

Bringing Transparency to an Emerging Asset Class: S&P Cryptocurrency Indices

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EXECUTIVE SUMMARY

- S&P Dow Jones Indices has developed a series of cryptocurrency indices to measure this new emerging asset class.
- The [S&P Cryptocurrency Indices](#) are designed to have broad coverage since cryptocurrencies are not homogenous, and the level of activity beyond Bitcoin and Ethereum reflects a dynamic and evolving ecosystem.
- The goods and services provided by the projects (applications, protocols, and products created) in the ecosystem may add to the value of individual coins.
- There is no global regulatory body for cryptocurrencies, nor is there consensus among regulators as to a response to these new innovations.
- The S&P Cryptocurrency Indices have historically experienced high annualized returns accompanied by significant volatility and downside risk.
- Indexing aims to bring accessibility and transparency to the digital assets market.

INTRODUCTION

Because digital assets are an emerging asset class, it is helpful to discuss what cryptocurrencies (also referred to as “coins” in this document) are, how the asset class has grown, and how they are regulated. As cryptocurrencies are not identical in terms of what they offer, it is also important to understand how they can be used, along with some of the real and perceived challenges related to the asset class. This background helps to provide added context to the need for indexing to bring accessibility and transparency to this new market. The S&P Cryptocurrency Indices aim to meet these challenges. The indices are designed to serve as benchmarks for the performance of a selection of cryptocurrencies that are listed on recognized, open exchanges while meeting liquidity and market capitalization criteria.¹

¹ See Glossary for terms that are unique to digital assets.

BACKGROUND

Because digital assets are an emerging asset class, it is helpful to discuss what cryptocurrencies are, how the asset class has grown, and how they are regulated.

Cryptocurrencies are a new, emerging asset class with almost USD 2.1 trillion in market cap as of Aug. 31, 2021.² While 12-year-old Bitcoin is the largest and most well-known cryptocurrency, there are currently over 10,000 different cryptocurrencies, and more are continually being launched. These coins are not identical—while many may serve as a store of value, many may be used as a medium of exchange (i.e., to acquire various goods or services). These goods and services, in turn, may add to the coin's value as an asset. While many countries do not recognize cryptocurrencies as legal tender nor as financial instruments, market participants have pursued these assets, nonetheless.

Cryptocurrencies may provide a unique risk/return profile and uncorrelated returns.

While initially the domain of retail investors, institutional investor interest in cryptocurrencies³ has grown exponentially over the past two years. For example, MicroStrategy, PayPal, and other firms have started to hold Bitcoin in their treasury; large global banks (BNY Mellon) have launched custody services; new fund administration services (State Street Global Advisors) have emerged; trading desks (Goldman Sachs) have been developed; traditional exchanges (CME, ICE) have released new offerings; and fund inflows into cryptocurrency hedge funds have reached record levels.

Cryptocurrencies may provide a new risk-based profile and uncorrelated returns, and some financial institutions are recommending investors hold some cryptocurrencies to provide diversification to a traditional 60/40 portfolio.⁴

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S&P Dow Jones Indices' (S&P DJI) entrance into the cryptocurrency space reflects its perception that the asset class is gathering broad appeal among market participants.

The scope of this paper is limited to cryptocurrencies, a subset of digital assets, and excludes other types of digital assets such as non-fungible tokens (NFTs) and corporate coins (e.g., JPM Coin). Pegged currencies, such as stablecoins (e.g., USDC or Tether), state-sponsored digital currencies, and digital asset securities are also out of scope.

² Source: Lukka, based on 950+ assets priced by Lukka Prime, as of Aug. 31, 2021. www.lukka.tech.

³ This document includes tokens in its description of cryptocurrencies. The biggest differentiation between the two is that cryptocurrencies have their own blockchains, whereas crypto tokens are built on an existing blockchain. <https://www.gemini.com/cryptopedia/cryptocurrencies-vs-tokens-difference>.

⁴ See research from Fidelity, JP Morgan, and others: https://www.fidelitydigitalassets.com/bin-public/060_www_fidelity_com/documents/FDAS/bitcoin-alternative-investment.pdf; https://www.tbstat.com/wp/uploads/2021/02/JPM_Bitcoin_Report.pdf; <https://www.cnbc.com/2020/01/30/heres-the-right-amount-of-cryptocurrency-to-keep-in-a-portfolio.html>.

THE CASE FOR CRYPTOCURRENCIES

Cryptocurrencies and the ecosystem around them represent a generational shift in how financial assets can be created and used. These new digital assets are generally issued and transferred on a blockchain network that is:

Cryptocurrencies are generally issued and transferred on a blockchain network that is decentralized, censor-proof, technologically secure, and immutable.

- **Decentralized:** There is no central administrator, no centralized data storage, and no single party that controls the data;
- **Censor-proof:** Most are not issued by a central authority and as such immune to government intervention but not regulation;
- **Technologically secure:** Cryptography makes it nearly impossible to counterfeit or double spend but not immune from theft; and
- **Immutable:** No single entity can alter or reverse a cryptocurrency transaction due to the consensus mechanism and verifiable, permanent distributed ledger.

The technology behind these assets (predominantly blockchain) solves the challenge of how to establish trust between unrelated parties (“trustless,” in that they allow for peer-to-peer cryptocurrency transactions to take place without the need for an intermediary institution) over a network. While this paper will not focus on the technology breakthroughs, it is worth noting that the breakthroughs are substantial and merit further reading.⁵

Institutional Interest

Media coverage has contributed to institutions viewing cryptocurrencies as an entirely new and important asset class. Concepts like Bitcoin being referred to as “digital gold,” its inflation hedging potential, and its importance as a potential diversifier to a traditional 60/40 portfolio have been discussed widely in the press. This media coverage, plus the unique concepts of trust, transparency, and security that are core properties of cryptocurrencies, has helped to accelerate institutional interest over the past few years, particularly for Bitcoin.

Media coverage and cryptocurrencies’ unique concepts have helped to accelerate institutional interest over the past few years.

Key metrics illustrate increased institutional activity in the space, particularly with respect to Bitcoin. These include record inflows of USD 5.8 billion into cryptocurrency funds, most notably Grayscale (USD 2.4 billion YTD).⁶ Approximately 20% of hedge funds overall are investing in digital assets.⁷ In addition, corporations are buying Bitcoin to hold on their balance sheet (e.g., MicroStrategy, Square, Tesla⁸), and there is a surge in open interest in CME Bitcoin futures, amounting to 9.6% of global total

⁵ Resources include: “[Blockchain 101](#),” CoinDesk, March 2017; Brownworth, Anders. “[How Blockchain Works](#),” blockchain.mit.edu.

⁶ As of Aug. 20, 2021. “[Digital Asset Fund Flows Weekly](#).” CoinShares Research.

⁷ “[3rd Annual Global Crypto Hedge Fund Report 2021](#).” PWC, Elwood, and Aima. May 2021.

⁸ [Bitcoin Treasuries](#). Buy Bitcoin Worldwide.

open interest (USD 1.7 billion, of an aggregate USD 17.8 billion, as of Aug. 23, 2021).⁹

REGULATIONS

There is no global regulatory body for cryptocurrencies.

Because cryptocurrencies are both emerging and borderless, there is no consensus among regulators as to a response to these new innovations. There is no global regulatory body for these assets, and most local and national laws and regulations are not tailored specifically to cryptocurrencies and their unique characteristics. We will touch on some examples here. While they are not exhaustive, they are representative of the various regulatory approaches to cryptocurrencies today.

Most local and national laws and regulations are not tailored specifically to cryptocurrencies and their unique characteristics.

Globally, in 2020, the international Financial Action Task Force (FATF) issued additional detailed guidance on the application of a corollary to the travel rule to virtual asset service providers (VASPs) who facilitate transactions in cryptocurrencies. The travel rule is a provision of the U.S. Bank Secrecy Act that aims to require all originators and beneficiaries of fund transfers to exchange certain identifying information, and the FATF guidance recommends that member jurisdictions impose a similar rule on VASPs operating in their jurisdictions. FATF member jurisdictions are now in various stages of implementing this guidance. As of June 2021, 37 countries¹⁰ have implemented the standards, essentially eliminating the pseudonymous aspect of Bitcoin and other cryptocurrencies with respect to transactions occurring through VASPs subject to compliance with the standards in these countries.

In Asia, perhaps due to strong retail investor interest in cryptocurrencies, regulations are advanced, and regulators have been active.

