



THE STATE STREET DIGITAL DIGEST

Symbiotic Solutions

The Role of Industry, Technology and Regulations
in Meeting the Challenges of a Digital Future

April 2023

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State Street Digital Digest, Fall 2022

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Preface

Top-down, bottom-up, or somewhere in-between? In establishing the combination of influences necessary to make digital assets a safer and more trustworthy space for institutions and how they interact with each other, this might be the essential regulatory question in the digital finance space (perhaps a matter even more pressing than arriving at legal clarity around the classification of digital assets as either a commodity or a security).

The January issue of our award-winning Digest examined how legislators, regulators and responsible agents such as State Street were entering the digital finance market. In this edition, we advance that conversation by analyzing how these actors are mutually shaping each other's thinking and behavior, and are providing solutions to each other's challenges.

Challenges often take the form of questions, and there's no shortage of them in the digital finance regulatory space. Top-of-mind ones include:

- How symbiotic will regulation and emerging technology need to be when developing in tandem with each other?
- Where might tensions exist between consumer desire for simpler, easier, more streamlined ways to trade assets, and what do governments and oversight bodies require of regulating intermediaries to ensure investor protection and market integrity?
- Can technology used to tokenize existing asset classes be brought into today's financial infrastructure and, as a result, help modernize it? And might tokenization lead to further fragmentation of that infrastructure (as well as fragmentation between public and private blockchains)?
- Does new technology also have the potential to advance regulatory movement? And will embedding regulatory constraints and compliance tenets into that structure make it more efficient (similar to the regulatory implications of T+1 or T+0 rule changes)?
- Do we need a new regulatory framework to deal with crypto assets or can they live within existing national structures? For example, how do Markets in Crypto-Assets regulation (MiCA) and Markets in Financial Instruments Directive (MiFID II) in EMEA build upon pre-existing approaches?

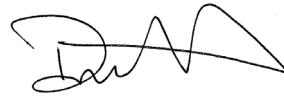
Suggested by all of the above looms the bigger question: will the answers to all of this feel more like a revolution or evolution?

This quarter's Digest attempts to grapple with these issues and more. It features articles on how varying property laws and the absence of consistent legal definitions of digital assets across jurisdictions can present regulatory challenges; the role responsible market participants and stewards of institutional assets play in teasing out digital asset ownership questions; our outlook on how crypto and digital asset markets might operate in the near-term; an analysis of Bitcoin's performance, in the recent period of high inflation, relative to other assets; consideration of geographic disparity and competition and how differing postures on all things digital might lead to a kind of regulatory arbitrage; and a continued expansion of our living glossary of handy digital finance terms.

Legislators and regulators increasingly view digital assets as a topic that needs to be urgently addressed. State Street supports healthy regulation in the space to prevent

disasters like FTX in the future, and believes that rigorous compliance, governance and risk practices will provide a competitive advantage in the digital space. But where will those mandates emerge from most powerfully: top-down or bottom-up? We're looking forward to meeting the future in the happy middle.

Sincerely,



Donna Milrod
Chief Product Officer and
Head of State Street Digital®

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Section 1

2023 Outlook for Digital Assets

By Nitin Gaur

Global Head of Technology and Asset Design,
State Street Digital®



Undoubtedly, 2022 was a tumultuous year for cryptocurrencies. The FTX fiasco dominated the news cycle at end of the year. It followed what I have labelled the 'contagion of incompetence' — the crash of the Luna crypto network in May, the bankruptcy of crypto lender Celsius in June and the collapse of crypto hedge fund 3AC in July.

The entire year was sprinkled with hacks, rug pulls and ill-designed protocols leading to crypto scams. According to Forbes research, the industry lost nearly US\$1.5 trillion worth of market capitalization in 2022, triggering an array of actions by regulators, a series of enforcement actions and mass liquidation of crypto assets, further adding downward pressure on crypto asset valuation. This not only caused panic amongst regulators over concerns about the stability of global financial systems but also massive reputational damage to the entire industry and its workforce.

Historically, market changes in the crypto industry have been grassroots ones, with changes being driven by entrepreneurs and the community. Therefore, I am confident the industry will once again pivot and shift through these forces and emerge with a stronger foundation. For this to occur, however, the industry needs a sound market structure and systemic independence from current transactional systems. The industry must not only coexist with current market structures but also act as a bridge for current asset classes.

The 2023 narrative for the crypto industry should start with new energy, include the application of existing technology innovations, centre on growth and mainstream adoption, and involve regulatory clarity and technological innovation. I have taken a pragmatic approach to better define the digital asset space (shifting away from 'crypto' as a catch-all term) and understand the utility of assets and value drivers. The industry needs to focus on robust infrastructure investment that emphasizes processing efficacy for the verification and validation systems that blockchain and

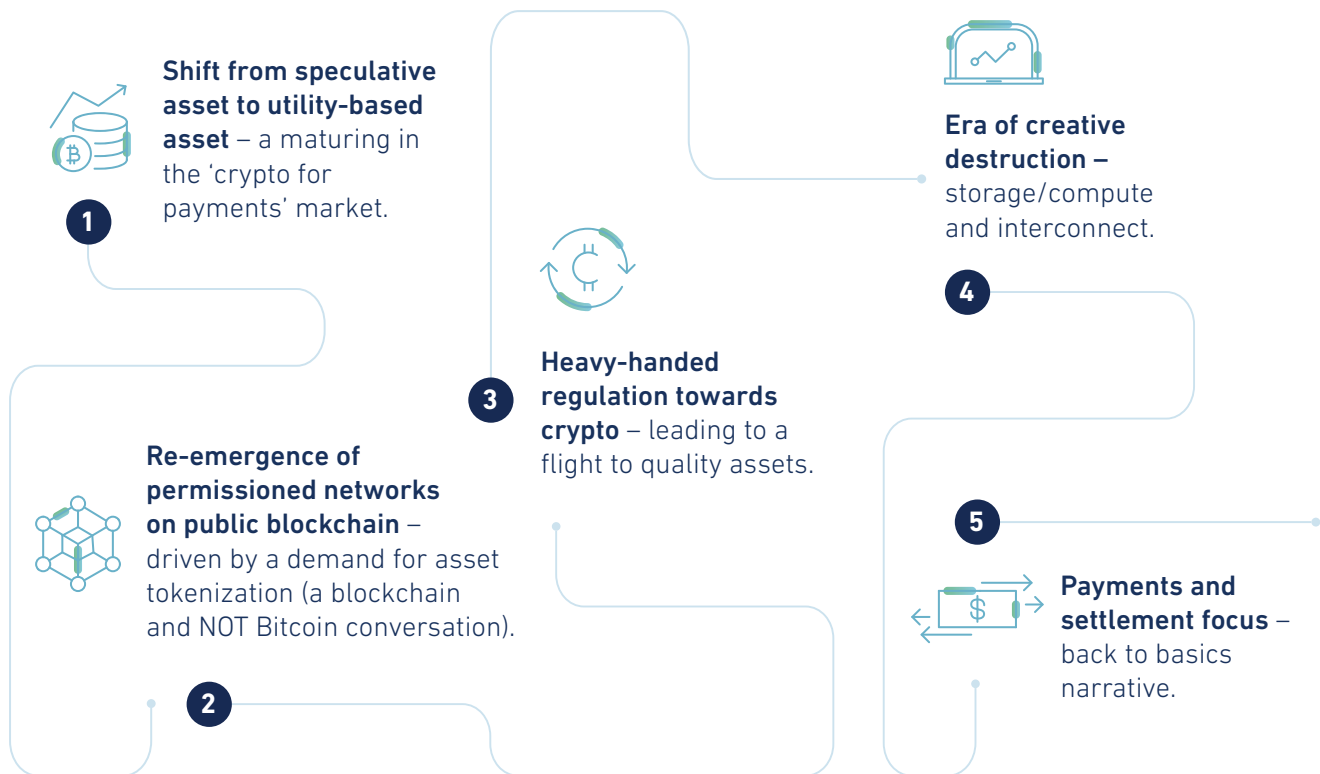
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The industry lost nearly US\$1.5 trillion dollars worth of market capitalisation, triggering an array of actions by the global college of regulators

