

2021 in Review and Look Ahead

Greg Cipolaro
GLOBAL HEAD OF RESEARCH

Ethan Kochav
RESEARCH ANALYST

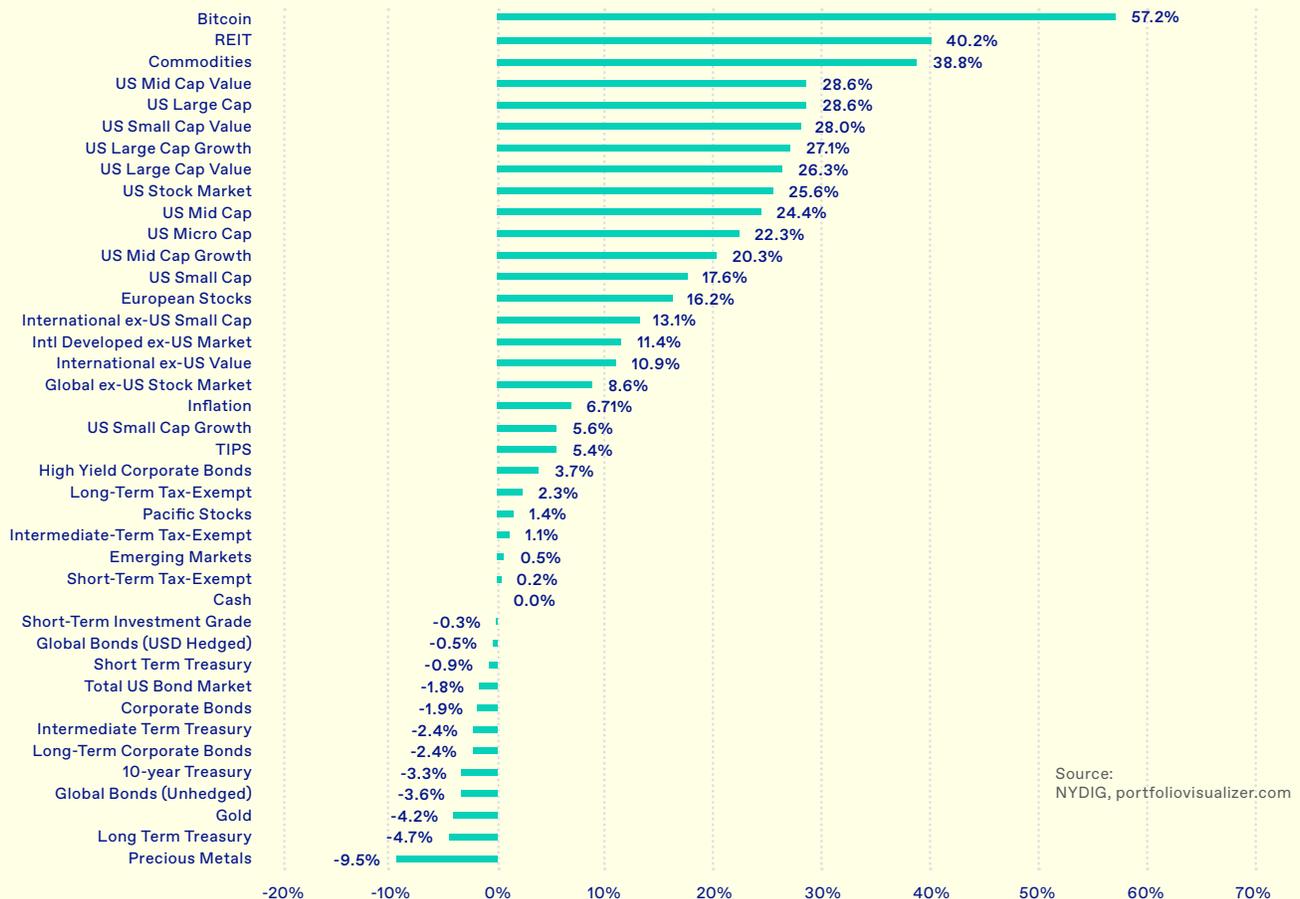
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Performance Review

Bitcoin opened 2021 with strong performance, carrying on its momentum from the previous year. The price doubled in Q1 as the digital currency appeared to be rapidly institutionalized, with the first bitcoin exchange-traded fund (ETF) beginning to trade in Canada, MicroStrategy, Square, and Tesla all announcing big bitcoin purchases (and Tesla accepting bitcoin payment for its vehicles), and Visa entering the space through multiple products and services. Performance reverted somewhat in Q2 after Tesla announced it would stop accepting bitcoin over environmental concerns and China announced bans of mining and trading of cryptocurrencies, but the summer saw a renewed rally following “The B Word” conference featuring a conversation with Elon Musk, Jack Dorsey, and Cathie Wood on the value of Bitcoin. This rally continued through early November, after which performance stalled and began drifting lower into the end of the year. In all, bitcoin was up 57.2%, well above any other asset class for the year.

2021 ASSET CLASS RETURNS



Top 10 Themes of 2021

2021 was another momentous year for Bitcoin and the digital asset ecosystem. With trading around the clock, rapidly scaling technology and payments infrastructure, swiftly growing derivatives markets, and an asset that transcends national borders, a year in digital asset markets is like several in any other industry. We look back at the year and the important trends and topics that were on our and our clients' minds.



01 Regulations are Front and Center Once Again

The changing regulatory landscape for digital assets is a perennially important discussion for clients. Most traditional market investors do not need to consider whether the asset they are considering purchasing is classified as a stock, commodity, currency, or something else, or whether that asset is illegal in one country versus another. However, bitcoin is different from many other digital assets, especially in the U.S., in that it benefits from a well-understood regulatory and taxation framework. But let's review the important news and commentary from major U.S. and supranational regulators.

WHITE HOUSE

The White House, at times, coordinates administration policy and may act as a coordinating entity for global regulators. With the change in administrations this year came a changeover in the heads of many if not all regulatory agencies. The White House's explicit efforts in crypto were focused mostly on the explosion in ransomware attacks and regulatory coordination on stablecoins. This resulted in international cooperation to combat ransomware and a November paper by the President's Working Group on Financial Markets focused on stablecoins.

SECURITIES AND EXCHANGE COMMISSION

On April 17, 2021, Gary Gensler was sworn in as chair of the SEC. Gensler, who previously headed the Commodity Futures Trading Commission (“CFTC”), was expected by some to be a bullish force for the digital asset industry given his experience as a course instructor at MIT on blockchain technology. Gensler has indeed demonstrated a deep and intimate knowledge of the industry, but that has not stopped him from focusing primarily on the SEC’s core mission of protecting investors, maintaining fair and orderly markets, and facilitating capital formation, which has been met with a mixed industry response. The main sticking points in 2021 were the SEC’s refusal to allow the listing of an ETF that holds spot bitcoin, Gensler’s assertion that many cryptocurrencies (as well as lending, borrowing, and staking activities) should be classified as securities and thus regulated by the SEC, and the desire to regulate stablecoins, which Gensler has likened to the United States’ “wildcat” banks of the 19th century. Unfortunately, there was little resolution on any of these matters, setting the stage for an eventful 2022.