More recently, the FATF released an update to its guidance with respect to cryptocurrencies and VASPs.¹¹ This guidance is currently open for public comment and is expected to be finalized by November 2021. The revisions to the FATF guidance interpret the definition of a VASP broadly to include “a central party with some measure of involvement” with a decentralized application. Such an interpretation would potentially bring many different participants within the ambit of the guidance and subject them to compliance with anti-money laundering and counter-terrorism financing (AML/CFT) laws in jurisdictions that adopt this interpretation of the VASP definition.

In Asia, perhaps due to strong retail investor interest in cryptocurrencies, regulations are advanced, and regulators have been active. In China, there has been a renewed focus to shut down mining in five regions, as well as a

⁹ [Aggregated Open Interest of Bitcoin Futures](#). The Block.

¹⁰ “[Countries](#).” Financial Action Task Force (FATF).

¹¹ “[Public consultation on FATF draft guidance on a risk-based approach to virtual assets and virtual asset service providers](#).” FATF. March 2021.

As of the end of July 2021, European cryptocurrency ETPs had surpassed EUR 4.6 billion in AUM.

The European Commission proposed recommendations for a MiCA regime with the primary goal of enabling innovation while mitigating risk.

The Ontario Securities Commission approved the first Bitcoin ETF in Canada in February 2021.

ban on banks for cryptocurrency-related activities.¹² As a result, many miners have relocated outside China, and exchanges have stopped trading certain products. In September 2021, China's central bank declared all transactions involving Bitcoin and other virtual currencies illegal,¹³ which may result in additional relocation of mining and crypto activity. In addition, Hong Kong's Securities and Futures Commission, which operates separately from China, has licensed its first virtual asset trading platforms under comprehensive new standards.¹⁴ South Korea's Financial Services Commission announced restrictions on privacy coins and new guidelines for exchanges, including a requirement to partner with a domestic bank and register by September 2021.¹⁵ Laws in Japan are generally supportive of blockchains and cryptocurrencies.¹⁶

Over the past few years in Europe, financial regulators in Germany¹⁷ and Switzerland¹⁸ approved the listing of ETNs backed by cryptocurrency assets, and as of the end of July 2021, European cryptocurrency ETPs had surpassed EUR 4.6 billion in AUM.¹⁹ Now, over 100 cryptocurrency ETPs are listed, including four issuers that launched cryptocurrency ETPs on Euronext Paris and Amsterdam in June 2021. In addition, the European Commission has proposed recommendations for a Markets in Crypto-Assets (MiCA) regime, with the primary goal of enabling innovation while mitigating risk.²⁰

Within North America, the Ontario Securities Commission (OSC) approved the first Bitcoin ETF in Canada in February 2021. Since then, two additional ETFs have launched. However, the OSC has sought to regulate cryptocurrency trading platforms as dealers of securities²¹ and recently took action against unregistered exchanges.²² In the U.S., few formal laws and rules specific to cryptocurrency have been introduced.²³ That said, activities involving cryptocurrencies can touch upon a variety of U.S.

¹² Hamacher, Adriana. "[China's 2021 Bitcoin Crackdown: What You Need to Know.](#)" Decrypt. June 22, 2021.

¹³ "[China Declares Cryptocurrencies Illegal.](#)" CBS News. Sept. 24, 2021.

¹⁴ "[Regulatory Approaches to Cryptoassets in Selected Jurisdictions.](#)" Law Library of Congress, April 2019, p. 106.

¹⁵ Im, Felix. "[South Korean Banks to 'Review' Partnerships With Crypto Exchanges.](#)" CoinDesk. June 21, 2021.

¹⁶ "[Japan Crypto Asset Regulations.](#)" Coinform. Jan. 30, 2021.

Awataguchi, Taro and Takeshi Nagase. "[Blockchain & Cryptocurrency Laws and Regulations 2021 | Japan.](#)" Global Legal Insights.

¹⁷ "[Germany's Cryptocurrency Regulations.](#)" Coinform. Feb. 8, 2021.

¹⁸ "[Switzerland Crypto Regulations: KYC, Taxes & FINMA.](#)" Coinform. Jan. 12, 2021.

"[Crypto Products on the Upswing on the Swiss Stock Exchange.](#)" Six-Group. May 28, 2021.

¹⁹ Source: S&P Dow Jones Indices LLC and Morningstar. Data as of June 30, 2021.

²⁰ Vermaak, Werner. "[MiCA: A Guide to the EU's Proposed Markets in Crypto-Assets Regulation.](#)" SYGNA.

²¹ For example, see, <https://www.osc.ca/en/news-events/news/osc-working-ensure-crypto-asset-trading-platforms-comply-securities-law>.

²² Faridi, Omar. "[Ontario Securities Commission has Taken Action Against Non-Compliant Global Crypto Trading Platform Bybit.](#)" Crowd Fund Insider. June 23, 2021.

²³ Dewey, Joe. "[Blockchain & Cryptocurrency Laws and Regulations 2021 | USA.](#)" Global Legal Insights.

In the U.S., few formal laws and rules specific to cryptocurrency have been introduced.

The SEC has made a number of public statements refocusing on digital assets and their use in a variety of contexts that may implicate the securities laws.

Suspicious that cryptocurrencies have been used for illicit activities continue today and have the potential to resonate worldwide.

regulatory regimes including securities, commodities, and money transmission laws and regulations, depending on the circumstances. With respect to the latter, the Financial Crimes Enforcement Network (FinCEN) has provided detailed guidance regarding the application of the Bank Secrecy Act and related regulations to activities involving cryptocurrency,²⁴ focusing on a variety of issues including the use of privacy coins in money transmitter businesses. In New York, the BitLicense is a strong, detailed framework for businesses looking to engage in virtual currency business activities in the state or with New York residents. With respect to securities regulatory issues, the U.S. Securities and Exchange Commission (SEC) has made a number of recent public statements indicating a renewed focus on digital assets and their use in a variety of different contexts that may implicate the securities laws.²⁵ One area of focus has been with respect to cryptocurrency ETFs, none of which have received SEC approval at this point, although many players have filed (17 with direct exposure to Bitcoin and Bitcoin futures, as of Aug. 12, 2021).²⁶ In June 2021, the SEC announced it would delay its decision on ETFs a second time^{27, 28} Finally, the U.S. Senate's approval of the Infrastructure Bill in August 2021, which requires reporting by a range of players within the crypto ecosystem, may dampen growth within the U.S.

CHALLENGES OF INVESTING IN CRYPTOCURRENCIES

One of the biggest challenges for the industry has been the allegation that Bitcoin and other cryptocurrencies have been used for illicit activities. Suspicious like these, which have come from government agencies globally and major media outlets, continue today and have the potential to resonate worldwide.²⁹

However, because the technology allows the review of on-chain data (i.e., data immutably recorded on the native blockchain network providing transaction size, type, IP address, and more), whether Bitcoin or other cryptocurrencies are primarily used for illicit financing can be verified. According to respected chain data provider Chainalysis,³⁰ the total cryptocurrency value sent and received by known illicit entities in 2020 was less than 1% of all cryptocurrency activity and less than USD 10 billion in volume (see Exhibit 1). By contrast, the UN estimates that between 2%

²⁴ ["Application of FinCEN's Regulations to Certain Business Models Involving Convertible Virtual Currencies."](#) FinCEN Guidance. May 2019.

²⁵ Gensler, Gary. ["Remarks Before the Aspen Security Forum."](#) U.S. SEC. Aug. 3, 2021.

²⁶ Bloomberg

²⁷ Matthews, Chris. ["SEC delays approval of bitcoin ETF yet again."](#) Market Watch. June 16, 2021.

²⁸ Mutual funds follow different guidelines, and in July, the first publicly available Bitcoin mutual fund in the U.S. launched. See: ["ProFunds Launches The First Bitcoin Strategy Mutual Fund."](#) Business Wire. July 28, 2021.