Distributed Ledger Technology (DLT) employ. It also needs sturdy scaffolding on which to build an edifice of transparency, data processing and the capacity to understand utility metrics. It must also discern between fraud, protocol design deficiencies, technical hacks and tokenomics design. To employ true digital commerce powered by blockchain-based digital transaction systems and create robust Decentralized Autonomous Organizations (DAOs) that can digitally enter into contractual engagements with peer DAOs, we will need a significant investment

in underlying infrastructure to embed trust and protect against the vulnerabilities seen in 2022, which had been building over the last decade. We cannot build decentralized castles on weak foundations. We will need a strong infrastructure layer, which includes (but is not limited to) decentralized storage, compute, interconnect and structures supporting governance systems embedded into various protocols, starting from Layer 1 systems.

To that end, I have identified five perspectives that I believe will guide digital finance developments in 2023:





1. Shift from speculative asset to utility-based asset – a maturing in the 'crypto for payments' market.

In 2022, the crypto market saw significant growth as institutional investors entered the market, driving up the price of many cryptocurrencies. This trend was driven by a growing recognition of the potential for cryptocurrencies to serve as a store of value and a means of payment. The industry needs to focus on a shift from speculative to utility-based assets in the crypto asset market. The utility can only be driven by the increasing number of real-world applications for crypto and other digital assets and the growing adoption of blockchain technology. This trend of focusing on utility is likely to continue in the coming years, as more use cases for crypto and other digital assets are developed and more people become familiar with the technology. The development of real-world use cases, such as decentralized finance (DeFi) and non-fungible tokens (NFTs), has helped establish their baseline value and utility beyond speculation (although this is debatable for NFTs). My hope for 2023 is that regulatory developments and increased government oversight provide more clarity and stability to the crypto market, making it more attractive to investors who are looking for utility-based assets with real-world applications.



2. Re-emergence of permissioned networks on public blockchain – driven by a demand for asset tokenization (a blockchain and NOT Bitcoin conversation).

The permissioned blockchain always emerges when public networks and related assets are in question. However, this time, the conversation is less about private networks than it is about permissioned structures on public blockchain utilities. As the conversation around tokenization of existing asset classes gains traction, this technology trend is taking shape as financial services and adjacent industries, especially in private markets, adopt blockchain and tokenization as their foundational transaction infrastructure. The re-emergence of permissioned blockchain networks can be attributed to several factors, including the need for increased privacy and security in certain use cases, such as financial services and supply chain management. Permissioned blockchains can offer greater control over the network and its participants, as well as improved scalability and faster transaction times, and meet the burden of regulatory reporting requirements. Overall, the re-emergence of permissioned blockchain networks is a sign of the continued growth and evolution of blockchain technology and its use cases, and it will be important for the industry to carefully consider the trade-offs and challenges associated with this 'private versus public' approach.



3. Heavy-handed regulation towards crypto – leading to a flight to quality assets.

As governments and regulators around the world increase their scrutiny of the crypto market, investors may seek out high-quality assets that are less likely to be affected by regulations or enforcement actions. For instance, cryptocurrencies with a strong track record of security and compliance, such as Bitcoin or Ethereum, may be more attractive to investors than newer or less established assets. Similarly, cryptocurrency exchanges and other service providers that have a strong reputation for security, compliance and transparency may be more appealing to investors than those that are perceived as less reliable. We saw this during 2022 with a rise in institutional adoptions, such as hedge funds, pension funds and endowments. As supporting financial institutions and market utilities gravitate toward regulatory certainty to support asset classes, wider support from mature financial institutions entering the crypto industry is leading the flight to quality limited assets. This has played an important role in terms of market depth and has set an example to other asset classes aspiring to achieve a Bitcoin-like quality characterization. Bitcoin does provide utility to institutional investors as a store of value and not a payment or settlement instrument.



4. Era of creative destruction – storage/ compute and interconnect.

Infrastructure investment, file storage protocols, meaningful use cases of NFTs/gaming and new enterprise entrants, including permissioned DeFi, all represent creative destruction.

In periods of rapid change and innovation, new and disruptive technologies displace established ones. During this era, the crypto market is likely to experience a high degree of volatility, with some cryptocurrencies and digital assets rising to prominence while others fade away.

However, along with the opportunities for growth and innovation, the era of creative destruction in cryptocurrency also comes with risks and challenges. The lack of regulation in many countries and the relative inexperience of many investors in the crypto market can make it difficult for start-ups, companies and individuals to navigate the complex and rapidly changing landscape. It is important for those involved in the crypto market to stay informed and adapt quickly to changes in order to remain competitive and successful.



5. Payments and settlement focus – back to basics narrative.

Bitcoin triggered a revolution, and it originally aspired to embody properties of money, such as a store of value, unit of account and medium of exchange. This conversation is back on the table to address the cross-border movement of money and related assets – still an unresolved issue – at a global scale. Bitcoin, the Lightning Network, stablecoins and Central Bank Digital Currencies (CBDCs) all are part of the narrative to solve this issue. The rise of stablecoins and CBDCs also raises a number of challenges and risks, such as the potential for greater centralization, the need

for adequate regulations to protect consumers and the potential impact on financial stability and monetary policy. Bitcoin and the Lightning Network are being used by innovative payment service providers to embark on a global low-cost payment system, but stablecoins and CBDCs are likely to have a profound overall impact on the payment and settlement landscape as well. So, it is important for governments, financial institutions and market participants to closely monitor and adapt to these developments.

Conclusion

Wider adoption, technological innovation and regulatory clarity will continue to drive the adoption of digital assets in 2023. Regulatory clarity and consistency are also expected to play a major role in the growth of the crypto market. As governments and regulators around the world develop more comprehensive and consistent regulations for cryptocurrencies, it could provide a more stable and predictable operating environment for market participants and help increase the overall legitimacy and appeal of cryptocurrencies.

Overall, the crypto market is likely to continue to evolve and grow in the coming years, and there are many reasons to be optimistic about its potential. Of course, there are also risks and uncertainties associated with investing in cryptocurrencies as an asset class. Hence, our focus should turn to utility, which not only strengthens the use case narrative but also provides a narrative of effective technology–use and not just another speculative asset. This narrative is vital for long-term growth and will help repair the reputational damage of crypto as an industry.

Section 2

Tokenization and Regulation – What Exists and What Is Needed?

By Justin McCormack

Head of Legal,
State Street Digital®

As the wintry weather for cryptocurrencies continues, efforts to tokenize traditional assets, such as securities and real estate, are starting to create a break in the clouds. While cryptocurrencies and tokenized assets both rely on tokens and distributed ledger technology (DLT), the key difference between the two types of tokens is what they represent.

Cryptocurrencies generally do not have any particular asset backing them, while tokenization of traditional assets is meant to use a token to represent a claim to a particular asset or right that has a verifiable value. From a legal and regulatory perspective, key questions in tokenization are whether the resultant token effectively represents the stated claim, whether transfers of such tokens will effectively transfer the legal rights that they represent and whether there is market infrastructure to support their use.

In this article, we explore the fundamental question of what is a token from a legal and regulatory perspective, including activities being taken by various legislators and regulators to help provide clarity. We then focus on security-related tokens and explore the concept of effective transferability, identifying certain limitations that currently exist in many financial markets and how regulation can help address those items. Finally, we examine certain novel aspects for service providers and investors in security-related tokens and how regulatory developments can provide some welcome clarity.

