

CRYPTO IN CONTEXT

The social and technical underpinnings of an emerging asset category

By Galen Moore and Noelle Acheson

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INTRODUCTION

The global economy has ridden a recovery of unprecedented length into the spring of 2019. With a sense that this market is maturing, some investors are looking for new sources of alpha. Many of them are finding it in bitcoin and other crypto assets.¹

There is no need for them to become a libertarian, anticipate a global currency crisis, or see around the corner to new business models these assets may enable. It would be more useful to have a clear understanding of:

- How is crypto innovative?
- What, beyond speculative fervor, is driving demand for these assets?
- What is the risk-return profile of a crypto asset?
- What are the fundamentals?
- What is the infrastructure?

The purpose of this paper is to suggest answers to these questions. We are not labeling crypto assets as an “asset class,” or making the case for institutional participation.

Instead, we aim to illuminate possible paths of investment and operational analysis that may support or refute strategies for institutional investment in crypto. This paper offers concepts and data to support a clear-headed decision about whether, when and how to participate. You can find more, similar resources at coindesk.com/intro-to-crypto-investment. We welcome your feedback and suggestions there, and at our annual investor event in November, [Consensus Invest](#).

This paper offers concepts and data to support a clear-headed decision about whether, when and how to participate.

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¹ Cambridge Associates, “[Cryptoassets: Venture Into the Unknown](#),” February 2019, accessed May 19, 2019.

EXECUTIVE SUMMARY

Crypto assets, led by bitcoin, introduce verifiable scarcity to the digital world, without trusted intermediaries. They are the first digital assets that can be owned in the same way a \$100 bill, or a work of art, is owned. As such, bitcoin is used as “digital gold”; because it is digital, it is programmable, and it introduces the idea of programmable ownership, which leads to other potential uses, including new ways to organize capital, information and people.

Institutional investors have followed retail into crypto; case studies and data show more than speculative fever at work: search for alpha and familiarity with novel forms of money have helped crypto assets incubate. Like ETFs and mutual funds before them, crypto assets reflect a generational preference.

Crypto assets fall well outside the norms of volatility, returns and correlation. While bitcoin may be like digital gold, a volatile new commodity in this emerging asset category, most other crypto assets are better compared to venture capital – a high-risk investment that may, in the long term, deliver stratospheric returns, or go to zero. Peer-to-peer settlement, cross-border transfers and store of value have been proven as use cases, but the market for them remains uncertain. Even estimating the number of users is difficult.

In crypto, operational and investment decisions are intertwined, due to obstacles in infrastructure and fundamentals.

- **Investability:** total market depth is about equivalent to the market cap of a single large-cap stock
- **Lack of trusted venues:** as much as 95 percent of global volume is faked, according to some estimates
- **Lack of service providers:** the ecosystem of fund administrators, trading systems and others is immature; custody in particular is challenging
- **Undiscovered fundamentals:** no accepted system exists for evaluating the fundamentals of crypto asset valuation

Like ETFs and mutual funds before them, crypto assets reflect a generational preference.

Crypto assets' volatility, returns and correlation make venture capital a better analogy.

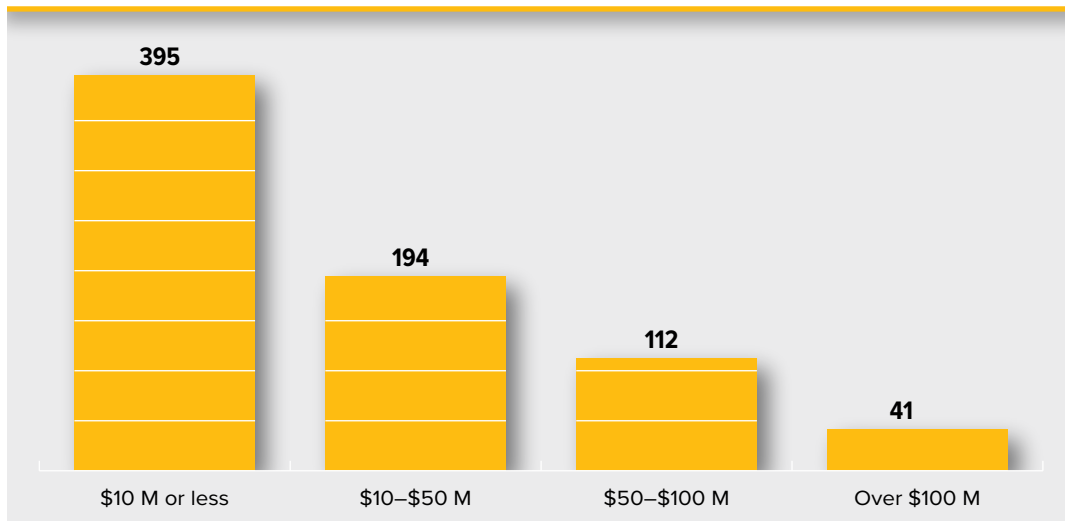
Obstacles exist in infrastructure and fundamentals.

CRYPTO ASSETS' VALUE PROPOSITION(S)

Institutional participation

In the first quarter of 2019, crypto funds' assets under management grew by \$4 billion, a rate not seen even in the headiest days of 2017.² Still, institutions are estimated to hold only 7 percent of crypto assets,³ underscoring the extent to which retail investors drive this phenomenon. Despite crypto markets' reputation as a 24/7 "casino,"⁴ data show most of these retail investors tend to hold through bear markets, becoming active only when the chips are up.⁵ What drives institutional interest and retail investors' commitment to these assets through downturn?

Figure 1. Funds investing in crypto assets, grouped by assets under management



Source: <http://cryptofundresearch.com> (accessed June 30, 2019)

An iPhone-like invention

Bitcoin is an iPhone-like invention: it incorporated several pre-existing technologies into a new technology. Blockchain existed before bitcoin; so did proof-of-work, consensus algorithms and public-private-key cryptography. Bringing these elements together created the first crypto asset: a new form of programmable ownership, in which the asset itself is a form of technology. It's not uncommon to hear people talk about the technology behind crypto assets, called blockchain or distributed ledger technology (DLT).⁶ Those statements should be reversed. Crypto assets are the technology that makes blockchain and distributed ledgers possible.

Bitcoin itself is considered by many to be "digital gold": a highly liquid store of value. Because of its cryptographic properties, it has additional qualities that make it difficult to seize and that put its supply outside the policy decisions of central banks. The kernel of these capabilities is this: crypto assets, led by bitcoin, introduce verifiable scarcity to the digital world. Bitcoin cannot be duplicated. It can be owned in the same way that a \$100 bill is owned, or a print by the artist Andy Warhol, with assurances as to its scarcity. It brings those qualities of ownership into the digital world.

Crypto assets are the technology that makes blockchain and distributed ledgers possible.

2 Crypto Fund Research, "[Growth of Crypto Assets Under Management](#)," accessed May 29, 2019.

3 Binance Research, "[Investigating Crypto Asset Cycles](#)," April 11, 2019, accessed May 29, 2019.

4 Nic Carter, "[The Dark Underbelly of Cryptocurrency Markets](#)," September 3, 2018, accessed May 29, 2019.

5 Binance Research, 2019.

6 "[Blockchain, Explained](#)," *Investopedia*, revised February 10, 2019.

Venture bets on new uses

It's useful to think about crypto assets in two categories: bitcoin, and everything else. Bitcoin's use case as digital gold is, to some extent, de-risked. Its pioneering technology for managing incentives across a network, without a central authority, has been compared to the formation of the joint stock corporation.⁷ This example has led other innovators to try new ways of organizing capital, information and people on that principle.

These innovations come with new crypto assets, formed to govern incentives and record ownership on novel crypto networks. If bitcoin looks like gold, a volatile new commodity of this emerging asset category, these assets look like venture capital: high risk, with a high potential for long-term returns.