DEPARTMENT OF THE TREASURY

Janet Yellen, the new Secretary of Treasury under President Biden and former chair of the Federal Reserve, has been vocal on several aspects of crypto but most of her comments have concerned stablecoins. These statements culminated in a November paper released by the President’s Working Group on Financial Markets that urged Congress to enact legislation to address systematic risks posed by stablecoins. In addition, Senator Elizabeth Warren, chair of the Senate Banking, Housing, and Urban Affairs Subcommittee on Economic Policy, sent a letter to Yellen urging the Financial Stability Oversight Council (FSOC) to use its authority to address risks posed by cryptocurrency markets.

The **Financial Crimes Enforcement Network (FinCEN)**, the enforcement and monitoring arm of the U.S. Treasury, was active in crypto this year. The bureau appointed its first-ever Chief Digital Currency Advisor, Michele Korver, assessed a \$100M civil penalty against crypto derivatives exchange BitMEX for violations of the Bank Secrecy Act, and made numerous efforts to combat ransomware. However, it did not put into practice the proposed reporting requirements for banks and money services businesses (MSBs) as well as the Report of Foreign Bank and Financial Accounts (FBAR) requirements, two of the most discussed items at this time last year.

The **Office of Foreign Assets Control (OFAC)**, which administers and enforces economic and trade sanctions based on U.S. foreign policy under the U.S. Treasury, designated two exchanges, Chatex and SUEX, for facilitating transactions with ransomware actors and placed numerous digital asset addresses and associated individuals on the Specially Designated Nationals and Blocked Persons List (SDN). OFAC also released sanctions compliance guidance for the virtual currency industry and continues to bring enforcement actions against crypto firms that allow users in sanctioned regions to access their platforms.

Acting Comptroller of the Currency Brian Brooks of the **Office of the Comptroller of the Currency (OCC)**, holding the role in the final months of the Trump Presidency, put in place several measures that were deemed favorable to the crypto industry. His acting successor under Biden, Michael Hsu, has been much less supportive, even comparing crypto to the financial innovation that led to the Global Financial Crisis. After being sworn into office in May, Hsu vowed to review his predecessor's actions regarding cryptocurrencies, including the ability for banks to hold stablecoin reserve-related deposits, provide direct crypto custody services, and run nodes in a distributed ledger. That review resulted in a letter that national banks and federal savings associations must demonstrate that they have adequate controls in place before they can engage in these cryptocurrency activities and receive written notification of the supervisory non-objection, a less onerous outcome than expected by much of the cryptocurrency community.

FEDERAL RESERVE

Throughout the year, Fed chair Jerome Powell has referred to bitcoin as digital gold or a substitute for gold rather than for the U.S. dollar and has repeatedly said that he has no intention of banning crypto. The Fed has been evaluating a U.S. dollar-based Central Bank Digital Currency (CBDC), which would be competitive with stablecoins. A long-awaited report from the Fed on a CBDC is still forthcoming. Separately, the Board of Governors released a joint policy statement along with the FDIC and OCC outlining a crypto asset policy sprint initiative and next steps that are expected to result in greater clarity in 2022. Highlighting the current lack of clarity in the space, in a Wall Street Journal Opinion article Wyoming Senator Cynthia Lummis claimed the Fed has not been responsive to applications by Wyoming-based cryptocurrency banks called Special Purpose Depository Institutions (SPDIs) for master accounts with the Federal Reserve Bank of Kansas City, which would give those entities some of the benefits of traditional banks.

DEPARTMENT OF JUSTICE

In October, the Department of Justice announced the creation of a National Cryptocurrency Enforcement Team (NCET) to address complex investigations and prosecutions of criminal misuses of cryptocurrencies. There were also several cases against individuals charged with money laundering or fraud related to cryptocurrencies.

COMMODITY FUTURES TRADING COMMISSION

The CFTC was active this year with enforcement, clarifying its regulatory role within crypto, and fostering the development of regulated crypto derivatives. On the enforcement front, the CFTC settled a \$6.5M charge against Coinbase for reckless false, misleading, or inaccurate reporting as well as wash trading by a former employee on Coinbase's GDAX platform (now Coinbase Pro). The regulator was also instrumental in the \$100M civil penalty against BitMEX for violations of the Commodity Exchange Act and \$42.5M in fines levied on Tether and Bitfinex for misleading statements and illegal commodity transactions. The CFTC took several opportunities to clarify its

regulatory authority over the crypto industry, with Commissioner Dawn Stump publishing a primer on the matter. Finally, the Micro Bitcoin Futures contract (with a contract size 1/10th of a bitcoin) launched on the Chicago Mercantile Exchange (CME) on May 2nd, the Ether Futures contract on February 8th, and the Micro Ether Futures on December 6th.

FEDERAL DEPOSIT INVESTMENT INSURANCE CORPORATION

The FDIC's most public action on crypto was its announced crypto policy sprint in conjunction with the Federal Reserve. Also noteworthy, FDIC Chairman Jelena McWilliams, a holdover from the Trump administration, announced that she would resign from her position on February 4th, 2022, paving the way for Democrats to replace her with a more politically aligned candidate. While Chairman McWilliams was relatively friendly towards the crypto industry, it is not yet clear how this will impact FDIC policy going forward.

SUPRANATIONAL BODIES

In October, the **Financial Actions Task Force (FATF)** released its long-awaited updated guidance for virtual asset service providers (VASP). The guidance, which was previewed in the spring, includes some tweaks and suggestions to the Travel Rule, but its focus was on decentralized finance (DeFi). This suggests that developers that maintain control or sufficient influence over a project could be subject to AML requirements. The intent is not to impose regulations on entities that provide ancillary services, such as miners, wallet manufacturers, unhosted wallet providers, or software developers.

The **Bank for International Settlement (BIS)** was active during the year, publishing several papers on cryptocurrencies and CBDCs. It explored the socioeconomic drivers of crypto ownership, highlighted the benefits of CBDCs, and highlighted the risks and centralization of DeFi projects.

