

## Research Primer

# Bitcoin — Digital Gold

This research primer is a guide to understanding Bitcoin. It explains why Bitcoin is important, how the technology for Bitcoin is likely to change over the next decade, how we can value Bitcoin, and what the main risks associated with investing in Bitcoin are. We believe Bitcoin presents the investment opportunity of the decade, and that this research primer will help guide your investment decisions.

DATA AS OF JUNE 2020



# Bitcoin Research Primer

## Executive Summary

This research primer acts as a guide for investors to understand how Bitcoin works, the current state of Bitcoin, the future of the crypto asset, valuation and portfolio optimization for the asset, and its various investment risks. Bitcoin is the world’s first “digital gold” and offers an extremely viable alternative for gold as a Store of Value and a hedge against global economic instability. As we show in this research primer, the potential value of Bitcoin is a vastly greater than its current value, meaning that an investment in Bitcoin is arguably one of the best investment opportunities currently available.

Over the last three years Bitcoin has posted returns of over 290 percent, making it one of best-performing assets over the last time period and over the decade. Currently, Bitcoin’s total market capitalization sits at over \$170 billion. Despite Bitcoin’s strong performance over the last decade, the rest of this report will show that there is still a massive amount of upside for the crypto asset going forward. The table (right) shows some of the current key metrics for Bitcoin, including its ticker, price, circulating supply (the number of Bitcoin currently in existence) and market capitalization.

Bitcoin Key Metrics		As of June 15, 2020
Ticker		BTC
Price (USD)		\$9,441.38
Circulating Supply (BTC)		18,405,654 BTC
Market Capitalization (USD)		\$173,774,840,415
Block Reward (BTC)		6.25 BTC

Figure 2: BTC Performance 1-Year Performance (Source: CoinMetrics)

Figure 1: BTC Key Metrics (Source: CoinMetrics)



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## How Bitcoin Works

So you may be wondering: **how exactly does Bitcoin work?** The key innovation of Bitcoin is that it allows for peer-to-peer, decentralized financial transactions on the internet. This is facilitated by two inventions: blockchains and Proof Of Work mining.

### Blockchains

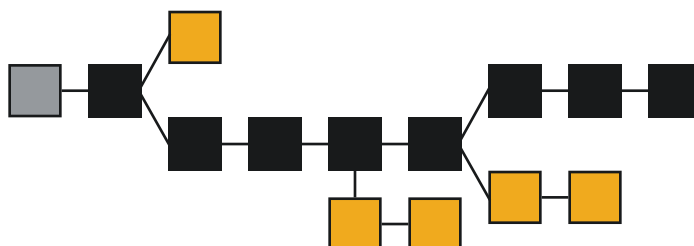
A blockchain is a data structure — in the same way an excel sheet is a data structure — which holds a growing list of records, called blocks, which are linked to each other through the use of cryptography. Within a blockchain each block is ordered in a sequence and each contains encoded information about its predecessor (a hash), the date and time at which it was created, and data about the transactions included in it. Every transaction which has settled on the Bitcoin network is contained within a certain block in its blockchain.

Blockchains are useful for storing sensitive data which one needs strong assurances over, such as security, safety, and integrity. Typically, blockchains are stored on a network of users across the internet who each store a version of the Bitcoin blockchain. Once data has been recorded onto a blockchain, the block cannot be altered retroactively without changing all subsequent blocks: this is only possible if the majority of the network agrees.