What markets are they entering? The most relevant and obvious are in peer-to-peer finance, but there are others. Here are a few examples of specific use cases proposed by individual projects:

- **derivatives:** [Abra](#)
- **automated compliance:** [Harbor](#)
- **“decentralized autonomous organizations,”** in which an organization's governance is fluid: [MakerDAO](#)
- **property title in virtual reality environments:** [Decentraland](#)
- **virtual goods,** transferrable between game players across different gaming platforms: [Crypto Kitties](#)
- **transparent online gambling:** [FunFair](#)
- **collateralized peer-to-peer lending:** [Dharma](#)

None have yet demonstrated real-world utility over legacy solutions. Even bitcoin's use case is subject to change and debate. The first four words of the bitcoin white paper are “commerce on the Internet,”⁸ but many have successfully argued for its primary use as a store of value due to its utility and scarcity.⁹ Bitcoin's technical development has disfavored commerce.¹⁰ In other words, bitcoin has become more like gold than cash—good to hold in a vault, useful in a limited number of large transactions, not something you would buy coffee with. Even

7 Jorge Izquierdo and Ramón Recuero, “[The Future of Organizations](#),” *Aragon blog*, Nov. 22, 2018, retrieved June 7, 2019.

8 Satoshi Nakamoto, “[Bitcoin: A Peer-to-Peer Electronic Cash System](#),” October 31.

9 Saifedean Ammous, *The Bitcoin Standard: The Decentralized Alternative to Central Banking*, (Hoboken: Wiley, 2018), 235.

10 Rusty Russell, “[The Three Economic Eras of Bitcoin](#),” December 1, 2017.

Bitcoin Pizza Day

The medium-of-exchange narrative has largely been discounted, as fees and transaction times have increased with network usage. Still, it is baked into bitcoin's history. A watershed moment for bitcoin was its use in the purchase of two pizzas, on May 22, 2010. The 10,000 bitcoin paid for the two pies would be worth more than \$50 million at bitcoin's prices in April 2019, which offers a succinct explanation why people are reluctant to use bitcoin for small transactions.



estimating the number of users is difficult, though the Cambridge Centre for Alternative Finance offered a lower-bound estimate at 139 million bitcoin users as of late 2018,¹¹ and the ethereum wallet provider MetaMask reported 192,000 weekly active users in April 2019.¹²

Data supporting either use case is hard to come by. It's difficult to parse momentum investment from the kind of value investment consistent with a store of value. Chainalysis, a blockchain forensics firm, has reported some 60 to 80 percent of bitcoin transaction activity is in "speculative" trading.¹³ It remains to be told what the other 20 to 40 percent are for, and whether their numbers are growing.

Even bitcoin has not produced a widely accepted set of data to support a user narrative that goes deeper than hoping someone will pay a higher price, tomorrow. A 2019 investment in crypto may be akin to predicting smartphones in 2004 and pricing a mobile investment accordingly. The App Store is not yet obvious, let alone Uber or Facebook. Global trading on exchange interfaces that resemble a Bloomberg knock-off may provide the trappings of a mature market. The assets and technology traded are far from it.

A 2019 investment in crypto may be akin to predicting smartphones in 2004 and pricing a mobile investment accordingly.

11 Michel Rauchs, et al., "[2nd Global Cryptoasset Benchmarking Study](#)," Cambridge Centre for Alternative Finance, December 2018.

12 Bobby Dresser, "[MetaMask Metrics: a First Look](#)," MetaMask, May 23, 2019, accessed May 24, 2019.

13 Nathaniel Popper, "[After the Bust, Are Bitcoins More Like Tulip Mania or the Internet?](#)," *The New York Times*, April 23, 2019.

WHO IS BUYING CRYPTO ASSETS AND WHY?

New asset categories emerge not just because they diversify portfolios or satisfy a risk-return analysis. Some asset categories historically exhibit a demographic character, growing and sustaining on the strength of their popularity with a specific group. Beyond speculative fervor, there are cultural and economic drivers that support adoption.

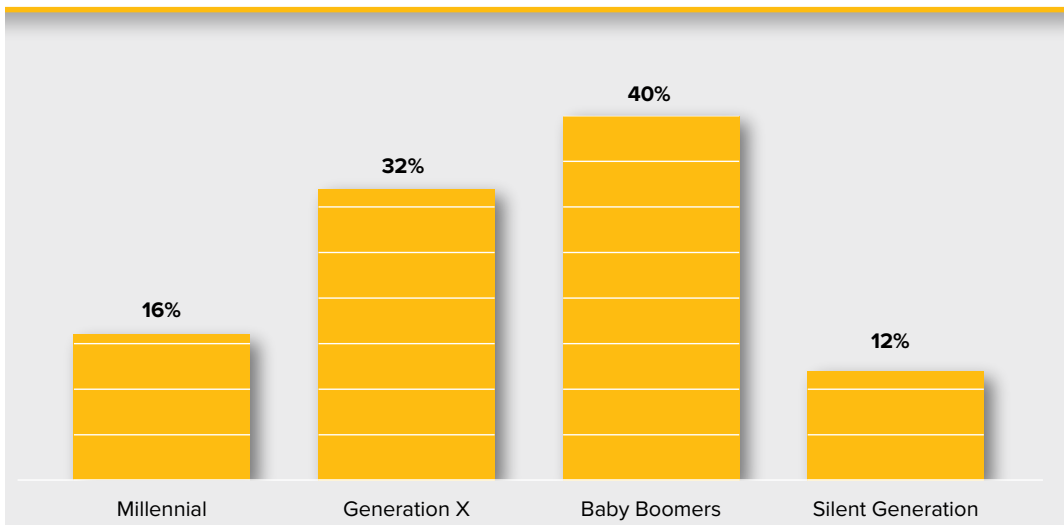
Beyond speculative fervor, there are cultural and economic drivers that support adoption.

Generational characteristics of asset category emergence

New investment vehicles and alternative asset categories emerge and grow with generational preference. Each generation's investment habits are driven by economic conditions of their upbringing and other cultural factors.

In 1985, as the oldest members of the Baby Boom generation¹⁴ entered their peak earning years,¹⁵ there were 650 U.S. equity mutual funds. Six years later, that number had more than doubled, and by 2004, with the youngest Boomers solidly in the middle of their peak earning period, there were 3,934.¹⁶ The mutual fund was an appropriate vehicle for the Baby Boom generation's prosperity, consumerism and freedom from worry about their financial future.

Figure 2. Percentage of mutual fund-owning households



Source: Gene Walden, "[Money and Baby Boomers – Part I: Peace, love, rock 'n' roll, and the retirement crisis.](#)" Thrivent Funds (accessed May 21, 2019)

As the chart above shows, Boomers still favor the category. Their millennial and Generation-X children decidedly favor exchange traded funds (ETF).¹⁷ The maturation of these new generations into their peak earning years has coincided with the rise of the ETF, much as their parents' peak earning years coincided with the mutual fund. Millennials, in particular, have also shown an elevated preference for, and awareness of crypto assets.

14 Baby Boom generation defined as Americans born 1946 to 1964. Pew Research Center, "[The Generations Defined](#)," accessed May 21, 2019.

15 Peak earning years defined as 35 to 54 years of age. Jill Mislinski, "[Median Household Incomes by Age Bracket, 1967-2017](#)," *Advisor Perspectives*, October 19, 2018.

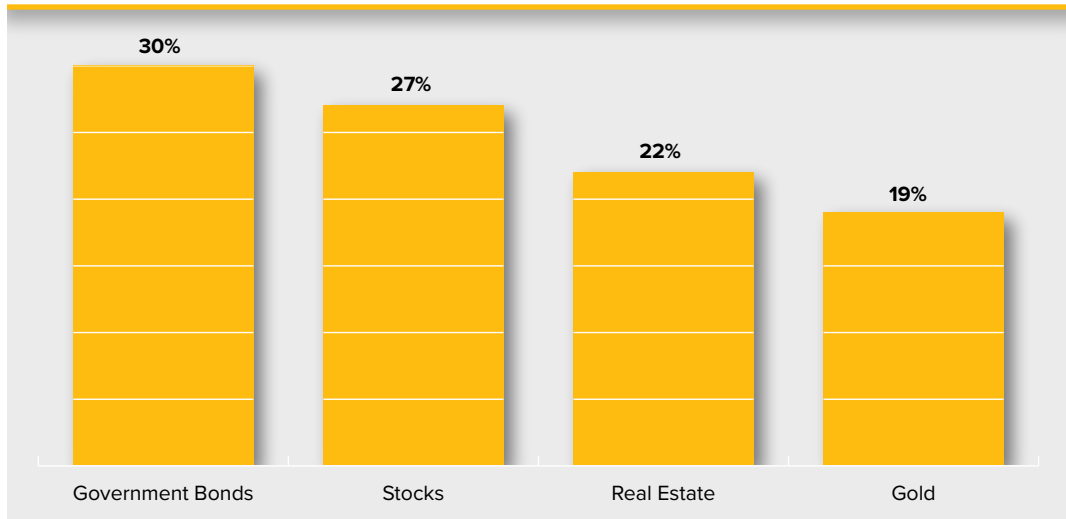
16 John C. Coates and R. Glenn Hubbard, "[Competition in the Mutual Fund Industry: Evidence and Implications for Policy](#)," Harvard John M. Olin Discussion Paper Series, August 2007.