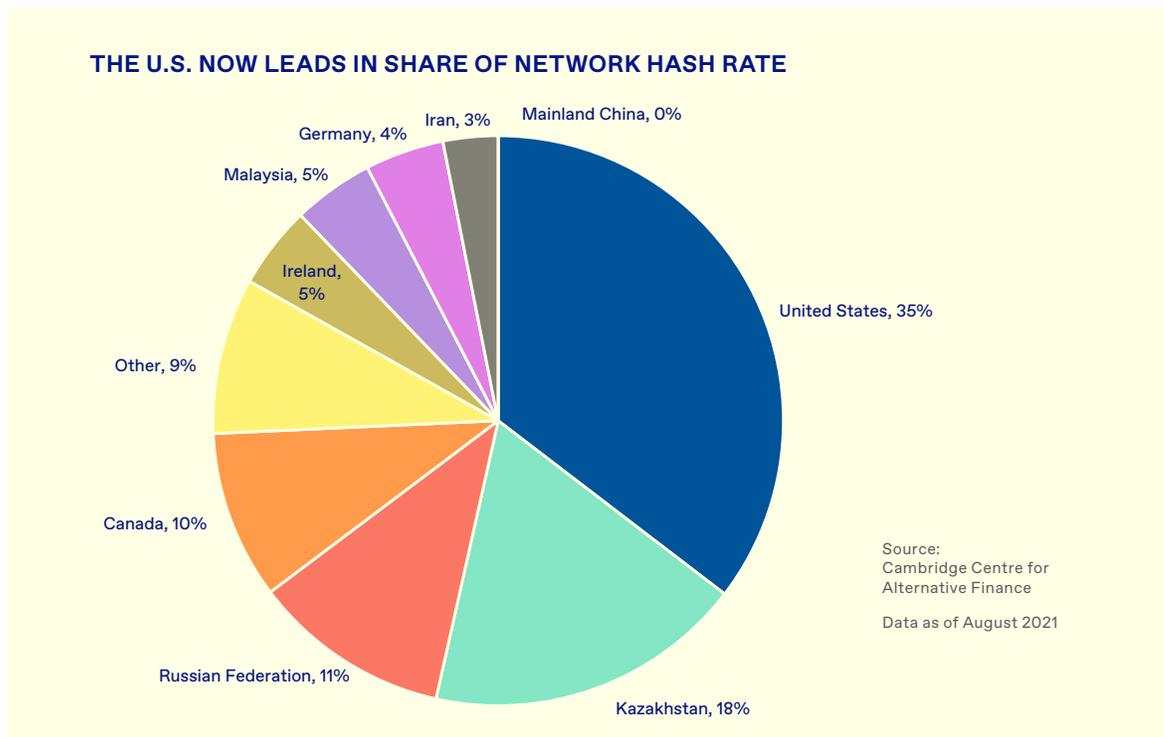
In June, the **Basel Committee on Banking Supervision (BCBS)** published a public consultation on preliminary proposals for the treatment of banks' exposure to crypto-assets. The proposal suggested segmenting digital assets into 2 categories: Group 1 crypto assets, which are composed of tokenized traditional assets plus stablecoins; and Group 2 crypto assets, which are composed of native crypto assets, such as bitcoin, and financial assets based on those native assets, such as a bitcoin ETF. Group 1 assets would have capital requirements at least equivalent to those of traditional assets, with stablecoins getting a risk weight equal to the underlying asset plus an unsecured loan to the redeemer. Group 2 assets like bitcoin were given the most punitive treatment, a 1250% risk weight. Comments were due in September, and we expect a revised policy based on that guidance sometime in 2022.

With El Salvador recognizing bitcoin as legal tender, the **International Monetary Fund (IMF)** has been publicly active on the crypto front. Shortly after El Salvador's announcement, the IMF penned a cautionary blog post "Cryptoassets as National Currency? A Step Too Far." It also published posts highlighting the risks of crypto assets and urging regulators to "step up." Finally, the IMF guided how to treat crypto assets in macroeconomic statistics and devoted a third of its October Global Financial Stability report to a more even-handed look at the opportunities and challenges associated with the asset class.

02 China's Loss is the US's Gain

"China bans bitcoin" has been a headline published many times since 2013 when the Chinese government first announced restrictions on the use of cryptocurrencies. Each subsequent announcement has seen incremental prohibitions on cryptocurrency activities, with China slowly enveloping bitcoin in a wholesale ban. In 2021, China came as close as they could to fully banning bitcoin without banning it by prohibiting mining in the spring and then trading in the summer. That second ban, while meaningful, did not have quite the same price impact as the first ban; it seems that, after having tracked the regulatory arrow to its logical endpoint, investors had already psychologically priced in the move. Holding bitcoin in wallets and executing peer-to-peer transactions are still permissible, and it is unclear whether China will take this final step. Banning the holding of bitcoin in a geography would be difficult if not impossible to enforce from a practical standpoint. Regardless, even though China's role in crypto is significantly diminished, we would be surprised if this is the last we hear from the country on the matter.

China's mining ban had international ramifications beyond the immediate price impact. China was by far the biggest source of Bitcoin mining in the world, generating nearly two-thirds of the network hash power immediately before the ban. Following the prohibition, the total network hash rate dropped from 180 EH/s to 84 EH/s. Some mining rigs migrated across the border to Kazakhstan and Russia and some miners tried to move overseas to the US, but most of the hash power sat idle. In the months that followed, new rig deliveries have brought the network hash rate back to where it was before the China ban. Although some hash rate appears to have come back online in China, the main beneficiary of that new network hash rate has been the U.S., which is now the clear leader in hash rate share. Miners have appreciated the stable regulatory landscape in the U.S. and access to a relatively green grid with favorable electricity costs.



03 Tesla Adds Bitcoin to Treasury, Accepts and then Rejects it for Payments

For part of the year, bitcoin's price movements seemed highly reliant on Elon Musk's sentiments and actions by Tesla. Early in the year, Musk previewed his support for Bitcoin by adding the Bitcoin logo and #bitcoin hashtag to his Twitter profile. This was followed by Tesla's purchase of \$1.5B worth of bitcoin for its treasury, and its acceptance of bitcoin as payment for the purchase of its vehicles. This event, unsurprisingly, sent the price of bitcoin sharply higher. Then, on May 12th, Tesla abruptly announced that it would stop accepting bitcoins as payment, with the about-face driven by Musk's concern over Bitcoin's energy use, sending the price of bitcoin down and creating significant bearish sentiment. Bitcoin's subsequent bull market would also be sparked by Elon Musk following his appearance at "The B Word" conference in July, where he discussed the digital asset alongside Jack Dorsey and Cathie Wood, which viewers felt was positive. Since then, Musk has not commented as much on Bitcoin, moving his attention to dogecoin. Musk's whimsical views on Bitcoin had significant impact on markets in the first half of 2021, frustrating many in the space. It does appear, however, that his grip on investor sentiment has weakened in recent months as broader institutional adoption has taken over as the dominant narrative.

04 Energy Discussion Comes Front and Center

Tesla's decision to stop accepting bitcoin for payment on the grounds of mining energy consumption sparked an intense discussion on Bitcoin's environmental impact. Detractors often pointed out that the scale of Bitcoin's energy usage was comparable to a small country while supporters countered that the energy consumption was not equivalent to carbon production, a metric made less worrisome with mining coming to the U.S.'s relatively green grid, which continues to get cleaner over time. This was a heated topic and one that is of utmost importance to the institutional investor community, but it is also a topic that is more nuanced than the headlines often portray. We weighed in on the topic (research report found [here](#)) and found that Bitcoin mining in 2020 was responsible for 0.04% of global primary energy consumption and 0.1% of global carbon emissions. Now, this is not zero, but it is far less than modern conveniences such as domestic refrigeration and domestic tumble dryers. The reality is that if one does not think there are benefits to an open-source, decentralized monetary system with a computationally enforced fixed supply, any amount of energy consumption is too much. If one does see the utility of Bitcoin, then one must make the judgment of whether its benefits outweigh the costs.

