



# What to know about bitcoin and cryptocurrency before investing

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**Justin Tantalo**, CFA®, Senior Lead Research Analyst

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Bitcoin was introduced on October 31, 2008, by Satoshi Nakamoto in a nine-page white paper sent to a mailing list of cryptography enthusiasts.<sup>1</sup> In it Nakamoto described a novel peer-to-peer payment network that utilized cryptographic processes to overcome the shortcomings of previous attempts at decentralized digital cash. The innovative solution – which generated consensus in a distributed blockchain – not only addressed the complications of a digital currency but also laid the foundation for what would become a multi-trillion-dollar asset class in less than 15 years.

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## What is Bitcoin, and how does it work?

Bitcoin is a decentralized digital currency, commonly referred to as a cryptocurrency,<sup>2</sup> that is not issued or administered by a government authority such as a central bank. Transactions are conducted on a peer-to-peer network, verified using secure cryptography, and recorded on a distributed ledger called a blockchain. Consider that:

- A record of all transactions ever made are stored on Bitcoin's blockchain, where time-stamped 'blocks' of data (transactions) are 'chained' together to previous blocks cryptographically. As a result, the ledger tells a single, immutable story of how current balances came to be.
- The Bitcoin network is distributed and decentralized. The same blockchain record is maintained concurrently on thousands of independent nodes globally, making Bitcoin both hard to shut down and secure.
- Every existing bitcoin was created and distributed as a reward to specialized participants called Bitcoin miners, who expend computing power in a process that generates and maintains consensus amongst the nodes.
- Bitcoin is permissionless software: Anyone can send and receive bitcoin, anyone can operate a node, and anyone can be a Bitcoin miner. It runs 24/7/365 and is accessible anywhere there is internet connectivity.
- There will only ever be 21 million bitcoins created.
- Finally, specialized crypto exchanges act as the on-ramp and off-ramp for cryptocurrencies (and other digital assets). Exchanges intermediate bitcoin sellers who send bitcoin and bitcoin buyers who send money (USD), thus facilitating the trade. There are hundreds of exchanges worldwide.

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<sup>1</sup>"Satoshi Nakamoto" was an alias used by the person (or persons) who developed Bitcoin. The true identity of Nakamoto is still unknown.

<sup>2</sup>Somewhat confusingly the word Bitcoin refers to two separate but related concepts. It refers to both the blockchain network and the cryptocurrency that trades on that network. A differentiation is sometimes made: "Bitcoin" with an uppercase "B" refers to the blockchain network protocol, while "bitcoin" with a lowercase "b" refers to the cryptocurrency itself. Think of a railroad analogy: the goods (bitcoin) travel on the rails (Bitcoin).

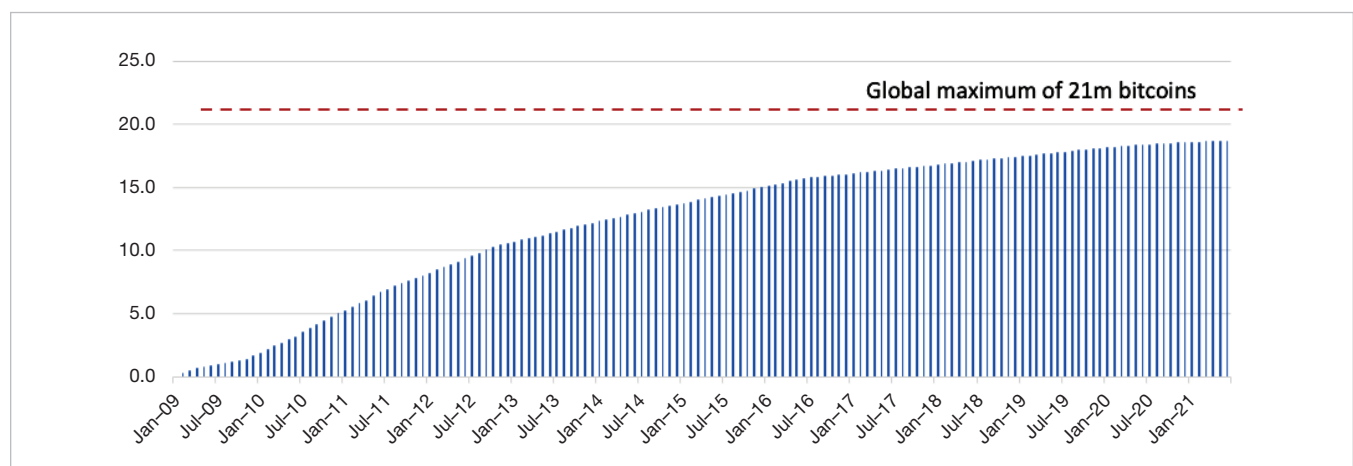
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## Digital scarcity

