chain will simply shift to different intermediaries. Participants are also concerned about the risk of interoperability of DLT services and fragmentation, which could result in systemic vulnerabilities or a flight to safety.

- **The business and economic model of cryptoassets and DeFi**

Participants and investment managers proposing to invest in the sector need to better understand the potentially circular nature of cryptoasset services. The variety of economic propositions offered by cryptoasset projects requires careful consideration of their business model and client acquisition process. The DeFi sector faces an uphill battle as it endeavors to penetrate mainstream economic transactions and convince a broader set of individuals to take part.

6.4. Detailed Observations

6.4.1. The Technological Development That Underpins Cryptoassets and DeFi

The observations in this section pertain to DLT as an information technology framework and the concept of the blockchain as the bedrock of DeFi. The key observations are in bold text below, with explanatory text that follows.

The principle of DLT is sound and may transform the current basis of economic exchanges in society.

The decentralized nature of DLT-enabled economic applications may provide meaningful advantages or process efficiencies in terms of day-to-day usage for both businesses and individuals. In theory and practice, it could transform the modes of interaction between economic agents through programmable smart contracts.

A significant issue here, however, revolves around human idiosyncratic logic in most interactions, which is part of the reason why we have developed a robust ecosystem of intermediaries in the first place. Human-constructed contracts are subject to regular changes, amendments, or challenges. DLT will need to adapt to this intrinsically changing or unstable nature of contractual agreements, which will not always be standardizable; that is, DLT will need to adapt to real-life situations.

As with any technology, blockchain protocols get old and suffer from compatibility or scaling problems.

The protocol that supports the bitcoin blockchain is 15 years old. Given its age, this technology creates issues of compatibility with newer protocols, and these challenges will only grow in importance over time. The other issue to consider is that of scale. Earlier protocols were not expected to handle the number of transactions we see today. The system depends on backward compatibility to maintain its wide appeal, which requires complex architecture. This issue gets compounded when factoring in the rise of large users (also known as "Big Whales"), which creates concentration and raises the system's level of vulnerability to attacks.

It is possible new technological infrastructure will emerge and compete with DLT.

Big Tech firms may game the system through sheer technological advantage.

For some interviewees, large technology firms already have a significant advantage over other actors and the public at large in terms of market access, information, and processing power. They can exploit this advantage to extract meaningful gains through arbitrage, speed, or information on flows. One example is the California Gold Rush in the nineteenth century, in which those making the most money from the phenomenon were the merchants of mining material and shovels.

All recognize that asymmetries are built into the system, from both a technology and an information standpoint, which will impact user acceptance. From this perspective, regulatory developments represent a dichotomy of interests because they would inevitably aim at reducing this asymmetry.

6.4.2. The Demand for Cryptoassets and Acceptance by the Public

These observations pertain to the nature of the demand for crypto services, where it originates, and how it may lead to broader public acceptance. We have also touched on the notion of financial inclusion and how crypto services may have a role to play.

Retail investors are the driving force behind the rise of crypto services and assets.

Individuals may well be the leading force that is fueling the development of crypto and DeFi services. In turn, this demand will translate into institutional interest. The underlying premise here is that crypto and DeFi services are democratizing access to financial services and offer investment potential. Investors may benefit from easier access to industrial and technological innovation.

Wider public participation in the promised ecosystem of Web 3.0 will require that the public acquire an identity in this universe.

DeFi and Web 3.0 are promoting the notion that individuals will be able to capitalize on the ownership of parts of the internet for economic purposes. This will require some form of identity setup and the associated verification mechanisms. It is currently unclear how this will work at the scale that would be required for it to become mainstream.

It may be that such a network is primarily for wholesale exchanges—one where individuals do not need to interact directly but would, ironically, use new forms of intermediaries and centralizing agents as operational interfaces.

The use cases of crypto services for average individuals remain vague.

Interviewees had no clear-cut response to the advantages for individuals brought by crypto services. We continue to debate the economic value that DeFi adds to society beyond the trading advantage or economic returns it provides to those who directly participate in it through arbitrage and client acquisition activities.

It is also possible that we are still very early in the product cycle. Client acquisition could lead to a growing base of users, which may lead to the emergence of concrete economic opportunities.

It is not yet clear how cryptoassets and DeFi may help in enhancing financial inclusion of underbanked sectors.

The perception is that, for the most part, users of crypto services are affluent individuals and investors. It is not clear how or why DLT could naturally create an economic incentive to service underbanked individuals or businesses, particularly given that most underbanked issues stem from lack of funds rather than lack of access. DeFi services will need to show that they can unlock economic value (or create it) in sectors that are allegedly underserved.

6.4.3. Considerations of Financial Stability and Regulation

These observations pertain to the possible linkages between the development of crypto markets and financial stability, which include questions related to the possible deployment of CBDCs.

Could DeFi or Web 3.0 developments recreate the conditions for the emergence of too-big-to-fail services?

The development of blockchain-based activities should consider the chain of support services that are required to make these activities function properly. One of these services concerns data servers. As it stands, most of these servers are run by a small number of major providers of cloud services. It is possible some of the individual service providers could become a key chain link in the digital asset ecosystem, taking advantage of economies of scale to cement its position.

Cryptocurrencies could make economic sense as legal tender in jurisdictions with endemic financial instability.

There could be a logical economic incentive for countries that have historically experienced financial instability to allow cryptocurrencies as legal tender, even if alongside fiat currency. It is possible such a move could help stabilize financial flows and economic activity in such jurisdictions. Access to one or more stable cryptocurrencies could be beneficial when local means of payment are less stable.

It is more difficult to justify in more advanced economies, where central governments appear to have an interest in retaining their monopoly over money and legal tender.

There is inherent difficulty in regulating cryptoassets.

Many are of the view that regulating cryptoassets will be rendered difficult by the inherent statelessness of these instruments and the cross-national manner in which they are traded. Decentralization is a feature of the crypto system, and regulating it would invariably introduce a layer of re-centralization and intermediation akin to traditional spot and derivatives asset markets.

Crypto is progressing because of a deficit of trust in the traditional banking system.

One argument for the rise of cryptoassets is that individuals and businesses no longer seek the intermediation of traditional financial institutions and believe the central governments' actions on monetary policy have debased the value of the fiat currency. They instead prefer an independent system.

A corollary argument has been the parallel desire to emancipate from Big Tech companies, which have in effect and over time asserted and maintained their control over Web 1.0 and Web 2.0 frameworks. Web 3.0 may offer a way to decouple from these large agents as well.

A significant issue with the above argument is that DeFi is still inherently unstable and risky. The solution may come from an inevitable consolidation cycle and also perhaps from regulation, as use cases for the DLT protocols emerge more clearly.

Central bank digital currencies may act as a positive catalyst for private cryptocurrencies.

The development of financial technology in general, including digital assets, could benefit from the stamp of respectability that a CBDC could provide. In this respect, a CBDC may convince a broader spectrum of society to engage in new forms of financial services offered through non-traditional providers.

It is also possible to imagine that CBDCs and private cryptocurrencies will have different use cases and therefore ecosystems within which they will operate. There are likely to be several important challenges to address, however, including such things as the tracking of transactions, privacy concerns, and anonymity considerations. In at least some cases, interests in using crypto instruments will diverge in terms of these considerations.

The regulatory conundrum of crypto: Will crypto develop thanks to regulation or in spite of it?

It is possible one way this situation will develop is in a balance between the necessary hands-off approach that has characterized the burgeoning of DLT-enabled services and a robust regulatory framework to stabilize the market, which will be conducive to raising the public's level of confidence. A key aspect of this balance will be for policymakers to be mindful of not recreating the intermediaries that DLT was originally meant to make obsolete.

Cryptocurrencies in general and stablecoins in particular could reduce or diffuse the overall amount of financial risk in the system.

While systemic risk in the financial system arises from many factors, a significant source of risk is due to settlement and clearing processes, including the built-in time lags. CFA Institute (2022b, Section 7, "Identification of Risk: Financial vs. Non-Financial Risk") refers to the Herstatt risk to describe risks in settlement processes caused by timing effects.

It is possible that this risk could be significantly reduced through the immediacy and certainty of execution conferred by the use of cryptocurrencies. The reduction in the amounts represented by unsettled transactions would, in theory, be a like-for-like reduction in the amount of exposure or credit risk in the system, which concurrently would reduce overall leverage. There could be a cascading positive impact on the capital ratios of both banks and other financial institutions, which means that more productive capital could be put to work through higher efficiency of operational and payment processes.

6.4.4. Is There an Investment Case for Cryptoassets

These observations pertain to an assessment of cryptoassets as a potential investment.

Finance is digitalizing anyway, so crypto is about being there early in the process.

Provided they can accept the volatility, early adopters in the emerging cryptoasset sector stand to gain the most from its development. The underlying principle and business case is to begin accumulating tokens that will then provide access to a wealth of services on blockchain protocols that will potentially develop.

The cycle towards digitalization is still in its infancy and has not yet reached mainstream acceptance. Proponents of the Web 3.0 internet evolution promise that it will allow individuals to create economic opportunities at a micro level with little intermediation and friction.

Investing in crypto is akin to venture capital and investment in startups.

Depending on the channel used to obtain an exposure to cryptoassets, the potential success in this field is very similar to venture capital investments. In an environment of low and converging returns in traditional asset classes, crypto offers the potential for outsized performance.

Nevertheless, cryptoasset services are still largely equivalent to a promise or claim about the future, as opposed to a present formal economic venture.

Web 3.0 could be a major economic development asset managers can participate in.

Some see Web 3.0 and its associated economic opportunities as a major industrial and commercial disruption. Web 1.0 was the internet revolution that decentralized access to information. Web 2.0 was a new form of internet that would power mobile devices, thus allowing the rise of social media and electronic commerce. Web 3.0 promises to allow individuals to own their own parts of the internet to create decentralized microeconomic opportunities.

It remains to be seen how this development takes hold and how asset managers may turn it into a rational investment case.

The technology that underpins cryptoassets is a separate investment case than that for acquiring tokens.

Here, a distinction exists between investing in technological development as opposed to acquiring digital assets themselves. Experts can justify an investment in cryptoassets or into companies active in the sector as gaining an exposure to a developing technology that may transform financial services in the future. There is an educational element to this thesis, which entails that investment professionals and investors need to gradually accept this technology and better appreciate the economic opportunities it will eventually offer.

Another way of looking at this is to consider that the potentially disruptive nature of DLT does not necessarily mean that any specific cryptoasset today has value. An analysis of the economic proposition remains necessary.

2022 is seen by some commentators as a year of maturing for the crypto industry rather than a crisis.

The issues experienced by the cryptoasset industry in 2022 reflect a sector that is maturing. The market has had to adjust to two important economic truths: (1) Crypto is not immune to the macroeconomic environment of which it is a part (including economic crises and monetary policy shifts); and (2) those macro events have exposed the weaknesses of the cryptoasset industry (including excessive leverage and poor lending practices). Still, the fundamental principle that underpins the development of DeFi and its economic opportunities remains valid.

The ETF route may be an intermediate step to access cryptoassets that is worth considering.

An exchange-traded product may have arguments worth considering for retail investors wishing to gain an exposure to cryptoassets. Depending on their structure and strategy, some risks associated with custody and diversification management may be alleviated by using such an intermediate approach.

Most advanced economies have yet to authorize ETFs with direct investment in cryptoassets due to market manipulation concerns, so most vehicles available in the United States, for example, are structured using crypto derivatives. As the regulation of the digital finance sector gradually clarifies, we will obtain a better idea of the growth potential for this corner of investment management. ETFs may provide single-name exposure or may be interestingly based on crypto indexes, where the main advantage is to diversify the risk across a selection of tokens.⁴

⁴London-based research and consultancy firm ETFGI (2022) reports that the total global assets invested in crypto exchange-traded products (ETPs) and ETFs was USD13.21 billion in April 2022, after a peak of USD16.0 billion at the end of 2021. The total number of vehicles is 140.

Use a limited portion of AUM exposure as a starting point.

One argument for investors interested in considering cryptoassets would be to characterize them as other alternative assets and assign the category a maximum exposure.

This approach does not resolve the issue of fiduciary duty as such (to be discussed later), but rather, it provides a framework from which to set forth a risk-based strategic asset allocation at a portfolio level. This is the approach described in the CFA Institute Research Foundation guide on cryptoassets and bitcoin (Hougan and Lawant 2021).

6.4.5. Institutional Investors and Fiduciary Duty

These observations pertain to the conundrum that institutional investors are facing as they consider the opportunity and the rationale for investing in the crypto sector. A driving component of this dilemma concerns the extent to which cryptoassets are compatible with fiduciary duty; this point in particular will be discussed in more detail in Section 8.

The crypto sector needs to institutionalize.

A recurring comment we received is that digital finance in general remains too immature for institutions acting as fiduciaries to seriously consider a material investment. More simply, crypto is not yet of institutional quality, largely because of the following challenges:

- Custody and safekeeping of client assets is unclear.
- Volatility is too high.
- KYC (know-your-client), AML (anti-money-laundering), and financial crime monitoring is unclear.
- Regulatory status is fluid.
- Valuation principles are not straightforward.

In general, large asset owners, such as pension funds, do not see themselves as first movers into the crypto field. They consider their level of knowledge to be too low, so the perception is that they first need to build their knowledge base about the sector.

Because what a token represents in terms of ownership is unclear, it again points to the need to separate the technology from the specific digital assets it supports. An investment in technological innovation may constitute a more rational and justifiable investment case than the tokens in and of themselves. Moreover, digital assets are not necessarily yet recognized as a distinct asset class.

Key risks to consider include (1) reputational risk and (2) sudden shutdown of a service due to legal issues, regulatory status, fraud, or technical failure.

Custody is a problem.

This issue will be discussed in detail in Section 9.

A number of institutions are raising the issue of the unclear status of custody of client assets. Although this could be resolved via technical and contractual solutions (internal or external service providers), these are likely to be costly and additive to the level of operational complexity of existing processes.

What would be the turning point to convince institutional investors of the validity of crypto's investment case?

Institutional investors and asset owners are waiting for the following conditions to be met before they are ready to consider a material exposure to cryptoassets or the technology that is underpinning this development:

- A clearer and coherent regulatory framework
- A decent track record
- The emergence of clearer potential for economic applications

Fiduciary duty is a key consideration for institutional investors.

Institutional investors, asset owners, and pension schemes have mentioned fiduciary duty as a current obstacle to considering potential investments in the cryptoasset market, including the following issues:

- Difficulty of explaining the basis for the market price movements
- Unpredictability
- Difficulty of rationalizing entry and exit points for an investment or setting an absolute return target
- Difficulty of quantifying the upside potential
- Difficulty of including an investment in cryptoassets in the existing compliance and risk management framework
- Difficulty in classifying cryptoassets, perhaps because they may be midway between a commodity and a security
- Wariness of the level of crypto usage for illicit activities and the associated reputational risk

A general sense is that for cryptoassets to become more directly acceptable from a fiduciary perspective, there needs to be a clearer investment case and sufficiently robust governance policies in place. This means:

- Clarity and certainty on the safekeeping aspects
- Clear audit trail and transparent information on the due diligence process and acquisition details
- Reliable cost-benefit analysis

From a fiduciary standpoint, institutional investors are wary of the current risks related to asymmetry of information and the moral hazard that this entails.

Institutional investors may choose to gain exposure to the crypto market indirectly.

One key recurring theme of our discussions with institutions is the perceived lack of knowledge and the need to gradually build a knowledge base on crypto. From this perspective, it could be that institutions and asset owners prefer to start exploring this field in an indirect manner, through third-party specialist asset managers bound by their fiduciary duty as opposed to direct investments into cryptoassets.

6.4.6. Market Infrastructure and Decentralization

These observations pertain to the notion that digital finance services may improve the efficiency of financial markets and access to financial services through decentralization and disintermediation.

DLT could significantly enhance back- and middle-office processes in financial services.

The technology underpinning blockchain protocols could meaningfully reduce frictions and costs in all processes related to clearing, settlement, transfers, and reconciliation of financial transactions.