05 Banks, Payment Companies, and Card Networks Adopt Crypto

The adoption of cryptocurrencies by banks, credit card networks, and payment technology companies was a big trend in 2021. On the payment technology side, PayPal launched its Checkout with Crypto service, allowing its users to convert crypto holdings into fiat during the checkout process. PayPal's Venmo product enabled its user base to buy and sell cryptocurrencies, a service that was enabled on PayPal in 2020. PayPal also bought crypto custodian Curv. Square went all in Bitcoin, rebranding as Block. The company owns Cash App, Spiral, TIDAL, and TBD54566975. Cash App is still a popular way for its users to purchase and sell bitcoin, while Spiral, formerly Square Crypto, is focused on advancing Bitcoin through grants and the creation of Lightning and Bitcoin development kits. TBD is a new initiative for a decentralized exchange, with the only information released being a white paper on the matter.

On the card network side, Visa and Mastercard were both busy this year. Crypto-linked and crypto rewards cards were popular this year after having limited launches at the end of 2020. Crypto-linked cards, which allow users to convert and spend their crypto, and crypto rewards card that pay their users rewards in crypto instead of points, miles or cash had very high interest amongst crypto users. Visa was also busy settling its first transaction with the USD Coin stablecoin and exploring use cases and support for non-fungible tokens (NFTs). It also partnered with neobank First Boulevard to allow its clients to buy and sell bitcoin using Visa's crypto APIs. Mastercard also began testing the use of USD Coin for payment and partnered with a host of crypto companies to solve the challenge of paying with cryptocurrencies as well as streamlining the issuance of new cards. Mastercard also bought Know Your Transaction (KYT) software service provider CipherTrace.

On the bank and banking software provider side, banking software and application providers have stepped in to help banks offer crypto to their clients. Alkami, Allied Payment Network, CSI, FIS, Fiserv, Jack Henry, NCR, and Q2 all announced partnerships with NYDIG this year enabling customers at their client banks to buy, hold, and sell bitcoin.



06 El Salvador is First Country to Make Bitcoin Legal Tender

On September 7th, 2021, the Republic of El Salvador achieved a major milestone by becoming the first nation to call bitcoin legal tender. This accomplishment was celebrated across the Bitcoin community, with supporters flooding in from all over the world to take videos of themselves making purchases at global franchises like Starbucks, McDonald's, and Pizza Hut. Transactions were enabled by the Lightning Network, a second-layer payment network that rides on top of Bitcoin and is designed to make fast payments at a low cost.

While many in the community celebrated this accomplishment, the roll-out has not been without controversy. For one, the law is not particularly popular with Salvadorans, with various polls indicating that a majority disapproved of the law. Perhaps unfairly, this skepticism was exacerbated by bitcoin's price decline following the September 7th launch. There have also been concerns with the technical implementation of the government-sponsored Chivo wallet, although it is worth noting that third-party wallets are allowed in the country and appear to work seamlessly. Chivo wallets can hold both bitcoins and U.S. dollar balances, but it is unclear how the users' holdings are custodied, concerning observers that the government may centrally control and monitor holdings. Furthermore, the international community's disapproval is noted, with Salvadoran bond yields more than doubling since the intention to adopt bitcoin as legal tender was first unveiled at the beginning of June. Bond yields further increased following President Nayib Bukele's announcement of a \$1 billion "Bitcoin Bond" designed to fund the purchase of more bitcoin and the construction of a "Bitcoin City" on the base of a volcano that would be used to power bitcoin mining activity. Regardless, we think the El Salvador case is important to follow and may serve as a template for other countries that may be interested in adopting bitcoin as legal tender.



07 Institutional Adoption Continues to Grow

The bitcoin bull market of 2020/2021 has differed from the last ones in that it has been accompanied by significant institutional adoption. Institutional adoption takes various forms. The first is direct investment. Several companies began to place bitcoin on their balance sheet, most notably MicroStrategy, Tesla, and Block (formerly known as Square). Even a pension fund began investing in cryptocurrencies, with the Houston Firefighters' Relief and Retirement Fund investing \$25 million in bitcoin and ether. Traditional hedge funds also entered the space, with many engaging in the bitcoin futures basis trade in Q3 as futures appreciated significantly relative to spot.

The second form of institutional adoption is from client service-based institutions onboarding bitcoin into products to be offered to retail clients. Investment banks began offering bitcoin funds on their wealth platforms and banks and credit unions across the country began to allow customers to trade directly on their platforms. Newer "fintech" and traditional payment rails onboarded cryptocurrencies in various forms. A futures-based bitcoin ETF was launched in the U.S. and an ETF that invests in spot bitcoin was launched in Canada. Several firms began accepting bitcoin as payment.

We believe that the institutionalization of cryptocurrencies has fundamentally changed bitcoin markets. For one, we have noticed an increased correlation to equity markets and macro events like CPI prints and FOMC meetings, which makes sense given the new set of traders involved. We have also seen a significant shortening of bitcoin market cycles, which may be as a result of the stabilizing forces of institutions. The market will continue to evolve as it gathers new participants.



08 Taproot is Bitcoin's Biggest Technical Upgrade in Four Years

On November 14th, at block number 709,632, Bitcoin activated its most significant technical upgrade in over four years — a series of technology updates collectively known as “Taproot.” Taproot is designed to improve Bitcoin’s security, privacy, and throughput rate while reducing fees and laying the groundwork for future upgrades. The upgrade joins two foundational technologies:

MERKELIZED ABSTRACT SYNTAX TREES (MAST) will improve privacy and reduce storage on complex transaction types.

SCHNORR SIGNATURES are an improved digital signature scheme that will also bring privacy and storage benefits, particularly to multi-signature transactions.

Taproot has been a long-awaited addition to the Bitcoin network that has been met with optimism in the community, though the adoption rate remains small as many wallets and exchanges have yet to add support for the technology. To learn more about the upgrade, please read our report linked here.

09 Infrastructure Bill Cements Crypto's Acceptance

Crypto regulations and taxation were highly topical and contentious in the final stages of the Senate’s negotiations on the new bipartisan infrastructure bill. The bill sought to raise \$28B from better tax reporting and compliance from digital asset “brokers.” The points of contention were (1) the definition of the term “broker” and who that applied to in the digital asset industry and (2) the reporting requirement to the IRS of digital asset transfers greater than \$10K. While both provisions made it into the law, the fact that the industry played a significant role in attempting to shape the bill and that lawmakers acknowledged the industry in the bill and will rely on it as a source of revenue is a legitimizing one, a far more important takeaway to us than the fight over semantics. There has already been one bill introduced (the “Keep Innovation in America Act”) designed to make these provisions less onerous with several more on the way, definitively proving that the government is beginning to listen to the crypto industry.

10 Bitcoin ETFs Begin Trading First in Canada, then in the U.S.

This September, after 8 years of failed attempts by the crypto industry, the first bitcoin ETF began trading in the US. This was not the spot-based ETF many in the industry had hoped for, and it wasn't even the first bitcoin ETF to begin trading in North America — that crown was captured by Canada in February. This first U.S.-traded ETF, the ProShares Bitcoin Strategy (BITO) ETF, is based on bitcoin futures traded on the CME. BITO, like the other bitcoin futures ETFs that followed its launch, is registered under the Investment Company Act of 1940, which, while preferred by the SEC, entails futures rolling costs that would not be associated with a spot-based ETF. Historically, those costs would be about 6% per annum on top of the 0.95% management fee. Since BITO launched in October, it has underperformed spot bitcoin by 2.5%. Regardless of the drawbacks, the product has been one of the most successful ETF launches ever and now has about \$1.2B in AUM. Other futures-based ETFs have launched in the wake of BITO, but none have been nearly as popular.