In designing the protocol, Satoshi Nakamoto appreciated that for Bitcoin to be adopted for use in making payments, it needed to be grounded in sound money principles. Trust would be difficult to establish if an unlimited supply of bitcoin could be conjured up in a discretionary manner, a weakness Satoshi believed to be inherent with fiat money and central banking. To address this, the code specifically dictates that new bitcoin awarded to miners follows a known trajectory with ultimate supply capped at 21 million bitcoins.

The supply of bitcoin is scheduled to grow at a decelerating rate until sometime in the year 2140, when all 21 million bitcoins will have been mined. As of mid-2021, approximately 18.7 million bitcoins have been mined.<sup>3</sup> With this construct, Bitcoin introduced the world to the concept of digital scarcity — a digital good with verifiably limited supply.

## History of Bitcoin Supply (Millions)



Source: Coinmetrics

## Value, price, and bitcoin as an investment asset

Bitcoin is a cleverly designed peer-to-peer payment network which utilizes a digitally scarce native coin. The attributes of the coin have drawn comparisons to gold, both being liquid, volatile, quasi-bearer assets whose incremental supply is verifiably constrained.

Bitcoin and gold share an additional similarity: Neither yield any cash flow. This is important for understanding and estimating fair value, since an asset without cash flow has no obvious intrinsic value. That is not to say that bitcoin is worthless but rather that any theoretical model or narrative on the fair value of bitcoin requires a good dose of abstraction. In this sense, bitcoin shares some of the speculative attributes of fine wine, art, and collectibles, which differ from traditional assets like stocks, bonds, and real estate whose intrinsic value can be estimated by discounting productive cash flows.

Despite the required abstraction, there are models that have been put forth within the cryptocurrency community which attempt to estimate the fair value of bitcoin. Some of them focus on relative price compared to gold, some focus on the relative pace of new bitcoin creation, and some focus on the implicit cost of electricity used in Bitcoin mining (a proxy for production costs). While these models help illuminate the attributes of bitcoin as an asset, they often rely too heavily on vagaries and fall short on fundamental rationale. This is not a situation unique to bitcoin: The concept of fair value has been a perennial challenge for nonproductive assets.

<sup>3</sup>Interestingly, multiple sources have estimated anywhere from 2 million to 4 million bitcoins may be lost or permanently inaccessible due to owner death, or loss of wallet password/private keys that control the coins.