17 "[2018 ETF Investor Study by Charles Schwab](#)," San Francisco: Koski Research, June 2018.

Crypto case study: Millennials

Millennials have emerged as adopters and drivers of cryptocurrencies, with one poll, taken during the 2017 crypto bull market, showing today's 18-to-34-year-olds preferring bitcoin over more traditional investments.¹⁸ Taking animal spirits into account, the survey results show a surprising awareness of, and openness to, a high-risk asset that has only just emerged and is difficult to understand.

Figure 3. Percentage of 18- to 34-year-olds who say they prefer bitcoin to...



Source: Blockchain Capital and Harris Poll, "Blockchain Capital Survey Finds Over One-in-Four Millennials Would Prefer Investing in Bitcoin Over Stocks and Bonds," News release, November 8, 2017

Younger generations have shown tendencies toward libertarianism¹⁹ and came of age not in the go-go 60s, but in the Great Recession.

If millennials are looking to bitcoin as an alternative to trusting their banks and governments, analogs from their own experience were available to facilitate their understanding of a new asset category.

18 Blockchain Capital and Harris Poll, "[Blockchain Capital Survey Finds Over One-in-Four Millennials Would Prefer Investing in Bitcoin Over Stocks and Bonds](#)," News release, November 8, 2017.

19 "[Beyond Red Vs. Blue: The Political Typology](#)," Washington: Pew Research Center, June 26, 2014.



Photo by David Shankbone, CC BY 3.0

On Generational Change

British author Zadie Smith, 43, captures perfectly the resulting gap in trust in the social contract implicit in government and finance: "Having one's own history so suddenly and abruptly made unreal is an experience of a whole generation of British people, who must now wander around like so many ancient mariners boring foreigners about how they went to university for free and could once find a National Health dentist on their high street."

—from "Northwest London Blues," in *Feel Free: Essays*, (London: Penguin, 2018)

Figure 4. Fortnite V-Bucks



Source: Fortnite (in-game screenshot)

A generation of video gamers, millennials are familiar with virtual goods and currencies, which drove \$87.7 billion in 2018 revenue.²⁰ Early adopters of cryptocurrencies have come from the ranks of entrepreneurs²¹ and participants²² in this virtual economy: “I pretty much learned everything on (neopets)...html...how to invest in stocks...I learned about volatility,” says Linda Xie,²³ co-founder of Scalar Capital, a small crypto-focused venture fund, referring to a virtual pet website that Viacom acquired for \$160 million in 2005. Echoing their older siblings’ preference for cryptocurrencies over more traditional investments, some teenage members of “Generation Z” last holiday season told analysts from Piper Jaffray²⁴ that they would prefer to receive cryptocurrency or Fortnite “V-Bucks,” over traditional gift cards. It makes sense that a digital generation will adopt a digital asset.

It makes sense that a digital generation will adopt a digital asset.

20 Richter, Felix. “Fortnite Made Billions in 2018 Despite Being Free-to-Play,” *Statista*, January 17, 2019.

21 Dibbell, Julian, “The Decline and Fall of an Ultra Rich Online Gaming Empire,” *Wired*, November 24, 2008.

22 Redman, Jaime, “The Long Relationship Between In-Game Gold and Bitcoin Continues to Thrive,” *Bitcoin.com*, March 13, 2019.

23 “Linda Xie, co-founder of Scalar Capital: What Linda Thinks About Basically Everything,” *The Token Daily*, podcast, January 31, 2019.

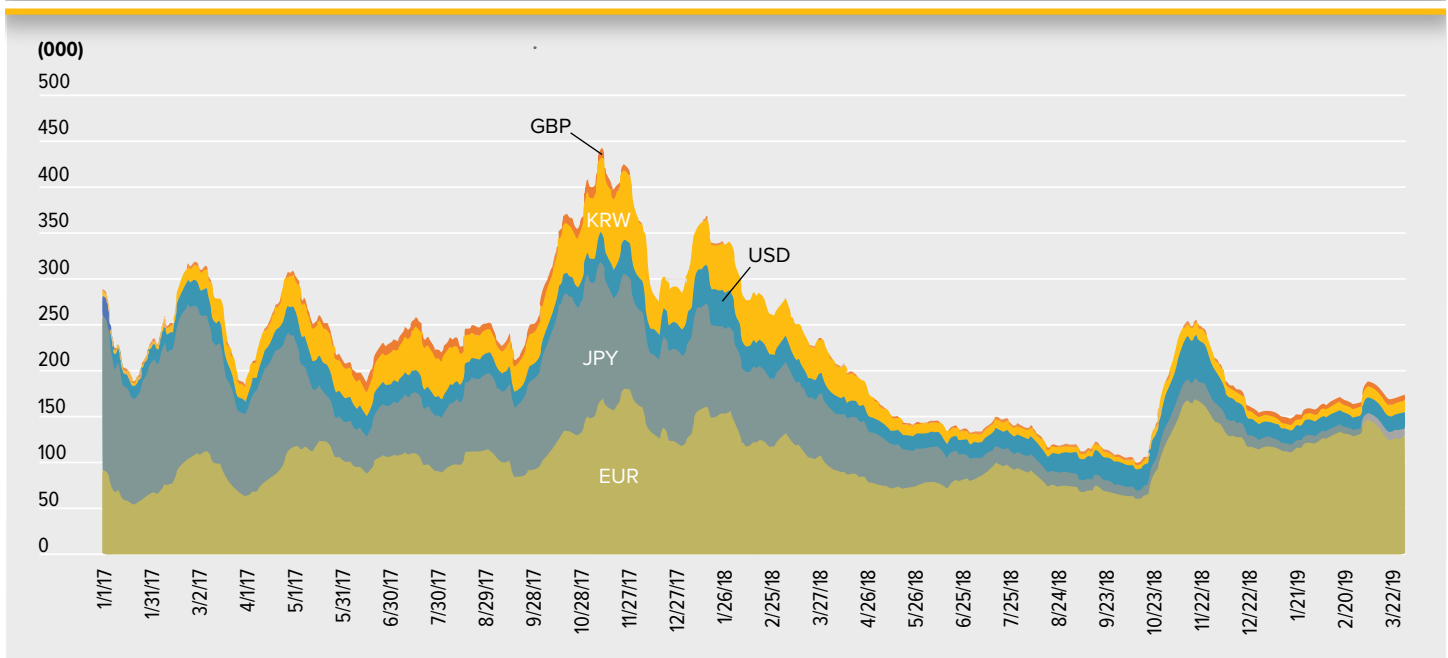
24 Quentin Fottrell, “Hark! This Is the One, Very Expensive Gift Teenagers Want for Christmas,” *MarketWatch*, December 25, 2018.

Crypto case study: Japan

Crypto asset adoption also has political dimensions. Venezuela, in a currency and constitutional crisis, is an often-cited example.²⁵ Bitcoin makes it possible for anyone to walk across a political border with millions in wealth stored only as a string of numbers and letters, possibly memorized. Most investors probably hope this use case will remain the stuff of news reports and spy novels.

Instead of looking at an extreme case like Venezuela, it will be more useful to look at what is driving adoption of alternative assets in the world's third largest national economy, Japan.²⁶ Japan has at times been the largest or second-largest fiat quote currency in bitcoin trading. (See chart.) It is also the G7 nation with the highest rates of crypto asset knowledge and awareness, and the highest rate of ownership among all nations, according to a May 2018 study.²⁷ The following examples show some of the cultural underpinnings of Japanese investors' aptitude for crypto assets.

Figure 5. Top fiat quote currencies by BTC volume



Source: [Brave New Coin](#)

Mrs. Watanabe

Japanese retail investors have a long history with foreign currency exchange trading, exemplified by “Mrs. Watanabe,”²⁸ an archetype for the Japanese retail investor. She is known as an avid hunter of alpha returns. Her skills sharpened in Japan’s “lost 20 years,” Mrs. Watanabe became a savvy foreign currency exchange (forex) trader, borrowing the cheap domestic yen to buy Australian dollars in a carry trade. Like forex, crypto markets are highly leveraged and trade 24 hours a day, seven days a week. It’s easy to see how Japanese retail investors made the transition.