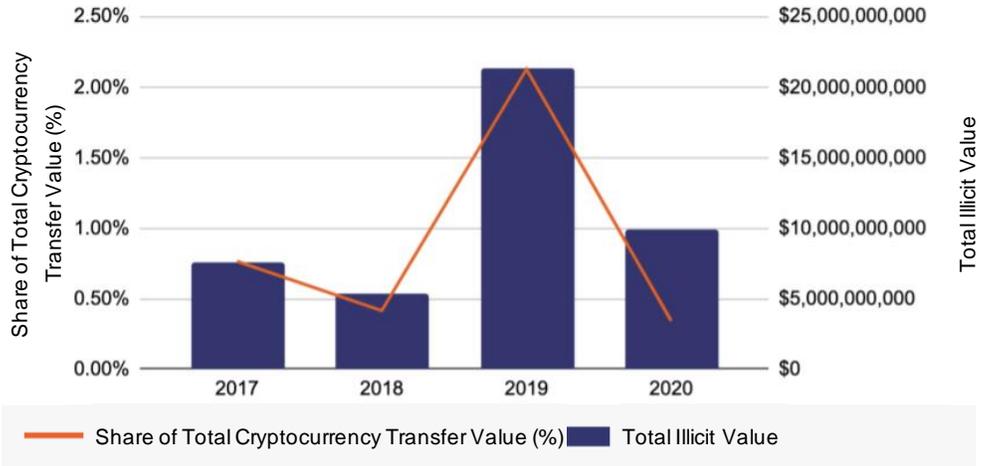
²⁹ Lahart, Justin and Telis Demos. ["Why Crime Could Kill Crypto."](#) *The Wall Street Journal*. June 18, 2021.

³⁰ ["The 2021 Crypto Crime Report."](#) Chainalysis. Feb. 16, 2021.

and 5% of global GDP (USD 1.6-USD 4 trillion) annually is connected with illicit activity.³¹

Exhibit 1: Total Illicit Cryptocurrency Activity versus Total Cryptocurrency Activity

Because the technology allows the review of on-chain data, whether cryptocurrencies are primarily used for illicit financing can be verified.



Source: Chainalysis.²⁹ Data as of December 2020. Chart is provided for illustrative purposes.

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Cryptocurrencies are not without risks, however. A short list includes the potential for fraud (e.g., financial crimes such as money laundering or tax avoidance, Ponzi schemes, and scam offerings such as certain initial coin offerings (ICOs) and pump and dump schemes³²), price manipulation, market manipulation, risk of being hacked, and violation of local or national regulatory or other laws. These risks are demonstrated by the number of criminal and civil charges that have been raised against executives from various exchanges and market participants globally.

Market Structure

To investors familiar with traditional financial markets, it is worth discussing some of the attributes of the cryptocurrency market structure, its trading venues, and how it is different from other more mature financial markets.

In the growing crypto ecosystem, there are 300+ spot exchanges and 30+ derivatives exchanges for trading cryptocurrencies.

Within the growing cryptocurrency ecosystem, there are currently over 300 spot exchanges and over 30 derivatives exchanges for trading cryptocurrencies.³³ What this means is that there is not a definitive market price nor the concept of a “consolidated tape.” Additionally, the quality of exchanges varies widely—in terms of operational aspects, the regulations to which they are subject and their conformity with them, their governance

³¹ Lennon, Hailey. “[The False Narrative Of Bitcoin’s Role In Illicit Activity](#).” Forbes. Jan. 19, 2021.

³² “[Investor Alert: Ponzi Schemes Using Virtual Currencies](#).” U.S. SEC. “[Cryptocurrency Fraud](#).” Constantine Cannon.

³³ In addition to spot and derivatives, there are over 70 decentralized exchanges, in the fast growing DeFi space. Source: <https://coinmarketcap.com/rankings/exchanges/>.

practices, the security and robustness of their platforms, and the overall robustness of their trading volume, liquidity, pricing, and breadth of instruments on offer.

Several cryptocurrency price aggregator platforms have emerged to address the challenge of obtaining a unique indication of price from these exchanges.

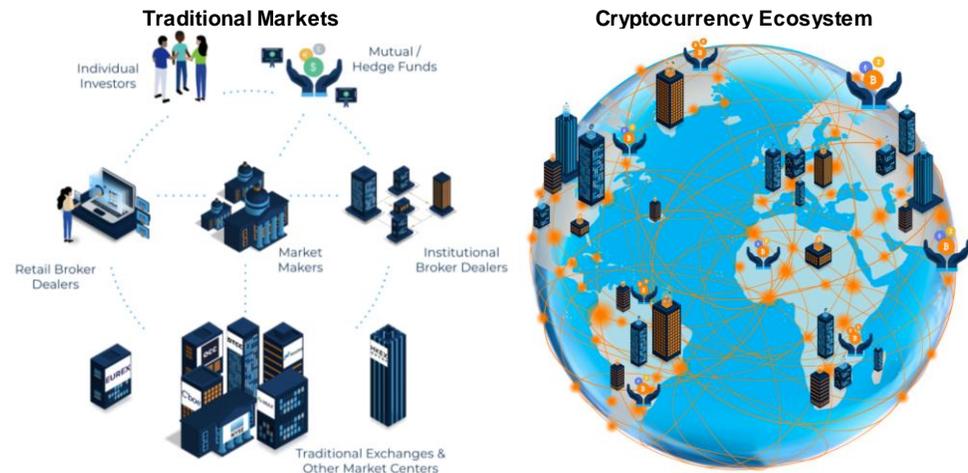
To that end, several cryptocurrency price aggregator platforms have emerged to address the challenge of obtaining a unique indication of price from these exchanges. Of course, these aggregators vary in their approach to which exchanges they select for their pricing (this can range from one to all), as well as in the type of pricing they offer. Among price aggregators, volume-weighted average pricing (VWAP), time-weighted average pricing (TWAP), variations using medians, and fair market value (FMV) pricing are all available.

Finally, because there is not a standard identifier (ticker) for each asset across exchanges, price aggregators must have a robust solution for addressing the data challenges.

Exhibit 2 illustrates the difference between traditional and crypto market structure. Besides one being centralized and the other decentralized, it is important to note the difference in key participants—central intermediaries such as the Depository Trust & Clearing Corporation (DTCC), conventional exchanges, and broker dealers do not play a critical role in cryptocurrency markets.³⁴

Central intermediaries such as the DTCC, conventional exchanges, and broker dealers do not play a critical role in cryptocurrency markets.

Exhibit 2: Traditional and Crypto Market Structures



Source: Lukka. Chart is provided for illustrative purposes.

One particular logistical industry challenge is cryptocurrency custody.

As with any market evolving this quickly, the infrastructure is also maturing to confront the issues previously mentioned—such as evolving regulations, emerging technology, unfamiliar risks (potential for hacks, lost keys, etc.), the need for security (operational and technological), and the interface between centralized and decentralized systems. Today, the infrastructure

³⁴ Source: Lukka, “Navigating the world of crypto asset tax reporting,” p. 6.

is diverse and complex. One particular logistical industry challenge is cryptocurrency custody.

For institutions that do want to hold cryptocurrencies directly, the most frequent approach is to integrate with digital native custodians.

For financial institutions that do want to hold cryptocurrencies directly, the most frequent approach is to integrate with digital native custodians (e.g., firms that were created specifically to service the blockchain infrastructure). This may allow traditional firms to manage operational complexities, navigate regulatory grey areas, and to get to market more quickly. For example, BNY Mellon is planning to use Fireblocks for digital custody.³⁵ Deutsche Börse recently acquired a stake in Crypto Finance AG to boost its regulated digital custody.³⁶ Other known digital custodians include Anchorage, BitGo (being acquired by Galaxy Digital), and Kingdom Trust, and some of the largest digital exchanges such as Coinbase and Gemini also offer custody services.

ASSET-LEVEL CHARACTERISTICS

Many coins may be used to pay fees on a platform or network and given out as rewards for the operation of a network.

Cryptocurrencies are not identical in terms of what they offer. Many coins have features that provide utility beyond being a store of value. In general, a number of coins may be used to pay fees on a platform or network and given out as rewards for the operation of a network.³⁷ These features, in addition to potential momentum created by investor interest, may add to their value as an asset. While these coins are not equity, holding them may allow a user to participate in the growth of a platform. Here are a few examples.

Bitcoin, Ether, and Financial Applications

Today, many people think of Bitcoin only as a store of value—likely because it is the most highly valued cryptocurrency, and the media portrays it as “digital gold.” However, Bitcoin was originally designed as a medium of exchange, offering peer-to-peer transactions in an otherwise “trustless” environment. This means someone can buy, sell, or exchange Bitcoin directly without needing an intermediary.

Bitcoin was originally designed as a medium of exchange to offer in peer-to-peer transactions in an otherwise “trustless” environment.