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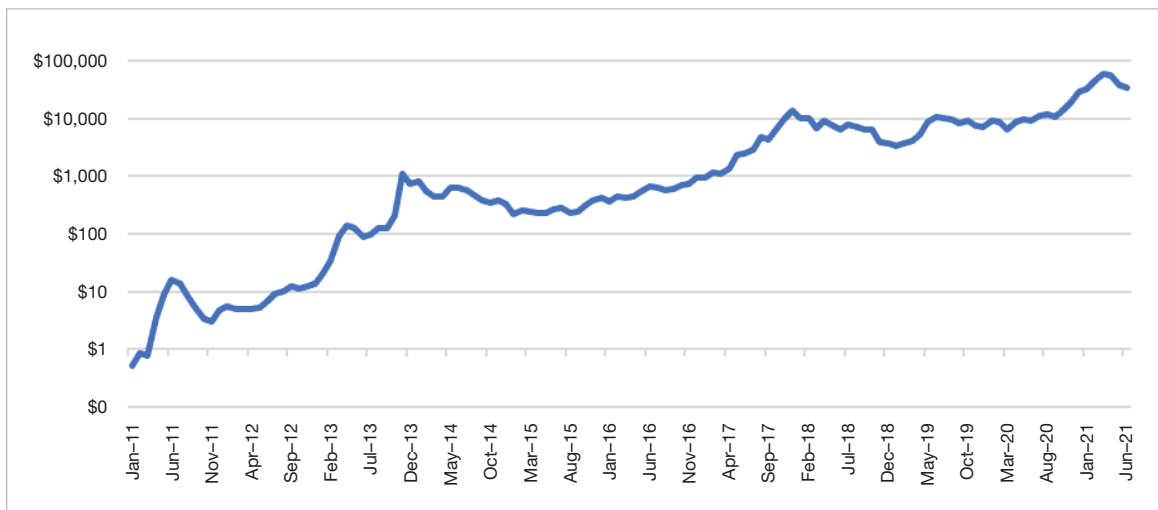
	Gold	Bitcoin
<b>Finite supply</b>	Supply increases about 2% per year.	Supply increases less over time, with a terminal limit of 21,000,000 coins.
<b>Liquid markets</b>	Gold has a highly liquid market with a huge variety of participants and contracts.	Bitcoin, like gold, appears to have highly liquid markets, including futures contracts.*
<b>Uncorrelated</b>	Correlations with other assets are typically low, especially in times of economic distress.	Price behavior is still evolving, with correlations increasing more recently.
<b>Inflation hedge</b>	Past inflationary episodes have shown gold tends to perform well in such environments.	Finite supply is attractive, but the asset remains untested given its limited history.
<b>Global acceptance</b>	Gold is a globally recognized store of value, held as reserve assets by most central banks.	Bitcoin is banned in a number of countries and is widely regarded with skepticism by authorities.
<b>Use in goods</b>	Gold is commonly used in high-tech manufacturing and jewelry.	Bitcoin has no uses outside its value as an asset.

Source: Invesco

\*Bitcoin trades 24/7, resulting in periods of relative liquidity. This appears to be especially true on Sundays, resulting in greater price volatility on these days.

The lack of consensus regarding bitcoin's fair value likely helps explain its wide range of historical prices and its elevated price volatility. At its low, bitcoin traded at less than one cent in 2010; at its high, it reached nearly \$65,000 in early 2021. The standard deviation of returns for bitcoin averaged 75% over the past five years. That is more than twice the volatility of crude oil, 5x the volatility of gold and US equities (S&P 500 Index), and more than 20x the volatility of US investment-grade bonds (Barclay's Aggregate Bond Index).