BITO HAS CONSISTENTLY UNDERPERFORMED BITCOIN SPOT



The appearance of the Canadian ETFs in February, which own spot bitcoin, likely had second-order effects on other investment vehicles in the bitcoin ecosystem, chiefly the Grayscale Bitcoin Trust (GBTC). This fund, which has at times allowed subscriptions at its Net Asset Value (NAV), but never redemptions, historically traded at a premium to its NAV. GBTC's premium reached well over 100% at times in its history. With the appearance of ETF alternatives in February, this premium rapidly flipped to a discount, removing a popular "arbitrage" trade in the market. This arbitrage was executed by subscribing to the trust at NAV, hedging the long position with a short bitcoin position, selling the shares at a premium in the market, and closing out the short position. Today, even though Grayscale has filed for an ETF conversion, which would allow for redemption at NAV, the discount is the largest in the fund's history.

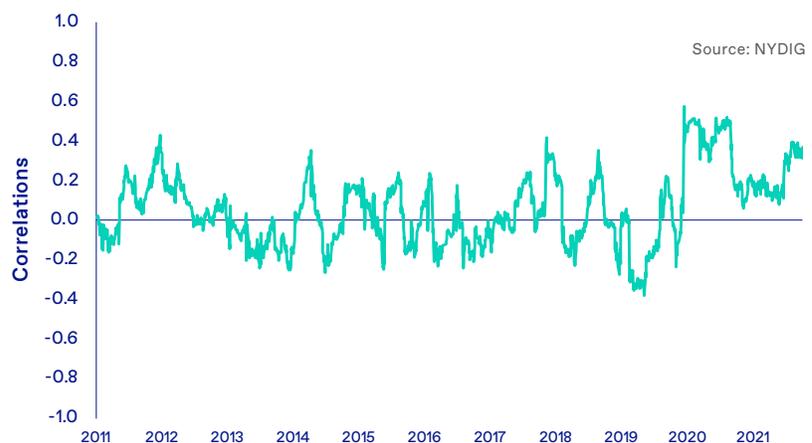
A Look Ahead to 2022



Macro Correlations Remain Elevated

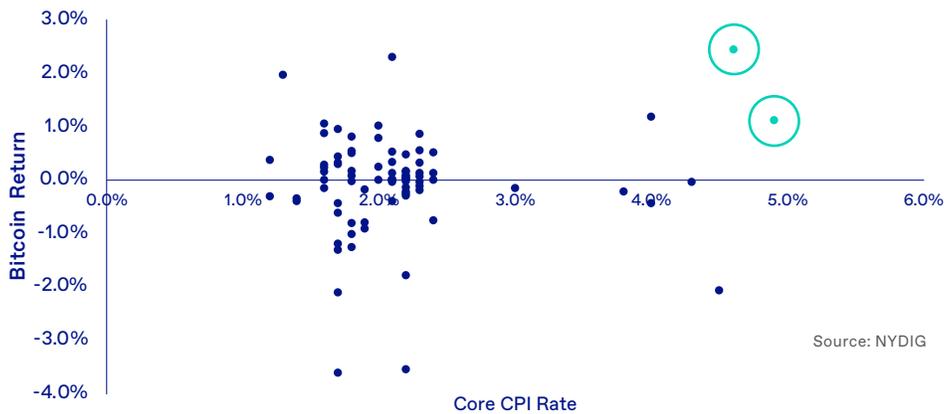
As discussed above, bitcoin has become increasingly accepted in the institutional space. The increased presence of institutional players has been felt in crypto markets. One way is in bitcoin's transition into a risk-on asset. Since March 2020, correlations to equities, which have historically hovered around 0, have increased to a persistent 0.2-0.4 range. Commodities went through a similar secular trend in the mid-to-late-2000s as commodity index investing became a popular investing tool, with correlations to equities generally drifting positive following the global financial crisis. Going forward, we should expect correlations to settle at these new higher levels; there is no reason to expect them to revert to a zero correlated asset. Like commodities though, despite modest positive correlations, bitcoin should still act as a portfolio diversifier.

BITCOIN CORRELATIONS REMAIN (RELATIVELY) ELEVATED

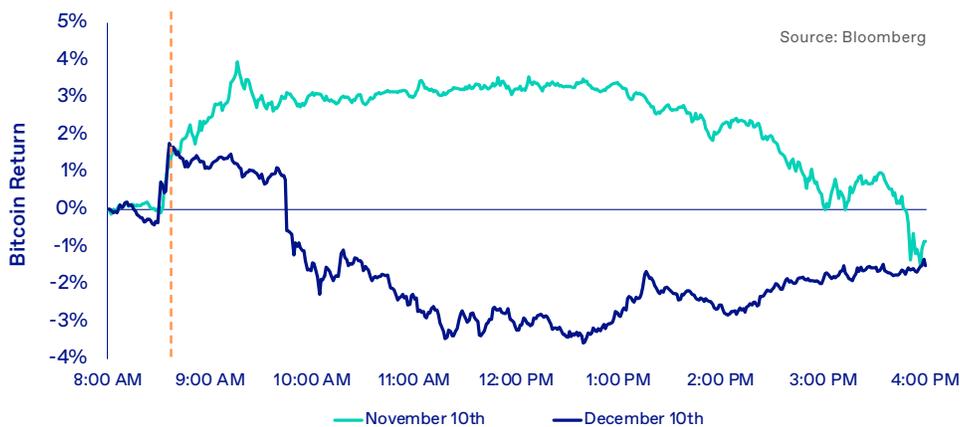


Another interesting shift that has occurred has been in bitcoin's reaction function to inflation prints. The last two U.S. Core CPI measurements, the highest measured in the last 30 years, were accompanied by significant price appreciations for bitcoin (when measuring the return in the hour that straddled the news release). This contrasted with historical data that showed no such relationship. Interestingly, neither of these gains held up very long. By the end of both days, bitcoin ended up with a negative return. It seems likely that traders have set up algorithms to trade bitcoin on the CPI news, processing macro information immediately just as they do for non-crypto assets. It is unclear whether the subsequent reversals were coincidental or whether parts of the market took advantage of the price jumps to take profits. Either way, it seems that bitcoin traders will have to pay much more attention to the same macro events as traditional traders.

BTC HAS NOT BEEN CORRELATED WITH CPI RATE



BITCOIN PRICE JUMPS REVERT BY END OF DAY



Incremental, not Wholesale, Clarity on Regulatory Items Likely

As discussed above, 2021 buzzed with new regulatory guidelines, enforcement actions, product approvals, and more. However, the work to create a coherent regulatory framework for cryptocurrencies is far from over. Below, we discuss some of the potential new regulatory actions that we may or may not expect in the coming year.