### Proof of Work Mining

Proof of Work mining is the process which allows new transactions and blocks to be added to the Bitcoin blockchain. It is also the method through which new Bitcoin enters into the money supply. Proof of Work is similar in abstract to the process for gold mining, users (called “miners”) make use of computer equipment to process an algorithm which creates a piece of data called a proof of work. A proof of work is, by definition, difficult to solve and requires extensive computing power, capital investment, and energy to find. Once the solution is found it is very easy for others in the Bitcoin network to verify. The Bitcoin network is designed so that miners only solve a proof of work on average every ten minutes and they are rewarded for their efforts through newly-inflated Bitcoin, currently at an amount of 6.25 BTC per block. The use of mining makes it extremely hard for Bitcoin’s transactions to be manipulated, as a malicious actor would have to expend a large sum of capital and energy to do so. The diagram below (Fig. 3) shows an illustration of a blockchain where the black blocks represent the path of the blockchain that all miners and nodes in the Bitcoin network agree on. If miners or nodes do not agree on a certain blockchain, it is discarded — as demonstrated by the yellow blocks.

Figure 3: A simplified illustration of a blockchain



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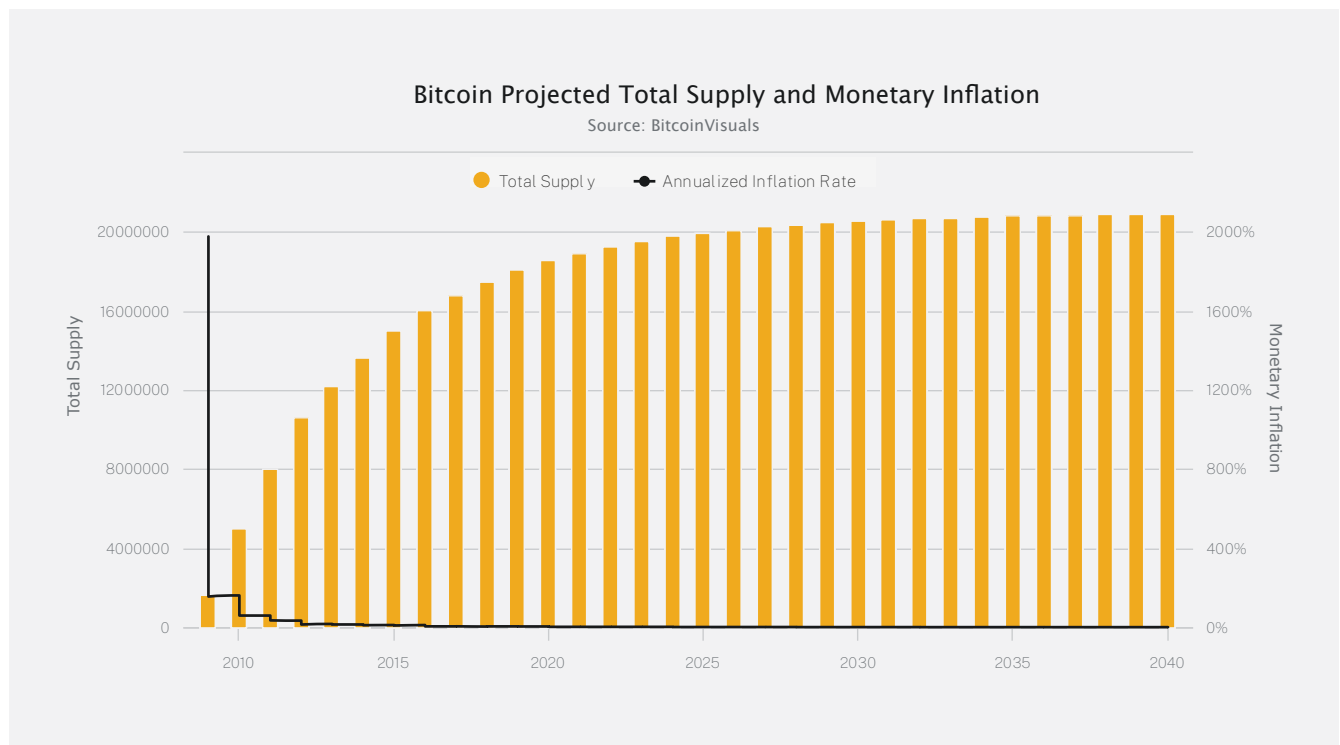
## The State of Bitcoin