The underlying idea is that such processes need not involve actual fiat currency transfers but, rather, could be conducted exclusively on blockchain protocols using tokens.

A source of protocol, such as Ethereum, can be developed into large-scale banking infrastructure and be made entirely digital, automated, and programmable, with the benefit of certainty of execution.

It remains unclear the extent to which all forms of contractual covenants or transaction events could be standardized or pre-coded, which are key issues to consider for automation.

Another challenge on this issue is the apparent lack of demand heard in the industry to improve back- and middle-office processes. Initiatives by incumbent banking institutions and central banks are already aimed at speeding trading, clearing, and settlement processes regardless of DLT applications.

In the same vein, it remains to be seen how the development of CBDCs by governments and central banks will be an enabler of such streamlined processes or whether it will render private initiatives moot.

DeFi is about disintermediating the role of the broker/dealer and decentralizing security lending.

The development of such activities as "staking as a service" may be accelerated by the switch to a proof-of-stake consensus mechanism.

In turn, DeFi may see a rise of lending and borrowing activities involving tokens. Such activities are by nature intermediated and centralized in traditional financial activities. DeFi protocols are proposing to transform such activities.

One key question involves credit and market risk, which would be traditionally assumed by intermediary financial institutions. DeFi participants would now directly face borrowers who may often be an unknown quantity as it relates to the risk they represent.

Is digital finance truly decentralized?

There seems to be a dichotomy between the genuine decentralized nature of blockchain protocols and the way that these protocols are used in economic applications by market participants who may be re-centralizing those processes.

Examples of this concern include the preeminence of centralized exchanges in the current volume of transactions in cryptoassets. As discussed, these entities do engage in centralization of trades through custody and commingling. Another example involves brokerage houses that offer limited alternatives in terms of storage.

There are two ways to consider this dichotomy:

- First, in order to incentivize the use of these protocols, there must be a primary economic benefit associated with the creation of crypto services. If a service is entirely decentralized, then it is difficult to see why providers would be interested in joining the ecosystem, which involves costs and risks.
- Second, it is possible to view the current state of the crypto industry as one that is in transition. Once client acquisition has generated enough flows and baseline participation, it would not be unrealistic to expect that a number of current centralizing agents would simply switch to other forms of services that no longer require their intermediation (e.g., staking as a service) since clients and users will be more savvy participants. But the conundrum related to the economic incentive remains. It is also possible to imagine that crypto services switch to a pure fee-based model in the future, which would ironically reintroduce friction costs into the system.

Crypto services are only magnifying the need for reliable sources of pricing data.

A natural corollary of a financial world that would gradually decentralize is an ever-expanding need for data that would be reliable and useful for decision making.

Data service providers and index providers could see DeFi and crypto services as an opportunity to expand their footprint because a multiplying user base would be in permanent need of data to assess valuations, pricing, or comparisons between offers. Their role in the financial ecosystem would probably enlarge as a result.

Large sections of current-state finance could be digitalized.

Given that DLT has the potential to enhance clearing and settlement back-office operations, processes could be built and turned into one-stop shops for all forms of transactions, including complex relationship-built transactions, such as swaps and other forms of derivatives, or even leveraged loans. In theory, potential benefits in terms of operational transaction support could be significant in most activities that are currently at the intersection of investment banking and investment management.

The benefits for agency services involving fiduciary duty could be palpable. For one, diminishing the reliance on middlemen provides operational efficiency gains. Second, reducing the related cascade of fee structures that current sequential banking services embed will permit cost reductions that could benefit end-investors.

In effect, the proposition here corresponds to the protocolization of trading platform interfaces.

Competition in DLT-based services could lead to an unstable banking infrastructure.

Blockchain protocols all compete for flows and transactions, which could cause stability issues for the banking infrastructure when considering needs for interoperability of tokens and protocols.

Should confidence drop for a particular protocol, it is possible to imagine a sudden flight to safety to other protocols, creating potential instability in the market.

6.4.7. The Business and Economic Model of Cryptoasset Services

These observations pertain to the specific nature of the crypto industry's business model and how it proposes to create real economic value and to effectively share those benefits across a wider set of users.

The current business model of decentralized finance is circular in many respects.

One question that we repeatedly heard in our interviews is, What happens when all the bitcoins have been minted?

At the root of all DLT-enabled and DeFi applications is the consensus mechanism that underpins the level of confidence in the system's integrity. Consensus is established by incentivizing participants (and so-called miners) to engage in validating transactions by being allocated new tokens.

The system cannot stop or operate in stasis. It requires a permanently expanding user base to provide sufficient economic incentive to participants to continue engaging with a particular protocol.

It can be argued that once an inflection point of usage is reached, then the system will be inherently sustainable through recurring flows and use, which will have become organic as opposed to incentivized through a client acquisition strategy. We are arguably in a transition towards this future state. Whether DeFi uses will become sufficiently mainstream to evolve the system to a state of self-sufficiency remains to be seen. It is also uncertain whether the crypto industry can operate with sufficient velocity by remaining on the fringes of economic activity in a structural manner.

A demand for over-collateralization from borrowers is an obstacle to the development of DeFi.

For those who wish to participate in DeFi activities, the threshold for entry is as high as the financial risks the activity currently entails. This means the following:

- The sustainability of the current business model depends on aggressive marketing subsidies (e.g., yield farming) for client acquisition to be successful and allow sufficient growth in terms of participation.
- It is difficult to see how such a business dynamic could be conducive to enhancing financial inclusion of underbanked sectors given the collateral that is required to even begin participating.

To the extent that crypto users mistrust the traditional financial system, CBDCs may not be a threat to private cryptos.

Proponents of crypto assets and derivative applications of DeFi see them as a means to decouple from the fiat currency system, which, in their view, has suffered from expansive monetary policy that is debasing the value of legal tender.

With such a context in mind, the introduction of a CBDC would not change the fundamental value proposition of private cryptocurrencies and cryptoassets, since a digital version of fiat currencies would continue to be governed by state authorities who may have an inherent interest in expanding money supply.

Alternatively, individuals and other economic agents preferring the safety of a government-backed digital currency may result in a CBDC attracting deposits away from private cryptocurrencies. This development will need to be monitored by authorities as they design and deploy digital versions of their fiat currencies.

Productive tokens (e.g., ether) should be considered an entirely different category than non-productive tokens (e.g., bitcoin).

Productive blockchain protocols allow and encourage the establishment of a variety of services that will be using these protocols to generate derivative economic applications.

This comes in stark contrast to the proposition made by non-productive cryptocurrencies, such as bitcoin, whose motive is more simply to act as an alternative means of exchange.

How can DeFi fulfill its promise of decentralizing access to real economic cash flows?

One of the most significant issues DeFi and blockchain protocols will have to contend with is to find a way to genuinely distribute and democratize economic value creation away from centralizing agents in favor of individuals.

For DeFi and DLT-enabled applications to become mainstream, these services need to find a practical way to effectively transfer cash flows to the users of tokens. Existing cryptoasset service providers already are generating cash flows, including exchanges, brokers, and lending/borrowing activities. The challenge is, What mechanisms are needed to transfer parts of this economic value back to token users?

At its core, DeFi proposes to move economic value creation away from traditional intermediating agents. It is not yet clear how the sector proposes to keep large financial institutions and Big Tech organizations at bay. Given the significant capital investments that are required to design and maintain a technological competitive advantage, we will see whether users end up simply shifting their allegiance to new, yet still dominant, intermediaries or whether they will be enabled to capture a share of the economic upside directly.

Client acquisition is the key determinant of success in DeFi.

Like any new industry, the primary consideration of businesses consists of acquiring users and establishing a client base.

DeFi and DLT-enabled economic activities are fundamentally network-based applications. Thus, how can cryptoasset service providers jumpstart a network, create interest, and attract users?

In general, the crypto industry has chosen to pay users to incentivize usage of their network—hence the development of yield farming activities. Yet as a client base develops, these service providers will need to diversify away from a model that only attracts yield seekers.

The longer-term strategic view of crypto probably resides instead in the idea that what users receive in return for providing liquidity is the acquisition of shares in a network that is developing. This idea is related to the wider concept of a platform economy, which has progressed significantly during the COVID-19 crisis, as we have discussed in our most recent report on the effects of the crisis (CFA Institute 2021, p. 43): "Digital platforms are essentially transforming what used to be linear value chains between producers and consumers into technology-driven adaptable models with a wider product offering tailored to client needs. McKinsey describes this new ecosystem as the 'integrated network economy'" (see McKinsey 2018).

7. DETERMINING THE INTRINSIC VALUE OF CRYPTOASSETS THROUGH USE CASES

The difficulty in evaluating the intrinsic value of cryptoassets, as opposed to their market price, lies in the relative absence of traditional metrics, such as cash flows, balance sheet assets, or typical economic multiples. We are positing that the fundamental value of cryptoassets should be related to an analysis of use cases as part of a network approach. The objective is to determine the base economic use cases that will support the value of cryptoassets regardless of economic or market conditions.

7.1. A Short Introduction to Fundamental or Intrinsic Value

In the section of the CFA Program curriculum addressing equity valuation, CFA Institute (2022a, pp. 2–6) establishes a clear distinction between the intrinsic or fundamental value of a security and its market price:

Fundamental analysts use information to estimate the value of a security and to compare the estimated value to the market price and then base investment decisions on that comparison.

Intrinsic value is based on an analysis of investment fundamentals and characteristics, according to three possible approaches:

- *Present value models (or discounted cash flow models)*
- *Multiplier models (or market multiple models)*
- *Asset-based valuation models*

Most importantly:

Whatever the approach, an analyst who estimates the intrinsic value of an equity security is implicitly questioning the accuracy of the market price as an estimate of value.

7.2. What Is the Intrinsic Value of Cryptoassets?

With respect to cryptoassets, analysts face the difficult task of applying the valuation models mentioned above. Depending on the nature of the asset or enterprise in question, such notions as cash flows, earnings, or balance sheet assets are either nonexistent or only loosely defined.

As to cryptocurrencies themselves—which serve as a means of exchange—analysts use fiat currencies as a baseline. The challenge here, however, is that there are no data points, such as interest rate differentials or underlying economic conditions, to speak of, particularly when attempting to determine momentum or future demand. Attempting to use purchasing power comparison techniques also runs into the issue that there are still few goods and services priced in cryptocurrencies.

In "Cryptoassets: The Guide to Bitcoin, Blockchain, and Cryptocurrency for Investment Professionals," Hougan and Lawant (2021) list five different valuation techniques for cryptoassets:

- Total addressable market, or measuring the value of a cryptoasset using a comparable market with similar use
- The equation of exchange ($MV = PQ$), derived from Fisher's quantity theory of money, or using a method that applies to currencies by combining the following metrics in an equation: market value (money supply) times velocity equals price of transactions times number of transactions
- Valuing cryptoassets as a network, or calibrating value through the number of active users
- Cost of production valuation, or valuing crypto in a way similar to that used for commodities, thus using supply side constraints
- Stock-to-flow model, or positing that the price or value of bitcoin is a function of its scarcity, using a ratio of outstanding value and new bitcoin mining every year

In our view, the intrinsic value of cryptoassets is most logically related to an analysis of use cases for these instruments, or how participants are actually using them. That is, if we are unable to use any form of discounted cash flow analysis to value crypto, there must be a suite of permanent users and usages that constitutes the bedrock of why cryptoassets have value, at least for these users.

The other methods listed above seem remote from the reality of today's market volatility experienced by these assets. As such, they are less useful, at least for the time being.

Accordingly, we would simply complement the network approach described by Hougan and Lawant (2021), which is itself derived from "Metcalfe's law,"⁵ by specifying that the intrinsic value of a cryptoasset, or rather its minimum value, must at all times necessarily be the level at which the supply of the instrument is in equilibrium with demand for this instrument, construed as the sum of all use cases for the instrument at that specific moment in time.

By taking a use case approach as the basis for demand, we can understand with more clarity why a cryptocurrency, such as bitcoin or ether, did not drop to zero during the turmoil experienced by cryptoassets in 2022. If there are base use cases for these instruments regardless of market conditions, then this could constitute the floor value of these cryptoassets.

7.3. Global Number of Users of Cryptoassets

Exhibit 15 presents a chart from Statista of the global number of users of cryptoassets, showing that it has been

rising over the years, which has naturally been a support factor for the value of cryptoassets in general, with micro-variations at an instrument level. As we discussed earlier, there are still large variations in the number of users, depending on market price on a day-to-day basis.

7.4. An Analysis of Use Cases as the Basis of Demand for Cryptoassets

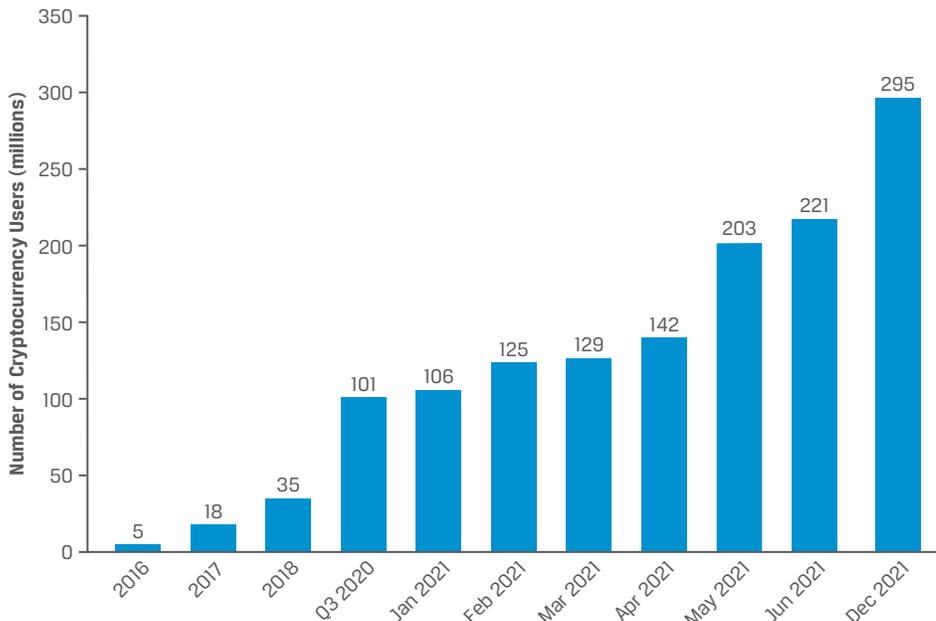
As noted, our premise is that the intrinsic or floor value of cryptoassets is related to the demand for such instruments at any point in time, understood as the sum of use cases for the instrument in question at that particular point in time.

In this section, we list—in a non-exhaustive way—the usages we have identified for cryptoassets of various forms. Our objective is to showcase a list of usages that may constitute a permanent source of demand for cryptoassets.

In this exercise, we are not quantifying the current value represented by the following use cases, nor are we claiming that they currently represent a sound or real basis for



Exhibit 15. Number of Identity-Verified Cryptoasset Users, 2016–December 2021 (in millions)



Source: Statista (www.statista.com).

⁵See Shapiro and Varian (1998), who stated that "the value of a network goes up as the square of the number of users."

the current market price of cryptoassets. To be sure, the industry continues to grapple with providing clients with a compelling and broad-based set of uses that would convince large swaths of the population to participate. Rather, we identify those use cases that we consider plausible.

7.4.1. A Store of Value

The store of value argument purports, for example, that bitcoin corresponds to digital gold. In part, the logic is that bitcoin should be a hedge against inflation and, therefore, that demand for the cryptocurrency should rise along with price inflation or weakness in the value of the US dollar. That relationship has not been evident over the last year, as shown in **Exhibit 16**.

Similarly, **Exhibit 17** shows that, at least for the time being, the number of daily active users of bitcoin (as defined using the concept of on-chain single entities) is more related to the market price of the cryptocurrency than other macroeconomic considerations.