Regulation of Stablecoins at the Forefront

Since the Global Financial Crisis, government regulation has had greater focus on financial stability. Stablecoins — financial instruments that are pegged to the dollar and allegedly backed by good credit instruments — seem to closely resemble the money market funds that buckled in the early days of the crisis. This has caught the attention of regulators in nearly every facet of financial services. Most notably, the President’s Working Group on Financial Markets, joined by the OCC and FDIC, wrote a sweeping report warning of destabilizing runs, technological disruptions, and the potential for money laundering. The report called for legislation that would limit issuance of stablecoins to FDIC-insured depository institutions and create greater federal authority over stablecoin issuers concerning risk management (like processes that exist for



banks and insurance companies). That this will be the ultimate government approach is far from a foregone conclusion. There appears to be a predictable partisan split on the issue, with Republicans preferring a lighter touch to regulation than Democrats. Democrats do not necessarily have enough control in Congress required to avoid compromise. Either way, we expect that finalizing an approach to stablecoins will continue to be a major focus for regulation in 2022.

Classification of Cryptocurrencies as Securities

Charmain Gary Gensler has repeatedly indicated that he believes that many of the cryptocurrencies currently traded should likely be treated as securities. However, despite being pressed for clarity on which assets in interviews, he has declined to give specifics. Unfortunately, this has become a familiar refrain for the industry since 2017. The most notable difference today is the SEC's ongoing lawsuit against Ripple, which could be viewed as a test case for other cryptocurrencies and could open the door to more cases brought forward by the SEC upon its resolution.

Bitcoin investors can take comfort in Gensler's historical comments that he does not believe that the digital asset is a security, mirroring the views of his predecessor, Jay Clayton. However, bitcoin lending products may be in scope for securities regulation. Staking a proof-of-stake currency may also be in scope. It is not yet clear when (or if) the SEC will begin to crack down on either activity.



Implementation Still Matters



The run-up in digital asset prices in the last couple of years has left many traditional market participants wanting to join in on the action. Sophisticated retail clients can access bitcoin through exchanges, but less knowledgeable retail clients or more constrained institutional clients need to use more familiar avenues to access the space. One such avenue is investing in the bitcoin-based companies: companies that hold meaningful bitcoin on balance sheets, companies that have bitcoin-based cash streams, or bitcoin miners. Equity returns of these companies are generally more correlated to bitcoin prices than the average company, but still generate significant tracking error to the price of bitcoin itself. Even MicroStrategy, which is the company perhaps most viewed as a bitcoin replacement, has been only 0.7 correlated to bitcoin returns in 2021, generating a tracking error of 68% per annum based on daily returns. This means that return deviations from bitcoin of 68% in one year would be considered normal; hardly what an investor might expect from a bitcoin replacement. Other crypto firms have even lower correlations and higher tracking errors to bitcoin. Holding firms in aggregate increases the correlation to bitcoin by removing some of the idiosyncratic company risk, but it also increases the correlation to equities, reducing the diversification benefit. This is not to say that these firms are bad investments. Many of them have even outpaced bitcoin's return this year. However, investors should not fool themselves into thinking that they are bitcoin replacements.

Another avenue for investment is through funds. While there are no ETFs or mutual funds in the U.S. that can hold spot bitcoin directly, there are closed-end funds like GBTC. These funds do not allow for redemption at par and infrequently offer new shares, resulting in frequent deviations in prices from NAV. These deviations cause significant statistical noise; 29% of returns per annum in the case of GBTC. This matters. In 2021, GBTC, which started the year



at a premium and ended it at a discount, underperformed a pure bitcoin investment by 50%. Without a redemption mechanism, no arbitrage can prevent it from trading at an even greater discount in the future. In addition to closed-end funds that trade bitcoin spot, some ETFs can trade bitcoin futures. These track the price of bitcoin much more closely, with tracking errors of only 4-5% (low relative to bitcoin volatility). However, there can be a significant drag on performance from rolling futures since futures tend to trade at more expensive prices than spot. We estimate this drag to be about 6% per annum. Unlike tracking error, this tends to be a stable, persistent cost. This has led the most popular bitcoin futures ETF, BITO, to underperform bitcoin by 2.5% since its inception in October. Lastly, some funds invest in bitcoin companies. As discussed in the last section, aggregating positions in crypto firms can create lower tracking error to bitcoin. However, the tracking errors of these funds to bitcoin is still not low (30-70% per annum) and correlations to equities can be much higher than pure digital asset investments.

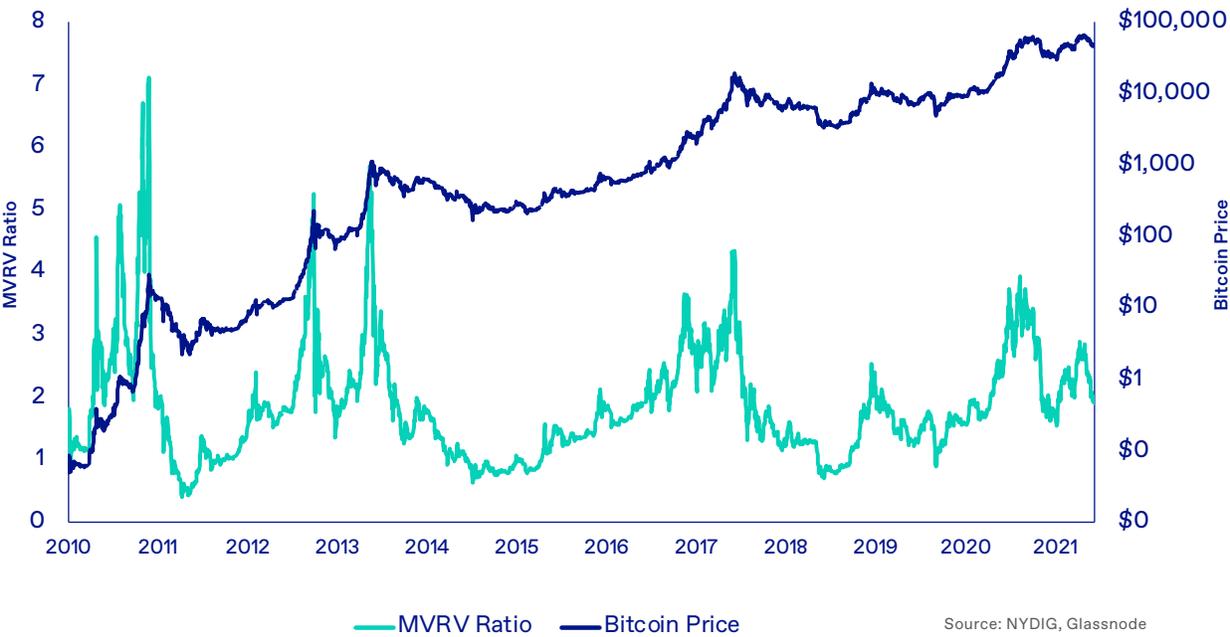
In Appendix 1 to this report, we summarize some return statistics of these investment options.

The End Bitcoin of Cycles

Bitcoin has exhibited cyclical pricing patterns that in the past have lined up around block reward halvings. With cyclical tops in 2011, 2013, and 2017, and with large drawdowns subsequently following, the question on everyone's mind has been whether 2021 will be another cycle high. While 2021 did see bitcoin rise to an all-time high in April, fall sharply through June, and then rise to a new all-time high in November, on-chain data shows today's price action is different from cycles of years past.