What Is a Token?

As noted in the article *The Property Law of Tokens*¹ by Moringiello and Odinet, the concept of using tokens has been around for centuries. More specifically, the authors note that there are “bodies of law that recognize the fact that possession or control of one thing, usually a piece of paper, may convey certain exclusive or relative rights in something else, which may be either an intangible right or a tangible asset”.² One example of legacy ‘tokens’ is negotiable instruments, which are governed by a legal framework that enables pieces of paper that satisfy specific requirements to “confer rights that are different from those conferred by an ordinary contract written on paper”.³ In the United States, this body of law is contained in the Uniform Commercial Code (UCC), which is a uniform law governing commercial transactions that is generally adopted by all states. The UCC is a statutory law that provides a framework for commercial transactions, such as transfers and security interests, enabling market participants to have confidence in the fact that a transferrable item representing

rights to a particular asset or claim that meets the requirements of, and is transferred in accordance with, the law will be respected by other market participants.

With that baseline, the question then becomes whether a digital token created through a tokenization exercise will be respected under the law to represent the specified rights, including when transferred among market participants. The Uniform Law Commission, the organization responsible for drafting uniform laws such as the UCC for consideration by the states, has addressed this by proposing a number of amendments to the UCC to accommodate certain digital assets. More specifically, the commission proposed a new Article 12 which introduces the concept of a 'controllable electronic record', which is "a record stored in an electronic medium that can be subjected to control" as defined under the act.⁴ As with other assets under the UCC, Article 12 also makes controllable electronic records subject to the so-called 'take free' rule, which provides that a good faith purchaser who acquires control of a controllable electronic record without knowledge of any competing claims of a property interest in that controllable electronic record acquires it free of any such competing claims that may actually exist.⁵ This is the same treatment, for example, that applies to a negotiable instrument. In addition to the creation of Article 12, the Uniform Law Commission also proposed a number of amendments to incorporate the concept of controllable electronic records into other relevant parts of the code, such as those governing security interests and

securities intermediaries.⁶ Article 12 and these amendments are in the process of being reviewed by the states to consider adoption.

In the United Kingdom, the UK Law Commission published a consultation on digital assets⁷ that provisionally proposed the explicit recognition of a 'third category' of personal property under English law (distinct from 'things in possession' and 'things in action'), which are referred to as 'data objects', to govern digital assets. Similar to the UCC, the UK Law Commission's proposal also incorporated the concept of a 'take free' rule for data objects. If adopted, this concept, as well as others, would facilitate orderly commercial transactions in digital asset tokens. The similarities to the UCC would also help in the promotion of consistency across jurisdictions, which is beneficial given the inherently cross-border nature of digital assets.

In the European Union (EU), while a comprehensive regulation governing the provision of services with respect to certain digital assets, referred to as the Markets in Crypto-Assets regulation (MiCA), has been finalized and is expected to be adopted in the coming months, the commercial law aspects of tokens have not been addressed bloc-wide. There are, however, certain jurisdictions within the EU that have adopted local frameworks to recognize the ability to use tokens for the representation and transfer of unlisted securities. One of the leading jurisdictions is France, through its amendment of the French Financial Code (*Code monétaire et financier*)⁸ to enable issuers to issue security tokens in registered form (not bearer form) provided

that they are not listed on an exchange or admitted to the operations of a central securities depository.⁹ In addition, Luxembourg similarly has adopted legislation¹⁰ supporting a framework in which the issuance, conversion or transfer of dematerialized securities can be affected by registering the securities through the use of accounts on DLT.¹¹ Of note, the European Investment Bank (EIB) has conducted two separate fully digital native bond offerings to date, one under French law and the other under Luxembourg law.¹² Finally, through adoption of the German Electronic Securities Act (*Gesetz über elektronische Wertpapiere – eWpG*),¹³ issuers can now issue dematerialized securities through entry of those securities into an electronic securities register, which can be maintained solely on DLT by a crypto securities registrar.¹⁴ The ability to issue securities in such token form is currently limited to bearer bonds and fund units to the extent not listed on an exchange or admitted to a central securities depository.¹⁵

Custody banks have a long history of providing safekeeping services for their clients, on the basis of a clearly defined body of law and regulation that defines and supports the clients' ownership rights.

Security Tokens and Transferability

With an understanding of how to consider the legal rights embodied by a token, it is then important to evaluate how those tokens can be used. As noted above, a key use case for tokens is security tokens. While the ability of a token to represent a security is addressed in a number of jurisdictions, transferability of those tokens is subject to a number of limitations that will need to be addressed in order to facilitate broader adoption of DLT in the securities issuance and transfer process. These limitations include restrictions on the ability to list natively-issued security tokens on regulated exchanges as well as challenges for broker-dealers in complying with certain aspects of the existing regulatory framework for trading of securities.

For example, while France, Luxembourg and Germany have all adopted legislative frameworks for security tokens, those frameworks do not apply to listed securities handled through a central securities depository. A key factor in this limitation is Article 3(2) of the EU Central Securities Depositories Regulation (CSDR),¹⁶ which states that securities can only be listed on a trading venue if they are recorded in book entry form on a central securities depository.

In the US, the existing regulatory framework for secondary trading of listed securities requires the involvement of a number of intermediaries, including registered broker-dealers. Attempting to reconcile the operation of DLT with certain requirements to which broker-dealers are

subject to, raises a number of questions, including how to demonstrate possession and control of customer securities. In an effort to help address some of these questions, the Securities and Exchange Commission (SEC) issued a statement in February 2021¹⁷ that created a five-year sandbox-like environment, whereby, if a broker-dealer complied with the framework, they would not be subject to an enforcement action for failing to comply with possession and control requirements. Some of the conditions to the framework are not easily met, such as the requirement that the broker-dealer limit its business to digital asset securities only, but its existence may prove useful if the creation and trading of security tokens becomes more widespread.

Service Provider Considerations for Token Holders

An additional relevant factor in the widespread adoption of security tokens is the existence of reputable service providers for needed investment services, such as securities exchanges, custody and related services.

Exchanges: Widespread adoption of security tokens will require the ability to trade the assets on multilateral trading venues. The exchange model that has developed for cryptocurrency tokens typically requires investors to pre-fund their exchange accounts before executing a trade. The SEC recently proposed a rule¹⁸ under the Advisers Act of 1940 that would call this model in to question for DLT tokens generally (i.e., both cryptocurrencies and security tokens). While the proposal contains a number of changes that are beyond the scope of this article, in the context of digital assets, the change to the definition of who would be eligible as a 'qualified custodian' would have a significant impact on the pre-funded trading model. Advisors would be required to hold all of their managed assets (not just funds and securities as is the case under the current rule) with a qualified custodian at all times. Commentary to the proposal provides, however, that many of the existing crypto asset exchanges would not be eligible as qualified custodians. As a result, the current DLT token trading model requiring pre-funding of trades would not be permissible for assets, whether cryptocurrencies or security tokens, managed by a registered investment advisor. All is not lost, however, as there are a limited number of SEC-registered alternative trading



systems that support the trading of digital asset securities without requiring pre-funding.¹⁹ Further review will be needed to determine the efficacy of these models, but at least they provide an avenue of exploration that could facilitate wider adoption of tokenization of securities.

Custody: Custody banks, such as State Street, have a long history of providing safekeeping services for their clients on the basis of a clearly established body of law and regulation that defines and supports the client's ownership rights over assets held in custody. In the banking industry, the safekeeping of client assets incorporates three core principles which are designed to effectively manage the potential risk of misappropriation or loss of assets. These principles can be summarized as follows:

- **Separation of Financial Activities:**
Safekeeping operations must be functionally separated from trading and other similar market activities.
- **Segregation of Client Assets:**
Client assets must be segregated at all times from the bank's proprietary assets to help ensure that they are bankruptcy remote.
- **Proper Control:**
The custodian must maintain proper control over client assets in order to identify the entitlement holder and to mitigate any 'single point of failure' in the record of ownership.