7.4.2. Alternate Forms of Money or Currency

We have discussed in previous sections how money traditionally fulfills three functions concurrently:

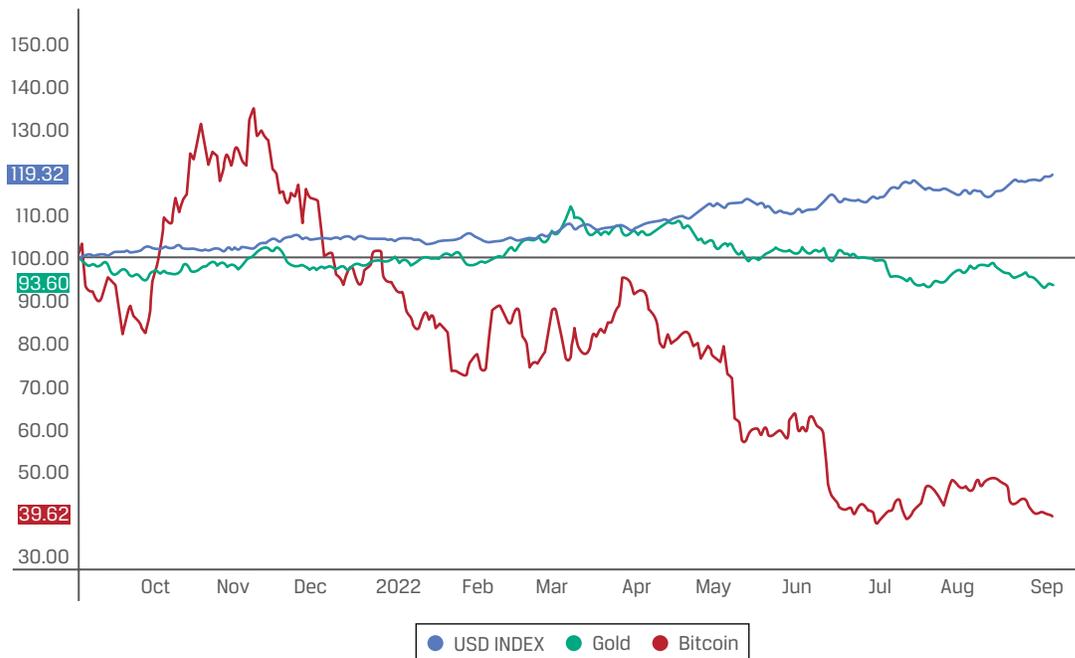
- It is a store of value.
- It is used as a unit of account.
- It is a medium of exchange.

It remains unclear whether cryptocurrencies or cryptoassets of any form can prove to have the same properties or be recognized as such by economic agents. It is also unclear the extent to which central governments will accept competing forms of money.

However, the fact that over half of the world's central banks are exploring or are already developing digital versions of their government's fiat currency, according to the International Monetary Fund (IMF),⁶ shows that these governments are either worried about losing control over the means of payment in their jurisdiction or are showing a genuine intention to enhance the banking-related services provided to the public in their day-to-day economic activities.



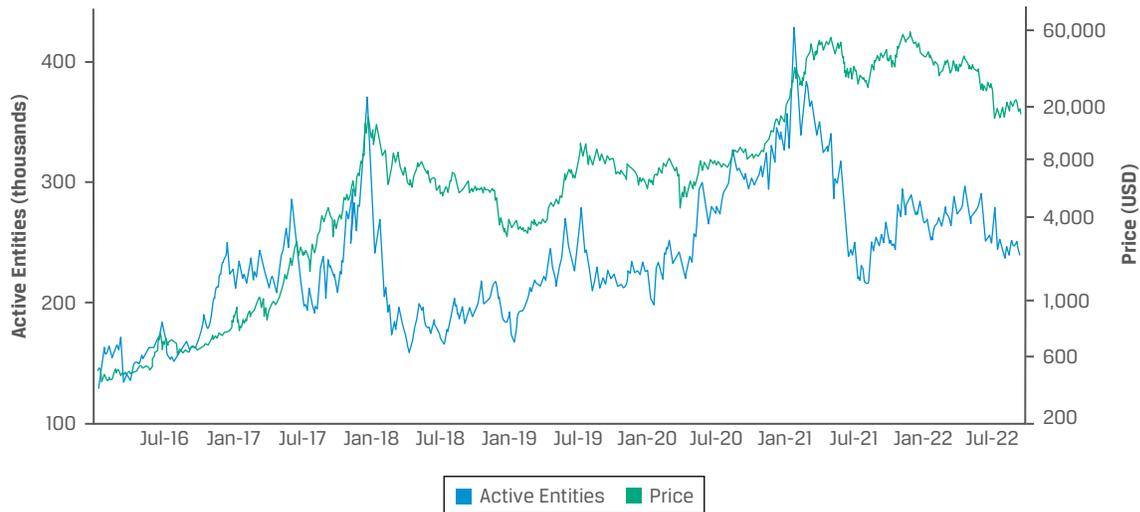
Exhibit 16. Relative Performance of Gold (XAU), Bitcoin (BTC), and the U.S. Dollar Index over a One-Year Rolling Period, as of 5 September 2022



Source: Refinitiv, an LSEG business (www.refinitiv.com/en).

⁶See Stanley (2022) and CBDC Tracker (<https://cbdctracker.org/>).

Exhibit 17. Bitcoin: Number of Active Entities (seven-day moving average), 2015–2022



Source: Glassnode (www.glassnode.com).

Demand for cryptoassets (or cryptocurrencies construed as money) will depend on a variety of factors, one of which is the added benefits these instruments offer to users. More importantly, however, it is clear to us that some significant movement away from fiat currency will need to take place for cryptoassets to become a mainstream staple of everyday economic life.

To demonstrate the challenge here, it is somewhat confusing or counterintuitive that the value of cryptoassets continues to be largely measured in terms of their fiat currency equivalent (essentially, the US dollar), as we have done ourselves throughout this paper. This tends to show that cryptocurrencies have not yet become a unit of account. Thus, we must revisit this concept in the future as we measure whether cryptoassets in general have penetrated mainstream economic processes.

7.4.3. A Source of Funding for Illicit Activities

A recurring argument about cryptoasset usage has been the extent to which these instruments assist in the funding of criminal activity. Although such usage is very real, we should keep a sense of proportion when it comes to relating overall progress in cryptoasset transaction volumes to criminal activity.

In "The 2022 Crypto Crime Report," data provider Chainalysis (2022b) reported that the total value of

cryptocurrency received by illicit addresses had reached an all-time high of USD14.0 billion in 2021, as compared to USD7.8 billion in 2020. The most significant categories in terms of value include cybercams, terrorism financing, sanctioned entities, stolen funds, dark net market activity, and ransomware.

Exhibit 18 shows the share of illicit activity as compared to all cryptocurrency transaction volumes since 2017.

The data shown in Exhibit 18 focus on cyberactivities specifically related to crime or identified as such. There is also the grey area of cyberactivities used to evade taxes, capital controls, or regulation. Although these activities are more difficult to measure because they are not always explicit, we believe they require attention.

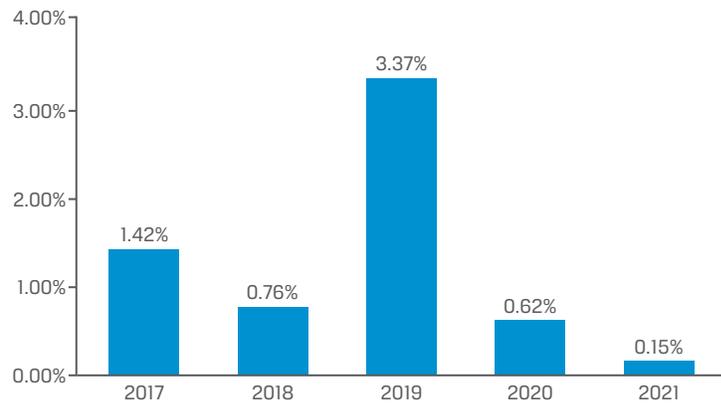
For comparison purposes, the United Nations estimates the amount of money laundered globally on a yearly basis ranges from 2% to 5% of global GDP, or between USD800 billion and USD2 trillion in volume.⁷

7.4.4. Investment and Speculation

This use case is the notion that cryptoassets are investable and can result in financial gains, either from a buy-and-hold strategy or from trading the instruments. Many investors consider these instruments an alternative investment, as well as part of a diversification strategy. On the issue of diversification, however, it is too early to form a definitive view given that the sector is still in its infancy

⁷See the United Nations Office on Drugs and Crime's money laundering overview at www.unodc.org/unodc/en/money-laundering/overview.html.

Exhibit 18. Illicit Share of All Cryptocurrency Transaction Volume, 2017–2021



Source: Chainalysis (www.chainalysis.com).

and therefore lacks the maturity of other economic sectors with a broad investor base.

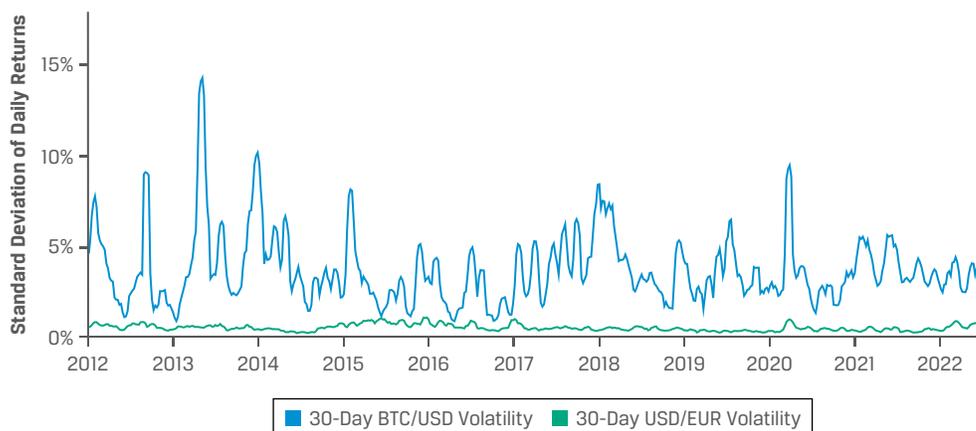
However, based on input from our interviews and external research, many worry that the trading activity as reported by exchanges (whether centralized or decentralized) suffers from data reliability issues, notably because of the potentially pervasive tactic of "wash trading,"⁸ where market participants do not necessarily end up realizing the purported market risk they announce. Forbes recently reported that its analysis showed 51% of all reported

trading volume at 157 crypto exchanges globally was fake or "non-economic" (Paz 2022).

Exhibit 19 shows a relative chart comparing the volatility (measured as the rolling 30-day nonannualized standard deviation of daily prices) of bitcoin (in US dollars) with that of the USD/EUR pair over 2012–2022. It demonstrates bitcoin remains a volatile instrument.

Using the same data source, we can extrapolate that the annualized volatility (standard deviation) of bitcoin has ranged from 65% to 82% over the same time period used in Exhibit 19. For comparison purposes, the Cboe Gold

Exhibit 19. Bitcoin Volatility Time Series, 2012–2022



Note: See Buy Bitcoin Worldwide's Bitcoin Volatility Index at <https://buybitcoinworldwide.com/volatility-index/>.

Sources: Buy Bitcoin Worldwide (www.buybitcoinworldwide.com); CoinDesk (www.coindesk.com/).

⁸Wash trading is a process whereby a trader buys and sells a security for the express purpose of feeding misleading information to the market" (Chen 2022).

Volatility Index has ranged from 8% to 48% over the same period (source: Refinitiv), while the realized 12-month volatility of the S&P 500 Index has ranged from 6% to 35%.⁹

Finally, the use of cryptoassets as investable instruments raises the question of whether they may constitute a long-term investment opportunity. On this question, Chainalysis has interesting data to share. **Exhibit 20** shows a comparable graph of cryptocurrencies in terms of the average holding period (or the age of each token, measured as the time it has stayed in its current wallet). Large variations between tokens would tend to demonstrate not all tokens or blockchain applications bear the same interest between their value as an investment or as a means of accessing other forms of services.

We have identified a series of questions that the market must answer to determine the future of cryptoassets as instruments worth considering for investment purposes. These include the following:

- What are the actual driving forces behind the market interest for a specific cryptoasset compared with others?

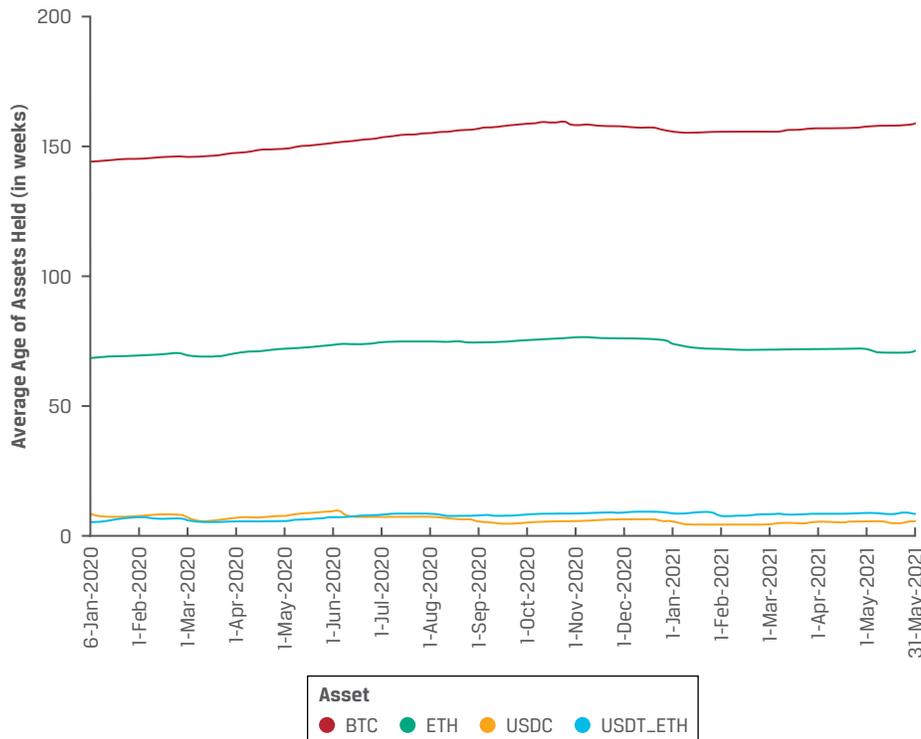
- Will traditional market forces determine which cryptoassets will achieve success?
- Is it reasonable to assume that cryptoassets with a wide variety of derivatives usages (e.g., Ethereum) will, over time, gain in popularity over mono-use cryptoassets (e.g., bitcoin)?
- Are there intrinsic limiting factors to the creation of new tokens based on blockchain technology (in a similar way as F. A. Hayek envisaged for private currencies)?

7.4.5. The Tokenization of Real Economy Assets and Processes

One of the central appeals of DLT is to transform the manner in which property or ownership of any asset or economic interest is established, recorded, held, and traded.

In 2017, Don Tapscott (Blockchain Research Institute) and Benjamin Roberts (Citizen Hex, Ether Capital) had already introduced the notion of the Internet of Value when discussing this development (Chase 2017).

Exhibit 20. Average Age of Assets Held



Source: Chainalysis, "Cryptocurrency Ecosystem Comparison: Bitcoin vs. Ethereum vs. Stablecoins" (1 July 2021). <https://blog.chainalysis.com/reports/cryptocurrency-ecosystem-bitcoin-ethereum-stablecoins/>.

⁹See S&P Dow Jones Indices' S&P 500 12-Month Realized Volatility Index at www.spglobal.com/spdji/en/indices/indicators/sp-500-12-month-realized-volatility-index/#overview.

In essence, tokens produced by blockchain protocols can be used to represent ownership over objects and properties that live in the real world outside of the blockchain. Tokenization can bring benefits in terms of access, pricing, and liquidity to assets that lacked such features in traditional financial mechanisms.