Ethereum has additional functionality—it uses smart contracts to run applications on its blockchain and has been central to the growth and development of decentralized finance (DeFi), which is a new alternative to traditional financial services. Instead of requiring large central intermediaries, it uses Ethereum and other blockchain platforms to create and offer financial products and services on a peer-to-peer basis, eliminating the middleman. One of the interesting applications of DeFi is its

³⁵ [“BNY Mellon picks digital asset custody firm Fireblocks which raises \\$133 million.”](#) Ledger Insights. March 18, 2021.

³⁶ [“Deutsche Börse Group acquires majority stake in Crypto Finance AG, extending its offering for digital assets.”](#) Deutsche Börse Group. June 29, 2021.

³⁷ See Gemini cryptopedia for more in depth explanations: <https://www.gemini.com/cryptopedia/cryptocurrencies-vs-tokens-difference>.

ability to offer yield from lending as well as providing liquidity to earn token-based rewards (yield farming). DeFi is also one of the biggest sectors of cryptocurrency trading.

The expansion of DeFi may translate to a rise in price for other coins related to DeFi protocols.

DeFi has recently experienced exponential growth. In the one-year period ending July 2021, total value locked (TVL)³⁸ across DeFi platforms grew to USD 110 billion from USD 2 billion.³⁹ TVL is a proxy for activity level and indicates the amount of assets that are staked in a protocol. Because many DeFi applications rely primarily on Ethereum smart contract capabilities, ether's rise in price can be partially attributed to DeFi growth. The expansion of DeFi may also translate to a rise in price for other coins related to DeFi protocols.

The addition of smart contract capabilities integrated with the Bitcoin blockchain may result in Bitcoin benefitting from DeFi activity in the future.

The Bitcoin blockchain, due to its lack of smart contract capabilities, had been unable to participate in DeFi growth directly. However, in July 2021, Jack Dorsey, CEO of Twitter and Square, announced he is planning to add open-source capabilities to bring DeFi to Bitcoin as part of a new decentralized exchange from Square.³⁸ The addition of smart contract capabilities integrated with the Bitcoin blockchain may result in Bitcoin benefitting from DeFi activity in the future.⁴⁰

Beyond Finance

Many coins perform non-financial functions as well. Due to the decentralized nature of these projects, governance capability is a key function. Governance coins, such as Uniswap's UNI, allow holders to vote on proposals related to the future development of a protocol, such as those that propose new features or propose a means of distributing any profit. Governance coins also help power decentralized autonomous organizations (DAOs). ShapeShift, a crypto exchange and wallet, recently announced its transition to a DAO from a traditional corporate structure. In doing so, it added more governance functions to its FOX token.⁴¹

Governance coins help power DAOs.

Other projects focus on sectors beyond finance. Filecoin, for example, powers a decentralized file storage protocol. Miners can earn filecoin by storing and retrieving data for users. Other protocols (e.g., Polkadot) are intended to improve blockchain scalability and interoperability.⁴² The DOT token helps with the operations and governance of Polkadot. Finally, and not unexpectedly, gaming is a popular, growing, and profitable segment.

³⁸ Total value locked represents the number of assets that are being staked in a specific DeFi protocol. For more information, see <https://coinmarketcap.com/alexandria/glossary/total-value-locked-tvl>.

³⁹ Akamo, Ajibola. "Jack Dorsey to bring Bitcoin into the mega \$110 billion DeFi industry." Nairametrics. July 19, 2018.

⁴⁰ To learn more about DeFi, visit the [Ethereum website](#).

⁴¹ "ShapeShift Decentralizes: FOX Airdropped to 1M+ addresses." ShapeShift.

⁴² Blockchain scalability—resulting in slow transaction speed, high energy consumption and high transaction costs—is a key problem that new blockchains or "layer two" solutions aim to solve. For Vitalik Buterin's view, see his blog: <https://vitalik.ca/general/2021/05/23/scaling.html>

The top three crypto derivative exchanges—Binance, FTX, and Bybit—are all nascent digital exchanges.

For example, the game Axie Infinity allows players to collect, breed, and trade NFT creatures, and the game is one of the highest grossing projects on the Ethereum blockchain.⁴³ Axie Infinity's AXS token is used for game governance, while a separate coin, SLP, is used for game earnings.

Derivatives

Some institutions are choosing cryptocurrency futures trading on regulated exchanges to track cryptocurrencies without needing to trade or hold the underlying coin.

One additional item worth noting is the proliferation of cryptocurrency derivatives. A study published in April 2021 indicated the traded volume of cryptocurrency derivatives was five times that of cryptocurrency spot markets.⁴⁴ As mentioned earlier, aggregated open interest in Bitcoin futures was USD 17.8 billion as of Aug. 23, 2021. The top three crypto derivative exchanges—Binance, FTX, and Bybit—are all nascent digital exchanges.⁹ Among traditional exchanges, only CME Group, the fourth-largest exchange by open interest in Bitcoin futures, trades contracts at this volume. For Bitcoin options, Deribit, another nascent digital exchange, is the dominant player.⁴⁵ Perpetual futures products—futures contracts that do not expire—are also popular. The FTX derivatives exchange lists over 200 perpetual futures on different coins.⁴⁶ As expected, some institutions are choosing cryptocurrency futures trading on regulated exchanges to track cryptocurrencies without needing to trade or hold the underlying coin and set up digital wallets and custody arrangements.

The next section describes how S&P DJI addresses the unique market structure and combines it with robust pricing to build its benchmarks.

WHY INDEXING?

Independent benchmarks can help bring transparency and accessibility to the emerging cryptocurrency market.

Independent, reliable, user-friendly benchmarks are a key component of financial markets. As with traditional financial markets, independent benchmarks can help bring transparency and accessibility to the emerging cryptocurrency market. Like traditional markets, indices can be used as a basis for products such as ETFs, mutual funds, hedge funds, and structured products. However, in cryptocurrency markets, we believe that one of the biggest challenges is providing robust, transparent pricing. Our selection of Lukka as our price provider for these indices gives us the ability to provide institutional quality, standardized, and reliable cryptocurrency index data. Together with the Lukka data, we anticipate that our well-known, rules-based indexing capabilities will become a standard in this market. These easy-to-understand benchmarks are an important tool in helping investors understand the complexities of the digital assets market.

⁴³ Ledesma, Lyllah and Omkar Godbole. "[Axie Infinity Token Price Doubles in 2 Days](#)." Coindesk. July 23, 2021.

⁴⁴ "[Cryptocurrency Derivatives Markets Are Booming, New Study Shows](#)." Carnegie Mellon University: Tepper School of Business. April 2021.

⁴⁵ [Open Interest Put/Call Ratios](#). The Block.

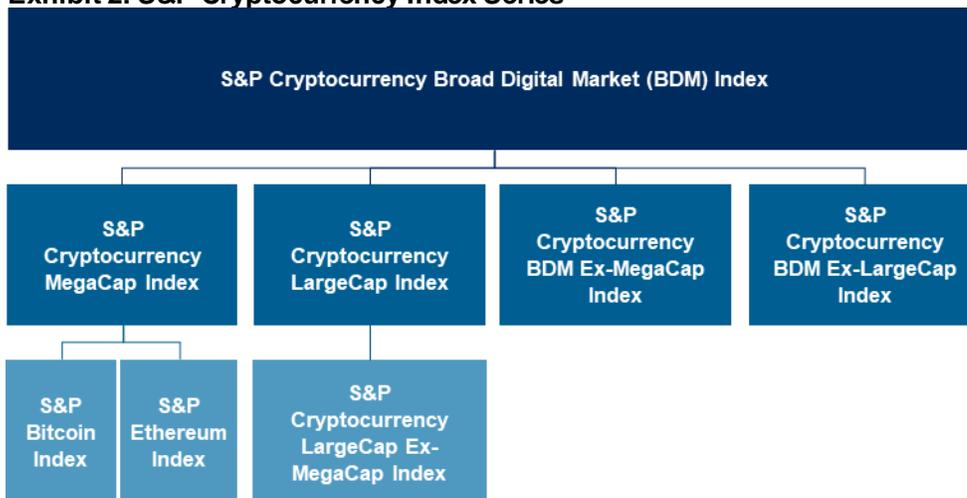
⁴⁶ [Futures Markets](#). FTX.

S&P Cryptocurrency Indices

The S&P Cryptocurrency Indices are designed to measure the performance of a selection of cryptocurrencies. As of July 13, 2021, the S&P Cryptocurrency Index Series includes eight indices.

Exhibit 2: S&P Cryptocurrency Index Series

The S&P Cryptocurrency Index Series includes eight indices.



The S&P Cryptocurrency BDM Index Series is meant to reflect a broad investable universe.