## Bitcoin Price USD (Log Scale)

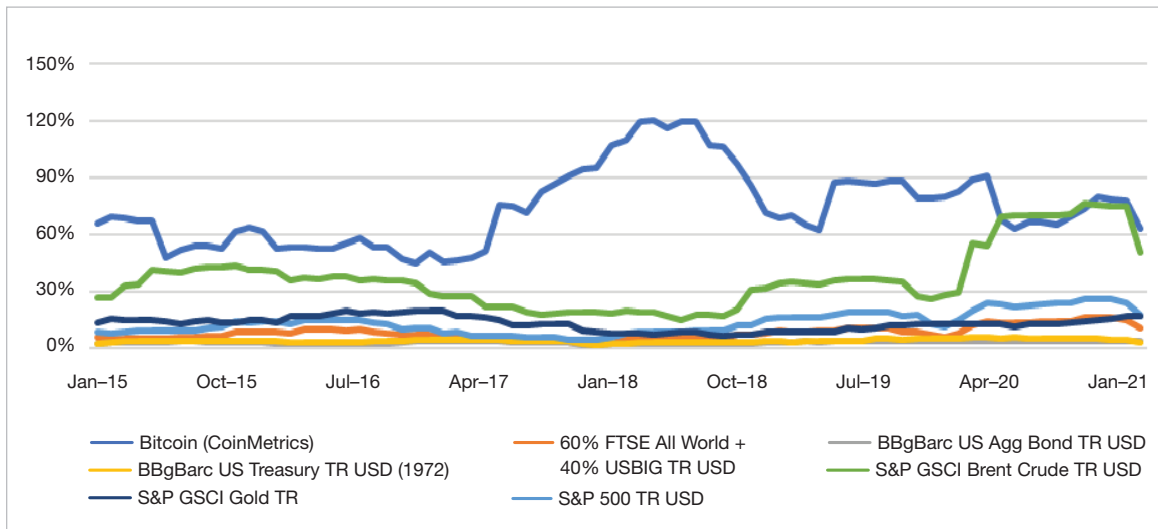


Source: Coinmetrics



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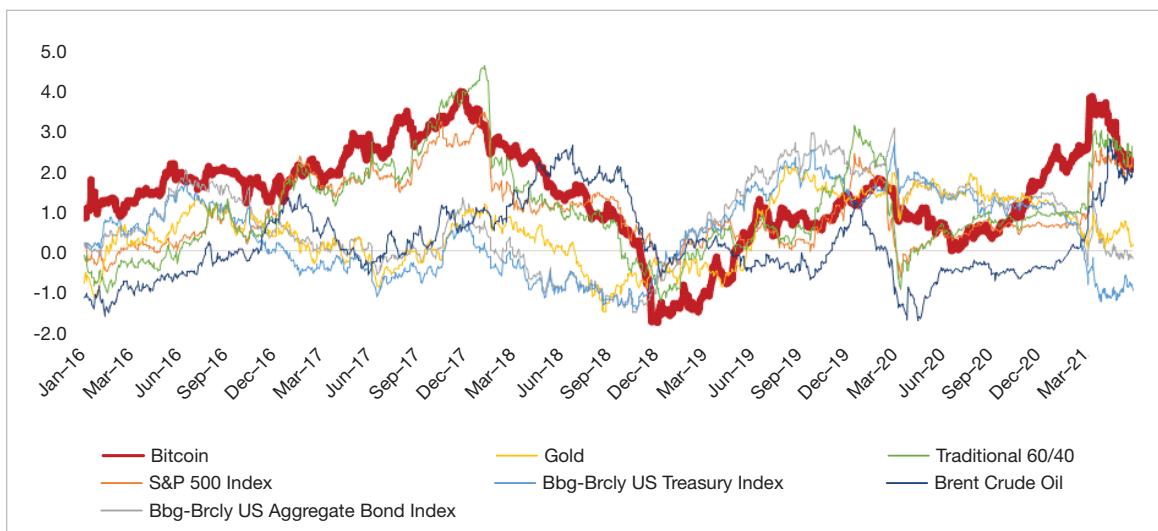
## Annualized Volatility (Trailing 12m)



Sources: Coinmetrics, Morningstar

The returns of bitcoin have more than compensated investors for the currency's elevated volatility, resulting in a stream of historically high risk-adjusted returns. The trailing one-year Sharpe ratios are shown below. As a reminder, the Sharpe ratio compares an asset's excess returns (over the risk-free rate) to its volatility (standard deviation of returns). Higher is better.

## Sharpe Ratio (Trailing 12m)



Sources: Coinmetrics, Morningstar



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Not only have historical risk-adjusted returns been attractive but correlations with traditional assets have been low. The characteristic of uncorrelated, high risk-adjusted returns has attracted the attention of a growing investor base that includes bitcoin and other digital assets in their investable universe.