Since its launch on January 3 2009, Bitcoin has grown into an asset with a market capitalization of over \$170 billion and created an entire asset class, crypto assets, with a cumulative market capitalization of over \$265 billion. We believe that Bitcoin represents a paradigm shift in finance by being the peer-to-peer, decentralized asset class and history’s first digital gold. This claim is justified given that Bitcoin has a fixed maximum supply of 21 million – making it an incredible scarce asset. Needless to say, Bitcoin in recent years has been able to mature as an investment product and become increasingly institutionalized. The chart below shows how Bitcoin’s supply follows a totally predictable schedule as it reaches the 21 million limit.

Over the next year Bitcoin will continue to grow as more institutional projects are built for it, like prime brokerages, custodians, derivatives, and exchange-traded products like those issued by 21Shares. These will make it easier to trade and invest in Bitcoin whilst also helping to reduce regulatory and security risks which have helped prevent mainstream interest up until now.

Aside from the adoption side, Bitcoin also has a thriving technological and developer community who will continue to expand the technical tools which can interact with the Bitcoin network – making it easier, for example, to self-custody one’s assets, transact at a low cost, or understand Bitcoin’s blockchain data.

Figure 4: Bitcoin’s project circulating supply over time



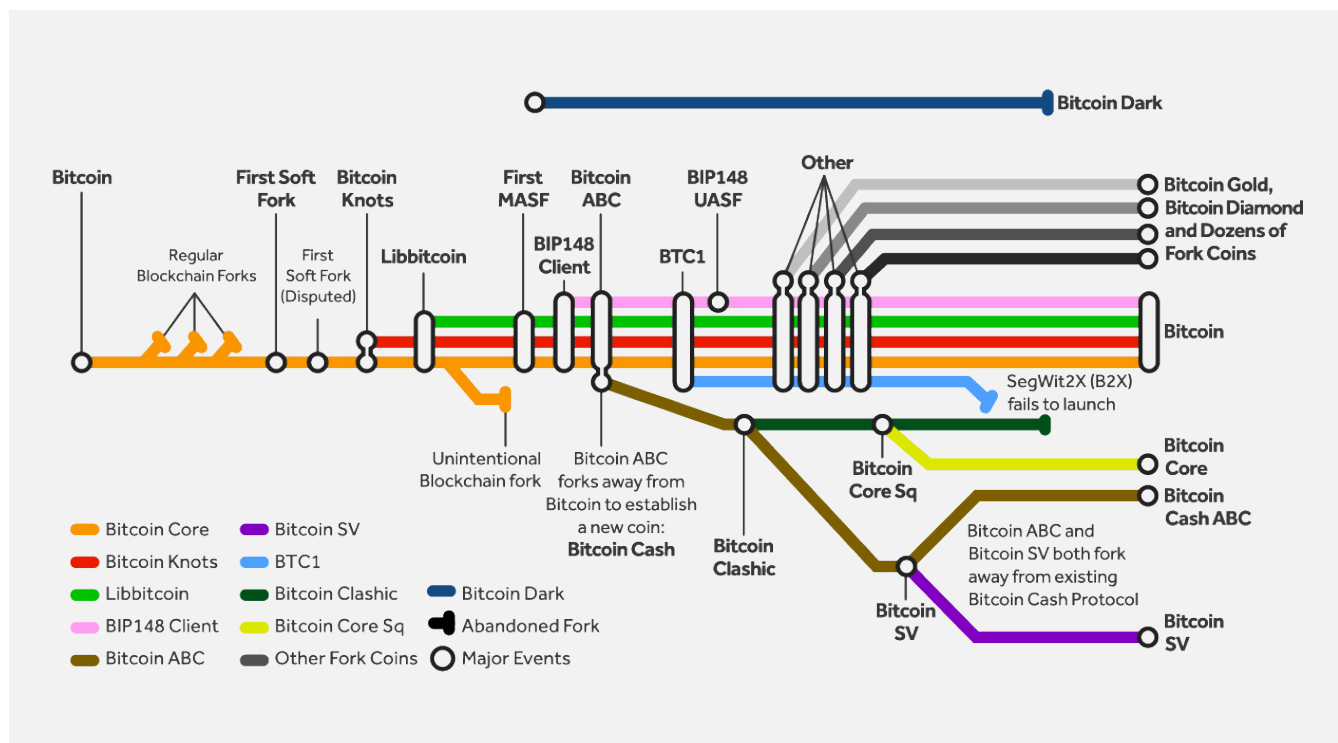
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## The Future of Bitcoin