Source: S&P Dow Jones Indices LLC. Data as of July 13, 2021. Chart is provided for illustrative purposes.

All S&P Cryptocurrency Indices are drawn from the S&P Cryptocurrency Broad Digital Market (BDM) Index Series, which is designed to track the performance of cryptocurrencies that meet minimum liquidity and market capitalization criteria and are listed on trading facilities included among the primary markets covered by Lukka Prime. The series is meant to reflect a broad investable universe.

Three of the indices—the [S&P Bitcoin Index](#), [S&P Ethereum Index](#), and [S&P Cryptocurrency MegaCap Index](#)—are designed to track the performance of the two most-liquid and well-known coins—bitcoin and ether—and a combination of the two weighted by market capitalization.

The S&P Cryptocurrency LargeCap Index uses a clustering algorithm to select the appropriate cohort of constituents.

The [S&P Cryptocurrency BDM Index](#) is weighted by market capitalization. This corresponds to coin supply multiplied by coin price for cryptocurrencies. The [S&P Cryptocurrency LargeCap Index](#) is one of its subindices. Because the digital assets market is dynamic, the use of fixed ratios or fixed values to determine the large market cap cohort is quickly outdated. Instead, the large-cap index uses a clustering algorithm to select the appropriate cohort of constituents.⁴⁷

Within the S&P Cryptocurrency BDM Index Series, we have built certain indices to exclude the components of the [S&P Cryptocurrency MegaCap Index](#). These exclusions are used to highlight the performance of the

⁴⁷ For additional details on the market capitalization classification algorithm, please refer to the [S&P Digital Market Indices Methodology](#).

The S&P Cryptocurrency LargeCap Index accounts for approximately 78% of total cryptocurrency market capitalization.

relatively smaller coins that would be otherwise overshadowed by the dominance of the two largest coins. Together, the market domination of Bitcoin and Ether is considerable—approximately 63% of the market capitalization of the total cryptocurrency market.⁴⁸ Similarly, other indices exclude the large-cap constituents. The large-cap index accounts for approximately 78% of the total cryptocurrency market capitalization.⁴⁹

Coin Eligibility

S&P DJI’s goal is to build reliable and easy-to-understand benchmarks for the cryptocurrency industry and to represent the broad market activity. Lukka’s identification of the best-in-class exchanges is the starting point for determining index-eligible coins. Coins are eligible if they trade on a Lukka-approved exchange and have a supporting white paper.⁴⁹ A “white paper” in this context refers to a detailed technical document created by a cryptocurrency’s project founders that discusses the concepts, goals, and future roadmap of the cryptocurrency. A cryptocurrency project with a white paper suggests that the project founders have done the research and supplied the data to demonstrate why cryptocurrency will likely become adopted. S&P DJI does not include stablecoins or any other pegged digital assets in their existing indices, because while they may be considered an essential part of the cryptocurrency ecosystem, they will not necessarily reflect growth (or decline) in the market.

Coins are eligible if they trade on a Lukka-approved exchange and have a supporting white paper.

In addition, any coins that are or become subject to a regulatory or legal concern may be considered ineligible. In recent years, we have seen the SEC file actions against ICOs and other coin projects, alleging that they conducted unregistered digital asset securities offerings. The allegations can lead to exchange delistings, volume decreases, and fewer custodians servicing the coins. These actions have the effect of making the coin less representative of the market overall.⁵⁰

Lukka’s pricing covers regulated exchanges who have “know your customer” rules.

Finally, S&P DJI’s index methodology is intended to screen out privacy-enhanced coins. Over the past few years, we have seen countries around the globe recommend the delisting of privacy-enhanced coins from exchanges. In the U.S., FinCEN requires exchanges to understand the identity and profile of its customers via the Bank Secrecy Act. Certain privacy-enhanced coins employ features to anonymize this information, making them a potential target of the regulators. Lukka’s pricing covers regulated exchanges who have “know your customer” rules. Privacy coins available on certain regulated exchanges will be tied to a specific exchange user as a result of these “know your customer” rules. Transactions in privacy coins outside of regulated exchanges are much more likely to be

⁴⁸ Source: Lukka. Data as of June 30, 2021, based on USD 1.46 trillion and 950+ assets priced by Lukka Prime.

⁴⁹ Please refer to the [S&P Digital Market Indices Methodology](#) for additional details.

⁵⁰ See SEC activity around Ripple and XRP: <https://www.sec.gov/news/press-release/2020-338>

truly anonymous.⁵¹ The S&P Digital Assets Index Committee reserves the right in its sole discretion to remove a digital asset that becomes subject to a legal, regulatory, or practical concern or due to potential market disruption. Coins may also be excluded from an index based on market capitalization and liquidity, as previously discussed.

The S&P Digital Assets Index Committee reserves the right to remove a digital asset that becomes subject to a legal, regulatory, or practical concern or due to potential market disruption.

Index Pricing

In order to properly provide transparency to the market via benchmarks, S&P DJI believes that working with an institutional-grade pricing provider that seeks to address certain market risks, such as fraud and market manipulation, is critical. We believe a robust cryptocurrency price provider should meet the following criteria.

- **Evaluate exchanges utilized for price sourcing on an ongoing basis:** Exchanges should be regularly evaluated, and only the highest-quality exchanges in sufficiently regulated jurisdictions should be selected.
- **Possess a robust, transparent pricing methodology:** The methodology should address the unique attributes of the market—such as volatility or potential for manipulation—to arrive at a reliable, transparent price.
- **Provide standardized, quality reference data:** Data should be normalized across exchanges and across currency pairs.

Our cryptocurrency price provider Lukka meets all these criteria.⁵²

Specifically, Lukka Prime's Fair Market Value (FMV) pricing uses a proprietary methodology with quantitative and qualitative factors to determine the primary market (exchange) of each asset at any given time, as well as each asset's FMV. The FMV pricing methodology reflects actual executed trades, is compatible with how fund assets are valued, and is aligned with the SEC's guidance on fair value, the U.S.'s generally accepted accounting principles (GAAP), and the International Financial Reporting Standards (IFRS). In contrast, average prices (such as VWAP or TWAP) are not considered to be FMV and usually do not exist in the market as tradable prices.

In addition, Lukka looks to normalize reference data across exchanges to uniquely identify each asset and allow the mapping of validated cryptocurrency reference data.⁵³ S&P DJI uses the Lukka Prime FMV price at 4:00 p.m. ET for its end-of-day branded cryptocurrency index

Lukka Prime FMV pricing uses a proprietary methodology with quantitative and qualitative factors to determine the primary market and FMV of each asset.

⁵¹ Morris, David. "[Consensus 2021: Can Privacy Coins, Exchanges and Regulators Coexist?](#)" CoinDesk. May 27, 2021.

⁵² S&P Global, Inc., the parent of S&P Dow Jones Indices LLC, is an investor in Lukka. For information on S&P Global's investment in Lukka, please see [here](#).

⁵³ For additional details on Lukka and FMV, see <https://data.lukka.tech/prime/>

calculations. This is the first, and we believe only, methodology designed specifically for determining the pricing of liquid cryptocurrency assets via actual executed prices.

In the following sections, we discuss index performance and analytics.

PERFORMANCE AND ANALYTICS

The following exhibits show back-tested results of the indices and their correlation with other asset classes.

The S&P Bitcoin Index has the longest back-tested history of the S&P Cryptocurrency Indices.