Like forex, crypto markets are highly leveraged and trade 24 hours a day, seven days a week.

25 Carlos Hernández, “[Bitcoin Has Saved My Family](#),” *The New York Times*, February 23, 2019.

26 “[GDP, Current Prices](#),” IMF DataMapper, International Monetary Fund, accessed May 19, 2019.

27 Rytis Jakubauskas, “[How Many People Actually Own Cryptocurrency?](#)” Dalia Research, May 9, 2018.

28 James Chen, “[Mrs. Watanabe](#),” *Investopedia*, last modified May 7, 2019.

A grass-roots history of alternative currencies

A less mainstream but notable narrative is modern Japan's surprising history with complementary currencies. It began in 1950s with the establishment of organizations run by women for the exchange of unpaid labor. In the 1990s, as the Japanese recession began, a former government official established a system of "Fureai Kippu," or "caring relationship tickets," earned by helping elders in a community. By 2003 they were exchanged through an informal banking system comprising 372 branches.²⁹ The history of Japanese complementary currencies compasses other grass roots efforts, including a local response to the devastating earthquake that struck the Japanese city of Kobe in 1995.

Pachinko

Consider Japan's appetite for pachinko. It's cooled somewhat, but still brings in greater annual gaming revenues than Las Vegas or Macao.³⁰ In an open work-around to a nationwide gambling prohibition, pachinko established mini-economies of gambling parlors and prize vendors, in which tiny metal balls function as currency. Winnings in these pinball tokens can be re-played, or cashed in for prizes, which can be sold around the corner at a shop that buys them back for cash. It's not hard to understand how a nation that can sanction this fluid treatment of money, could accept a currency backed only by cryptographically secured consensus.

Figure 6. A haul of pachinko balls, stacked behind a player's seat.



Photo by Michael Maggs, CC BY-SA 3.0

Conclusion

These two examples illuminate propensities and driving factors among investor populations that have led crypto asset adoption so far. They point to demand factors that are more consistent than speculative fervor. Understanding these factors may allow institutional investors to predict fund flows and construct valuation formulas, making crypto asset investment more feasible.

There are demand factors that are more consistent than speculative fervor.

29 Bernard Lietaer, "[Complementary Currencies in Japan Today: History, Originality and Relevance](#)," *International Journal for Community Currency Research*, Vol. 8 (2004).

30 "[Declining Pachinko Industry Still Worth a Bet?](#)" Kenkyo Investing, March 30, 2018.

CRYPTO ASSETS: TECHNICAL PARAMETERS

Crypto assets behave quite differently than more familiar asset categories, but they can be described in the same language of data. In volatility, correlation and returns, crypto assets are in a class unto themselves, but if you do give them a seat at the table, you can judge their behavior by the same rules.

In volatility, correlation and returns, crypto assets are in a class unto themselves.

To do that, we'll update some of the 2017 research of Chris Burniske and Adam White,³¹ which compared bitcoin to traditional asset categories. When that paper was published, crypto assets were at the threshold of a bull market that peaked in December 2017. Then followed a crash and a slump that erased most of 2017's gains. After this wild romp over peaks and valleys, how does bitcoin hold up?

Correlation of returns

Bitcoin's volatility is not to be underestimated, and its investability presents a challenge. But portfolio diversification is one of bitcoin's salient strengths.³²

Portfolio diversification is one of bitcoin's salient strengths.

Table 1. Correlation table, bitcoin, stocks, bonds, gold, oil, RE, forex

	S&P 500	US bonds	Bitcoin	Gold	US real estate	Oil	Emerging market currencies
S&P 500		-0.64	0.22	-0.32	0.91	0.63	0.61
US bonds	-0.64		0.17	0.50	-0.54	-0.47	-0.40
Bitcoin	0.22	0.17		0.21	0.29	0.12	-0.16
Gold	-0.32	0.50	0.21		0.25	0.36	0.59
US real estate	0.91	-0.54	0.29	0.25		0.52	0.51
Oil	0.63	-0.47	0.12	0.36	0.52		0.58
Emerging market currencies	0.61	-0.40	-0.16	0.59	0.51	0.58	

- low correlation (-0.4 to 0.4)
- middle correlation (absolute value 0.4 to 0.666)
- high correlation (absolute value > 0.666)

Source: Bloomberg and CoinDesk BPI.

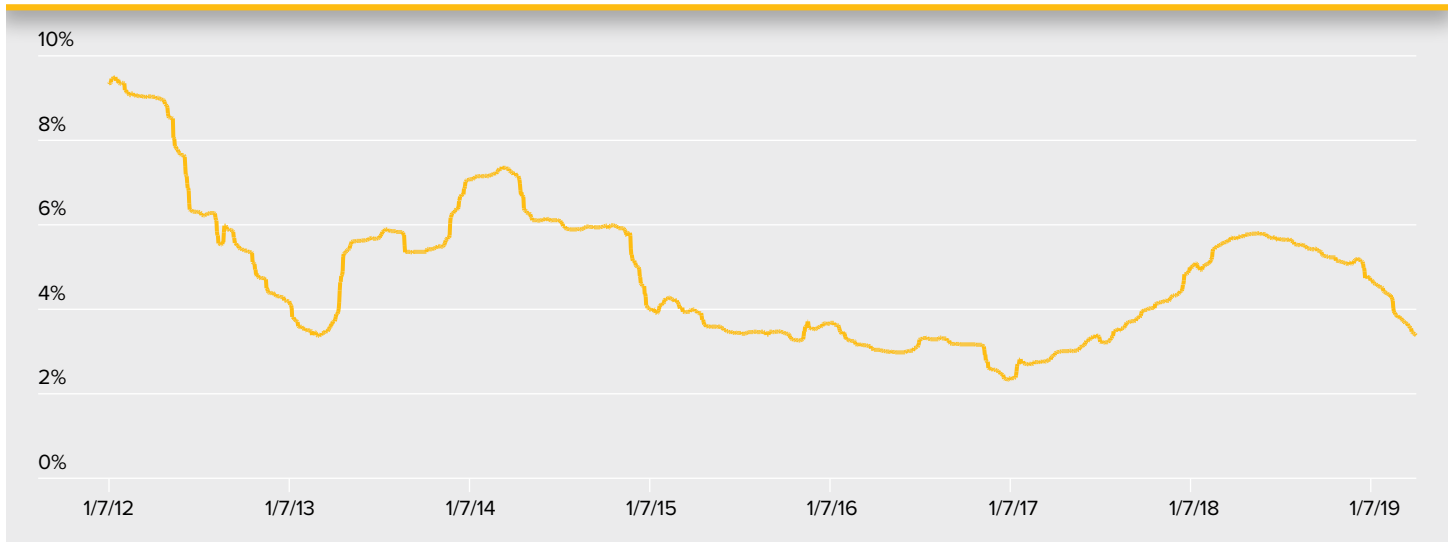
We measured bitcoin's one-year rolling correlation against six other representative assets over the past eight years, taking the highest absolute value for the table above. Our results differ on specific numbers from those Burniske and White obtained with a similar test two years ago, but substantively they are the same, at least as far as bitcoin is concerned. Bitcoin demonstrates remarkably low correlation with the broad array of comparable assets in our research. In an apples-to-apples comparison of our own six-year data from the 2011-2016 period, bitcoin's low correlation figures have remained consistent during the past two years of volatility.

31 Chris Burniske and Adam White, "Bitcoin: Ringing the Bell for a New Asset Class," Ark Invest Research and Coinbase, 2017, accessed April 15, 2019.

32 Table values reflect the highest absolute value rolling one-year correlation for each asset pair, calculated using Microsoft Excel's CORREL function on daily closing prices. Asset category price data from representative indexes as follows: US stocks, S&P 500 Index; US bonds, Bloomberg Barclays US Aggregate Bond Index; gold, index underlying SPDR Gold Shares ETF (GOLDLNPM); US real estate, Morgan Stanley Capital International (MSCI) US Real Estate Investment Trust Index; oil, crude oil futures (CL1 COMB); emerging market currencies, MSCI Global Currency Index. Method via Chris Burniske and Adam White, *ibid*.