One measure of on-chain profitability to note is the Market Value to Realized Value (MVRV) ratio, current market cap divided by a "market cap" obtained based on the cost basis of each coin, the price at which it was last moved. In past cycles, this ratio rose sharply and then peaked in the 4.0 – 7.0 range before bitcoin exhibited a major drawdown and repeated the cycle. This year, however, the ratio never broke 4.0 and exhibited a plateau rather than a sharp spike before correcting. The all-time high price in November was accompanied by an especially low MVRV ratio compared to past market peaks.

MVRV RATIO PEAKS AND TROUGHS ARE GETTING LOWER



This behavior raises the question of whether bitcoin’s price cycles are now over. Price action in 2021 seemed to indicate that cycle peaks and troughs will be tighter going forward. We think that changing investor composition from retail to institutions, which are structurally underweight the asset class, makes for a compelling secular demand story and one that may dampen cycles going forward.

Expansion to New Geographies

With each major price cycle, there has been a new investor base that has helped usher bitcoin to new all-time highs. In past cycles those new bases were western retail, Chinese retail, southeast Asia retail, and most recently western institutions. We think western institutional investors will continue to drive demand in 2022, but we wonder if crypto takes hold in new geographies. The most likely candidates, India, Russia, and Indonesia, all have either put the clamps on trading and ownership or may be about to do so. Perhaps India is more evenhanded in its regulation of crypto and the country can continue its growth in adoption. If not, parts of Africa have shown high adoption, and several politicians throughout Central and South America, most notably in El Salvador, have demonstrated a willingness to adopt bitcoin.

Payments as a Use Case Continues to Grow



Bitcoin is most famously known today as a non-sovereign-backed store of value like a digital form of gold. But that was not always the case. The Bitcoin white paper, for example, calls it “A Peer to Peer Electronic Cash System.” The reality is, however, that the medium of exchange use case has, for many years now, played second fiddle to the store of value function. With the growth in the Lightning Network, however, Bitcoin finally has a fast, cheap, and seamless way to make payments. The adoption of bitcoin as legal tender in El Salvador is an interesting experiment in merchant and user adoption as well as technology deployment. In addition, we have payment networks such as PayPal, which allow users to make payments with bitcoin and other cryptocurrencies.

Bitcoin rewards credit cards, which were rolled out by some companies in a limited fashion at the end of 2020, entered the mainstream in 2021 with the generally available Upgrade Bitcoin Rewards Card through the Visa network. These cards, which pay 1.5% or more of the user’s purchases back in bitcoin, rather than points, cash, or airline miles, have been popular since their launch, with users reportedly spending 450% more than the average annual credit card user.

“Get paid in bitcoin,” or bitcoin payroll, has been topical with mayors and professional athletes throughout 2021. We think 2022 is the year that getting paid in bitcoin can cross the sidelines and be available to the broader public.

Bitcoin Network Hash Rate Will Likely Continue to Grow in 2022

Mining hash rate grew by 13% in 2021, the lowest by far in the history of the Bitcoin network. This low growth was caused by a “black swan” regulatory event; the decision by China to ban mining in the country. The ban led to an immediate 50% crash in hash rate. Prior to the ban, the hash rate was on track for growth close to 60% in 2021, slightly higher than the 50% growth rate in 2020. Lower hash rates mean that it is less difficult for individual miners to mine bitcoin, so the ban coupled with higher bitcoin prices meant high profitability for the remaining miners, though this has leveled off as hash rate has recovered and while the price has retreated.

Breakeven prices for big miners are currently in the \$5-\$10K range, still well below current prices. While prices remain above these levels, we should expect to see hash rate come online as quickly as miners can be deployed, barring a big regulatory event like the one seen in 2021. One prominent trend in the industry has been energy companies finding that mining can be a profitable venture for using stranded or intermittent renewable energy. Stranded energy frequently refers to natural gas deposits that are found via fracking before pipelines can be set up to bring them to market or are small enough that it would be uneconomical to set up this infrastructure. Historically, drillers would have to either let this natural gas escape into the atmosphere or flare it to convert it to carbon dioxide, which is a much less potent greenhouse gas than the methane that comprises natural gas. Either way, this is lost revenue for the oil and gas company. Bitcoin mining can monetize these deposits, bringing mobile data centers and energy generators onsite and converting natural gas into hash rate. Using intermittent renewables as an energy source results from a similar logic; energy produced by renewables do not always time perfectly with demand, so mining can provide a sink for excess production. As energy companies continue to learn about bitcoin mining and understand the economic logic, we should expect them to continue onboarding the technology. We have already seen several make the pivot.