Part of the appeal of Bitcoin is its yet unrealized potential; whether it be technical developments that enable a deeper range of types of transactions and ways to improve transaction speeds, or improvements in the infrastructure running Bitcoin’s market microstructure. Several interesting product developments within Bitcoin include: the **Lightning Network** – a “Layer 2” protocol that exists on top of Bitcoin as a potential way to improve scalability; **Liquid** – a “Layer 2” settlement network built on Bitcoin allowing more complex transactions; and **Bakkt** – a futures and custody warehouse which, amongst other things, will allow users to trade and exchange Bitcoin and other digital rewards points.

In addition, Bitcoin has played a key role in the formation of a range of other crypto assets – known as “forks” – which either have been inspired by Bitcoin’s technical infrastructure (see Fig. 5) or which have borrowed heavily from the software which makes Bitcoin work. This allows for innovation from Bitcoin to spread to the rest of the industry and is a key factor behind the crypto asset industry’s high level of innovation.

Figure 5: Map of Bitcoin Forks (Source: Bitcoin Magazine)



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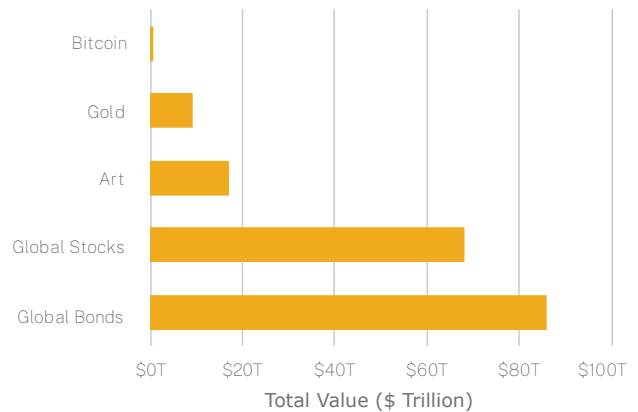
## Valuing Bitcoin

### Market Sizing

Bitcoin’s primary valuation proposition comes from its ability to act as a Store of Value. Therefore, the most accurate way to understand Bitcoin’s potential value in the longterm is by doing a market sizing analysis of Bitcoin compared to other assets which have historically served as reliable Stores of Value – Gold, Art, Stocks, and Bonds. Bitcoin currently represents around 1% of its immediate addressable market (Gold) and an even smaller proportion of other Store of Value markets that it could capture (see Fig. 6) – this presents a massive growth opportunity. If investors include even a small

percentage of Bitcoin in their portfolio, Bitcoin would make significant progress as a Store of Value.

Figure 6: Bitcoin Market Sizing



### Portfolio Allocation

Our analysis (Fig. 7) suggests that Bitcoin can act as an excellent way to improve an investor’s portfolio through diversification which therefore increases risk-adjusted returns. The chart shows several portfolios<sup>1</sup> – Stocks (60%) and Bonds (40%); Stocks (57%), Bonds (38%), and Gold (5%); and Stocks (57%), Bonds (38%), and Bitcoin (5%) to demonstrate how good Bitcoin is as an addition to a portfolio. Even a small addition of as little as 5% can lead to a significant improvement in an investor’s portfolio. The portfolio with 5% Bitcoin has returned 2.73% since the start of the year, compared to the portfolio with 5% Gold which returned 1.29%, and the portfolio split between stocks and bonds which returned 0.71%. It is clear that the addition of Bitcoin to a portfolio is an excellent strategy for investors who want to improve their risk profile. This is due to the strong performance

of Bitcoin and its uncorrelated nature when compared to other assets. For example, over the aforementioned time period Bitcoin’s returns have a 0.29 correlation with Gold, a -0.15 correlation with bonds, and a 0.51 correlation with stocks.