The main difficulty in this realm of thinking is the same as that which we have discussed for NFTs—that is, according to Benjamin Roberts, "when you get into tokenization of property, things outside the blockchain, then you need some kind of centralized institution or infrastructure that connects the token on the blockchain to the thing in the real world" (Chase 2017).

It is difficult to get around the very real need for enforcement of property rights and the need for centralized entities to act as the guarantor of these rights, which has traditionally been a duty assigned to the state or government in modern socioeconomic frameworks.

What can be tokenized, in theory, may include the following:

- Assets, whether physical or digital
- Traditional financial instruments (equities, bonds) and currencies
- Investment fund shares or fractions
- Services (e.g., loyalty rewards programs)
- IT capacity (e.g., computing power, file storage)

In large part, the future of cryptoassets and their acceptance by the public as part of the mainstream economy will depend on the reality of these processes finding an efficient usage and distribution channel through tokenization.

7.4.6. Smart Contracts

As a general rule, smart contracts are defined as follows: "Smart contracts are simply programs stored on a blockchain that run when predetermined conditions are met. They typically are used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss. They can also automate a workflow, triggering the next action when conditions are met."¹⁰

Smart contracts correspond to what we referred to earlier when discussing the benefits of DLT and blockchain protocols in middle- and back-office operations, clearing, and settlement, for example.

Practical examples of such developments could include such things as the following:

- Proxy voting, facilitated by the programming of direct voting by holders of shares in investment funds, as opposed to granting investment management firms (agents) a proxy to vote on their behalf
- Global commercial and financial transactions, making use of stablecoins to avoid transacting directly in fiat currencies, which has the potential to simplify operational chains (clearing and settlement) and therefore reduce the risk in the system due to outstanding unsettled transactions

Cognitive Market Research (2022) estimated that the global smart contract market reached USD397.8 million in value in 2022 and is forecast to grow to USD1.46 billion by 2028.

7.4.7. Decentralized Finance, Lending and Borrowing

We discussed in earlier sections how DeFi proposes to use blockchain protocols to decentralize the activity (and, importantly, the value chain and profits) of lending and borrowing money away from traditional financial intermediaries.

This could become another source of permanent demand for cryptoassets through the concept of the total value of tokens that is locked (total value locked, or TVL) at any point in time. IOSCO's (2022, p. 11) report on decentralized finance describes this activity in detail.

For our purposes, DeFi has in general developed and been fueled through the following sequence:

- First, early investors recognized the opportunity to allocate capital to nascent technologies with venture [capital]-type return (and risk) profiles.
- Second, cryptoasset holders have recognized a market thirsty for liquidity and so they perform market-maker and related services to DeFi protocols.
- Third, [traditional centralized finance] market participants have sought to diversify their activities and to seek yield in DeFi as an alternative platform with the potential for diversified higher returns.
- Fourth, blockchain communities have encouraged the proliferation of DeFi projects on their platform, as they are aware that their network can only scale with its adoption [and user participation (i.e., client acquisition)].

¹⁰The definition comes from IBM's website: www.ibm.com/topics/smart-contracts.

- Fifth, early adopters and proponents of cryptoassets have seen DeFi as a place where they can invest in products and services that align with their general outlook for this industry. (IOSCO 2022, p. 30)

Collectively, this process continues to generate demand for cryptoassets and services, at least for the time being.

7.4.8. New Forms of Digital Asset Transactions

This source of demand will emanate from the development of the cyberworld and the **metaverse**, including the gaming industry, live events, and social media, where participants will exchange fully digitalized assets whose value is recognized only in these digital universes.

Here is how *Wired* presents the metaverse (Ravenscraft 2022): "The metaverse does not refer to any one specific type of technology, but rather a broad (and often speculative) shift in how we interact with technology. Many companies that have hopped on board the metaverse bandwagon also envision some sort of new digital economy, where users can create, buy, and sell goods. Tech giants like Microsoft and Meta are working on building tech related to interacting with virtual worlds."

In December 2021, Bloomberg (2021) reported that the current size of the metaverse was approaching USD500 billion in value and could reach USD800 billion in 2024.

7.4.9. The Search for Privacy in Transactions

In our view, the question of using cryptographic processes to engage in transactions in an anonymous manner will be largely settled through regulation.

At this stage of its development, DLT and blockchain-based cryptoassets already provide pseudo-anonymity. In practice, the components of a transaction on a blockchain (addresses, keys, transaction details) are all represented as text strings that do not need to directly link to any participant's natural personal identity. However, if the transaction takes place on an exchange that, through regulation, has the duty to implement KYC, AML, and CFT (combating the financing of terrorism) verifications, then there should in theory be no secret about the identity of the ultimate beneficiaries or the parties to a transaction.

Given the quest for anonymity, it is ironic that, given how DLT operates, the level of transparency and therefore of tracking allowed by blockchain transactions could become greater than in traditional financial mechanisms.

In this context, it will be interesting to monitor the development of a new crypto-related activity called "mixing," which is a solution that allows users to mix their token transactions with those of other participants, thus allowing a preservation of privacy through anonymity. It is yet unclear how this activity will progress, given its grey nature, or whether regulators will restrict it. Nevertheless, the appeal of privacy is likely to constitute at least part of the demand for cryptoassets.

8. FIDUCIARY DUTY

Investment institutions and advisers acting in a capacity of fiduciary should continue to apply principles of prudence, loyalty, and care when considering a potential investment in cryptoassets. Hype and popularity do not in and of themselves constitute a sound investment basis. Fiduciaries should be in a position to explain the economic rationale for a proposed investment, the basis for return expectations, and an evaluation of risk factors.

8.1. Core Principles of Fiduciary Duty

Fiduciary duty is based on general principles rather than prescribed sets of specific rules. The two core principles are a duty of loyalty and a duty of care (called prudence in trust law). The duty of loyalty requires fiduciaries to act solely in the best interests of their clients or beneficiaries who, collectively, are owed the fiduciary duty. Fiduciaries must act prudently in their investment decisions and advice.

For example, the Uniform Trust Code (UTC), a uniform model law that most states have adopted in the United States, requires trustees to "administer the trust as a prudent person would" and to "exercise reasonable care, skill, and caution" (Uniform Law Commission 2022b, pp. 131–32). The federal law governing most private pension plans in the US contains similar provisions (see Box: ERISA: US Law Governing Private Pension Plans).

Crucially, the "prudent investor rule," which prevails in the United States, does not prohibit investments in any particular asset class or type of investment *per se*. Instead of categorically banning certain types of investments or investing strategies, the "prudent investor rule" requires fiduciaries to have "an overall investment strategy having risk and return objectives reasonably suited to the trust" and generally to "diversify the investments of the trust."¹¹

The challenge for fiduciaries is how to determine that their investment process is prudent. To make the discussion more concrete, the following subsections apply the fiduciary standard to specific attributes of digital assets.

8.2. Speculative Investments?

Fiduciaries must have a reasonable basis for investing in cryptoassets; mere speculation is not enough. The question is particularly pertinent with respect to digital assets

because some crypto platforms and products may provide a transitory but false sense of revenue streams and dedicated users. Indeed, some platforms—especially less established ones—may seek to gain scale and network effects by subsidizing new users. For example, the sponsor of the now-bankrupt twin cryptocurrencies Luna and Terra apparently lured users by offering higher-than-market interest rates. In reality, this amounted to a customer acquisition strategy to subsidize users. This type of strategy can only prove sustainable if the platform or product has features that the new users actually like and wish to continue using once the subsidy is removed. Otherwise, the strategy must rely on a continual inflow of new users to help defray costs to older users. Ultimately, once the inflow stops, the strategy will collapse like a pyramid scheme.

Before the ultimate collapse, however, investors may be lured into believing that the platform or product is a legitimate investment with real revenue and an expanding user base. Enthusiasts may seek to justify an investment based on actual or projected revenue and an expanding user base. That would be an illusion, not an investment justification, however, if the product or service is unsustainable.

These considerations inevitably raise critical questions about valuation and use cases. On the one hand, to the extent that a product or service has genuine use cases, it may well have the potential to become a profitable business and a lucrative investment. On the other hand, there would be no reasonable basis for investing in a product, platform, or service with no convincing use cases. Crypto supporters often draw analogies to extraordinarily profitable high-tech companies that have taken flight from the ashes of the dot-com bust. Who is to say that among the thousands of cryptoassets, there are some that represent future Amazons or Googles? In our view, however, invoking the names of iconic tech companies is no substitute for careful analysis; it does not provide a reasonable basis for investing in a specific digital company or asset. Nor is it reassuring if, confronted with specific questions about use

¹¹Uniform Law Commission (2022b, p. 427), citing Uniform Prudent Investor Act § 2(b), (e) (Uniform Law Commission 1994).

cases, enthusiasts profess a generic faith in future uses that are today unknown and unseen.

Use cases for specific cryptoassets can serve as the foundation for valuations with a reasonable basis. Absent compelling use cases, however, this valuation may be impossible. Pension fund investment professionals and other investment fiduciaries must examine these questions expertly and with care, in a substantive and sound process, to arrive at a reasoned decision for themselves. Fiduciaries should only invest in cryptoassets if they have satisfied themselves that, after considering these questions, they have a reasonable basis for their investments.

8.3. High-Volatility and Risky Investments

Cryptoassets are risky assets that exhibit high price volatility. Volatility *per se*, however, does not necessarily make an investment unreasonable or incompatible with fiduciary duty. Indeed, pension funds are often comfortable investing a portion of their overall portfolios in assets that have higher levels of risk and volatility. The long-term investment horizons of pension plans can enable them to weather the volatility of risky assets. A volatile asset could nonetheless constitute a prudent investment if it improves the risk-return profile of the portfolio as a whole.

Volatility would raise fiduciary concerns, however, if it could not reasonably be expected to enhance the overall risk-return profile of the investor's portfolio. A pension fund or other fiduciary cannot invest in highly volatile and risky assets merely for the sake of speculation. Nor could the investment be justified on the grounds that it represents only a small portion of the overall portfolio. A fiduciary cannot dismiss the risks simply on the basis of the small size of the investment. There must be a reasonable basis for the investment, no matter how small it is.

To determine the line between speculation and a reasonable investment, it helps if the fiduciary can explain the volatility based on underlying economic or investment conditions, such as the level of inflation or interest rates. But if the volatility is inexplicably random, that would raise questions about whether the investment is a prudent one.

8.4. Evolving Regulatory Environment

It remains uncertain whether crypto exchanges or DeFi platforms may be violating current laws and regulations—for example, by the sale of unregistered securities or by

failing to comply with anti-money-laundering rules. If a platform's illicit activities prompted authorities to shut it down, that could place the platform's users at risk of losing their assets. That risk alone might make the investment appear imprudent and incompatible with fiduciary duties. These considerations explain pension fund concerns about participating on crypto platforms at this stage.

As noted above, laws and regulations governing cryptoassets and platforms are still evolving. New laws and regulations no doubt will have a significant impact on the crypto industry and particular platforms, products, and participants. Again, the unpredictability of that impact could raise questions of the prudence of participating on crypto platforms or investing in cryptoassets at this stage.

8.5. Custodial and Record-Keeping Concerns

Custodial challenges are an important concern for investment professionals but not an insurmountable one. Given the importance of the issue, we discuss this issue separately in the next section.

The key unresolved question is whether the combined weight of the risks outlined above makes crypto investments imprudent from the perspective of a fiduciary. Again, our purpose is not to provide a simple yes-or-no answer but instead to shine a light on the contours and substance of the question. The aim is to provide information to assist investment fiduciaries and other investors to reach their own conclusions based on their individual facts and circumstances.

8.6. Department of Labor Warns Pension Fiduciaries in the United States

Meanwhile, however, the regulator of private pension funds in the United States has weighed in with a warning against their investing in cryptoassets. That regulator is the Department of Labor (DOL), which administers the ERISA laws governing private pensions. (For more on ERISA, see the related box.)

ERISA: US Law Governing Private Pension Plans

In the United States, most private pension plans are governed by the Employee Retirement Income Security Act of 1974 (ERISA). This federal statute requires plan fiduciaries to act solely in the interest of participants and beneficiaries and for the exclusive purpose of providing benefits and paying plan expenses. ERISA requires fiduciaries to act "with the care, skill, prudence, and diligence" that a prudent person would exercise in his or her own affairs.¹² The law emphasizes the need for a sound

investment decision-making process rather than the investment outcome. Fiduciaries who do not follow these principles of conduct may be held personally liable for any losses.

ERISA does not cover public plans, which instead are generally governed by state law. The state laws, however, generally mirror the fiduciary principles found in ERISA. (See Section 8.7 below.)

As we have seen, the prudent investor rule does not make any blanket prohibitions on particular investments. Nonetheless, DOL (2022) issued guidance in March 2022 that stopped just short of declaring that a crypto investment option would violate a pension plan's fiduciary duty. While the DOL guidance focuses on defined contribution plans, such as 401(k) plans, nearly all the fiduciary concerns raised would apply equally to defined benefit retirement plans. And although ERISA governs private-sector retirement plans only, government retirement plans generally follow similar state law fiduciary duties. Finally, while it refers specifically to cryptocurrencies, the DOL guidance states that the same reasoning and principles also would apply to a wide range of digital assets.¹³

The DOL (2022) guidance begins with a warning: "The Department cautions plan fiduciaries to exercise extreme care before they consider adding a cryptocurrency option to a 401(k) plan's investment menu for plan participants." DOL (2022) goes on to express its "serious concerns about the prudence of a fiduciary's decision to expose a 401(k) plan's participants to direct investments in cryptocurrencies, or other products whose value is tied to cryptocurrencies."

Referring to defined contribution plans that offer participants an investment menu to choose from, DOL (2022) notes that "fiduciaries may not shift responsibility to plan

participants to identify and avoid imprudent investment options" and that the "failure to remove imprudent investment options is a breach of duty." Characterizing cryptocurrencies as "highly speculative" and subject to "extreme price volatility," the DOL (2022) guidance adds that investments in cryptocurrencies raise "significant risks of fraud, theft, and loss."

DOL (2022) then discusses distinguishing features of cryptocurrencies that it suggests could conflict with a plan's fiduciary duties. These characteristics largely overlap with the crypto features discussed above and include the following considerations: speculative and volatile investments, valuation concerns, the challenge for plan participants to make informed investment decisions, custodial and record-keeping concerns, and an evolving regulatory environment.

8.7. Fiduciary Duty and Investment Advisers

In the United States, investment advisers registered with the SEC are subject to a fiduciary duty to their clients. Though fiduciary duty is one of the most important aspects of the Investment Advisers Act of 1940, it is never specifically defined in either the federal statute or the SEC's implementing regulations.¹⁴

¹²See 29 U.S. Code § 1104: "with the care, skill, prudence, and diligence under the circumstances then prevailing that a prudent man acting in a like capacity and familiar with such matters would use in the conduct of an enterprise of a like character and with like aims."

¹³See DOL (2022): "Although this release specifically references 'cryptocurrencies,' the same reasoning and principles also apply to a wide range of 'digital assets' including those marketed as 'tokens,' 'coins,' 'crypto assets,' and any derivatives thereof."

¹⁴The SEC did, however, issue a "Commission Interpretation Regarding Standard of Conduct for Investment Advisers" (see SEC 2019a, p. 6). The absence of detailed, prescribed rules can be seen as an advantage, not a flaw. A general principle, rather than a set of prescribed rules, is arguably more consistent with the dynamic nature of fiduciary duty. The resulting flexibility allows the fiduciary principle to accommodate a variety of sizes and structures of investment adviser businesses. See SEC (2011, p. 122), summarizing a point of view expressed in various comment letters to the SEC.