Volatility

Figure 7. Bitcoin daily volatility over the trailing seven years



Source: CoinDesk BPI

Bitcoin's volatility has indeed come down over time, but that decline has been peppered with swings back upward to intense volatility not measured in other asset categories. The chart above, which includes the 2017-2018 boom-and-bust cycle, shows this pattern.³³

Volatility in crypto assets has increased a great deal since the end of 2016, when Burniske and White measured bitcoin's volatility against a list of mainstream asset categories. Charted next to more familiar asset categories, bitcoin's volatility is indeed in a class of its own.

Charted next to more familiar asset categories, bitcoin's volatility is indeed in a class of its own.

33 Trailing-year standard deviation of daily price changes (Microsoft Excel STDEV.P function). Method via Burniske and White, 2017.

Dad jokes

Bitcoin's sudden, unexplained price swings make its volatility the stuff of lame humor.

Child: "Mom, can I have one bitcoin?"

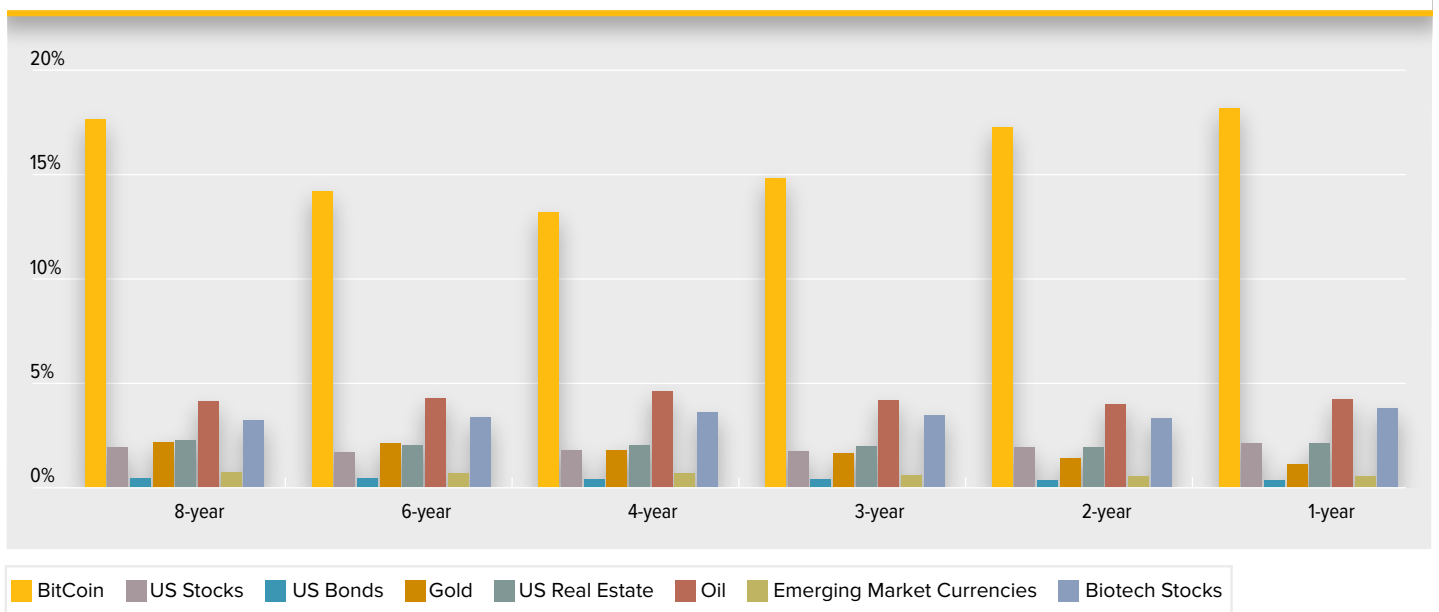
Parent: "Sorry, we don't have \$6,851 just to throw around. \$8,052 is just too much money, honey. Besides, what would you do with \$7,095, anyway?"



Bitcoin vs. biotech

In Figure 8, we added an index of the volatile biotech sector – one category that, like bitcoin, trades in liquid markets and is valued on the expectation of future technological breakthroughs. Even compared against oil, or the volatile biotech sector, bitcoin's standard deviation of weekly price changes is an order of magnitude above the rest.

Figure 8. Standard deviation of weekly price changes, compared to other asset categories

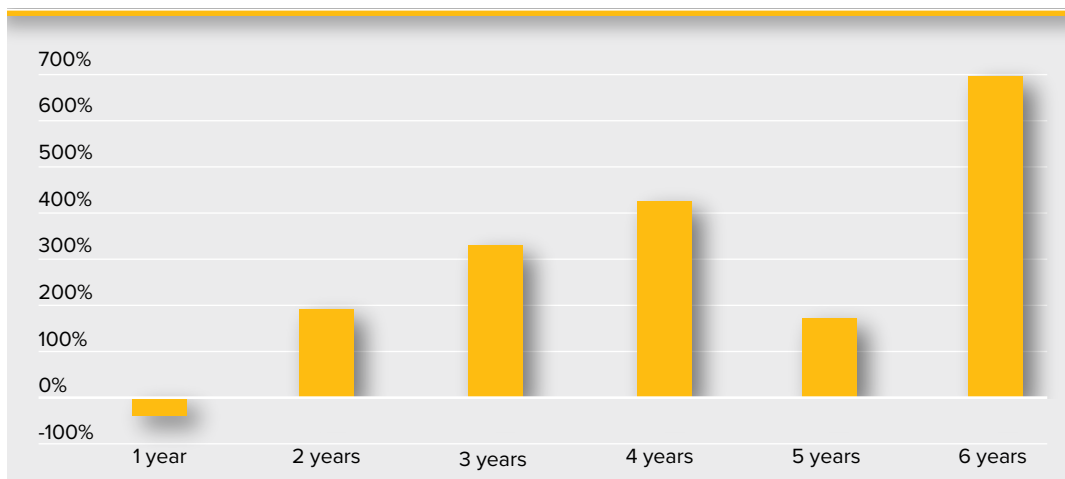


Source: Bloomberg and CoinDesk BPI. Standard deviation of the change in the weekly closing price, taken on consecutive Fridays, calculated using Microsoft Excel's STDEV.P function. Biotech price data represented by Nasdaq Biotechnology Index. Method via Burniske and White, 2017.

Returns

Like its volatility, bitcoin's compound annual returns are in a category of one. An investment early in the history of bitcoin would be equivalent to an early-stage investment in any one of the most successful venture-backed companies in history. Compared against stocks, bonds and most alternative assets, there is no comparison, as the chart below illustrates.

Figure 9. Bitcoin compound annual returns going back 6 years

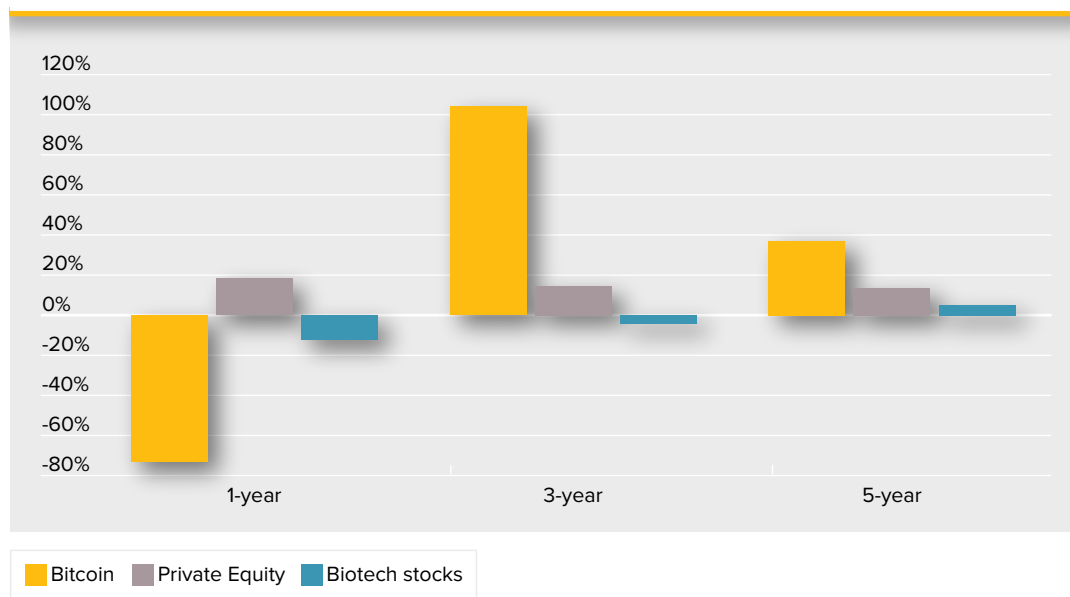


Source: Bloomberg and CoinDesk BPI

How does bitcoin compare against private equity, another long-term, high-risk investment? Again, there is no comparison, either against private equity as a whole or against the high-risk biotech sector. But, like a technology company with a rocky path to the public markets, bitcoin has had its up rounds and down rounds. And, as recent high-profile IPOs illustrate, the last private investors in don't always see an immediate return on investment.