These principles apply equally to security tokens on DLT. While the first two items are relatively straightforward, custodians may not be clear as to how to provide evidence of control over security tokens. The core focus of such control will likely hinge on private key management practices. Qualified custodians who are pursuing development of digital asset custody solutions will undoubtedly be focused on designing robust key management solutions and will be looking to ensure they meet relevant regulatory expectations.

In the commentary to the SEC proposed rule referenced above, the SEC provided some clarity on its expectations on this topic:

For example, under the proposed rule, a qualified custodian would have possession or control of a crypto asset if it generates and maintains private keys for the wallets holding advisory client crypto assets in a manner such that an adviser is unable to change beneficial ownership of the crypto asset without the custodian's involvement.

While this is just a proposal, it does provide some guidance to market participants as they design their systems to be able to service the expected growth in tokenized assets.

Depository: Certain collective investment vehicles in the EU are required to engage a depository to provide safekeeping. A depository's obligations include, among other things, recordkeeping, ownership verification and, where the asset in question is a financial instrument to be held in custody, custody of such asset. While MiCA and certain European national laws provide some guidance on effective custody of digital assets, the ownership verification requirement is more challenging. To the extent the rights embodied in the token or the legal status of the token are not clear in a particular jurisdiction, it may be difficult for a depository to assume the obligation to verify ownership of such token. Efforts made to clarify the legal status of tokens, particularly in the case of security tokens such as noted above, as well as guidance from local regulators on best practices for ownership verification will help facilitate the development of depository services for tokenized assets.

Financial Infrastructure Technology Is Evolving; the Regulatory and Legal Framework Needs to Evolve as Well

The technology powering the global financial market infrastructure is rapidly evolving with the growth of DLT. The core application of such technology in financial markets is tokenization of traditional assets, such as security tokens. Broad adoption and use of security tokens requires the development or confirmation of a commercial law framework for the rights embodied by a token and their ability to be transferred with legal effect; the development of market regulations supporting the trading of such instruments and regulatory clarity on how service providers can meet their obligations while interacting with the new technology. A number of these issues are challenging, but steps are being taken in a number of jurisdictions as noted above to begin the evolution of the regulatory and legal framework.

Section 3

Challenges to Organizations Creating Digital Custody Propositions

By Swen Werner

Head of Custody, State Street Digital®

Dayle Scher

Research Principal, Celent



In this article, State Street and financial services technology consultants Celent discuss a number of problems that have to be solved to create a workable custody proposition for digitally tokenized assets and a blockchain-based trading environment.

Despite recent market events and the collapse of a number of crypto platforms, there remains significant institutional interest in investing in digital assets as a means of achieving alpha, or of gaining experience interacting with these assets. State Street and Celent's recent research showed that many institutional investors are still planning to move ahead with preparations for digital assets and tokenization, despite the market downturn. While our research found high levels of interest in digital assets, we also found that in the short- to medium-term future, asset owners expect to take a hybrid approach, investing in both traditional and digital assets. Indeed, most of the top global custodians either already do or have plans to support and service digital asset holdings.

At its core, crypto custody shares the same basic objective as traditional custody services: the safekeeping and servicing of assets. However, due to vast differences in the underlying blockchain technology supporting digital assets, how they achieve this diverges significantly. In several areas, Whereas traditional custodians exercise control over securities by maintaining accounts at various sub-custodians and central securities depositories (CSDs), crypto custody requires cryptographic processes (key management)

instead to transfer digital assets recorded on cryptocurrencies' respective blockchains.

Cryptocurrencies are not traditional financial instruments and can present legal challenges around how to establish property rights. Although cryptocurrencies can be maintained without an intermediary (i.e., investors manage their own wallets and keys), many investors are choosing a specialized custodian as a preference or for regulatory compliance reasons, although the regulatory status under which a crypto-native custodian or with a traditional custodian operates will have material impacts on anything from services offered, to investor protection.

Regulated banks are viewed as trusted institutions, when it comes to custody, with some having been around for centuries. They have the expertise, processes and controls that people look for when it comes to their investments, and are generally subject to a comprehensive set of regulations covering behavior, capital requirements, reporting and safeguarding of assets.

The aforementioned Celent research identified that institutional investors are comfortable with traditional custodians, with nearly three-quarters preferring an integrated provider for their digital asset servicing.

The use of blockchain technology reveals a new set of risks that must be considered by investors and regulators alike, particularly since traditional process methods do not extend directly to servicing digital assets, whilst the overall control principles (eg. segregation or dual controls) are independent of technology. The following are some of the areas worth mentioning:

Segregation of Client Assets

The Securities and Exchange Commission (SEC) asserts that “segregation is a fundamental element of safeguarding client assets” and considered bringing crypto currencies within scope of its “custody rule” as seen in its proposed rule — **Safeguarding Advisory Client Assets** — currently out for comment. The SEC “continues to believe that segregation is a fundamental element of safeguarding client assets” by qualified custodians. The proposed requirement is meant to ensure that client assets are easily identifiable as client property. According to the regulator, client assets must remain ‘available’ to the client, despite custodian default, insolvency, or even if the custodian’s creditors assert a lien against its proprietary assets or liabilities.

As was seen in the Celsius bankruptcy in July 2022, most of its customers will be last in line for repayment. In **January 2023**, a United States bankruptcy judge ruled that Celsius owns most of the cryptocurrency that customers held in its interest-bearing ‘earn’ accounts (as opposed to its ‘custody’ accounts that did not generate interest), impacting an estimated 600,000 accounts with assets valued at US\$4.2 billion.

Reconciliation

Segregation of assets applies to custodian versus client assets as well as client assets versus client assets, and requires appropriate controls to ensure that segregation is achieved. Effective segregation requires controls such as consistent and frequent reconciliation, which is subject to supervision and audits. In traditional securities markets, the custody reconciliation process is in place to identify and resolve differences in holdings and transactions between its own records and those of the sub-custodian or central securities depository. Larger custodian banks employ teams of employees to complete this function. The data model of blockchain requires new methodologies: there is no Start of Day/End of day. Ledger information is stored as transactions records, as opposed to account balances. This is information typically required to perform reconciliation. So where does that leave the digital custody industry?. In the Celsius example, neither client versus client segregation nor custodian versus client segregation protocols were in place. Additionally, Celsius did not reconcile the number of coins reflected in

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U.S. bankruptcy impacting an estimated 600,000 accounts with assets valued at \$4.2 billion (USD)

the custody accounts with the number of coins actually held in the custody wallets. In fact, there were no documented reconciliation processes, policies and procedures in place. The aforementioned technical challenges, however, don't resolve the issue that segregation without controls is insufficient, as the Celsius example shows.

Conclusion

When considering the differences between crypto and traditional custody, it is important to understand that it is not just about the technology; it is about the need to ensure the safety of clients' assets. An investor's due diligence process for custodian providers will need to evolve to reflect that the types of protection mechanisms and controls for digital assets can differ compared to traditional assets.

As digital assets become increasingly integrated into traditional investment portfolios, it is crucial that investors and regulators alike understand the differences between traditional and digital asset custody. While both aim to achieve the safekeeping and recording of assets, there are fundamental differences in how they are executed. Custodial services must develop new methods and controls to ensure that customer protections are in place and the residual risk is understood when dealing with digital assets.

As the digital asset market continues to grow and evolve, it is critical for investors to be able to trust that their chosen custodian fully understands the complexities of digital asset custody, including how to implement the appropriate safeguards for the digital asset world, that investors and regulators have come to rely on in the traditional asset world.