Nonetheless, the key elements of the principle of fiduciary duty are clear and well established.¹⁵ The fiduciary duty of investment advisers, like that of other fiduciaries, consists of the duty of loyalty and the duty of care. The combination of those duties requires the investment adviser to act in the best interest of its client at all times. In the words of the SEC, "an investment adviser's obligation to act in the best interest of its client is an overarching principle that encompasses both the duty of care and the duty of loyalty."¹⁶ State laws in the United States generally place similar fiduciary duties on investment advisers, including the duties of loyalty and prudence.¹⁷

The CFA Institute *Standards of Practice Handbook* establishes detailed guidelines about charterholders' duty as fiduciaries. In particular, in regard to the notion of trust, the organization determines that "the duty required in fiduciary relationships exceeds what is acceptable in many other business relationships because a fiduciary is in an enhanced position of trust" (CFA Institute 2014, p. 82).

Investment advisers must have a reasonable belief that the advice they provide is in the best interest of the client based on the client's objectives. To arrive at a reasonable belief, advisers must consider both the objectives and circumstances of the client¹⁸ and the nature of the investment. Advisers must "conduct a reasonable investigation into the investment sufficient not to base [their] advice on materially inaccurate or incomplete information" (SEC 2019a, p. 16).

Costs would be one, but not the only, factor in that investigation. Other factors would include an investment product's or strategy's investment objectives, characteristics (including any special or unusual features), liquidity, risks and potential benefits, volatility, likely performance in a variety of market and economic conditions, time horizon, and cost of exit (SEC 2019a, p. 17).

In light of these factors, it is not difficult to see why some investment advisers balk at investments in cryptoassets. Depending on the cryptoassets or platform in question, each of these factors might be problematic. Liquidity, for example, has proven quite limited for certain cryptoassets, and volatility has been extraordinarily high. Moreover, volatility and prices in general appear to be poorly understood, with no compelling explanations of the economic causes driving either volatility or prices.

Fiduciaries—indeed, all investors—should also consider an array of other risks involving a variety of platforms, products, and activities. First, some platforms fail to protect against market manipulation. That is a key reason why the US SEC has refused to permit a cash-market bitcoin ETF (see, e.g., SEC 2022). In a possible worst case, the platform may encourage or engage in manipulative actions, such as wash trades. Second, questionable or inadequate underlying reserves have made some stablecoins anything but stable, and the lack of transparency further undermines investor confidence. Third, at least one now-bankrupt lending platform, Celsius, apparently engaged in highly risky investing activities under the cloak of opacity, raising the question of whether other lending platforms might be doing the same. Risky investments could undermine the platform's ability to pay interest or return users' deposits (i.e., the assets staked by users to the platform). Fourth, bankruptcies, fraud, and loss, in the eyes of some fiduciaries, may constitute a special characteristic of crypto investments. Fifth and finally, costs of exit may become prohibitively expensive, with transaction costs (called "gas fees") sometimes exceeding the value of the asset itself for smaller retail investors (OECD 2022, p. 49). While this is not an exhaustive list, it demonstrates the breadth of risks that investors should consider. The accompanying box provides further details on three of these risks through real-world examples involving regulatory action.

¹⁵See SEC (2011), summarizing a point of view expressed in various comment letters to the SEC.

¹⁶See SEC (2019a, p. 15). The duty of care requires an investment adviser to provide investment advice in the best interest of its client, based on the client's objectives. The adviser has an obligation not to subordinate clients' interests to its own. Under the duty of loyalty, an investment adviser must eliminate or make full and fair disclosure of all conflicts of interest which might incline an investment adviser—consciously or unconsciously—to render advice which is not disinterested.

¹⁷The Uniform Trust Code (UTC), a uniform model law that most states have adopted in the United States, contains a duty of law provision. The provision stipulates, "A trustee shall administer the trust solely in the interests of the beneficiaries" (Uniform Law Commission 2022b, p. 124). The UTC also contains a prudent person requirement, which obliges trustees to "administer the trust as a prudent person would" and to "exercise reasonable care, skill, and caution" (Uniform Law Commission 2022b, pp. 131–32).

¹⁸These include the client's ability and willingness to tolerate the risks of the investments and a conclusion that the potential benefits justify the risks. See SEC (2019a).

Three Crypto Investing Risks

Risks of Fraud and Market Manipulation

The US SEC has rejected various attempts to register bitcoin ETFs because of its concerns over potential market manipulation and fraud (see, e.g., SEC 2022). The SEC has identified the following sources of fraud and manipulation:

- wash trading,
- manipulation of bitcoin pricing,
- hacking of the bitcoin network and trading platforms,
- malicious control of the bitcoin network,
- trading based on material, non-public information or based on the dissemination of false and misleading information,
- manipulative activity involving stablecoins, and
- fraud and manipulation at bitcoin trading platforms (SEC 2022, p. 22).

Wash trades, which create fake volume, figured prominently in a Forbes analysis showing that slightly more than half of reported daily bitcoin trading volume was likely bogus (as noted above).¹⁹ By giving the illusion of inflated trading volumes, wash trades exaggerate the importance and liquidity of the affected assets and trading platforms.²⁰

Hacking and compromises alone have caused nearly USD10 billion in losses since 2011 (at current valuations), according to a study by KPMG (2020, p. 8).²¹

The Adequacy of Stablecoin Reserves: Questions about Tether

The implosion of Terra and its sister currency Luna highlighted the risks of stablecoins that rely on algorithms. Other stablecoins, however, claim to back up their coins with reserves, such as US dollars or US Treasuries. Nonetheless, a string of regulatory and court actions has raised questions about the adequacy of the reserves for some of the biggest stablecoins. Tether's US dollar USDT token is the world's largest stablecoin, with a market value of USD68 billion (Eaglesham and Huang 2022). In 2021, Tether Holdings and its sister cryptocurrency trading platform Bitfinex paid a USD18.5 million penalty in a settlement with the New York attorney general, who, after a two-year investigation, alleged that Tether had suffered "massive" losses and had lied about its collateral (Chipolina 2022).

Several years earlier, in 2017, Tether paid USD41 million in penalties to the Commodities Futures Trading Commission (CFTC) to settle similar charges. Specifically, the regulator alleged that Tether had misrepresented that its stablecoin had one-for-one collateral of US dollar reserves (CFTC 2021). Further, the CFTC accused Tether of falsely representing that it would undergo routine, professional audits to demonstrate that it fully maintained reserves at all times (CFTC 2021). According to the CFTC, Tether selected the date of one review in advance, and Bitfinex transferred USD382 million into Tether's bank account in advance of the review.²²

As of early October 2022, Tether has yet to produce a routine, professional audit but instead has engaged in less rigorous auditor attestations of

¹⁹See Paz (2022), citing a US Commodity Futures Trading Commission definition of wash trading as "entering into, or purporting to enter into, transactions to give the appearance that purchases and sales have been made, without incurring market risk or changing the trader's market position."

²⁰See Paz (2022), citing a US Commodity Futures Trading Commission definition of wash trading as "entering into, or purporting to enter into, transactions to give the appearance that purchases and sales have been made, without incurring market risk or changing the trader's market position."

²¹For a chart of major hacks, including the value of the crypto and method of attack, see KPMG (2020, p. 10).

²²CFTC (2021). See also Eaglesham and Huang (2022), saying Bitfinex transferred the funds just hours before the accountants reviewed the numbers.

a snapshot of its assets at a single point in time (see, e.g., Eaglesham and Huang 2022; Ostroff 2022). Greater transparency into Tether's finances and reserves may be coming soon, however, as a result of a court order in an ongoing lawsuit filed by plaintiffs against Tether. In September 2022, a judge ordered Tether to disclose its financial statements and produce documents, including bank account statements, to demonstrate the adequacy of its reserves (Ostroff 2022).

A Lending Platform's Risky Investing: The Example of Celsius's Bankruptcy

Fallout from the bankruptcy of crypto lending platform Celsius has highlighted the risks that investors may face when they stake their cryptoassets in lending platforms. Celsius attracted crypto deposits by offering annual interest rates as high as 18.6% and then invested the deposits in DeFi and other investments, in what was a de facto crypto wholesale market (Lang, Mandl, and Howcroft 2022).

There is no real understanding of Celsius's crypto holdings, according to the US trustee overseeing the bankruptcy case (Kharif 2022). The trustee asked the court to appoint an examiner

to investigate Celsius's financial affairs, including its investments and lending transactions (Kharif 2022). Regulators for the state of Vermont, meanwhile, filed court papers alleging that Celsius made false and misleading claims about its finances after incurring huge losses (Biswas 2022).

Shortly before Celsius's bankruptcy filing, one of its former money managers filed a suit against it, alleging that his former employer had used customer funds to manipulate prices and had failed to hedge risks properly (Kharif 2022). In a countersuit, Celsius alleged that the former money manager had lost or stolen tens of millions of dollars in assets (Kharif 2022).

Celsius's implosion has generated media articles portraying the platform's highly risky trading strategy and illiquid investments in DeFi and other ventures (see, e.g., Lang et al. 2022; Mint 2022; Huang and Biswas 2022; Zuckerman, Huang, and Singh 2022).

For all the tangled claims and counterclaims involving Celsius, one thing is clear: its plight does nothing to inspire confidence in crypto lending platforms that promise to pay above-average interest rates.

A fiduciary would need to investigate potential risks such as these and then determine that (1) the client had the willingness and ability to withstand the risks and (2) the potential benefits exceeded the risks.

8.8. Fiduciary Duty in the European Union and United Kingdom

The primary principles underpinning fiduciary duty are largely equivalent among the United States, the EU, and the United Kingdom.

Interestingly, though, the main body of legislation covering the functioning of capital markets and the duties of its participants in the EU, the Markets in Financial Instruments Directive II (MiFID II),²³ does not directly refer to the concept

of fiduciary duty of investment firms. Rather, the obligations to put investor interests first are defined indirectly through a strong focus on the need for investment firms to put in place robust policies governing the mitigation and management of conflicts of interest.

As such, the European Commission establishes that "the duties of care, loyalty and prudence are embedded in the EU's financial framework governing obligations that institutional investors and asset managers owe to their end-investors/scheme members. These duties are the foundation of the investment process."

Regarding cryptoassets, and with the above principles in mind, EU authorities have in no ambiguous terms warned investors and consumers about the risks of investing in or using such instruments. In March 2022, the European Supervisory Authorities (ESAs) released a statement that characterized cryptoassets as "highly risky and

²³See European Commission (2004) for information on the first iteration of MiFID. See European Union (2014) for information on the second iteration, MiFID II, which has been in effect since 2018.

speculative" (ESMA 2022). In particular, it was the view of the ESAs that cryptoassets "are not suited for most retail consumers as an investment or as a means of payment or exchange" (ESMA 2022). In this statement, the ESAs specifically referred to the following risks:

- Extreme price movements
- Misleading information
- Absence of protection
- Product complexity
- Fraud and malicious activities
- Market manipulation, lack of price transparency, and low liquidity
- Hacks, operational risks, and security issues

All these points have been discussed across the various sections of this research paper.

In the United Kingdom, the key regulatory apparatus with regard to business conduct is the FCA Handbook (Financial Conduct Authority 2022a) and, in particular, the Principles for Businesses, which are derived from the overarching Financial Services and Markets Act 2000. Across various core principles, investment firms are required to act with skill, care, and diligence and must pay due regard to the interests of their customers.

Recently, as part of its work on the new Consumer Duty to apply in 2023, the FCA released a policy statement that creates a new Principle 12, the Consumer Principle, to focus more precisely on consumer interests (Financial Conduct Authority 2022c). The objective was to set the focus on delivering good outcomes for consumers and the requirement that investment firms justify how they have achieved such outcomes.

Regarding cryptoassets, the FCA has issued numerous warning statements over the past few years, aimed at retail consumers. The FCA considers cryptoassets as "very high risk, speculative investments" (Financial Conduct Authority 2019). Most recently, referring to social media campaigns, its communications have focused on reminding consumers about the absence of regulation in direct investments in cryptoassets and the absence of typical consumer

protection insurance schemes that apply to bank deposits (Financial Conduct Authority 2021, 2022b). The FCA's statements in general point to risks similar to those mentioned by the ESAs in the EU.

8.9. Pension Schemes

Most defined benefit pension funds do not currently invest in cryptoassets, though some have set up internal working groups to gain a better understanding of digital assets. We are aware of only a few public pension funds that have invested directly in cryptoassets—and even then, with only a small sliver of their overall assets. Such funds range from three local pension funds in the United States—the Houston Firefighters' Relief and Retirement Fund²⁴ and two county pension funds in Virginia²⁵—to a few of the largest Canadian pension funds. These funds have included Caisse de dépôt et placement du Québec (CDPQ), the Ontario Teachers' Pension Plan (OTPP),²⁶ and the venture capital investment arm of the Ontario Municipal Employees' Retirement System (OMERS).²⁷ The investments themselves range from exposure to bitcoin and Ethereum to venture capital-like investments in tech startups and crypto platforms.

Not all the crypto investments have gone well. In November 2022, OTPP announced that it was writing off its entire USD95 billion direct investment in FTX.²⁸

CDPQ, Canada's second-largest pension fund manager, announced in 2022 that it had written off a USD150 million investment in the bankrupt crypto lending platform Celsius Network. The fund's chief executive acknowledged that CDPQ went into crypto too soon and had lost interest in further investments (Chipolina and Cumbo 2022).

For the few pension funds currently invested in cryptoassets, the primary attraction lies in the perceived opportunity to gain exposure to a new digital asset class with disruptive blockchain technology. The opportunity to boost returns from interest earned on crypto yield farming represents another attraction, at least for the Virginia funds.²⁹ Pension funds with crypto-related investments believe they are managing the risks by limiting their exposure to very small slivers of their overall assets.

²⁴The Houston pension fund in 2021 invested USD25 million in bitcoin and Ethereum or a bit less than 50 bps of its USD5.5 trillion in assets. See NYDIG and Houston Firefighters' Relief and Retirement Fund (2021).

²⁵The Fairfax County Police Officers Retirement System and the Fairfax County Employees' Retirement System invested a combined USD21 million in 2019. That represented nearly 30 bps of their combined assets of USD6.8 billion. They moved to expand their investments in the summer of 2022. Fairfax County is a northern Virginia suburb of Washington, DC. See Kharif (2021); Cumbo, and Franklin (2022).

²⁶OTPP invested USD420 million in a 2021 funding round for FTX, the cryptocurrency exchange. See OTPP (2021).

²⁷According to its website (www.omersventures.com/portfolio/digital-currency-group/), OMERS Ventures began its investment in the Digital Currency Group in 2012 and exited in 2020.

²⁸OTPP had invested the USD95 billion in FTX's international and US entities in October 2021 and January 2022. See OTPP (2022).

²⁹That is the attraction for the Fairfax County Police Officers Retirement System. See Cumbo and Franklin (2022).

Pension funds with crypto investments, however, appear to be the exception to the rule. Most pension funds have concluded that cryptoassets are simply not an attractive investment, according to several pension fund investment officers and service providers. It is not that pension funds are wedded to plain-vanilla investments in the stocks and bonds of public companies. On the contrary, pension funds are quite comfortable with alternative investments and limited allocations to risky assets over long-term investing horizons. Pension funds generally believe, however, that other asset classes are cheaper and more efficient and, unlike cryptoassets, have a proven track record of returns. Other concerns include the immaturity of the sector as an asset class, volatility, risk of fraud, uncertainty of custody, and a degree of discomfort related to pension funds' own level of knowledge about cryptoassets.

Then there is the regulatory uncertainty. Pension funds are concerned that (1) cryptoassets remain largely unregulated, (2) crypto platforms or providers may be violating current laws, and (3) future laws and regulators will be coming that will have a profound impact on the crypto industry and its participants.