Monthly Return Correlations (10 years to Jun-21)	Bitcoin USD	60% FTSE All World + 40% USBIG TR USD	BBgBarc US Agg Bond TR USD	BBgBarc US Corporate High Yield TR USD	BBgBarc US Treasury TR USD (1972)	S&P 500 TR USD	Russell 2000 TR USD	FTSE Dvlp ex US All Cap NR USD	FTSE Emerging Markets	FTSE Nareit All Equity REITs TR USD	Bloomberg Commodity TR USD	S&P GSCI Brent Crude TR USD	S&P GSCI Gold TR	S&P GSCI Industrial Metals TR USD	S&P GSCI Softs TR USD
Bitcoin USD	1.00														
USD	0.12	1.00													
BBgBarc US Agg Bond TR USD	0.00	0.11	1.00												
BBgBarc US Corporate High Yield TR USD	0.12	0.85	0.20	1.00											
BBgBarc US Treasury TR USD (1972)	(0.04)	(0.27)	0.88	(0.23)	1.00										
S&P 500 TR USD	0.14	0.95	(0.07)	0.77	(0.41)	1.00									
Russell 2000 TR USD	0.12	0.84	(0.15)	0.75	(0.47)	0.89	1.00								
FTSE Dvlp ex US All Cap NR USD	0.11	0.96	(0.03)	0.80	(0.39)	0.88	0.80	1.00							
FTSE Emerging Markets	0.05	0.87	0.09	0.78	(0.27)	0.75	0.68	0.85	1.00						
FTSE Nareit All Equity REITs TR USD	0.01	0.73	0.35	0.69	0.03	0.69	0.65	0.63	0.59	1.00					
Bloomberg Commodity TR USD	0.03	0.58	(0.09)	0.62	(0.33)	0.53	0.52	0.60	0.63	0.37	1.00				
S&P GSCI Brent Crude TR USD	0.06	0.55	(0.15)	0.66	(0.42)	0.53	0.57	0.59	0.48	0.28	0.73	1.00			
S&P GSCI Gold TR	(0.11)	0.20	0.42	0.20	0.35	0.07	0.00	0.15	0.29	0.15	0.40	0.08	1.00		
S&P GSCI Industrial Metals TR USD	(0.02)	0.54	(0.07)	0.48	(0.27)	0.47	0.48	0.55	0.65	0.33	0.71	0.49	0.34	1.00	
S&P GSCI Softs TR USD	0.03	0.43	0.04	0.42	(0.17)	0.35	0.35	0.44	0.50	0.37	0.65	0.43	0.25	0.45	1.00

Sources: Coinmetrics, Morningstar

## Allocation sizing considerations

Digital assets like bitcoin are new to most portfolios. Investors should consider the risks involved, which we discuss in the next section. But they should also recognize that these assets represent the next layer of a digital transformation that's been taking place over the past 30 years. It has been a costly theme to ignore.

For those investors who manage risk using benchmark tracking error, we examined the impact of adding bitcoin to a portfolio of traditional assets. We start with a traditional "60/40" portfolio composed of 60% MSCI ACWI Index (global equities) and 40% Bloomberg Barclays US Aggregate Bond Index (US bonds), and we subsequently add 1% increments of bitcoin.

	Stocks	Bonds	Bitcoin	Tracking Error
Traditional 60/40 portfolio	60.0%	40.0%	0.0%	—
Traditional plus 1% BTC	59.4%	39.6%	1.0%	1.1%
Traditional plus 2% BTC	58.8%	39.2%	2.0%	2.2%
Traditional plus 3% BTC	58.2%	38.8%	3.0%	3.3%



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The five-year back test suggests that bitcoin adds tracking error in roughly equal parts to the size of its allocation in a portfolio. In other words, a 2.0% allocation to bitcoin added 2.2% tracking error to the neutral 60/40 portfolio. This relationship may be somewhat overstated due to skewed historical upside volatility, but it helps frame the sizing question using relative risk. It reinforces the idea that in terms of portfolio risk and tracking error, a little bitcoin goes a long way.