Section 4

Does Bitcoin Supply a Hedge Against Inflation?

By Michael Metcalfe

Global Head of Macro Strategy,
State Street Global Markets



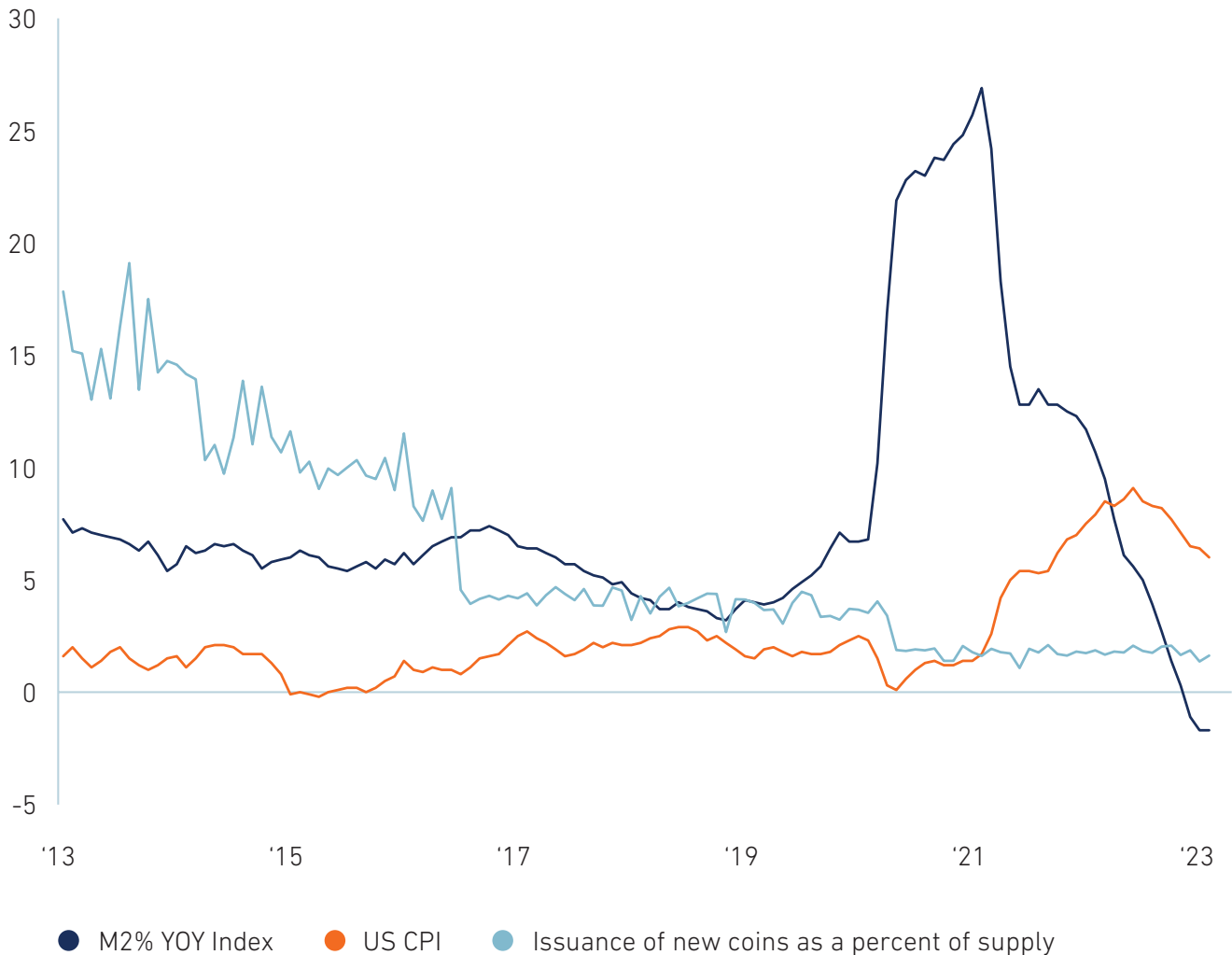
For some, there are 21 million reasons as to why Bitcoin should be an inflation hedge. This is the total supply of coins that will ever be produced. It is fixed and is immutable. With more than 90 percent of this total supply already mined, and with the rewards for miners set to systemically halve again in the coming year, the absence of new Bitcoin supply is one of life's few certainties.

This can and does vary widely as has been demonstrated once again with the response to the recent banking crisis. As the supply of fiat currency increases, so theory goes, the more the price, value or purchasing power of money should decline, due to inflation. In principle, assets or potential money substitutes, like Bitcoin, that are fixed in supply should offer a hedge against inflation. The practice, however, as we argue here is far less straightforward and the case for Bitcoin being a 'hard currency' that offers protection against inflation remains a long way from being made, even if its performance so far during the inflation and banking crises of 2023 has been impressive.

Money Supply and Inflation

The relationship between supply and inflation is complex, so we will start by clarifying terms. In crypto terminology, Bitcoin's 'inflation rate' is usually defined as the growth in its supply. Specifically, the issuance of new coins as a percentage of total supply. However, when we use the term inflation in this article, we are referring to the traditional economic definition – the rate of growth in the price of a weighted basket of consumer goods. We can then investigate the interactions rate of consumer price inflation, the supply of Bitcoin and traditional money.

Figure 1: Money and Bitcoin Supply and Inflation



Source: State Street Global Markets, Glassnode, Bloomberg

As Figure 1 highlights, the issuance of new Bitcoin has declined in line with the process known as halving. As a result, the supply of newly mined Bitcoin is currently running at just under two percent and in between halving periods, the growth in supply has been stable

for the past five years. The same cannot be said of the growth rate of the traditional money supply, proxied here by the United States M2 money aggregate. What is also clear, however, is that the link between this volatility and the inflation rate faced by consumers is not linear.

In theory, increasing the money supply should reduce the price or purchasing power of money via higher prices (inflation). So we might expect a more robust positive correlation between money supply growth and inflation. In reality, the determinants of consumer price inflation are far more complex; money supply is just one factor. As we explored in a [recent paper](#), the drivers of inflation range from government spending, inflation expectations, interest rates, consumer demand and supply side pressures, to highlight just a few. They also vary in their influence in each inflation episode. Sometimes, the growth in the supply of money is just one determinant, a fact that is apparent in Figure 1. There are periods, like during 2015 and 2017, when money supply and consumer price inflation trend in the same direction. But there are equally periods, between 2018 and 2020, for example, where they decouple, as different factors begin to drive inflation.