Like a technology company with a rocky path to the public markets, bitcoin has had its up rounds and down rounds.

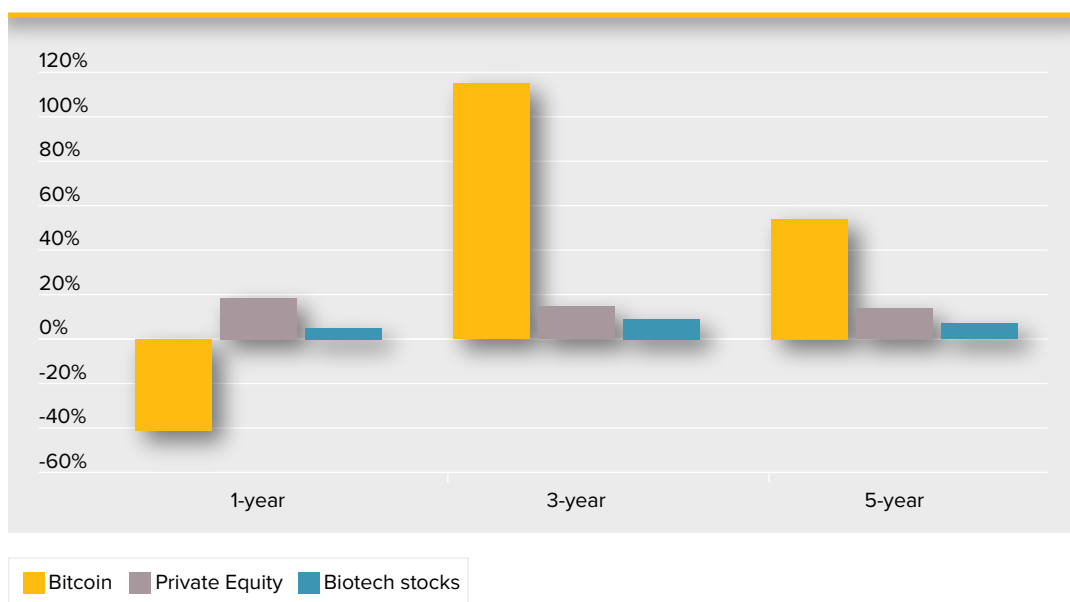
Figure 10. Bitcoin, private equity and biotech compound annual returns, April–March fiscal year



Source: Bloomberg and CoinDesk BPI

Charting bitcoin's one-year, three-year and five-year returns shows timing matters a great deal in crypto. The first chart, above, measures bitcoin's returns over an April 1 to March 31 fiscal year.³⁴ Shifting the time series by three months significantly impacts the return profile across all three of the periods measured.

Figure 11. Bitcoin, private equity and biotech compound annual returns, Jan.–Dec. fiscal year



Source: Bloomberg and CoinDesk BPI

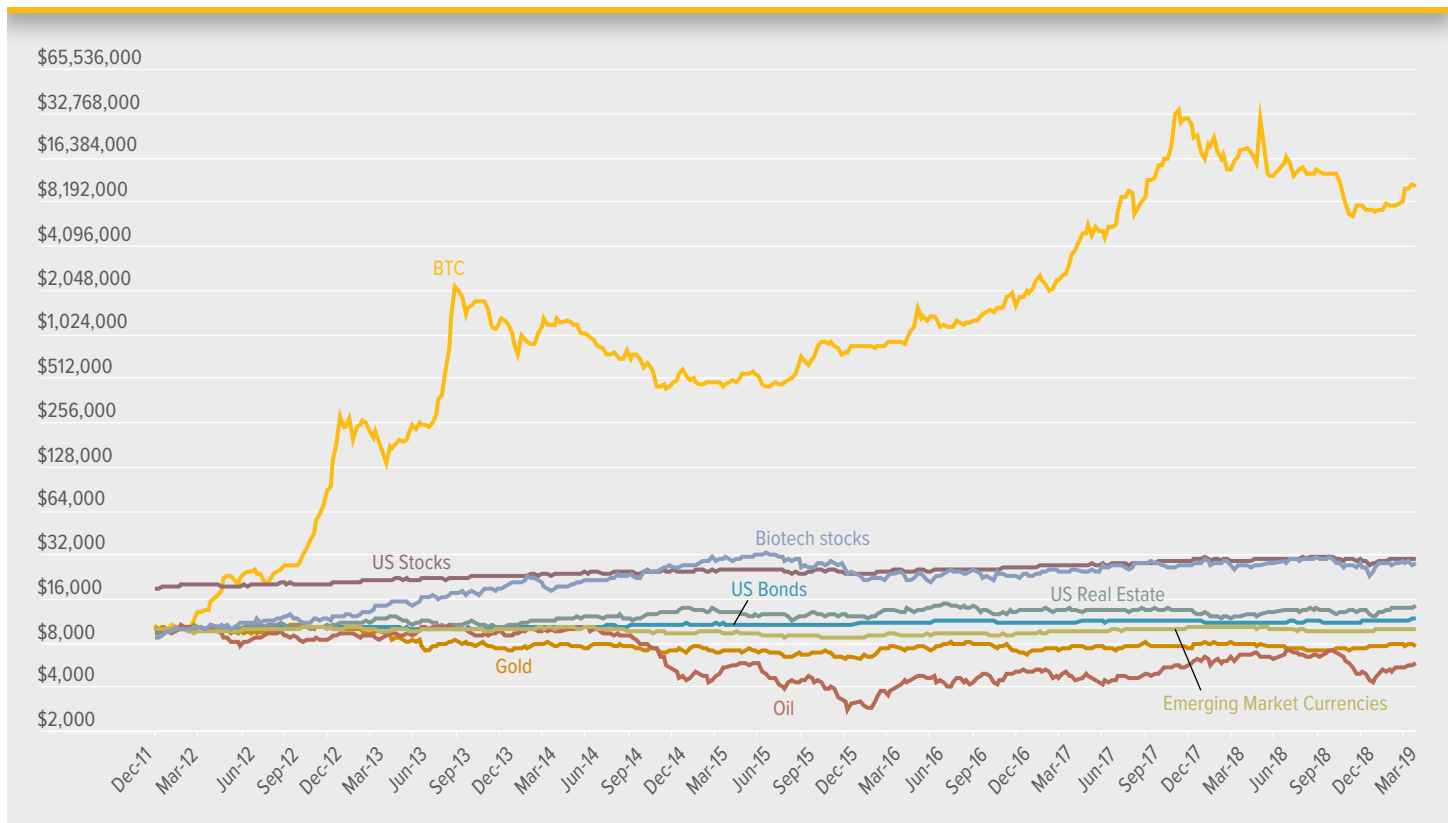
³⁴ Compound Annual Returns taken from year-end daily closing prices, calculated using the formula, $(\text{EndValue} / \text{StartValue})^{(1/\text{NumberOfYears})-1}$. Method via Burniske and White, 2017.

The question for an investor interested in crypto assets in 2019 is, do bitcoin and other crypto assets look like a company heading into a disappointing IPO, or like a fast-growing opportunity that still has a lot of room to run? As we'll discuss in the next section, the fundamentals needed to make such a judgment are, in many ways, up to investors and analysts to determine.

Over the long-term, bitcoin has absolutely dwarfed the returns of any other asset category.

Over the long-term, bitcoin has absolutely dwarfed the returns of any other asset category, including private equity.³⁵ The chart also underscores that in terms five years and shorter, timing has mattered a great deal.³⁶

Figure 12. Growth of assumed \$10K investment, December 2011 to December 2018, bitcoin vs. other assets



Source: Bloomberg and CoinDesk BPI

35 "Pooled horizon return," per Cambridge Associates, "[US Private Equity: Index and Selected Benchmark Statistics](#)," Sept. 30, 2018.

36 Growth data reflect an assumed \$10,000 investment on April 13, 2012, the first Friday trading day of the second quarter in US stock markets.