Apart from the risks of losing money, pensions funds worry about reputational risks. Public pension funds are especially sensitive to public and political scrutiny and particularly concerned with what they call headline risks. Specifically, pension funds are wary of participating on crypto exchanges or DeFi platforms that may be violating current laws and regulations, ranging from securities laws to rules on anti-money laundering and combating the financing of terrorism. Pension funds are also wary of investing funds that might be commingled with illicit funds. If authorities moved to shut down such a platform, its users might be at risk of losing their assets. Apart from the direct investment risk, there are reputational and political risks for any fund connected with such platforms and with illicit activity. Most state and municipal pension funds are

regulated by state legislatures, which exert political control over the funds.³⁰

As we have seen, these concerns raise profound questions about the fiduciary duties of pension plans (including a pension fund's investment officers and investment advisers). Nonetheless, some pension fund professionals have argued that there are grounds to justify investments in cryptoassets. The investments could be positioned as a buying opportunity for funds charged with asset/liability management responsibilities over time horizons stretching for decades. Arguably, an extended time horizon could reduce concerns over volatility and valuation: High volatility may be smoothed over a period of decades, and a pension fund could perhaps assuage valuation concerns by easing into the asset and believing that it would work out valuation details in the future. Nor are custodial issues insurmountable. Rather than investing directly in digital assets, for instance, pension funds could invest indirectly via regulated mutual funds or private funds that hold digital assets. That, in fact, is what both the Houston and Fairfax County pensions did.³¹

In practice, however, most defined benefit pension fund investment managers remain unconvinced. Their bottom line is that they simply do not see cryptoassets as a worthwhile investment.

A similar reticence prevails in private company defined contribution (DC) retirement plans, at least for now. DC plans generally offer participants a range of investment options from which to choose. Most DC plans, such as 401(k) plans in the United States, do not offer digital assets as one of the investment choices. Theoretically, the plans could include best-in-class digital investments as a distinct asset class. In practice, however, few have done so. For those that have, the crypto investment option often appears in a brokerage window linked to the platform of a brokerage firm (see accompanying box).

³⁰For the same reason, most pension funds remain leery of investing in marijuana. Even though marijuana is legal in many US states, its legality at the federal level remains in question. That raises the risk of investment loss significantly.

³¹The Houston fund invested in NYDIG, a bitcoin-focused subsidiary of asset manager Stone Ridge. The Fairfax County pension funds invested in the Morgan Creek Blockchain Opportunities Fund in 2019 and moved to expand to other funds in the summer of 2022. See Moran (2021); Kharif (2021); Cumbo and Franklin (2022).

Pension Plan Brokerage Windows

A brokerage window expands the range of investment choices available to participants in defined contribution plans. Such plans offer a core set of investment options—typically 15–25 choices—called designated investment alternatives (DIAs). In recent years, an increasing number of defined contribution plans also have offered brokerage windows, which are linked to platforms run by a third-party brokerage firm that offers a wide array of investment choices. The brokerage window allows DC plan participants to have a self-directed brokerage account.

Whereas plans have a fiduciary duty to prudently select and monitor the designated investment alternatives—and to remove those that become imprudent—the brokerage firm selects and manages the investment options in the brokerage window.

"The critical difference between DIAs and investment options offered through brokerage windows is that, in the case of the latter, there is no guarantee that a fiduciary has reviewed and selected

investments through a prudent process designed to benefit only the plan participants,"³² according to two legal experts. "In fact, many plan fiduciaries have expressly disclaimed that they have undertaken review of such investments."³³

Plan sponsors have a fiduciary duty to monitor and remove imprudent investments.³⁴ There has been an open debate, however, as to whether that fiduciary duty extends beyond the core investment options (the "designated investment alternatives") to the investment options in the brokerage window as well (St. Charles and Rosenthal 2022). Recent DOL guidance strongly suggests that, in DOL's view, a plan's fiduciary duties also apply to brokerage windows. Promising to conduct an investigation, DOL (2022) warned, "The plan fiduciaries responsible for overseeing such investment options [in cryptocurrencies and related products] or allowing such investments through brokerage windows should expect to be questioned about how they can square their actions with their duties of prudence and loyalty in light of the risks described above."

Despite the limited take-up among pension plans so far, some service providers to pension plans see strong interest in exploring digital asset offerings as a potential investment choice for plan participants.³⁵ These observers attribute the demand largely to the company's own employees, many of whom are relatively young, already have invested in crypto, and would like the option in their retirement plans as well. Moreover, company executives are adding to the demand. They may have a business interest in understanding how the crypto ecosystem could affect their industry in general and their company in particular.

Fidelity made news in April 2022 by announcing what it called the pension fund industry's first-of-its-kind bitcoin

offering for 401(k) plans (Fidelity Investments 2022). Fidelity's solution allows 401(k) plan sponsors to offer bitcoin as a core investment option (i.e., as one of the plan's designated investment alternatives rather than a self-directed brokerage account available through a brokerage window).³⁶ To assure robust security, Fidelity would hold the bitcoin assets in its institutional-grade Fidelity Digital Assets custody platform.

In sum, the current state of attitudes on crypto investing reflects a mixed picture. Service providers for pension funds express high expectations; regulators, such as the US Department of Labor, urge caution; and most private DC plans appear to have adopted a wait-and-see attitude.

³²See St. Charles and Rosenthal (2022), citing testimony to an ERISA Advisory Council.

³³See St. Charles and Rosenthal (2022), citing testimony to an ERISA Advisory Council.

³⁴See St. Charles and Rosenthal (2022), citing a 2015 US Supreme Court ruling.

³⁵See, for example, Fidelity Investments (2022), quoting one of its executives as stating, "There is growing interest from plan sponsors for vehicles that enable them to provide their employees access to digital assets in defined contribution plans, and in turn from individuals with an appetite to incorporate cryptocurrencies into their long-term investment strategies."

³⁶See Fidelity Workplace webpage, available at www.fidelityworkplace.com/s/digitalassets (noting that "no Fidelity entity functions in an ERISA fiduciary capacity with respect to DAA assets or provides 'investment advice' with respect to DAA assets.")

9. CUSTODY AND SAFEKEEPING OF CLIENT ASSETS

Before thinking about return ON capital, first think about return OF capital.

That advice, conveyed to us by a retired chief operating officer of a top venture capital firm, nicely sums up the purpose of custody. Custody safeguards investors' assets, in the event that their intermediary or the custodian holding their assets becomes insolvent or goes bankrupt.

A number of pension fund managers cited custody issues as one of the main concerns keeping them from investing in cryptoassets. Given the significance of the concern as a barrier to investments in cryptoassets, this section examines the issue of custody in detail.

9.1. The Basic Purpose of Custody Rules and the Problem with Cryptoassets

Traditional finance has established an elaborate system of laws, regulations, case law, and industry standard practices to govern the custody of customers' assets. The system has built up an enviable track record—spanning decades—of protecting customers, even when intermediaries, such as brokerage firms, go bankrupt.

That infrastructure, however, has been largely and conspicuously missing in crypto. That is beginning to change, however, and a nascent industry of institutional investor-grade custodians has begun to emerge. Recently, custody concerns have mushroomed, with a pair of high-profile bankruptcies—at crypto lender Celsius Network LLC and, separately, at broker Voyager Digital Holdings—along with the closure of more than 20 smaller exchanges.³⁷ The concerns have reached a new apex with the collapse of FTX.

Both Voyager and Celsius froze customer withdrawals in the weeks preceding their bankruptcies. Voyager listed its customers as creditors with unsecured claims, treating custodial and rewards customers alike. When customers entered into a customer agreement, Voyager considered them to have opted into its rewards program. Even if a customer opted out of the rewards program and into a custodial arrangement, Voyager commingled the assets.

Celsius also argued that customers gave up their ownership of assets when they used them to earn rewards on the platform. "The terms of use . . . explicitly state that in

exchange for the opportunity to earn rewards on assets, users transfer 'all right and title' of their crypto assets to Celsius," CEO Alex Mashinsky asserted in a Celsius bankruptcy filing (Mashinsky 2022; see also Hansen and Sullivan 2022).

After a group of custodial account holders banded together and filed suit, however, Celsius acknowledged a distinction between custodial and rewards customers. In a court filing on 1 September 2022, Celsius stated that the cryptoassets of its custodial customers were not property of the estate, and Celsius asked the court's permission to allow those customers to withdraw their cryptoassets.

These examples illustrate the importance of a set of principles for financial market infrastructures jointly proposed in 2012 by two international organizations of securities regulators and central banks.³⁸ Financial market infrastructures facilitate the clearing, settlement, and recording of monetary and other financial transactions.

In formulating a principle to address custody and investment risks, the two organizations advised, "It is particularly important that assets held in custody are protected against claims of a custodian's creditors. The custodian should have a sound legal basis supporting its activities, including the segregation of assets" (BIS and IOSCO 2012).

Because of the unique nature of distributed ledger or blockchain technology, digital assets present novel and complex challenges to traditional custodial norms. To understand what makes crypto custody different, it is helpful to review how custody works for traditional assets, such as stocks and bonds. To make the discussion more concrete, we focus on the Customer Protection Rule, which applies to

³⁷Voyager filed for Chapter 11 in early July, in a domino action triggered by cryptocurrency hedge fund Three Arrows Capital, which defaulted on a USD650 million loan from Voyager and declared its own Chapter 15 bankruptcy. See Hansen and Sullivan (2022).

³⁸See "Principle 16: Custody and investment risks" in BIS and IOSCO (2012).

broker/dealers in the United States. The purpose of this example is to illustrate broader considerations that apply in markets around the world.

The Customer Protection Rule has two main requirements. First, it prohibits broker/dealers from commingling customer assets with their own. Second, it requires broker/dealers to possess or have control over the assets. We consider each requirement in turn.

The first prong of the rule requires a broker-dealer to segregate customer securities and related cash from the firm's proprietary business.³⁹ This helps ensure that in the event the broker/dealer becomes insolvent, customers' assets will not be subject to the claims of unsecured creditors and that customers can recover their money and securities without waiting for the resolution of the court bankruptcy proceedings. Broker/dealers can either maintain custody of clients' assets themselves or place customer assets in the custody of a qualified custodial bank. Corollary rules apply to such custodial banks. The banks may not, for instance, place any liens on the customer's assets held in custody. Here again, the purpose is to safeguard customer assets, in this case if the custodial bank rather than the broker/dealer becomes insolvent.

9.2. How Custody Could Work for Cryptoassets

Though the technology of digital assets differs from that of traditional assets, there is nothing inherent in digital asset technology to prevent a custodian from segregating a customer's digital assets. Indeed, some institutional-grade digital custodians have built businesses by assuring their customers they do just that.⁴⁰ Other crypto participants, including some exchanges and DeFi platforms, however, appear to do the opposite.⁴¹

For example, Coinbase—the largest US cryptoasset trading platform and one of a small number of crypto firms that are publicly traded—recently made a widely noticed acknowledgment. Coinbase added a new risk factor in its Q2 2022 quarterly statement filed with the SEC, stating, "Because custodially held crypto assets may be considered to be the property of a bankruptcy estate, in the event of a

bankruptcy, the crypto assets we hold in custody on behalf of our customers could be subject to bankruptcy proceedings and such customers could be treated as our general unsecured creditors."

In August 2022, however, Coinbase updated its retail user agreement to state that it is a securities intermediary and its customers' cryptoassets are financial assets.⁴²

According to one legal scholar, once an exchange files for bankruptcy, a stay goes into effect automatically to prevent collections of the property of the estate. Customers can petition the court to lift the stay, but doing so would involve time and expense with no guarantee of success.

Commingling customer and firm proprietary assets makes it likely that a bankruptcy court would consider customer assets to be property of the estate and would deem customers to be general unsecured creditors. As such, they would have no priority among creditors to recover their assets.⁴³ Any eventual recoveries could take a long time and amount to just pennies on the dollar. Customers would receive a pro rata share of leftover assets, if any are left, but only after the secured creditors have recovered their assets (or a portion of them) and other priority creditors—including the bankruptcy lawyers—received their payment.

For these reasons, investors should perform careful due diligence to assure themselves that their custodian will indeed separate their digital assets with the aim of making them bankruptcy-remote.

While the first prong of the Customer Protection Rule mandates segregation of customer assets, the second prong requires broker/dealers to obtain promptly and maintain physical possession or control over customers' fully paid and excess margin securities. This prong appears to present a greater and more innate challenge to cryptoassets than the first. Questions here revolve around the security of the private keys and the operational integrity of blockchains and smart contracts.

It is relatively straightforward to demonstrate control over the private key that controls any transfers of the digital asset itself. For instance, a broker/dealer in possession of the private keys could write a message tied to the owner's digital address. Once the message was appended to the

³⁹The rule applies to all of a customer's fully paid and excess margin securities, not to securities borrowed on margin.

⁴⁰See, for example, Charles Cascarilla's testimony in Committee on Financial Services (2021): "We are required . . . to custody client assets bankruptcy remote and fully segregated from the corporate treasury that funds our business and operations."

⁴¹For this reason, SEC Chair Gary Gensler has cautioned the public, "If the platform goes down, guess what? You just have a counterparty relationship with the platform. Get in line in bankruptcy court. The nature of this is you are basically transferring ownership on that underlying bitcoin ledger or other ledger." See Hansen and Sullivan (2022), quoting Gensler's remarks at a chat at FINRA.

⁴²See Shenson (2022), citing Section 2.7.2 (Application of the Uniform Commercial Code) in Coinbase (2022).

⁴³This may be true even if a customer's contract with the exchange assures the customers that they own the assets. See Levitin (2022): "It doesn't matter that the exchange's contract with you says that you 'own' the currency. That's not determinative of what will happen in bankruptcy."

blockchain, it would be visible to the public. In this way, an asset owner, auditor, or regulator could verify that a broker/dealer has control over the private key. To satisfy the Customer Protection Rule, however, a broker/dealer must show not just control but *exclusive* control: No one else can hold a private key. Exclusive control is critical to protect against theft, loss, and unauthorized and accidental use of the private keys.

9.3. The Potential Issues Related to the Decentralization of Transactions

In traditional finance, intermediaries and custodians rely on several established procedures and practices to demonstrate exclusive control. First, laws and regulations limit custodians to broker/dealers themselves or to qualified banks, which themselves are heavily regulated and must meet a host of conditions to safeguard assets. Second, settlement and clearing processes for traditional securities involve a number of third parties, such as clearing agencies, depositories, clearing banks, transfer agents, and issuers. These third parties can verify assets and transactions and catch mistakes or discrepancies. Third, the time lag to clear and settle transactions in traditional finance gives these agents time to cancel or reverse mistaken or unauthorized trades (SEC 2021).

Cryptoassets, however, may eliminate traditional third parties and collapse the chain of established practices. That is particularly true in DeFi, which, as the name "decentralized finance" suggests, seeks to eliminate intermediaries and enable peer-to-peer transactions. Rather than relying on a third party, DeFi relies on smart contracts, which are executed nearly instantaneously in automated processes. The immutability of the blockchain may make it difficult or impossible to cancel or reverse mistaken asset transfers.

While the private keys control the transfer of digital assets, the assets themselves reside on a blockchain. Any vulnerabilities in the blockchain itself would place the digital assets at risk of theft, loss, or mistaken transfer. For example, if certain individuals or entities held administrative keys to change the ledger—or more generally, if any party had the ability to make changes to the blockchain—that would place the digital assets residing on the blockchain at risk.

Smart contracts, which operate a layer above the blockchain itself, represent still another potential weakness. Any programming defects in smart contracts could place digital assets at risk of loss, theft, or mistaken transfer. Exploiters can and have exploited bugs in smart contract code to misappropriate digital assets.

To demonstrate exclusive control over digital assets, a custodian must address not only the security of the private keys but also the integrity of other operational elements, including the blockchain and smart contracts.

While the challenges appear novel, they do not appear insurmountable. The US Securities and Exchange Commission, in a 2021 statement, suggests a potential solution that emphasizes broker/dealer adoption of industry best practices.⁴⁴ The statement sets out a series of conditions that would allow what it calls special-purpose broker/dealers to serve as crypto custodians. Specifically, the statement assures these special-purpose broker/dealers that the SEC will take no enforcement action against them regarding the Customer Protection Rule's requirement for control over customer assets, provided that the special-purpose broker/dealers meet certain conditions.⁴⁵ The SEC limits that assurance, however, in two key ways. First, the statement applies only to those broker/dealers who limit their business solely to digital asset securities ("special-purpose broker/dealers"), which excludes the vast majority of broker/dealers who transact business in traditional assets. Second, the statement, which took effect on 27 April 2021, will expire after five years.