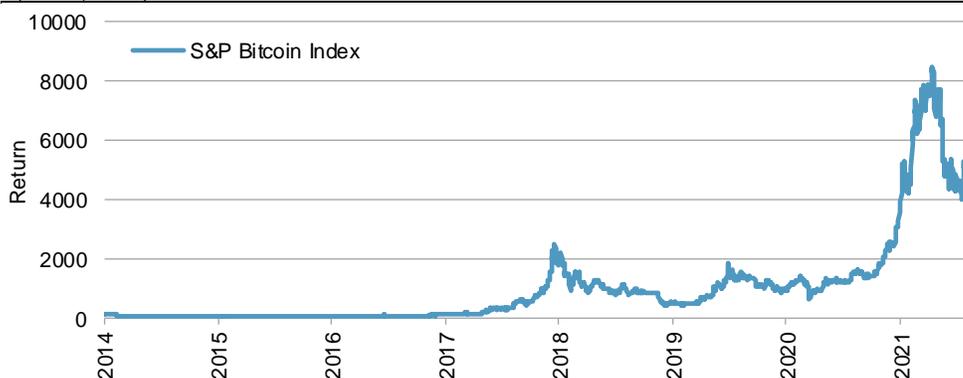
S&P Bitcoin Index

Designed to measure the oldest and most well-known cryptocurrency, the S&P Bitcoin Index is the S&P Cryptocurrency Index with the longest back-tested history, with a first value date of Jan. 1, 2014. Since inception, its historical annual return based on back-tested data has been over 71%, amounting to a total return above 5,700% through Sept. 30, 2021. The annualized back-tested returns are characterized by high volatility, which lowers the risk-adjusted return. It is worth noting that the risk-adjusted return of this index over the one-year period ending Aug. 31, 2021, was higher than that of the S&P 500®, which had a banner year, with returns over 29%.⁵⁴

Exhibit 3: Performance of the S&P Bitcoin Index

PERIOD	RETURN (ANNUALIZED, %)	VOLATILITY (ANNUALIZED, %)	RISK-ADJUSTED RETURN
1-Year	303.29	72.56	4.18
2-Year	121.97	68.65	1.78
3-Year	88.69	72.29	1.23
Since Inception (Jan. 1, 2014)	71.73	70.27	1.02

The risk-adjusted return of the S&P Bitcoin Index for the year ending Aug. 31, 2021, was higher than that of the S&P 500.



Source: S&P Dow Jones Indices LLC. Data as of Aug. 31, 2021. Index performance based on total return in USD. Past performance is no guarantee of future results. Table and chart are provided for illustrative purposes and reflect hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

⁵⁴ Source: S&P Dow Jones Indices LLC. For the S&P 500, the one-year annualized return was 29.21%, and the one-year annualized risk-adjusted return was 1.95 as of Aug. 31, 2021.

S&P Cryptocurrency MegaCap Index and S&P Ethereum Index

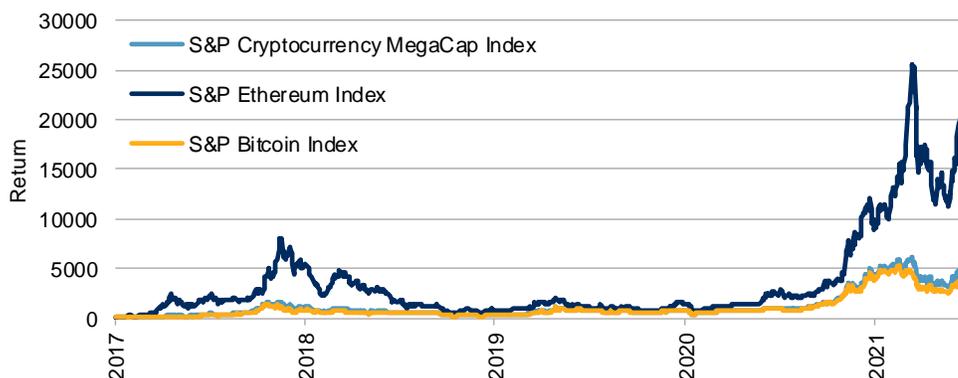
The S&P Cryptocurrency MegaCap Index seeks to track the performance of a market-capitalization-weighted index portfolio consisting of Bitcoin and Ethereum. The S&P Cryptocurrency MegaCap Index and S&P Ethereum Index have back-tested historical data going back to Feb. 28, 2017, and April 4, 2016, respectively. The back-tested history for the S&P Ethereum Index reflects a total return of over 26,000% through Sept. 30, 2021.

The S&P Cryptocurrency MegaCap Index seeks to track the performance of both Bitcoin and Ethereum.

In the chart in Exhibit 4, the levels of the S&P Bitcoin Index and S&P Ethereum Index have been rebased at the first value date of the S&P Cryptocurrency MegaCap Index to allow a visual comparison of the performance.

Exhibit 4: Performance of the S&P Cryptocurrency MegaCap Index and S&P Ethereum Index

PERIOD	RETURN (ANNUALIZED, %)	VOLATILITY (ANNUALIZED, %)	RISK-ADJUSTED RETURN
S&P CRYPTOCURRENCY MEGACAP INDEX			
1-Year	374.39	74.31	5.04
2-Year	153.23	70.11	2.19
Since Inception (Feb. 28, 2017)	140.14	78.39	1.79
S&P ETHEREUM INDEX			
1-Year	681.05	100.31	6.79
2-Year	349.75	92.05	3.80
Since Feb. 28, 2017	228.91	106.27	2.15



The back-tested history for the S&P Ethereum Index reflects a total return of over 26,000%.

Source: S&P Dow Jones Indices LLC. Data as of Aug. 31, 2021. Index performance based on total return in USD. Past performance is no guarantee of future results. Table and chart are provided for illustrative purposes and reflect hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

S&P Cryptocurrency BDM Index and S&P Cryptocurrency LargeCap Index

The S&P Cryptocurrency BDM Index is designed to track the performance of digital assets that satisfy minimal market cap and liquidity requirements.

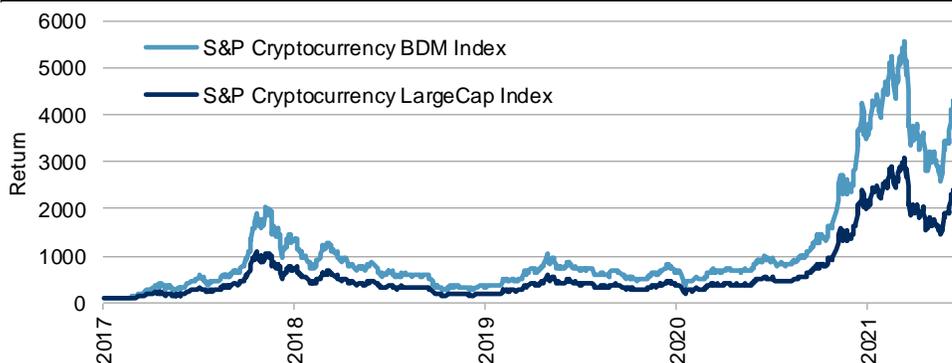
The S&P Cryptocurrency BDM Index is designed to track the performance of digital assets that satisfy minimal market capitalization and liquidity requirements, along with qualitative constraints.⁵⁵ As of September 2021, it included 240 constituents.

The S&P Cryptocurrency LargeCap Index is designed to measure the largest constituents of the S&P Cryptocurrency BDM Index. Constituents are selected by using a modified K-means algorithm to group the constituents of the S&P Cryptocurrency BDM Index by the logarithm of their market capitalization. Although it only has 34 constituents, the index represents more than 95% of the S&P Cryptocurrency BDM Index in terms of market capitalization and has performed similarly over the past three years (see Exhibit 5).

Exhibit 5: Performance of the S&P Cryptocurrency BDM Index and S&P Cryptocurrency LargeCap Index

PERIOD	RETURN (ANNUALIZED, %)	VOLATILITY (ANNUALIZED, %)	RISK-ADJUSTED RETURN
S&P CRYPTOCURRENCY BMD INDEX			
1-Year	384.85	75.86	5.07
2-Year	159.65	71.34	2.24
3-Year	90.94	74.22	1.23
Since Inception (Feb. 28, 2017)	133.94	79.44	1.69
S&P CRYPTOCURRENCY LARGE CAP INDEX			
1-Year	383.78	75.48	5.08
2-Year	155.17	71.11	2.18
3-Year	90.94	74.18	1.23
Since Inception (Feb. 28, 2017)	105.36	79.16	1.33

The S&P Cryptocurrency LargeCap Index is designed to measure the largest constituents of the S&P Cryptocurrency BDM Index.



Source: S&P Dow Jones Indices LLC. Data as of Aug. 31, 2021. Index performance based on total return in USD. Past performance is no guarantee of future results. Table and chart are provided for illustrative purposes and reflect hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

⁵⁵ Market capitalization requirements greater than or equal to USD 10 million, liquidity requirement of a three-month MDVT of USD 100,000.