LIMITATIONS AND CHALLENGES

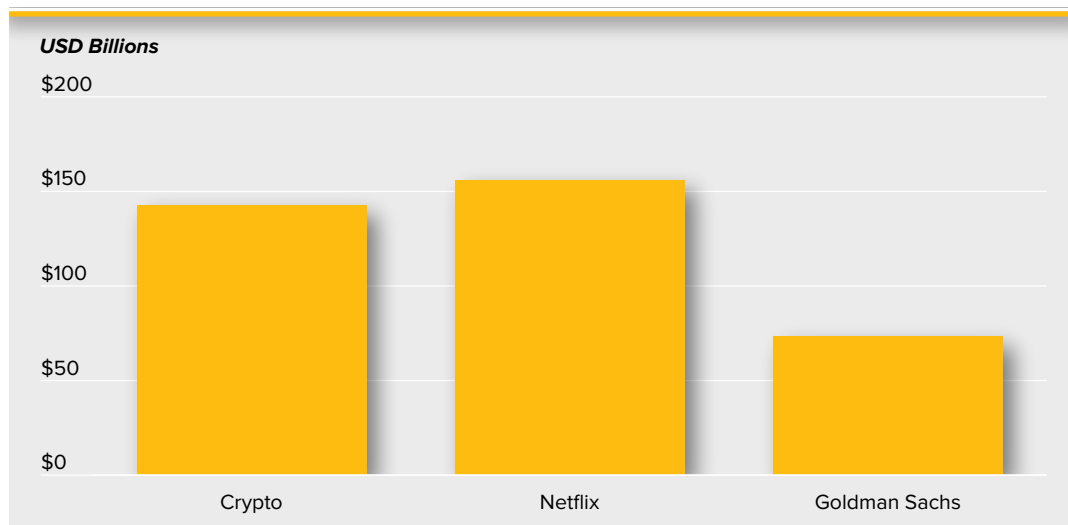
In crypto, operations teams are involved earlier and more integrally in an investment decision. The institution that embarks upon an earnest evaluation of crypto must know early what obstacles those operational considerations are likely to unearth.

In crypto, operations teams are involved earlier and more integrally in an investment decision.

The asset category is too small

Investability presents perhaps the biggest obstacle to institutional interest in crypto assets. Bitcoin's daily exchange traded volume by some measures exceeds that of well-known institutional products, which may lessen its impact on liquidity budgets. However, total market capitalization is a more relevant figure for institutional investors interested in buy-and-hold, which some analysts recommend over day-trading.³⁷ As a long-term investment, there is not that much of crypto to go around.

Figure 13. Total market cap as of March 29, 2019



Source: Nomics Crypto, <http://nomics.com>

The aggregate value of crypto assets available for investment is about equivalent to the market cap of Netflix, a single large-cap stock. It would be difficult for an asset category measured in the hundreds of billions to absorb even basis points of allocation from the largest money managers.

The trading infrastructure is immature

Trading in bitcoin and other crypto assets presents some advantages under the hood. For example, crypto trades settle instantly, rather than the T+2 standard for stock trades.

Crypto trades settle instantly, rather than the T+2 standard for stock trades.

Crypto advocates tout the simplicity of crypto's peer-to-peer settlement, but trading and investing in general are complicated processes that must be managed with a high level of care and attention to operations. Asset managers have a tool set they are familiar with, and that tool set is not necessarily set up for crypto trading. New tools introduce risk that must be calculated and carefully considered before adoption.

That risk may be acceptable for a startup, a pure-play fund or a crypto trading desk. It may be unacceptable for an established institution considering whether to add assets in the crypto category to approved lists for traders.

New tools introduce risk.

³⁷ Cambridge Associates, February 2019.

Custody is complicated

For a fund manager, custody is normally a relatively routine part of operations, a conversation that can take place after an investment decision is made. With crypto assets, the concept is totally different.

Traditional securities tend to be represented by receipts, or certificates, that confer ownership rights to an underlying asset. These rights change hands, after payment and clearing, through an adjustment to the “ownership ledger.” If the digital certificate representing those rights goes missing, it can be re-issued, because ownership belongs to a specific person or entity.

With crypto assets, the actual asset changes hands, not just the rights—and with it, responsibility for its safe-keeping. Crypto assets are “bearer assets,” they are not issued to a specific person, and if access to the wallet where they are held gets misplaced, there is no recourse. If a third party gets access to the wallet and moves the digital coins, they are gone.

This is understandably a risk that fund managers are uncomfortable with, and it may even be one that they legally cannot undertake. (The legal requirements for crypto custody are still unclear, but most funds operate on the assumption that the 1940 Investment Advisers Act applies.)

Several businesses have emerged that aim to offer “qualified custodian” services to investors in crypto assets. Two of the earliest ones are Xapo, which covers bitcoin, and BitGo, which is licensed as a qualified custodian and can custody a wide range of crypto assets. A handful of traditional trust companies have pivoted to service crypto assets, and some crypto exchanges such as Coinbase and Gemini also offer custody for institutional clients.

The market still lacks crypto custody from a large incumbent provider such as State Street or BNY Mellon. All are studying the sector, and we could in the near future see some global custody leaders decide to include crypto assets in their offering. Financial giant Fidelity Investments, through its subsidiary Fidelity Digital Asset Services, has developed an institutional crypto custody service and is already onboarding clients.

Crypto assets are “bearer assets.”

The market still lacks crypto custody from a large incumbent provider such as State Street or BNY Mellon.

There is a lack of needed service providers

Earlier, we discussed the formation of pure-play crypto funds. For some asset managers, these funds may represent a less problematic path to crypto asset investing, one that does not involve directly trading or custodying crypto assets themselves.

However, limited partners and general partners may be hampered by the lack of fund administration service providers. Funds that choose to self-administrate may be adding a layer of operational risk atop the already substantial technological, market and regulatory risks inherent in crypto investing.

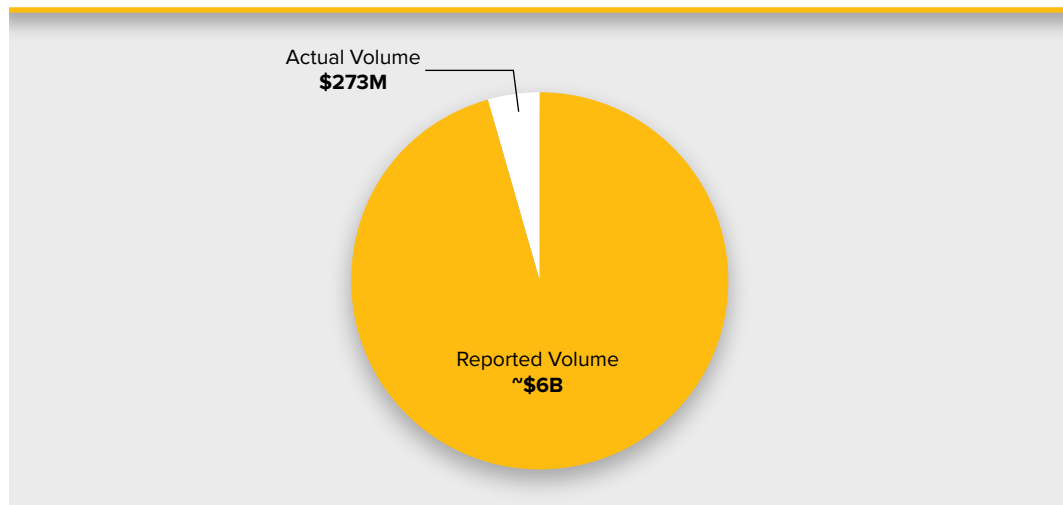
Here, again, service providers are emerging. Startups such as Lukka and Interchange, as well as incumbent fund service providers such as Stonegate and Trident Trust, now offer administration services for crypto investments. The diversity of participants and the breadth of the services offered is likely to continue to grow as the market matures and as institutional demand deepens.

Limited partners and general partners may be hampered by the lack of fund administration service providers.

The trading venues can't be trusted

Crypto assets' capacity for trading activity beyond the limits of political boundary and time zone has given rise to a dizzying array of trading venues. While Apple stock trades on one exchange, bitcoin is listed on hundreds. Competing venues might be counted a benefit, but like most of crypto assets' salient features, there are two sides to this coin.

Figure 14. Real vs. reported volume



Source: BitWise Asset Management.