According to the statement, special-purpose broker/dealers could establish written policies, procedures, and controls consistent with "industry best practices to protect against the theft, loss, and unauthorized and accidental use of the private keys necessary to access and transfer the digital asset securities the broker/dealer holds in custody" (SEC 2021). The statement goes on to discuss specific best practices involving the secure generation, storage, use, and backup of private keys.

9.4. How Technology May Provide Solutions

The crypto industry has developed, and continues to develop, technological solutions to meet some of the security challenges. For example, the technique of key sharding allows private keys to be represented by multiple encrypted

⁴⁴SEC (2021) serves as a kind of SEC no-action letter. A no-action letter responds to a specific inquiry from someone about whether a particular product, service, or action would violate federal securities laws. In a no-action letter, the staff concludes that it would not recommend an SEC enforcement action based on the facts and representations presented. The SEC staff typically issues no-action letters, but it was the SEC itself that issued the statement.

⁴⁵SEC (2021): "[A] broker-dealer operating under the [prescribed] circumstances . . . will not be subject to a Commission enforcement action on the basis that the broker-dealer deems itself to have obtained and maintained physical possession or control of customer fully paid and excess margin digital asset securities."

"shards," in which no single party can authorize the transfer or disposition of the digital asset (SIFMA and American Bankers Association 2022, p. 10).

Even the immutability of blockchains may present less of a challenge than may first appear. Depending on the specific blockchain, there may be ways around immutability to correct mistaken or unauthorized transfers. For example, DeFi protocol operators may retain administrative keys, which would allow them, if they chose, to adjust the code to correct mistakes. In a more drastic step, users on a blockchain network could reach a consensus to execute a hard fork—that is, to reject the bad transactions on the blockchain and start anew as if they had never happened.⁴⁶ Though a rather extreme measure, hard forks have been known to happen. For example, Ethereum executed a hard fork in 2016 to return funds lost in 'The DAO Hack' (see, e.g., Reynolds 2021; del Castillo 2016). Still another solution, less drastic than a hard fork but perhaps just as effective, would be to write a new transaction to the blockchain that has the effect of reversing a previous one (e.g., adding new assets to an account to restore those that had been mistakenly transferred or stolen). The reversibility of blockchain transactions (or mutability) is still at the research stage (Erdine 2022).

9.5. The Emergence of Institutional-Grade Specialized Custodians

Just as new technologies have emerged, so too has a new cadre of specialized institutional-grade custodians to safeguard cryptoassets. There are at least nine state-chartered crypto custodians in the United States, all but one licensed in New York. Paxos, for example, became the first regulated digital asset financial institution in the United States when it was approved as a trust company by the New York State Department of Financial Services in 2015. In congressional testimony in 2021, the company's CEO and co-founder emphasized that his firm complies with a full gamut of requirements, including AML, asset segregation, and prudential capital reserves.⁴⁷

Nor is Paxos alone. Gemini, for instance, describes itself as a fiduciary and qualified custodian under New York Banking Law, and the firm notes that it has license from the State of

New York to maintain custody of digital assets. Gemini says that its custody solution is regularly audited and subject to the capital reserve requirements and compliance standards of a traditional financial institution.⁴⁸ Fidelity Digital Assets offers an institutional-grade crypto custodial service for its in-house products and third-party institutional investors, including hedge funds and family offices.

BNY Mellon, the United States' oldest bank, announced in October 2022 that it has begun to offer custodial services allowing certain clients to hold and transfer bitcoin and ether (Baer 2022; BNY Mellon 2022). The custodial bank also announced "plans to launch the industry's first multi-asset platform that bridges digital and traditional asset custody" (BNY Mellon 2022). BNY Mellon bills itself as the world's largest custodian bank, with USD43.0 trillion in assets under custody and/or administration (BNY Mellon 2022).

Nasdaq also plans to launch its own crypto custodial service for institutional clients, subject to regulatory approval. In September 2022, Nasdaq announced the launch of a new business unit called Nasdaq Digital Assets, with the aim of "providing trusted and institutional-grade solutions, focused on enhanced custody, liquidity and integrity" (Nasdaq 2022). The new unit plans initially to develop an advanced custody solution that will incorporate liquidity and execution services.

Prior to that announcement, Nasdaq developed a list of 10 criteria that it considers in designating a custodian as one of its Core Custodians. (Nasdaq stops short of requiring that Core Custodians always comply with all 10.) The list includes segregating individual accounts to make customers' assets bankruptcy-remote in case of bankruptcy or insolvency of the custodian. The criteria also address various aspects of handling of private keys to avoid theft or misappropriation. These include generating account-segregated private keys, storing private keys in offline digital vaults, and deploying security such as multi-signature authorization (Nasdaq 2022, pp. 4–6).

Meanwhile, the Uniform Law Commission and the American Law Institute have proposed amendments to the Uniform Commercial Code that would address virtual currencies, NFTs, and electronic fiat money.⁴⁹ Under one proposed provision, if a securities intermediary—such as a crypto exchange—agrees to treat a customer's fungible cryptoassets as financial assets, it holds those assets as a

⁴⁶The decision would be determined by a majority vote of token holders. In a number of blockchains, a small number of individuals or entities hold a large or controlling number of tokens. Thus, a majority vote could be decided by a small minority of users.

⁴⁷Charles Cascarilla's testimony in Committee on Financial Services (2021): "As a regulated trust company, we adhere to the same anti-money laundering and 'know your customer' rules as banks. We are subject to regular examinations of our operations, procedures, capital levels, and books and records. We are required to keep high capital reserves and to custody client assets bankruptcy remote and fully segregated from the corporate treasury that funds our business and operations."

⁴⁸See Gemini's website at www.gemini.com/custody, accessed 9 August 2022.

⁴⁹See Shenson (2022), citing Uniform Law Commission (2022a).

custodian (Shenson 2022). The customer would keep its property interests even if an exchange commingled the assets (Shenson 2022). Individual states must adopt the amendments before they become law. Similarly, two congressional bills address customers' rights over assets held by crypto exchanges. Specifically, the bills would require crypto exchanges to treat customer cryptoassets as belonging to the customer and generally would prohibit commingling of assets (but would allow customers to opt out of the commingling protections in certain cases; Shenson 2022).

Two financial industry associations—SIFMA, which represents major broker/dealers, and the American Bankers Association—have argued that custodial banks already have established a set of practices that can readily be applied to the safekeeping of cryptoassets. The groups classify the practices into three key principles:

- Separation of custody and trading activities
- Segregation of client assets from (the custodial) banking organization assets
- Proper control, including "management of private key technology [as] a critical and foundational element to exercising control over the asset" (SIFMA and American Bankers Association 2022)

These developments notwithstanding, the custody of cryptoassets continues to face some gaping challenges. To begin with, it is unclear whether current laws would apply to the various types of cryptoassets and, if so, to which ones in particular. For example, the Customer Protection Rule explicitly covers a customer's securities and related cash. Thus, the rule would appear to cover cryptoasset securities but not necessarily other types of cryptoassets. There may be gaps in current laws that only new ones can fill. Though policymakers and regulators increasingly have been focusing on cryptoassets, they are still struggling to develop a legal framework for them.

Meanwhile, custodial protections, like other investor protections for digital assets, remain largely untested in court. That will begin to change as the bankruptcy cases involving Celsius and other crypto entities work their way through the courts. Nonetheless, the paucity of legal jurisprudence regarding cryptoassets stands in sharp contrast to the rich body of case law and judicial precedent that traditional assets have developed over decades. To this extent, the custody of digital assets remains less secure than that of traditional assets.

10. DIGITAL FINANCE REPRESENTS A SERIOUS CONUNDRUM FOR REGULATORS AND POLICYMAKERS

10.1. The Crypto Paradigm for Regulators

Regulators around the world have had to react swiftly to a financial innovation that has been gaining traction since 2009.

Important questions regulators and policymakers have had to grapple with include the following:

- What are cryptoassets? Securities, financial instruments? Currencies? Commodities? None of these? Jurisdictional authority over cryptoassets or specific sections of the market will obviously depend on the answers to this question.
- Under what conditions should these instruments be regulated and, if so, do they fit in the existing regulatory framework or should we design specific policy and rules to address the risks they pose?
- How can regulators balance their stated intention and mandate to encourage financial innovation while continuing to protect investor interests?
- Could cryptoassets cause financial instability through new risk transmission mechanisms?
- What are the linkages between the ongoing gamification of financial markets and the development of digital finance? Should it be controlled or left to self-regulate?
- How can property rights be ascertained and enforced in a digital finance setting?
- What should be the determinants of an appropriate regulatory framework when a key objective is to avoid the risk of entrenching established players and aggravating market consolidation through higher entry costs?
- While decentralization of finance can bring efficiency benefits, should we not also worry about market integrity risks since technological advantage and information asymmetry are likely to play a key role in determining potential economic benefits in the sector? Can it be assumed *ex ante* whether digital finance will make financial markets more or less vulnerable to abuse?
- How can regulators stay technology-neutral and avoid getting involved in the adjudication of technology choices?

- If DeFi and cryptoasset services are truly decentralized, where does the accountability lie? We can enforce laws and regulations if we hold individuals and/or entities responsible, but how do we uphold the regulations or protect investors and markets if there is no one individual or entity to hold accountable? That has been a central dilemma of digital finance to the extent it aspires to be truly decentralized.

10.2. A Short Overview of the Current Regulatory Framework for Cryptoassets

In this section, we provide a brief overview of the regulatory state of play in the United States and the European Union with respect to digital finance and cryptoassets. Between them, these markets illustrate the challenges facing regulators and policymakers on the question of whether or how to regulate this new market and its expanding ecosystem.

10.2.1. United States

On 17 February 2022, the CFA Institute Systemic Risk Council (2022) sent a letter to the secretary of the US Department of Treasury, urging "the Financial Stability Oversight Council (FSOC) to address the risks to US financial stability posed by unregulated and underregulated stablecoins."

A few weeks later, on 9 March 2022, the White House (2022) released an executive order on "Ensuring Responsible Development of Digital Assets," in which it instructed much of the federal administration and related government agencies to take a series of actions ultimately aimed at coordinating regulatory and policy work on digital finance and cryptoassets: "We must take strong steps to reduce the risks that digital assets could pose to consumers, investors, and business protections; financial stability and financial system integrity; combating and preventing crime and illicit finance; national security; the ability to exercise human rights; financial inclusion and equity; and climate change and pollution."

For the time being, the regulatory landscape for all things digital finance in the United States remains fluid. The SEC considers most cryptocurrencies as securities (therefore falling under the jurisdiction of the SEC and the current securities laws, consisting of both the Securities Act of

1933 and the Securities Exchange Act of 1934). The CFTC has expressed the view that bitcoin is a commodity, while the US Treasury calls the same instrument a currency.

Most recently, as discussed in Levine (2022), the SEC clarified its view that most cryptoassets or electronic tokens meet the so-called Howey Test (SEC 2019b) and should therefore be considered investment contracts subject to disclosure and registration requirements under the securities laws.

It is not yet clear whether the SEC's approach will complement or conflict with that of other government agencies responding to the White House's executive order. At the moment, the status quo appears to be that crypto exchanges established in the United States are subject to the Bank Secrecy Act and the obligation to register with the Financial Crimes Enforcement Network, to satisfy AML, KYC, and CFT obligations.

10.2.2. European Union

In the late 2010s, the European Union determined that it needed to establish two major components for the development of its financial services sector and the completion of the Capital Markets Union:

- Sustainable finance
- Digital finance and financial technology

The European Union has endeavored since that time to develop a competitive advantage on the global scene by issuing regulations in these two sectors at an accelerated pace.

In relation to fintech and digital finance, the key texts so far have been, in sequence, as follows:

- The "FinTech Action Plan," released in March 2018 (European Commission 2018)
Largely focused on level setting of the current European fintech industry, the plan instructs the European Supervisory Authorities, along with the European Commission, to propose work aimed at determining whether specific policy, authorization, licensing, and regulations were made necessary by technological developments, including the cryptoasset sector.
- The "Digital Finance Package," initially proposed in September 2020 (European Commission 2020a)
The package builds on the FinTech Action Plan. It is composed of a specific regulation on markets in cryptoassets (MiCA; see European Commission 2020c), a

set of regulations harmonizing rules in the European Union pertaining to digital operational resilience of the financial sector (the Digital Operational Resilience Act or DORA; see European Commission 2020b), and a proposal on a DLT pilot regime to apply for wholesale services.

Most cryptoassets are currently considered out of scope in the EU regulatory framework, because they do not meet the definition of financial instruments under MiFID II,⁵⁰ but the question is not yet resolved.

In June 2022, the Council Presidency and the European Parliament reached a provisional agreement on the key MiCA regulation, which endeavors to cover out-of-scope unbacked cryptoassets, stablecoins, crypto exchanges, and crypto wallets. The regulation crystallizes the definition and scope for cryptoasset service providers (CASPs). MiCA is scheduled to come into force in 2024.

The European Union decided to move swiftly with MiCA as national frameworks were starting to emerge, including in France, Gibraltar, and Malta. Its objective was therefore to harmonize an EU-wide framework and agree on definitions and scope. By doing so, the European Union aims to provide legal certainty for the treatment of out-of-scope cryptoassets.

With MiCA, the European Union has not resolved the underlying issue of determining whether cryptoassets are financial instruments. This determination would clarify whether cryptoassets are captured under the MiFID regime. Instead, it attempts to specify which types of cryptoassets will fall under the new regime.

Thus, CASPs are defined as providers of any of the following services related to cryptoassets:

- Custody and administration on behalf of third parties
- Exchanges (both for fiat currency and for other cryptoassets)
- Execution of orders
- Placing or selling
- Reception and transmission of orders
- Providing advice on cryptoassets

MiCA characterizes cryptoassets as "a digital representation of value or rights which may be transferred and stored electronically, using distributed ledger technology or similar technology" (European Commission 2020c). Pursuant to this definition, MiCA identifies three types of cryptoassets that are in the scope of the regulation:

⁵⁰See Annex I, Section C: Financial instruments, in European Union (2014).

- Utility tokens, issued with nonfinancial purposes, such as those issued during an initial coin offering⁵¹
- Asset-referenced tokens (various asset-linked stablecoins)
- E-money tokens (single fiat currency-linked stablecoins)

As a result of these classifications, it is clear that MiCA does not cover unbacked cryptoassets, such as bitcoin and ether; it is worth mentioning that these cryptocurrencies are also not specifically captured under the Electronic Money Directive II (EMD II), which prescribes prudential and capital requirements for participating institutions defined as electronic money institutions. The fundamental conundrum is that EMD II refers to "electronic money" as a "stored monetary value as represented by a claim on the issuer which is issued on receipt of funds for the purpose of making transactions." As we have discussed previously, several cryptocurrencies lack the very notion of a centralized issuer on which a claim could be established.

With its focus on ICOs and stablecoins, MiCA leaves aside (for now) most activities linked to decentralized finance (lending and borrowing) and nonfractional NFTs.

In practice, the Digital Finance Package aims at gradually structuring the entire ecosystem of financial activities

and processes being digitalized, whether the finality of these activities corresponds to financial instruments under MiFID or out-of-scope cryptoassets under MiCA. **Exhibit 21** presents a summary of digital finance seen through the lens of EU regulation.

The Digital Finance Package appears highly skewed towards a technological framework or field of work, that of DLT and blockchain. Should financial technology evolve in different routes, it is probable that regulation will need to pivot once again. This is the reason why CFA Institute, in general, tends to favor technological neutrality.

With respect to covered institutions involved in services related to cryptoassets, MiCA provides the following rules (overview):

- Any CASP proposing to sell and promote cryptoassets in the European Union to retail investors must first disclose a white paper with the following information: characteristics, rights, obligations, underlying technology, and project details.
- Any CASP needs to receive prior authorization from a competent EU authority to begin providing services in the EU. They must have a registered office in the EU.
- Minimum capital requirements (depending on the type of services offered) must be met.