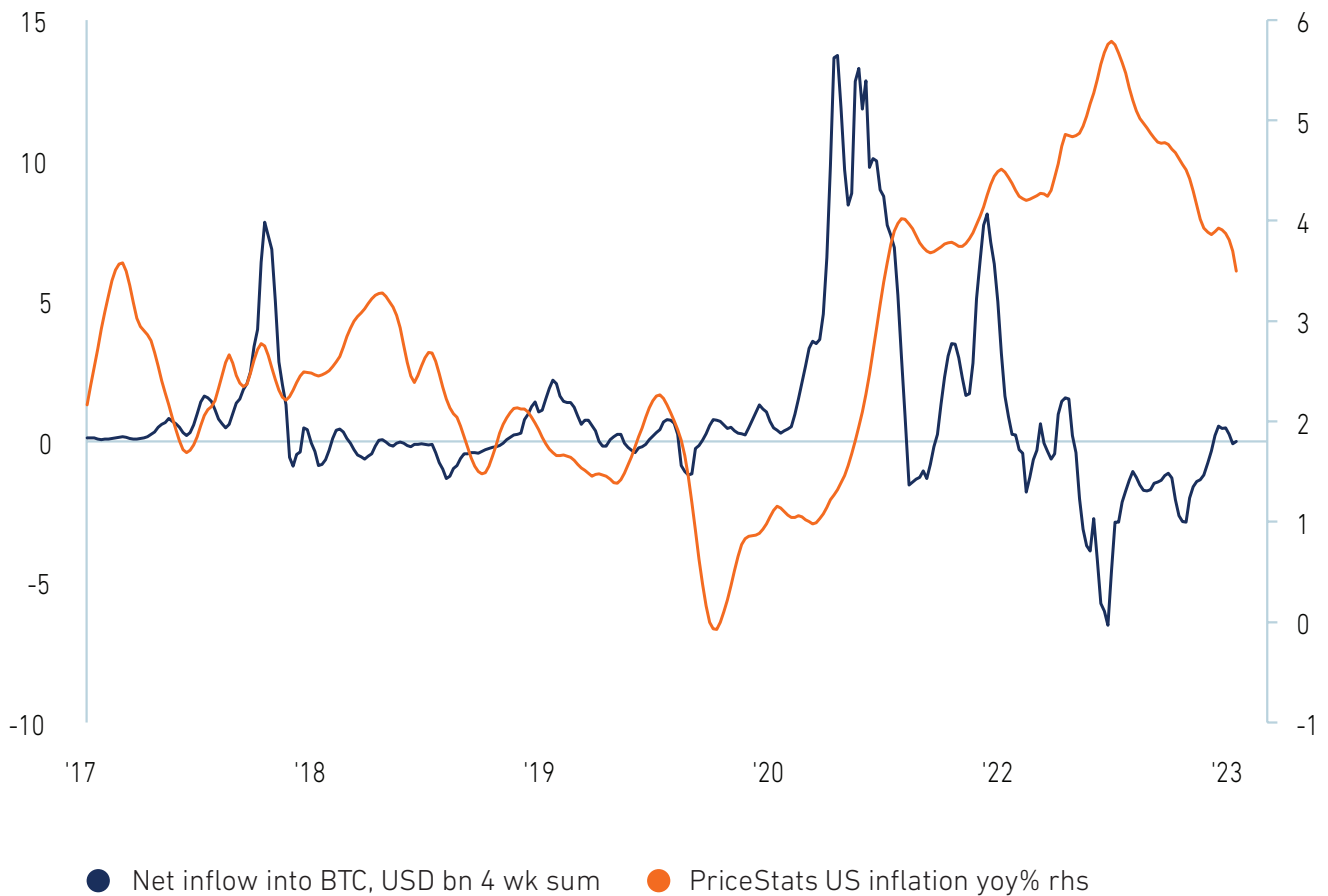
What is true of traditional money supply and the inflation rate is also true of the supply of newly mined Bitcoin. Just because supply is limited and eventually finite, does not guarantee that it should keep its value, either in absolute terms or relative to consumer prices (and therefore be a hedge against inflation). With more than 90 percent of total supply already mined, swings in demand and willingness of investors to supply existing Bitcoin at a given price are arguably more important price drivers than new supply. As we noted in January 2023's edition of the [Digital Digest](#), the rising share of

Bitcoin held by entities that typically buy and hold Bitcoin was one of the few silver linings for the cryptocurrency at the turn of the year. We concluded then, that it would likely limit the supply of existing Bitcoin into the market at prevailing prices and stabilize the decline in prices. To be clear, this does not mean that Bitcoin supply does not matter, rather the supply of new Bitcoin and its eventual fixed supply does not in its own right make it a consumer price inflation hedge.

Inflationary Motivations

A different, and perhaps better way, to frame the question is through the demand, not supply side. If an asset is expected to be an inflation hedge, regardless of the supply considerations, do people buy Bitcoin when inflation is going up? More importantly, does the asset actually protect those buyers from consumer price inflation and, specifically, their purchasing power? While it is difficult to parse exact motivations for buying and selling behavior, which are likely to be multifaceted, we can investigate these trends empirically in some detail thanks to our partnership with inflation data suppliers and analysts, PriceStats®. Their data series provides daily measures of inflation across the global economy by monitoring online price changes of millions of products sold by online retailers and allows us to capture the inflation sensitivity of Bitcoin flows and prices at a higher frequency than afforded by official consumer inflation statistics.

Figure 2: Flows into Bitcoin and Inflation



Source: Glassnode, PriceStats, State Street Global Markets

To get a better picture of these trends, Figure 2 plots the rolling net capital inflow into Bitcoin, as captured by the change in realized market capitalization from Glassnode, against PriceStats' annual inflation rate for the US. It highlights three trends. First, as we noted above, demand for Bitcoin is very volatile and episodic. Second, there are some linkages between Bitcoin demand and inflation trends. Since 2018, 60 percent of the

weeks that saw the annual inflation rate rise also saw Bitcoin inflows. We also see surges in Bitcoin demand at the end of 2017 and the beginning of 2021, ahead of episodes of higher inflation. Lastly, there were also periods of rapidly rising inflation and Bitcoin selling, most notably through much of 2022's inflation scare.

Given that 2022 was arguably (at least we hope it was) the peak of the inflation scare, this begs the question whether Bitcoin is actually delivering on the idea that it may be an inflation hedge. The high frequency nature of PriceStats data allows us to investigate this in a few different ways. First, we can simply compare the path of Bitcoin to our real-time price index over the past five years, as shown in Figure 3. Setting each series to 100 at the beginning of 2018, we see that there were three years where returns from Bitcoin were

below that of the rise in the price level, followed by three years when cumulative returns were higher. However, this is dependent on when you start the analysis. There are certainly periods where the nominal returns of Bitcoin would have been significantly above the rate of inflation, as well as periods where it would have been below. On average, over the last five years, there are many more starting points where Bitcoin would have been an inflation hedge than not.