Unsurprisingly, trade reporting is not standardized across this global landscape of exchanges. And where securities exchanges have turned transaction data into a lucrative revenue stream,³⁸ in crypto markets, exchanges' revenue comes from transaction fees and listing fees. Pumping fake volume with wash trading has allowed new entrants to rise to the top of listing services like CoinMarketCap.

Two recent studies have found suspicious exchanges represent as much as 95 percent of the widely reported daily exchange traded volume.^{39, 40} The vast fakery is comforting, in a way: it turns out the sweeping badlands of crypto's frontier are more populated with tumbleweeds than reckless gamblers. Most of the action is in a handful of orderly and well-run border towns, where honest dealers respect the sheriff.

Fake volume represents as much as 95 percent of the widely reported daily exchange traded volume.

Undiscovered fundamentals

As professional investors become more familiar with the concepts behind crypto assets and their potential use cases, investment theses will emerge that differentiate portfolios and investment styles. And unlike venture capital investments, crypto assets generally have a market price, which makes current valuations easy. Calculating expected values of the assets, however, adds a whole new layer of complication, largely due to the lack of established valuation methods.

With traditional assets, there are tried and tested valuation models that simply require plugging in certain variables. Most are based on discounted cash flows, which are generally not

38 Alexander Osipovich, "Wall Street Firms Plan New Exchange to Challenge NYSE, Nasdaq," *The Wall Street Journal*, January 7, 2019.

39 Bitwise Asset Management, "Presentation to the U.S. Securities and Exchange Commission," SEC.gov, March 19, 2019, accessed May 21, 2019.

40 Ribes, Sylvain, "Chasing Fake Volume: A Crypto-Plague," March 10, 2018, accessed April 20, 2019.

difficult to identify—the “art” comes in estimating how the input variables will evolve. This enables investments to be compared to similar assets and facilitates portfolio construction according to modern portfolio theory.

Crypto assets, however, are not so obliging.

First, they represent a totally new type of capital: a network is not the same as a company, and there may not be any future cash flows to identify. That does not mean the crypto asset does not have value. The value could be in the use of that asset and could be influenced by factors such as the number of users or asset holders. The value of a company, on the other hand, is generally not determined by the number of its shareholders.

Second, the term “crypto assets” encompasses a wide variety of vehicles, with different value drivers and business models. Using the same valuation process for a proof-of-stake asset and a proof-of-work asset, or for a layer 1 and a layer 2 network, does not produce comparable results.

Third, the asset category is new, and the valuation theories that do exist have not yet stood the test of time.

Even when opinion does start to coalesce around a certain valuation approach, investors will have to come to terms with a whole new set of variables that they are probably unfamiliar with, such as hash rate, unspent transaction outputs and token velocity, to name just a few.

While presenting a possibly daunting barrier to overcome, the lack of established models and the novelty of the concepts offer a significant opportunity to dedicated analysts and economists.

The term “crypto assets” encompasses a wide variety of vehicles, with different value drivers and business models.

Investors will have to come to terms with a whole new set of variables that they are probably unfamiliar with, such as hash rate, unspent transaction outputs and token velocity.

CONCLUSION

We can offer six takeaways for the investor considering crypto assets:

1. Crypto assets' value proposition is programmable ownership, via the world's first provably scarce digital products.
2. Use cases for this innovation begin with "digital gold." Further innovations built on this example have the potential to change industries, but carry the risks of early-stage technology investment.
3. Retail investors' enthusiasm for crypto has factors deeper than speculation: like other new asset categories in recent history, crypto assets' momentum has roots in cultural, economic and generational preference.
4. In volatility, returns and correlation, crypto assets are in a category of their own. The gap cannot yet be waved away as the growth or growing pains of a new asset category.
5. As a bearer asset, crypto presents obstacles to investment. It is wise to take operational considerations alongside investment decisions.

We hope this paper has provided facts and ideas useful for institutions evaluating an entry into crypto assets. We hope it can be a resource for the many investment firms that are beginning to explore investment in crypto assets. You can find more, similar resources at coindesk.com/intro-to-crypto-investment. We welcome your feedback and suggestions there, and at [Consensus Invest](#), our annual investor event.

FURTHER READING

Marc Andreessen, “[Why Bitcoin Matters](#),” New York Times

Nik Custodio, “[Explain Bitcoin Like I’m Five](#),” FreeCodeCamp

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Kyle Samani, “[\\$100 trillion](#)”

Chris Burniske and Adam White, “[Bitcoin: Ringing the Bell for a New Asset Class](#)”

Cambridge Associates, “[Cryptoassets: Venture Into the Unknown](#)”

Cambridge Centre for Alternative Finance, “[2nd Global Cryptoasset Benchmarking Study](#)”

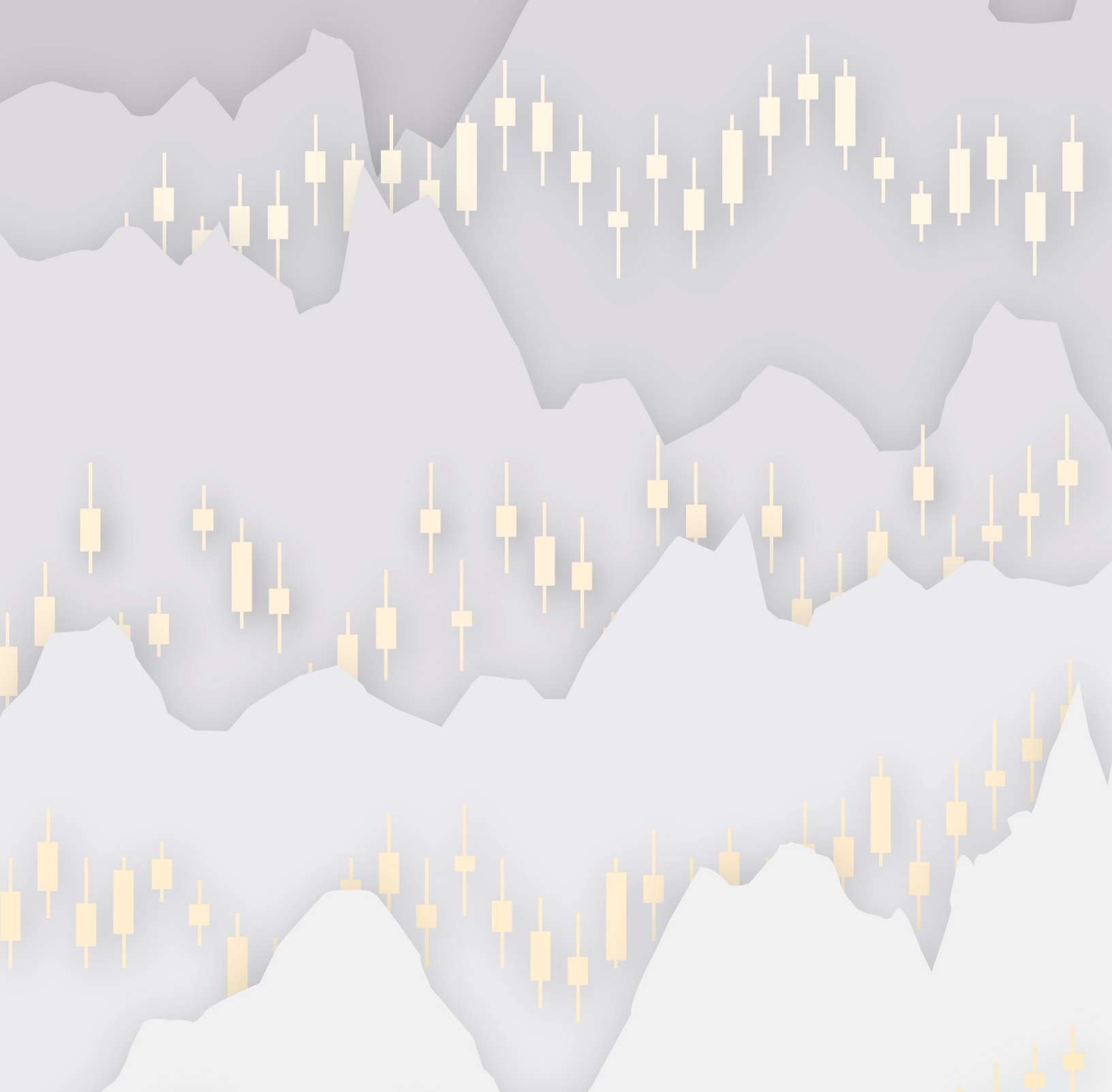
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