Exhibit 21. A Summary of the Regulation of Digital Finance in the EU

Digital Finance Package		
DLT Pilot Regime	MICA	Electronic Money Directive II (EMD II)
<ul style="list-style-type: none"> • Focused on financial instruments within the meaning of MiFID II that are issued, recorded, transferred and stored using DLT processes (security or investment tokens), also called <i>DLT financial instruments</i>. • The regime wants to create a framework for the effective tokenization of financial instruments. • The regime creates the possibility of benefiting from a regulatory sandbox (with minimum requirements) for the launch and operation of market infrastructure related to DLT financial instruments, including multilateral trading facilities, securities settlement systems, and trading systems. 	<ul style="list-style-type: none"> • Focused on out-of-scope (non-MiFID financial instruments) cryptoassets. • Covered instruments include utility tokens, asset-linked stablecoins, and single fiat-linked stablecoins. • The regime defines CASPs as providers of any of the following services related to cryptoassets: custody and administration; exchange; execution of orders; placing, reception, and transmission of orders; and providing advice. • The regime introduces a set of prudential and conduct rules for CASPs. 	<ul style="list-style-type: none"> • Focused on electronic money, narrowly defined as monetary value representing a claim on an issuer. • Electronic money institutions have to be granted authorization under EMD II to issue electronic money. Examples include Revolut Ltd. and Wise Payments Ltd. • The regime includes prudential and capital requirement rules.

⁵¹France already legislated on this topic, in 2019, with the *Loi Pacte*. See French Government (2019).

- Market abuse rules, with specific supervisory measures and a regime of sanctions, must be followed.
- AML/CFT provisions must be harmonized and aligned with the Financial Action Task Force (FATF) and its 40 recommendations. In this way, MiCA confirms that its definition of cryptoassets corresponds to that of virtual assets set out by the FATF (2022).

The most important development for MiCA, however, will be the design of technical standards by the European Commission, the European Banking Authority, and ESMA. The specific "Level 2" rules and parameters of application will constitute the actual demonstration of where the European Union has decided to set the bar in terms of balancing competition, innovation, economic development, financial stability, and investor protection in its search to develop a strong digital finance sector.

10.3. Key Considerations for Regulators

Based on our discussion above, it is clear that regulation of cryptoasset markets remains a patchwork of stated intentions with little coordination at an international level.

To be fair, regulators and policymakers face a myriad of challenges in overseeing this digital market. Among the most difficult issues is the highly complex and technical nature of cryptoassets themselves, which are a significant and advanced form of convergence among finance, mathematics, and technology. As a general rule, authorities are not experts in this interplay, but they are learning quickly out of necessity that DLT essentially purports to decentralize and disintermediate most of the processes upon which current regulations have been carefully crafted over the twentieth century.

As such, regulators and policymakers are essentially playing catch-up both in terms of the technology development specifically and also regarding the very real consequences these developments are having on the manner in which economic agents are conducting financial and other transactions.

The challenge here is real and testing various limits, particularly when compared to past market developments. That is, when we compare DLT and digital finance with previous financial technology developments, including alternative investments, derivatives, quantitative strategies, statistical and algorithmic trading, or even high-frequency trading and exchange co-location, there is a fundamental paradigm shift. These earlier developments pushed boundaries and tested existing regulations and policies in terms of supervisory capacity, but they did not trigger the need for regulators to revisit the very purpose and foundation of regulations in place.

In the case of blockchain technology, depending on future developments in this area, some argue that we may need to revisit the very notion of the utility of an intermediary or financial institution, as well as the traditional principal-agent relationship. In such a context, it is important to understand how investors will be protected absent intermediaries traditionally subject to conduct rules when the ultimate objective of a blockchain process is to connect users directly with little or no intermediation. Should the technological infrastructure itself be regulated, and how would regulators propose to do this? In a future state, will regulators no longer oversee business conduct as they do today but instead become regulators of computer codes, algorithms, and smart contracts?

In light of these questions, we offer a series of considerations for regulators:

- There is a dichotomy between the inherently cross-border and decentralized nature of blockchain processes and the manner in which regulators have approached this development so far; that is, each regulation considers cryptoassets from its own jurisdictional vantage point. We would advise that international regulators find ways to align and harmonize definitions and their scope of application if they intend to properly supervise the sector and control risks to financial stability and market integrity and uphold investor protection principles.
- To the extent possible, regulators around the world should develop a common perspective on whether or how cryptoassets should be considered securities (or other forms of financial instruments). If different regimes adopt different approaches on this question, it could lead to regulatory arbitrage, market fragmentation, or both. The challenge for regulators is to adopt robust policies to protect investors while encouraging the innovative development of markets and economies.
- Regulators should maintain a technology-neutral policy and uphold this principle across economic development cycles.
- Regulators should take care in measuring the state of competition in digital finance markets. The development of the cryptoasset market should not result in a simple shifting of economic power from one corner of the economic landscape (banks) to another (Big Tech). Markets should be allowed to develop without undue technological or information advantage to certain participants, which would result in flawed competition at the expense of retail investors.
- The development of cryptoasset markets should not result in a flawed price discovery mechanism because of the potential for market abuse. The high technological entry barrier in this market may facilitate market abuse or economic concentration. Regulators must

continue to be vigilant in monitoring developments in this area, which will require advanced forms of supervision based on advanced data science and technological capacity that may not exist today.

- Regulators will need to consider advanced metrics to quantify the buildup of potential systemic risk in the cryptoasset sector. From this perspective, regulators across the globe should develop common tools to measure size, risk, and interconnectedness in the DeFi market.
- Ironically, for the sector to flourish as its potential may suggest, it will also be important for regulators to strike the right balance on regulation. Recreating a cumbersome framework based on the establishment of necessary intermediaries will only serve to generate the same level of frictions observed in traditional financial mechanisms that DLT proposes to eliminate or reduce.

11. CONCLUSION

Investing in crypto, as with any asset, must be grounded in rigorous analysis. The investment case need not necessarily hinge on a discounted cash flow analysis, as venture capitalists know well. But the investments should be based on sound analysis, which often revolves around compelling use cases that either meet current demand or create and sustain a new type of demand. Analysts should ask how consumers will use a particular cryptoasset and why they will want to do so.

Expectations of profit will prove illusory if network effects and customer acquisition growth are unsustainable. For example, customers may buy a crypto token with the expectation of staking or lending it for an interest rate that far exceeds prevailing fiat rates. The platform may subsidize the rate as a customer acquisition strategy to build up scale. On the other side of the deal, traders may wish to borrow the tokens to lend them out again or to leverage them for profit (e.g., by arbitraging price differentials of the same or similar cryptoassets on different crypto platforms). Some traders use the very cryptocurrencies they borrow as collateral for their leverage. If the cryptocurrency plummets in value, these traders will be able to buy the discounted cryptocurrency in the market to pay back their loan. In effect, they have a built-in put that protects them. These types of arrangements illustrate the prevalence of circularities in the crypto ecosystem—circularities that can quickly become doomed loops, particularly if there are no end users who actually wish to use or consume the token or its related services. The entire structure likely will prove unsustainable, and at its worst, it will resemble a pyramid scheme that will eventually crash.

Proponents often speak of the future promise of cryptoassets and their disruptive technology. While investors should indeed be focused on the future, they should proceed with care. At the start of the internet revolution, we could not have predicted that today we would use our smartphones to send photos, pay bills, and adjust our thermostats. Perhaps we are at a similar stage with distributed ledger technology. We cannot dismiss the possibility that disruptive new crypto products, services, and infrastructure will emerge with unforeseen uses. We must remain open to the possibility that at least some products and services—either today's or a future generation of them—will become as indispensable as our mobile phones.

Promise alone, however, does not constitute reasonable grounds for investing. To puncture the hype, investors must think through what is actual, what is potential, and what is merely aspirational. They should also distinguish between the underlying distributed ledger technology, which could

well prove disruptive, and the business prospects for the thousands of individual cryptoassets on the market today and more to come. The disruptive power of the internet was real, but most dot-com companies did not survive to see it evolve, much less benefit from it.

We should also ask what decentralization means in the crypto ecosystem. There are plenty of centralized entities in crypto, from well-known trading platforms to entities that operate on Level II of the Ethereum blockchain. Even in DeFi networks, participants must enter and exit through interfaces that often involve centralized third parties. As our interviews made clear, fintech professionals are not uniform in their views on decentralization. One proponent of crypto's decentralizing role acknowledged to us that centralized third parties dominate the crypto ecosystem today. Nonetheless, he insisted that the profits from crypto transactions are—or have the potential to become—decentralized. Perhaps expressing an aspirational view, he argued that crypto disintermediates the profit-taking role of traditional third-party financial institutions, such as banks and brokers, and, in their place, allows individual participants to profit directly from lending, staking, or other crypto transactions.

Similarly, we also question whether crypto transactions are truly trustless or instead transfer trust from traditional institutions (again, such as banks and brokers) to the smart contracts that automatically execute transactions and to the crypto platforms that facilitate the trades.

Decentralization also poses a fundamental conundrum for regulation: how to assure accountability if the crypto ecosystem has no centralized parties to hold to account (for instance, when things go wrong in the execution of a smart contract). This dichotomy between the decentralizing aspiration of crypto, on the one hand, and the need to hold parties accountable, on the other, represents one of the most fundamental challenges facing policymakers.

It is clear to us that the crypto ecosystem urgently needs a strong, clearly defined regulatory framework. It will benefit providers and users alike. There must be no diminution of investor and consumer protection or market integrity in the name of technological innovation. Revolutionary or not, technology alone cannot offer protection from age-old financial misdeeds, ranging from market manipulation and front-running to fraudulent disclosures and Ponzi schemes.

A strong regulatory framework also serves the best interest of the entrepreneurs and others who are building the

crypto ecosystem, as they themselves repeatedly have told us. The crypto ecosystem cannot remain in an ambiguous or inchoate state, and it must shed its Wild West image. Policymakers must either agree on the application of existing laws to various components in the crypto ecosystem or craft new laws to fill in any gaps. Trust in the integrity of

crypto markets is essential to attract investors and build crypto networks to scale. Regulation need not stifle innovation; on the contrary, a legal and regulatory framework that protects investors and ensures market integrity constitutes an indispensable precondition if the promises of crypto are to become reality.

12. GLOSSARY

Consensus mechanism (or consensus-based verification process)

Consensus in distributed systems is ensuring that a state, value, or piece of information is correct and agreed on by most nodes. A consensus mechanism guarantees this effort is carried out fairly and independently of any interested party, or in the case of private permissioned networks, to achieve other objectives desired by the network.

Source: Parma Bains, "Blockchain Consensus Mechanisms: A Primer for Supervisors," FinTech Notes 2022/003, International Monetary Fund (2022). www.imf.org/en/Publications/fintech-notes/Issues/2022/01/25/Blockchain-Consensus-Mechanisms-511769.

Cryptoassets (or digital assets or virtual assets)

This definition is used by the Federal Reserve System in the United States: "A crypto-asset generally refers to any digital asset implemented using cryptographic techniques."

Source: See Footnote 1 in Board of Governors of the Federal Reserve System, "SR 22-6/CA 22-6: Engagement in Crypto-Asset-Related Activities by Federal Reserve-Supervised Banking Organizations" (16 August 2022). www.federalreserve.gov/supervisionreg/srletters/SR2206.htm.

This definition is used by the Financial Action Task Force (FATF) and in the EU: "A crypto-asset means a digital representation of value or rights which may be transferred and stored electronically, using distributed ledger technology or similar technology."

Source: FATF, "The FATF Recommendations" (amended March 2022). www.fatf-gafi.org/publications/fatfrecommendations/documents/fatf-recommendations.html.

Cryptocurrency

A cryptocurrency is a form of decentralized money that only exists digitally on a blockchain. Rewards of cryptocurrency incentivize participants to validate transactions on that blockchain.

Source: Morningstar, "Morningstar's Cryptocurrency Landscape" (2022). www.morningstar.com/lp/cryptocurrency-landscape.

Decentralized finance (DeFi)

DeFi commonly refers to the provision of financial products, services, arrangements, and activities that use distributed ledger technology (DLT) in an effort to disintermediate and decentralize legacy ecosystems

by eliminating the need for some traditional financial intermediaries and centralized institutions.

Source: IOSCO, "IOSCO Decentralized Finance Report" (March 2022). www.iosco.org/library/pubdocs/pdf/IOSCOPD699.pdf.

Locking

Locking involves depositing cryptoassets with a protocol in exchange for tokens for a period of time during which the assets cannot be withdrawn until the end date.

Source: IOSCO, "IOSCO Decentralized Finance Report" (March 2022, p. 31). www.iosco.org/library/pubdocs/pdf/IOSCOPD699.pdf.

Metaverse

The metaverse includes any digital experience on the internet that is persistent, immersive, three-dimensional, and virtual (i.e., it does not happen in the physical world). Its experiences allow us to play, work, connect, or even purchase products.

Source: Deloitte, "Metaverse: Applications and Business Opportunities." www2.deloitte.com/th/en/pages/about-deloitte/articles/metaverse-en.html.

Non-fungible token

"A non-fungible token (NFT) is a unique, cryptographic unit of data that exists on a distributed ledger and cannot be replicated. Individual NFTs are not mutually interchangeable, which means no two are the same. They can represent digital media or real-world, tangible items like artwork and real estate, which makes buying, selling, and trading them more efficient, while reducing the probability of fraud. NFTs can also represent things like identities, property rights, or even a bundle of rights—all encoded into digital contracts or attestations."

Source: Deloitte, "Blockchain & Digital Assets." www2.deloitte.com/us/en/pages/about-deloitte/solutions/blockchain-digital-assets-definition.html.

Proof-of-stake consensus mechanism

This consensus mechanism uses an ownership model, requiring participants to lock up a certain amount of cryptocurrency as collateral to validate blocks on the network. A selected group of validators works one block at a time, which makes this consensus mechanism more energy efficient than proof of work.

Source: Morningstar, "Morningstar's Cryptocurrency Landscape" (2022). www.morningstar.com/lp/cryptocurrency-landscape.

Proof-of-work consensus mechanism

This consensus mechanism relies on competition between volunteers called "miners" to validate blocks. Every volunteer receives a copy of a block awaiting validation, triggering a race to identify the hash code that will validate the transaction. The first miner to correctly find the hash code receives newly minted coins as their reward.

Source: Morningstar, "Morningstar's Cryptocurrency Landscape" (2022). www.morningstar.com/lp/cryptocurrency-landscape.

Smart contracts

"Smart contracts are simply programs stored on a blockchain that run when predetermined conditions are met. They typically are used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss. They can also automate a workflow, triggering the next action when conditions are met."

Source: IBM, "Smart Contracts Defined." www.ibm.com/topics/smart-contracts.

Staking

"Staking is locking up crypto assets to earn a return on your principal and help secure the blockchain. The blockchains that support the staking process run on

the proof-of-stake consensus mechanism. Nodes with staked cryptocurrency validate new blocks and receive a yield on their investment."

Source: CoinMarketCap, "Staking."

<https://coinmarketcap.com/alexandria/glossary/staking>.

Yield farming

"Yield farming or liquidity mining is a process allowing DeFi users to lock up their crypto-asset holdings in applications and generate rewards in exchange for the provision of liquidity to the system (interest or new tokens issued by the protocol)."

Source: OECD, "Why Decentralised Finance (DeFi) Matters and the Policy Implications" (2022, p. 9). www.oecd.org/daf/fin/financial-markets/Why-Decentralised-Finance-DeFi-Matters-and-the-Policy-Implications.pdf.

Web 3.0

Web 3.0 "refers to a decentralized, blockchain-based online ecosystem posited to be the next iteration of the world wide web. Platforms and apps built on Web3 aren't owned or governed by a central authority, rather they are owned by network participants, who earn their ownership stake by helping to develop and maintain those services."

Source: Deloitte, "Blockchain & Digital Assets." www2.deloitte.com/us/en/pages/about-deloitte/solutions/blockchain-digital-assets-definition.html.

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