Figure 7: Comparison of Portfolios



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## Risks

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### Block Reward Halving

One of the biggest risks to Bitcoin's long-term success is the economic effect of its finite supply and reducing block reward. Miners within the Bitcoin network are rewarded for mining and ensuring the economic security of Bitcoin by transaction fees and newly-inflated Bitcoin. However, as this block reward decreases over time, miners will be compensated only by transactions fees. There is some research showing potential issues with a regime in which block rewards for miners are continually halved. For example, the amount miners receive in transaction fees alone may not be enough, or variability in transaction fees could lead to perverse incentives for miners such as an

increased probability of attempts to reverse transactions through "51% attacks"<sup>2</sup>; Both scenarios could harm Bitcoin's economic security. However, solutions have been suggested to mitigate the potential negative effects of the block reward halving — for example, introducing a minimal amount of inflation or finding ways to ensure (per block) the demand for transactions is always greater than supply. In conclusion, Bitcoin's block reward halving is a long-term issue which is yet to be resolved but there are several viable ways to solve the problem going forward.

### Environmental Impact of Proof of Work

Proof of Work mining is an extremely energy-intensive process that can require miners to be willing to pay up to the current price of Bitcoin in marginal costs to mine a single Bitcoin. The University of Cambridge Centre for Alternative Finance estimates that Bitcoin currently consumes 55.33 Terawatt Hours of energy per year and that that number will only increase as the network continues to grow. We agree that the energy consumption of the Bitcoin network is likely to continue to increase as the mining industry continues to professionalize and as the popularity of the Bitcoin network increases. It is unknown exactly what the energy mix of Bitcoin mining is but one can assume that at least some amount of Bitcoin mining is powered by non-renewable energy sources — meaning that Bitcoin mining may contribute to exacerbating current issues associated with the

climate crisis. However, some research<sup>3</sup> has argued that, on a conservative estimate, renewable energy makes up 74.1% of the energy of Bitcoin mining. This would, in fact, make mining more renewables-driven than most other mainstream industries in the world. While it is difficult to verify such numbers, there is no doubt that a large amount of Bitcoin mining is powered by renewable energy. Despite this fact, the mainstream perception is that Bitcoin mining is an unnecessarily energy-intensive process. There remains the possibility that, as policy action around the climate crisis intensifies, there could be a regulatory crackdown on Bitcoin predicated on a pro-climate agenda. Researchers in the industry can mitigate the risks of such a scenario by making a concerted effort to prove that Bitcoin mining relies heavily on renewable energy and find ways to reduce its reliance on fossil fuels.

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### Footnotes

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1) 'Stocks' are represented by the SPDR S&P 500 Trust ETF (SPY) and 'Bonds' by the iShares U.S. Treasury Bond ETF (GOVT). All price data is sourced from CoinMetrics and Yahoo Finance. We assume rebalancing costs of 0.1%.

2) A 51% attack refers to a hypothetical attack on a blockchain like Bitcoin where a group of miners who control more than 50% of the network's computing power (or hashrate). The group would be able to prevent transactions from becoming settled and possibly even reverse transactions, allowing them to "double-spend" units of a crypto asset like Bitcoin. For Bitcoin, due to the large and distributed mining industry, such an attack is extremely unlikely.

3) <https://www.vox.com/2019/6/18/18642645/bitcoin-energy-price-renewable-china>

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