Figure 3: Bitcoin’s Correlation to Inflation Over Different Time Periods

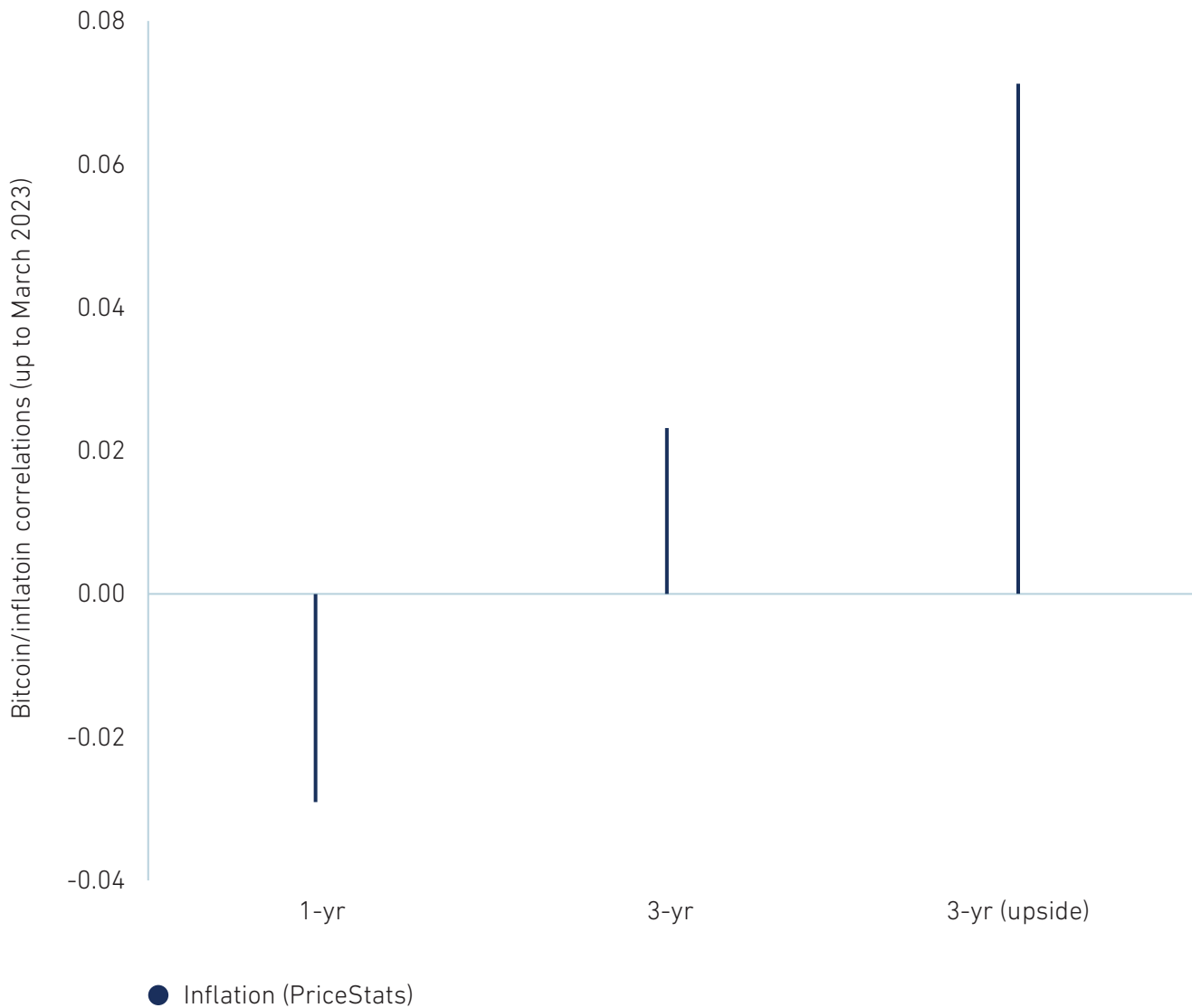


Source: State Street Global Markets, PriceStats, Bloomberg

Figure 4 digs into the relationship a little more closely. It looks at the correlation between weekly changes in the inflation rate and Bitcoin over the past one and three years. It suggests there are minimal empirical links between movements in inflation and Bitcoin prices. Even if we just focus on the weeks when inflation rose, the correlation

between inflation and Bitcoin movements fails to rise above 10 percent. This shows there is little direct statistical relationship between inflation and Bitcoin movements, even if Bitcoin's returns on average have exceeded the inflation rate over the past five years.

Figure 4: Bitcoin's Correlation to Inflation Over Different Time Periods



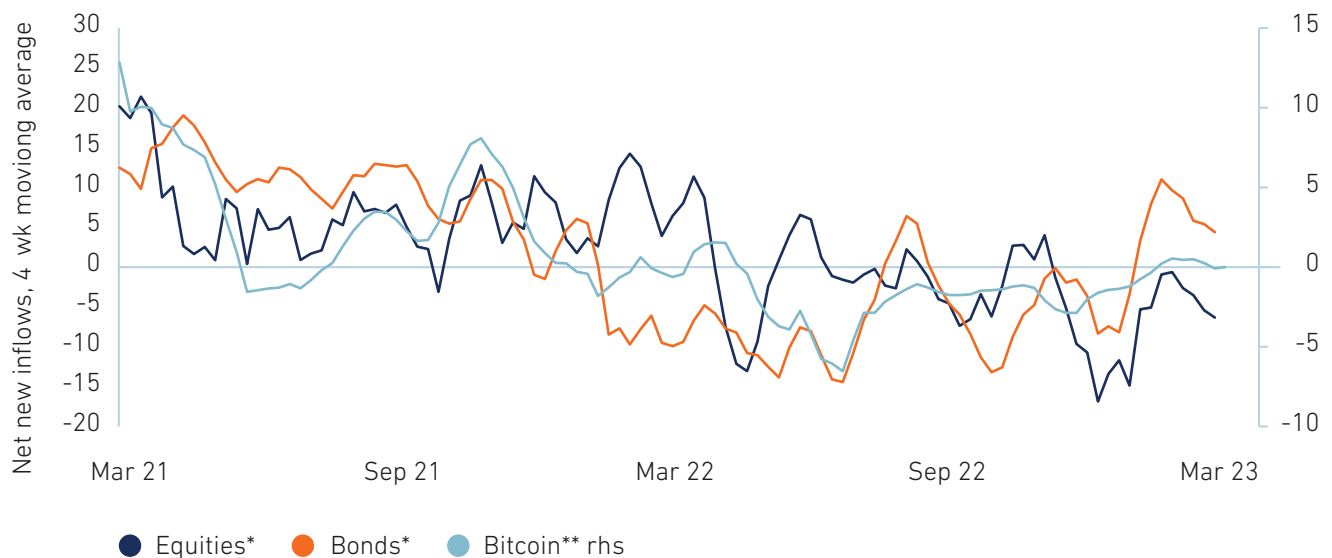
Source: State Street Global Markets, PriceStats, Bloomberg

A Question of Liquidity Not Inflation?

This raises the question: which traditional macro factors do, in fact, drive Bitcoin? One trend we noted in the inaugural edition of our Digital Digest more than a year ago was that net inflows into Bitcoin were increasingly correlated with flows into traditional asset classes. At that time, we noted that this was good news from the point of view of the asset's emerging acceptance, but it also highlighted that Bitcoin was increasingly linked to the global liquidity cycle. This offers a

better explanation of recent Bitcoin movements than inflation. Bitcoin suffered alongside equities and bonds in 2022 as liquidity was withdrawn to combat higher inflation. While in 2023 as hopes of a pause or a peak in the tightening cycle have grown, Bitcoin has begun to recover, with the help of long-term buy and hold entities (Figure 5). Given that inflation has been a consistent threat throughout this period, it seems that the liquidity narrative better explains Bitcoin's highs and lows, rather than inflation.

Figure 5: Bitcoin's Correlation to Inflation Over Different Time Periods



Source: ICI*, Glassnode**

To sum up, the finite new supply of Bitcoin on its own does not guarantee protection against consumer price inflation. Swings in Bitcoin demand and the willingness of holders to add existing Bitcoin supply to the market dominate. In a similar vein, the determinants of consumer price inflation are far more complex than simply the supply of traditional money. It is perhaps not too surprising then that an empirical investigation

of the links between Bitcoin and high frequency inflation measures finds no significant links between the two. This leads us to conclude that for now, at least, Bitcoin is more a risky liquidity-driven asset than it is an inflation hedge, even though it has enjoyed periods where its nominal returns have been higher than that of the consumer price inflation rate.

Section 5

Tokenization of Carbon Assets

By Barbara Widholm

Vice President, Digital Product Development, State Street Digital®

Ekaterina Stolyarova

Assistant Vice President, Digital Product Manager, State Street Digital®



Tokenization is the process of utilizing Blockchain technology throughout an asset's lifecycle. It can make the process more effective and efficient for both the fund issuer and the end investors by allowing shares of a fund to be freely traded on a digital ledger.

The recent crypto downturn has revealed some "elasticity in demand" among institutional investors who understand blockchain is here to stay and are enthusiastic about the wider opportunities that tokenization can offer.

The Advantages of Tokenization

Tokenization can increase accessibility to markets, create liquidity in historically illiquid markets, and generate efficiencies and cost savings. Like markets for real estate, infrastructure, and private equity, carbon assets are less efficient, more customized, have different operating models and requirements, and require a human settlement process.

Promoting greater accessibility

Market participation and capital inflow are constrained by limited access points or complicated restrictions of some investment instruments, such as carbon credits. The barrier of entrance into a market can be decreased and access points to tokenized assets can be standardized with blockchain technology.