APPENDIX 1

As of 12/31/2021

Asset/Index	Ticker	Price	MARKET CAP/		CHANGE					STATISTICAL SIMILARITY TO BITCOIN			
			AUM	7D	30D	1Y	MTD	QTD	YTD	Correlation	Beta	Tracking Error	Volatility
Digital Asset													
Bitcoin	BTC	\$45,867.86	\$867,648	-10.0%	-19.2%	57.2%	-20.2%	5.4%	57.2%	1.0	1.0	0%	76%
Digital Asset Companies													
Coinbase	COIN	\$252.37	\$54,311	-5.9%	-14.3%	N/A	-19.9%	10.9%	N/A	0.5	0.5	71%	69%
Microstrategy	MSTR	\$544.49	\$5,951	-8.8%	-22.8%	40.1%	-24.5%	-5.9%	40.1%	0.7	0.9	67%	99%
Galaxy Digital	GLXY	\$17.88	\$5,745	-14.1%	-22.2%	107.8%	-26.4%	9.7%	107.8%	0.6	0.9	101%	120%
Bakkt	BKKT	\$8.51	\$2,251	-14.9%	-39.2%	-15.6%	-45.5%	-15.8%	-15.6%	0.2	0.3	270%	267%
Voyager	VOYG	\$12.46	\$2,124	-18.6%	-11.3%	215.8%	-12.7%	23.8%	215.8%	0.4	0.7	114%	125%
Canaan	CAN	\$5.15	\$884	-5.5%	-39.8%	-13.2%	-41.4%	-15.7%	-13.2%	0.5	1.0	144%	162%
Ebang	EBON	\$1.03	\$191	-13.4%	-28.5%	-83.0%	-29.9%	-45.8%	-83.0%	0.5	0.8	116%	129%
Cyberpunk Holdings	HODL	\$0.14	\$23	-5.3%	-16.3%	-2.7%	-10.0%	20.0%	-2.7%	0.6	0.9	104%	126%
Miners													
Marathon Digital Holdings	MARA	\$32.86	\$3,372	-13.8%	-35.3%	214.8%	-35.7%	4.1%	214.8%	0.7	1.2	105%	138%
Riot Blockchain	RIOT	\$22.33	\$2,603	-13.0%	-37.3%	31.4%	-40.2%	-13.1%	31.4%	0.7	1.2	100%	135%
Northern Data	NB2	\$87.39	\$2,025	-3.1%	-28.2%	0.0%	-29.7%	3.9%	0.0%	0.3	0.4	95%	86%
Terawulf	WULF	\$15.05	\$1,505	4.6%	-55.0%	51.0%	-55.0%	-47.0%	51.0%	0.0	0.0	142%	121%
Applied Blockchain	APLD	\$4.19	\$1,342	-4.8%	47.0%	11789.9%	35.2%	109.5%	11789.9%	0.1	0.2	366%	362%
Hut 8 Mining	HUT	\$7.85	\$1,311	-10.3%	-33.4%	185.5%	-34.9%	-6.5%	185.5%	0.6	1.1	113%	138%
Cipher Mining	CIFR	\$4.63	\$1,141	-11.1%	-39.8%	-53.5%	-41.3%	-55.2%	-53.5%	0.1	0.1	99%	72%
Hive Blockchain	HIVE	\$2.64	\$1,029	-13.7%	-25.8%	39.7%	-30.0%	-1.1%	39.7%	0.7	1.0	85%	114%
Bitfarms	BITF	\$5.04	\$973	-13.8%	-34.1%	155.2%	-34.2%	18.8%	155.2%	0.6	1.0	99%	126%
Iris Energy	IREN	\$16.17	\$897	-5.8%	-12.5%	N/A	-10.9%	N/A	N/A	0.0	0.1	126%	113%
Greenidge Generation	GREE	\$16.05	\$652	-18.3%	-4.9%	N/A	-17.2%	-37.2%	N/A	0.3	0.6	117%	120%
Stronghold Digital Mining	SDIG	\$12.85	\$620	7.1%	-27.6%	N/A	-25.5%	N/A	N/A	0.5	1.2	147%	163%
Argo Blockchain	ARB	\$1.32	\$620	0.8%	-29.6%	196.4%	-28.4%	-19.8%	196.4%	0.5	1.0	141%	162%
Mawson Infrastructure	MIGI	\$6.63	\$457	-18.0%	-30.9%	215.7%	-33.7%	-33.7%	215.7%	0.3	0.5	144%	145%
Bit Mining Ltd - Spon	BTMC	\$6.14	\$434	-12.9%	-16.1%	-31.8%	-16.8%	-24.8%	-31.8%	0.5	0.8	125%	139%
Bit Digital	BTBT	\$6.08	\$421	-15.9%	-35.5%	-72.3%	-38.2%	-15.9%	-72.3%	0.6	1.2	157%	186%
Cleantech	CLSK	\$9.52	\$395	-20.1%	-41.7%	-67.2%	-46.5%	-17.9%	-67.2%	0.5	0.7	100%	110%
Bitnile Holdings	NILE	\$1.19	\$160	-16.2%	-26.5%	-72.6%	-33.1%	-51.0%	-72.6%	0.4	0.5	99%	96%
Soluna Holdings	SLNH	\$10.76	\$141	1.0%	-1.9%	128.5%	-10.4%	34.2%	128.5%	0.3	0.5	133%	132%
Digihost Technology	DGHI	\$4.71	\$118	-3.2%	-13.7%	99.0%	-14.7%	9.9%	99.0%	0.4	1.0	172%	190%
Dmg Blockchain Solutions	DMGI	\$0.62	\$104	-15.1%	-30.7%	27.4%	-33.1%	-15.1%	27.4%	0.6	1.2	159%	185%
Canada Computational	SATO	\$0.73	\$49	5.7%	5.7%	526.3%	6.9%	72.2%	526.3%	0.3	0.9	165%	172%
Cathedra Bitcoin	CBIT	\$0.40	\$34	-13.6%	-22.7%	117.0%	-29.2%	-3.8%	117.0%	0.5	0.9	139%	153%
Creek Road Miners	CRKR	\$3.00	\$19	1.7%	-11.5%	391.8%	15.4%		391.8%	0.0	0.0	267%	257%
Digital Asset ETFs													
ProShares Bitcoin Strategy ETF	BITO	\$28.90	\$1,159	-10.6%	-19.9%	N/A	-21.0%	N/A	N/A	1.0	1.0	5%	59%
Valkyrie Bitcoin Strategy ETF	BTFF	\$17.89	\$72	-10.3%	-19.7%	N/A	-20.7%	N/A	N/A	1.0	1.0	4%	58%
Vaneck Bitcoin Strategy ETF	XBTF	\$47.68	\$16	-5.6%	-15.3%	N/A	-16.6%	N/A	N/A	1.0	1.0	16%	61%
Global X Blockchain and Bitcoin Strategy ETF	BITS	\$19.57	\$9	-9.8%	-22.7%	N/A	-24.4%	N/A	N/A	0.9	0.9	27%	56%
Digital Asset CEFs													
Grayscale Bitcoin Trust	GBT	\$34.25	\$30,417	-12.5%	-23.7%	7.0%	-25.9%	1.2%	7.0%	0.9	1.1	29%	86%
Bitwise 10 Crypto Index Fund	BITW	\$38.15	\$974	-8.3%	-22.0%	-36.8%	-23.5%	-9.1%	-36.8%	0.6	0.8	89%	105%
Osprey Bitcoin Trust	OBTC	\$12.62	\$130	-10.9%	-23.7%	N/A	-26.5%	-3.0%	N/A	0.4	0.7	105%	115%
Equity ETFs													
Amplify Transformational Data Sharing ETF	BLOK	40.17	\$1,161	-5.1%	-14.6%	31.2%	-17.0%	2.8%	31.2%	0.7	0.5	51%	53%
Siren Nasdaq NexGen Economy ETF	BLCN	42.51	\$262	-2.3%	-7.6%	4.9%	-9.0%	-4.7%	4.9%	0.5	0.2	67%	24%
First Trust Indxx Innovative Transaction & Process ETF	LEGR	43.43	\$150	0.4%	4.0%	17.9%	3.2%	3.7%	17.9%	0.3	0.1	73%	14%
Bitwise Crypto Industry Innovators ETF	BITQ	21.01	\$121	-8.5%	-23.4%	N/A	-25.9%	-0.1%	N/A	0.8	0.6	44%	59%
Global X Blockchain ETF	BKCH	21.80	\$114	-10.4%	-27.1%	N/A	-29.9%	-4.0%	N/A	0.8	0.8	45%	69%
VanEck Digital Transformation ETF	DAPP	18.54	\$50	-9.8%	-26.5%	N/A	-29.2%	-10.3%	N/A	0.8	0.6	46%	61%
Capital Link Global Fintech Leaders ETF	KOIN	43.17	\$30	-0.2%	1.7%	17.6%	0.2%	4.8%	17.6%	0.3	0.1	72%	17%
Viridic Cleaner Energy Crypto-Mining & Semiconductor ETF Fund	RIGZ	28.84	\$14	-10.1%	-25.3%	N/A	-26.7%	0.3%	N/A	0.8	0.8	44%	67%
Invesco Alerian Galaxy Crypto	SATO	20.95	\$8	-10.6%	-23.0%	N/A	-26.0%	N/A	N/A	0.8	0.8	33%	55%
Invesco Alerian Galaxy Blockchain Economy ETF	BLKC	23.15	\$5	-6.6%	-11.5%	N/A	-14.0%	N/A	N/A	0.8	0.5	34%	36%

Source: NYDIG, Bloomberg, Federal Reserve Bank of St. Louis, Board of Governors of the Federal Reserve System, ICE

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