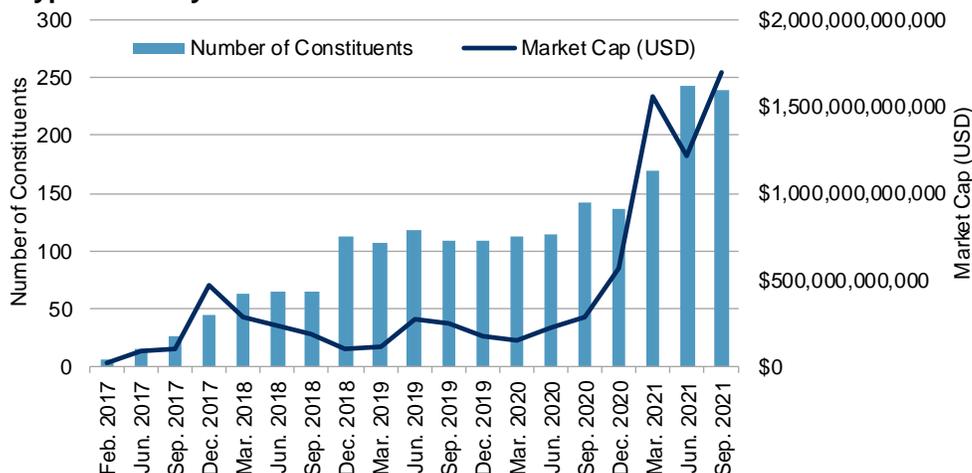
As previously discussed, the digital markets asset class has grown rapidly. One indicator of the rapid growth of this asset class is the number of eligible constituents for the S&P Cryptocurrency Index Series. Exhibit 6 illustrates the number of constituents and market cap of the S&P Cryptocurrency BDM Index.

Although the large-cap index only has 34 constituents, it represents more than 95% of the market cap of its BDM counterpart and has performed similarly over the past three years.

The digital markets asset class has grown rapidly.

The growth in constituents is largely driven by increased market cap of many coins beyond Bitcoin and Ethereum.

Exhibit 6: Number of Constituents and Market Cap of the S&P Cryptocurrency BDM Index



Source: S&P Dow Jones Indices LLC. Data as of Sept. 21, 2021. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

This growth in constituents is largely driven by increased market cap (defined by coin supply x price) of many coins beyond Bitcoin and Ethereum. As measured by back-tested data, the number of coins meeting these criteria has grown over the years, especially over the period from March-June 2021.

Liquidity

Exhibit 7 shows the liquidity of constituents of the S&P Cryptocurrency BDM Index as of its launch date on July 13, 2021, and illustrates a few aspects of the cryptocurrency market that may not immediately be apparent.

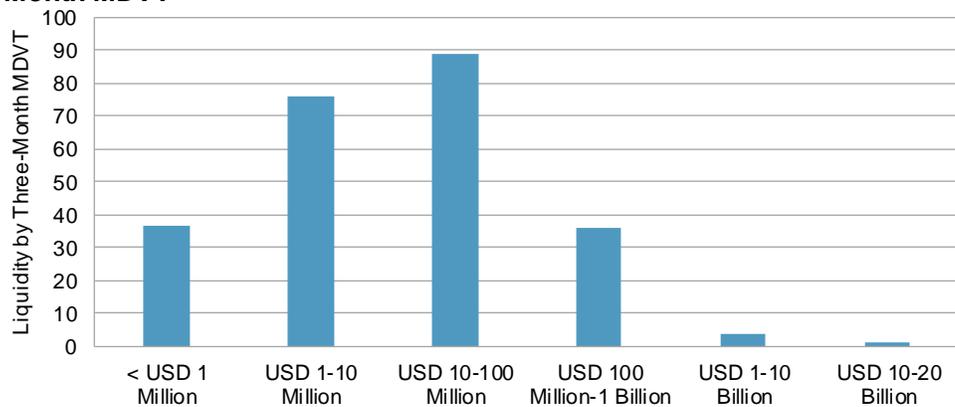
First, as of July 2021, there were over 200 coins with a three-month MDVT of USD 1 million or greater; there were 130 coins with an MDVT greater than USD 10 million; and there were 41 coins with an MDVT greater than USD 100 million.⁵⁶

There are 41 coins with an MDVT greater than USD 100 million.

Second, liquidity also indicates that the cryptocurrency market has grown rapidly. In the March 2021 rebalance, 30% of S&P Cryptocurrency BDM Index constituent coins had an MDVT between the minimum of USD 100,000 and USD 1 million. In the June 2021 rebalance, 15% of coins had an MDVT between that same range, with many more coins having significantly more liquidity.

Liquidity also indicates that the cryptocurrency market has grown rapidly.

Exhibit 7: S&P Cryptocurrency BDM Index Constituent Liquidity by Three-Month MDVT



Source: S&P Dow Jones Indices LLC. Data as of July 13, 2021. Chart is provided for illustrative purposes.

15% of S&P Cryptocurrency BDM Index constituents had an MDVT between USD 100,000 and USD 1 million in July 2021.

Comparative Analysis

Exhibit 8 contains the back-tested historical performance of the S&P Cryptocurrency Indices compared with traditional assets as represented by the S&P 500, S&P GSCI Gold, and S&P U.S. TIPS Index from March 2018 through August 2021.

⁵⁶ For the S&P Cryptocurrency BDM Index, the constituent coins must meet a minimum liquidity requirement (i.e., a three-MDVT of USD 100,000) and market capitalization requirements (i.e., greater than or equal to USD 10 million).

Exhibit 8: Performance of the S&P Cryptocurrency Indices

INDEX	1-YEAR (%)	2-YEAR (%)	3-YEAR (%)	SINCE MARCH 2018 (%)
S&P Cryptocurrency BDM Index	384.85	159.65	90.94	57.88
S&P Cryptocurrency LargeCap Index	383.78	155.17	90.94	57.53
S&P Cryptocurrency BDM Ex-LargeCap Index	416.94	237.21	82.54	50.65
S&P Cryptocurrency MegaCap Index	374.39	153.23	98.32	67.15
S&P Cryptocurrency BDM Ex-MegaCap Index	389.65	177.76	62.69	29.12
S&P Cryptocurrency LargeCap Ex-MegaCap Index	377.80	148.61	51.11	16.69
S&P Ethereum Index	681.05	349.75	129.24	71.03
S&P Bitcoin Index	303.29	121.97	88.69	65.02
S&P 500	29.21	24.32	15.95	15.96
S&P GSCI Gold	-8.11	9.03	14.64	9.64
S&P U.S. TIPS Index	5.60	7.10	7.09	6.68

Source: S&P Dow Jones Indices LLC. Data from March 19, 2018, to Aug. 31, 2021. Index performance based on total return in USD. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

In addition to the difference in performance between cryptocurrencies and other asset classes, Exhibit 9 shows the low correlation between cryptocurrencies and other asset classes.

Exhibit 9: Correlation

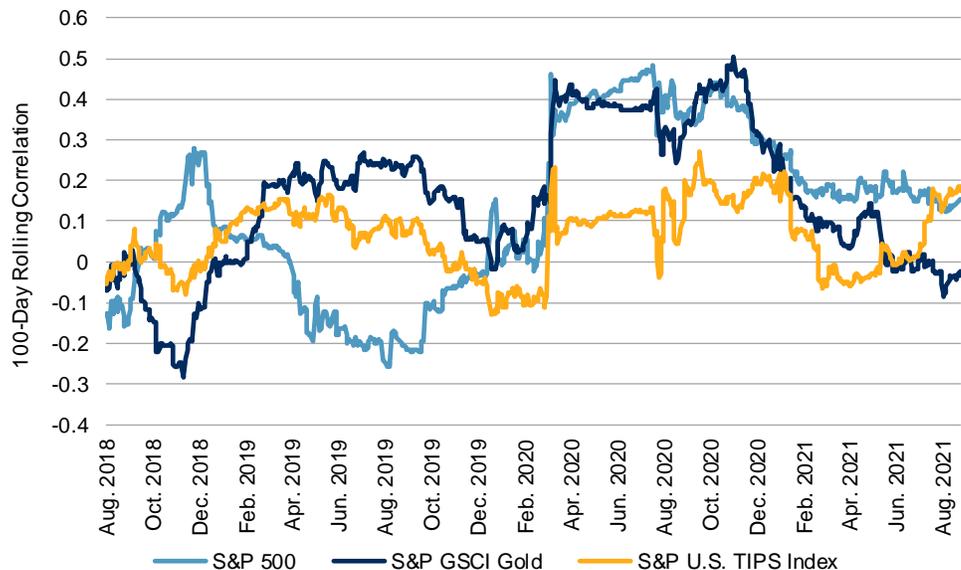
CORRELATION		S&P CRYPTOCURRENCY INDEX								S&P 500	S&P GSCI GOLD	S&P U.S. TIPS INDEX
		BDM	LARGECAP	BDM EX-LARGECAP	MEGACAP	BDM EX-MEGACAP	LARGECAP EX-MEGACAP	ETHEREUM	BITCOIN			
S&P CRYPTOCURRENCY INDEX	BDM	1.000	0.999	0.888	0.991	0.909	0.896	0.882	0.972	0.160	0.149	0.061
	LARGECAP		1.000	0.872	0.994	0.898	0.888	0.879	0.977	0.158	0.150	0.062
	BDM EX-LARGECAP			1.000	0.837	0.951	0.908	0.951	0.908	0.188	0.121	0.039
	MEGACAP				1.000	0.850	0.836	0.863	0.989	0.154	0.154	0.061
	BDM EX-MEGACAP					1.000	0.992	0.854	0.808	0.173	0.114	0.052
	LARGECAP EX-MEGACAP						1.000	0.844	0.794	0.162	0.108	0.055
	ETHEREUM							1.000	0.783	0.161	0.126	0.060
	BITCOIN								1.000	0.148	0.154	0.056
S&P 500										1.000	0.087	-0.132
S&P GSCI GOLD											1.000	0.335
S&P U.S. TIPS INDEX												1.000