Enhancing liquidity

Tokenized assets increase transaction flow competition which benefits issuers and leads to better pricing and more secondary market liquidity. Assets that have been tokenized can be immediately exchanged on-chain or across-chain.

Generating efficiencies

In certain markets, inefficient transfer of ownership leads to loss of alpha. Tokenization allows the settlement process to become almost instantaneous while the transfer of value and the validation of ownership are simultaneous. Processing of complicated events, such as corporate actions, can be expedited.

Additionally, some blockchains integrate smart contracts, self-executing programs with rules established in code. Smart contracts allow automated transactions by defining a set of parameters that, if met, execute automatically.

For instance, smart contracts can start making payments at predetermined benchmarks or on specified dates. As a result, tokenized platforms may one day enable investors to purchase, sell, and swap tokens in accordance with predetermined guidelines and with little assistance from outside brokers.

The Tokenization Opportunity for Carbon Assets

Over the past 10 years, investments in climate technology have grown at a rate five times²⁰ that of global start-ups, helping with efforts to achieve decarbonization goals and to create regulations for emissions disclosure.

One of the key drivers of growth in carbon credits has been ongoing efforts to reach net-zero emissions goals. However, the market is divided in terms of value and structure due to the vast range of standards being released and the lack of transparency in the data on underlying carbon intensity. Since the majority of agreements are OTC and carbon credits are distributed through a number of registries, market efficiency and transparency are necessary for scalability.

Blockchain technology can help overcome some of these key challenges. Its effective real-time settlement can promote greater volumes and liquidity by making carbon credits more composable.

A carbon credit needs an audit trail of the components contributing to its carbon intensity, and open blockchain could produce useful price data to encourage asset comparability.

Tokenized carbon credits can be representations of off-chain Verified Carbon Units (VCU) or natively digital carbon credits distinguished by traceability across underlying carbon offsetting chain to enable the scalability of carbon credits market.

Events affecting carbon intensity would be recorded on a distributed ledger and traceability would ensure a carbon credit's value on the market by creating inherent quality. Therefore, a VCU's value would be more accurate and not dependent on a manual, non-standardized audit evaluation of the underlying project. As a result of incorporating safe Internet of Things (IoT) and Blockchain, a credit's underlying data would be programmable, comparable, and produce price signals.

In digital asset markets, the ability of an asset to interact with other assets in the market, or interoperability, defines an asset's worth. Creating a worldwide data infrastructure that is constantly updated (e.g., using oracles to feed data to an asset, which cascade to other assets in the chain) makes sure that businesses cannot double spend by offsetting the same credit again. With smart contracts, the programmable capability of a token and underlying traceable data may be used to design the workflow, integrate regulatory requirements, and add business logic across the whole lifecycle of a carbon asset.

As a result, a carbon credit token is composable and opens up new types of trading and capital development.

A carbon credit's success, even when tokenized, depends on the way it was created and how well a smart contract was written. Understanding the foundations of a successful carbon credit token is crucial.

Fundamentals for Tokenized Carbon Credits

When working to build a composable structure for carbon credits, the fundamentals of decentralized finance must be considered. These fundamentals, often called primitives,²¹ are the essential building blocks of technology that can be combined and leveraged in a variety of ways. Oracles, blockchain protocols, smart contracts, token standards are all key primitives to consider when issuing a carbon credit token. Indeed, a blockchain can be chosen over another for its characteristics including the number of users, number of smart contracts available, activity and rules.

For example, Ethereum is open source, which means that smart contracts are public and any logic worked out once is available for reuse by the entire ecosystem (syntactic composability). The multitude of smart contracts are as much reliable code already tested by the protocol to which projects can integrate the carbon credit specific components.

The smart contract is as good as the rules it is governed by and a blockchain protocol is as composable as the data available in it. Therefore, a carbon credit quality is influenced by the blockchain it is issued and the smart contract governing it.

Ethereum facilitates composability by its architecture but that does not guarantee that tokens morphology is comparable by nature. For this purpose, a number of standards have been agreed to and are known as Ethereum Requests for Comment (ERC). The famous ERC20 and ERC721 define characteristics of fungible and non-fungible tokens. They define the parameters for a token interaction with other elements in the protocol and increase their comparability. On one hand, ERC721 has been utilized by carbon offsetting projects for its non-divisibility. Certain carbon credit tokens may represent a collection of multiple projects or activities contributing to creating a single carbon offset unit. Therefore, an NFT provides the exclusivity and unity required for a carbon offset to faithfully reflect real world activity. On the other hand, ERC20 are interchangeable and can be divided. Used by the majority of existing tokens, the standard is, therefore, more interoperable and unlocks new opportunities for targeted investments, portfolio diversification, and greater capital flows to facilitate the transition to net-zero emissions.

Unlocking the Opportunity for Institutional Investors

When considering tokenization opportunities, institutional investors must take into account the technology and tangible assets as investments vehicles, but also the technology applications in improving processes and products offered today.

Investor interest in an asset class is driven by tokenization's ability to diversify investable assets, creating an ability for new investment strategies and allowing investors to move

assets more seamlessly. Today, investors in tokenized securities are mainly wealthy individual (accredited) investors and the market is challenged by a lack of participation from high-quality institutional investors. Creating an effective marketplace to support institutional participation will drive overall issuance. Additionally, exploration of smart contracts and distributed ledger technology to automate certain processes, such as tokenization of trade collateralization, can help enhance servicing of these assets and reduce risk.



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Glossary

- **Bitcoin:** A decentralized digital cryptocurrency, with the token issued on the bitcoin protocol, that can be sent from user to user on a peer-to-peer network without an administrator or central bank involvement
- **Blockchain:** A distributed ledger technology that groups data into blocks when verified by members of the network, linked together to form the blockchain
- **Central Bank Digital Currency (CBDC):**
A digital token representing sovereign fiat currency
- **Cryptocurrency:** A digital token used as a medium of exchange or stored value, with transactions recorded using distributed ledger technology
- **Decentralized Autonomous Organization (DAO):**
An organization represented by rules encoded as a computer program that is transparent, controlled by the organization members and not influenced by a central government
- **Decentralized Finance:** Distributed ledger technology-based financial services without traditional intermediaries and central authorities
- **Digital Assets:** Any asset in a digital form on a blockchain
- **Digital Custody:** The holding and administration of crypto assets and/or cryptographic keys used to safekeep or transfer crypto assets
- **Distributed Ledger Technology (DLT):** A system of record that is shared and stored across a network of participants such as a blockchain
- **Fiat Currency:** A government-issued currency that is not backed by a physical commodity, but by the trust in the issuer
- **Instant Settlement (AKA, “T+0,” “same day,” and “atomic settlement”):** The transfer of funds from one account to another in seconds
- **Layer 1 Systems :** A base network and its underlying infrastructure that can validate and finalize transactions without the need for another network
- **Nonfungible Tokens (NFT):** A unique and non-interchangeable unit of data stored on a digital ledger
- **Programmable Money :** A cryptocurrency that can be programmed for a specific outcome using smart contracts
- **Smart Contract :** A dynamic, open-ended mechanism that provides coded sets of rules for a specific use case on a distributed ledger technology network
- **Stablecoin:** A cryptocurrency pegged to the value of a fiat currency such as the dollar, backed by traditional assets or algorithmically attached to digital assets that are automatically bought and sold in order to maintain a stable value
- **Tokenization:** The process of creating a digital token on a distributed ledger technology network
- **Tokenomic:** An analysis of the fundamental characteristics governing a token's utility and value
- **Web 3 :** An extension of the World Wide Web through standards set by the World Wide Web Consortium (W3C) with the goal to make Internet data machine-readable

For more information about State Street Digital®, please contact:
StateStreetDigitalCommunications@Statestreet.com



State Street Corporation
One Congress Street, Boston, MA 02114-2016
www.statestreet.com

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