A second approach to portfolio sizing is capitalization weighting. Consider that global listed equities were valued in aggregate at roughly \$75 trillion in June 2021. The largest digital assets like bitcoin and ether were valued at roughly \$1 trillion during the same period. If an investor were to use relative market prices as a basis for determining neutral weight, then they might consider \$1 of digital assets for every \$75 of equities in their portfolio. A neutral weight to digital assets for a 60/40 investor would then be approximately 0.80%.

## Risks

Bitcoin is risky.

We earlier referenced bitcoin's annual price volatility as being north of 75%, more than 3-5x as volatile as other traditional risk assets like equities and commodities. If one accepts that price volatility represents risk, an argument could even be made that bitcoin and similar digital assets are the riskiest of all investments.

Beyond risk as defined by price volatility, consider the following:

- **Regulatory risk:** Destabilizing regulation is the biggest risk faced by Bitcoin and the broader digital asset ecosystem. It would be a mistake to conclude that since blockchains are permissionless, decentralized, and global, they operate with regulatory immunity. If advances in decentralized blockchain technology create a risk of financial market destabilization, then one should expect a strong response from regulators. Regulators might not be able to extinguish Bitcoin, but they can certainly smother it.
- **Custody risk:** Most bitcoin holders maintain their coins at the exchange where they acquired them. Exchanges can and have been hacked, resulting in lost bitcoins for users that are custodied there.

Alternatively, bitcoins can be self-custodied by sending them to a private wallet outside of an exchange. The risk in that scenario is the lack of access redundancy in self-custody; if the password (i.e., private keys) to the address are lost, the coins are too. In other words, no keys, no coins.

- **51% attack risk:** A 51% attack refers to the risk in proof-of-work blockchains (such as Bitcoin) that a miner (or group of miners) gains enough hash power to take control of 51% or more of a blockchain mining network. If this happens, it would provide that miner with a mechanism to double-spend coins. Hardware costs (est. \$5-10 billion), chip shortages, and enough electricity to power a small country stand in front of would-be attackers. That said, state-sponsored commandeering of existing mining capacity cannot be ruled out.
- **Environmental impact:** Blockchains like Bitcoin that run on proof-of-work protocol consume significant amounts of electricity. The Cambridge Centre for Alternative Finance (CCAF) estimates that Bitcoin consumes approximately 0.5% of global electricity, or nearly the equivalent of the energy consumed in the Philippines or the Netherlands.
- **Unknown unknowns:** Bitcoin and distributed blockchain are new technologies with new terminology and a steep learning curve for investors. Those considering an allocation to bitcoin or any other digital asset should remember that public equities have been around since the Dutch East India Company was founded more than 400 years ago. Bonds are even older. The asset price behavior and range of possibilities in traditional assets are understood far better than nascent digital assets, which have existed for less than 15 years.

While the possibilities for digital assets are virtually endless, a fully informed investor should realize that there is equally impressive downside risk. We advise investors to tread carefully, understand the possible risks, and for active strategies in digital assets, partner only with the highest-quality managers.

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For more information about how cryptocurrency may impact your portfolio, [contact your Key Private Bank Advisor.](#)



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## About the Author

Justin Tantalo has 15 years of experience in investment management, both in Asset Allocation and Fund Management. As a Senior Vice President with Key Private Bank, Justin applies his expertise in Asset Allocation and helps oversee the equities and alternatives third-party manager research effort.

Justin received an MA in Economics from the University of Waterloo (Canada) and BA in Economics from the University of Western Ontario (Canada). Justin is a CFA Charterholder.