Source: S&P Dow Jones Indices LLC. Data from March 19, 2018, to Aug. 31, 2021. Index performance based on total return in USD. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 10 illustrates the rolling correlations between the S&P Cryptocurrency LargeCap Index and the S&P 500, S&P GSCI Gold, and S&P U.S. TIPS Index, respectively. The variability over time, as well as between asset classes, indicates cryptocurrencies may help with diversification. It also illustrates that the relationships between cryptocurrencies and other asset classes are still in flux and will continue to evolve as this asset class matures.

The variability over time, as well as between asset classes, indicates cryptocurrencies may help with diversification.

Exhibit 10: S&P Cryptocurrency LargeCap Index 100-Day Rolling Correlation



Source: S&P Dow Jones Indices LLC. Data from March 19, 2018, to Aug. 31, 2021. Index performance based on total return in USD. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Coin Intracorrelation

Exhibit 11 represents an analysis of the correlations as of July 13, 2021, among coins within the S&P Cryptocurrency LargeCap Index showed a varied range, affirming our discussion that coins have different profiles. Of the 34 coins in the S&P Cryptocurrency LargeCap Index, the correlation to Bitcoin ranged from 0.468 to 0.796. Similarly, the range of correlation of those same coins to Ether extended from 0.481 to 0.853. The coins with the highest correlation to both Bitcoin and Ether are “Ethereum competitor” blockchains (i.e., Solana and Avalanche). When we look at the second- and third-highest correlated coins to both Bitcoin and Ether, the coins are identical—those from the DeFi exchanges Uniswap and PancakeSwap.

Finally, the range of correlations among all 34 coins was even greater— from 0.291 to 0.935. This is what we would expect to see, as cryptocurrencies have different functions and utility and perform differently.

Of the 34 coins in the S&P Cryptocurrency LargeCap Index, the correlation to Bitcoin ranged from 0.468 to 0.796.

Exhibit 11: Coin Intracorrelation Ranges		
COIN	LOW	HIGH
Bitcoin	0.468	0.796
Ether	0.481	0.853
All Large-Cap Coins	0.291	0.935

Source: S&P Dow Jones Indices LLC. Data as of July 13, 2021. Table is provided for illustrative purposes.

The S&P Cryptocurrency Index Series seeks to provide market participants with new tools by which to measure and assess this emerging asset class.

CONCLUSION

As digital assets continue to gather broad appeal as an asset class, and flourish by creating an entirely new financial ecosystem, the importance of having transparent indices will only continue to grow. The S&P Cryptocurrency Index Series seeks to provide market participants with new tools by which to measure and assess this emerging asset class. Our analysis demonstrates that cryptocurrencies are not monolithic and may yield outperformance relative to conventional asset classes, though not without potential risk. S&P DJI aims to continue to enhance this index series to keep pace with the innovations and provide additional accessibility to market participants.

GLOSSARY⁵⁷

Airdrop: The distribution of a crypto asset to all current holders of a specific crypto asset, which is proportional to the holders' current ownership position. Airdrops present unique tax compliance.

Crypto asset: Any digital asset that utilizes cryptography to secure transaction records on a ledger, such as on a blockchain, to control the creation of additional assets, and to verify the transfer of asset ownership.

Crypto exchange: A venue that facilitates buying, selling, trading, or storage of crypto assets. Crypto exchanges often fulfill the role of a traditional securities exchange as well as a broker/dealer or a custodian by holding customer accounts and providing account-related services. Crypto exchanges can choose to list any crypto assets, and currently no centralized processes exist to standardize the names or ticker symbols of crypto assets that are listed on the various crypto exchanges around the world.

Cryptocurrency: A type of crypto asset that may be used as an electronic form of money. Cryptocurrencies are built and transferred on blockchains.

Cryptocurrency wallet: Software that interacts with the blockchain and enables the secure storage of cryptocurrencies. One can store, send, and receive cryptocurrencies via a wallet.

Digital asset: The binary representation of anything that has economic value and can be owned.

Hard fork: A change in a blockchain's code (protocol) that is significant enough to change the nature of a crypto asset, which the network participants do not agree to in majority. The result is two (or more) crypto assets that are treated as unlike assets and differ in value after the hard fork has occurred.

Initial coin offering (ICO): Equivalent to an initial public offering (IPO) for the creation of new crypto assets. Cryptocurrencies and other crypto asset protocols raise money from investors in exchange for early ownership of the crypto asset.

Mining: The act of verifying transactions on a "proof-of-work" blockchain through computational power and, therefore, the use of hardware and electricity. Typically, participating in mining results in the award of a small amount of the crypto asset to the miner, such as in Bitcoin mining.

Smart Contract: A program that runs on the Ethereum blockchains. It is a collection of code (its functions) and data (its state) that resides at a specific address on the Ethereum blockchain. The contracts have a balance, and they can send transactions over the network. However they're not controlled by a user, instead they are deployed to the network and run as programmed.⁵⁸ Smart contracts work similarly on Cardano and Solana blockchains.

Soft fork: A change in a blockchain's code (protocol) that is not significant enough to change the nature of a crypto asset, which the network participants do not agree to in majority. The result is a possible change to the cryptocurrency and its protocols without a new asset being created.

⁵⁷ Source: Lukka. "Crypto Ecosystem Basic Terms & Concepts." Spring 2021.

⁵⁸ Source: "[INTRODUCTION TO SMART CONTRACTS](#)." Ethereum. Sept. 21, 2021.

Stablecoin: A cryptocurrency that is designed to create greater asset value stability and prevent volatility. A stablecoin can be pegged to fiat money, exchange-traded commodities (such as precious metals), or even baskets of assets that are held in equal quantity to that of stablecoins.

Staking: The act of verifying transactions on a “proof-of-stake” blockchain. Staking also results in a reward, but in contrast to mining, it is in return for “staking” a quantity of the crypto asset instead of for computational power.

Virtual currency: The term created by the European Central Bank in 2012 to describe all cryptocurrencies. Since then, the definition has expanded to include use by the IRS to describe all crypto assets.

PERFORMANCE DISCLOSURE/BACK-TESTED DATA

The S&P Cryptocurrency Broad Digital Market Index, S&P Cryptocurrency Large Cap Index, S&P Cryptocurrency BDM Ex-LargeCap Index, S&P Cryptocurrency BDM Ex-MegaCap Index, and S&P Cryptocurrency LargeCap Ex-MegaCap Index were launched July 13, 2021. The S&P Cryptocurrency MegaCap Index, S&P Bitcoin Index, and S&P Ethereum Index were launched May 3, 2021. All information presented prior to an index's Launch Date is hypothetical (back-tested), not actual performance. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. Complete index methodology details are available at <http://www.spglobal.com/spdji/>. Past performance of the Index is not an indication of future results. Back-tested performance reflects application of an index methodology and selection of index constituents with the benefit of hind sight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results. Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations. Back-tested performance is for use with institutions only; not for use with retail investors.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its data feed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate S&P DJI's ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance. "Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the [FAQ](#). The methodology and factsheets of any index that employs backward assumption in the back-tested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used.

Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices maintains the index and calculates the index levels and performance shown or discussed but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US \$100,000 investment for a 12-month period (or US \$10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US \$1,650), the net return would be 8.35% (or US \$8,350) for the year. Over a three-year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US \$5,375, and a cumulative net return of 27.2% (or US \$27,200).

GENERAL DISCLAIMER

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