Investment Insights

Bitcoin and Blockchain Technology

BESSEMER TRUST

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Highlights

- Bitcoin's recent rise is grabbing headlines around the world as its price has soared over 130% since late March of this year.

- The technology behind bitcoin and other cryptocurrencies is also gaining traction in the business world due to its ability to create a secure network that can easily track a large amount of data.

- In this *Investment Insights*, we discuss our view on cryptocurrencies, what blockchain technology is, and the technology's business applications.

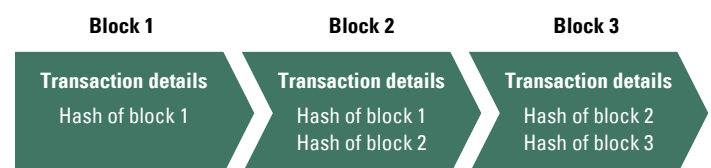## What is Bitcoin and Blockchain Technology?

Bitcoin is currently the largest type of cryptocurrency in terms of market cap and trading volume.[1] Bitcoins along with other cryptocurrencies are traded through online exchanges, including the U.S.-based exchanges, Coinbase and Gemini. In comparison, fiat currencies are traded through the foreign exchange market, which is the largest financial market in the world and includes numerous market participants (e.g., commercial banks, central banks, retail traders, and investment firms). Unlike fiat currencies, which are issued by central banks, cryptocurrencies are generated through a process called mining and rely on peer-to-peer technology in the

form of blockchain technology. Each individual that successfully adds a new block to the chain is rewarded with bitcoins once the members of the blockchain network collectively validate the transaction. No central banks or governments oversee these transactions.

In essence, blockchain technology is a sequential transaction database that is consensually shared and synchronized across a network. The first block is the initial transaction. Once a transaction occurs, a new block is added that contains a unique code linked to the prior transaction. New blocks are added through the mining process. For instance, if Michael has $100, the first block would indicate that he has $100. If Michael then gives $15 to Claire and $20 to Steven, the next block would list these transactions and contain the code that would tell all members of the blockchain that Michael started with $100 and two subsequent transactions with Claire and Steven; the members of the network must validate the transactions before a new block can be added.

Each block is encrypted with a unique code, called a hash, and includes the common transaction details and unique signatures of the parties involved in the transaction as well as a timestamp (Exhibit 1). Mining occurs when the members of the blockchain solve for the unique hash using software specifically designed for this. All new blocks are linked to older blocks in chronological order, so all members of the network can see the transaction history and must approve of each new block added to the chain.

Exhibit 1: Blockchain Technology: Simplified Example

Block 1	Block 2	Block 3
Transaction details	**Transaction details**	**Transaction details**
Hash of block 1	Hash of block 1	Hash of block 2
	Hash of block 2	Hash of block 3

[1] Source: CoinDesk

If a member of the blockchain makes a change to one of the blocks that has already been completed, all the subsequent blocks need to be changed. This is because the hash has changed, and all the following transactions are based on the now old hash. The person who changed the hash must then recode all the invalid transactions via mining before any new blocks can be added to the network. This takes a tremendous amount of time and more computing power than most individuals have access to. Additionally, all the members would know that a change has been made to one of the blocks. This provides a sense of security to all content within the network and is the comparative advantage of the technology. It is this element that makes blockchain appealing to the business world.

Additionally, blockchain technology can be split into two forms: public and private. Public blockchain simply means that anyone who takes part in the transaction can also read and write within the entire database. Cryptocurrencies are examples of public ledger and are ideal for their functionality because the individual members do not know each other.

Private blockchains function in the same way as public ones, but each member must be approved via pre-validated market IDs in order to participate. Many members of the business world are finding applications for private blockchains due to their needs for transaction privacy.

The Risks Around Cryptocurrencies

Bessemer client portfolios have no exposure to bitcoin or any other cryptocurrencies, nor do we have any intention of adding exposure in the near future. With that being said, we are invested in numerous companies that may benefit from the adoption of blockchain technology. Some holdings include technology companies (such as Microsoft, MasterCard, Visa, and Nasdaq) and finance companies (such as J.P. Morgan Chase, KeyCorp and Discover Financial Services).

Key Risks

As discussed in a piece we wrote in 2013, "Bitcoin's Success Does Not Mean the U.S. Dollar's Failure," there are sizeable risks associated with cryptocurrencies like bitcoin.

First and foremost, cryptocurrencies are largely unregulated, are not the official currency of any country, and are not a widely accepted form of exchange. For this reason, bitcoins and the like lack investor confidence and can be subject to significant volatility as investor confidence swings.

In addition to issues associated with the legality and regulation of cryptocurrencies, there is a legitimate issue associated with the account security of their exchanges. One high-profile example occurred in August 2016, when Bitfinex, the third-largest bitcoin exchange registered in Hong Kong, was hacked. A total of 119,756 bitcoins, or the equivalent of $65 million, were stolen. Bitcoin's exchange rate versus the U.S. dollar declined by 8.6% immediately following the announcement of the hack. The largest bitcoin heist occurred in February 2014, when hackers stole 850,000 bitcoins, valued at around $450 million at the time, from the Japan-based exchange Mt. Gox.

Along with the risks associated with account hacking, cybercriminals have also used digital currencies as ransom payments. During the recent global cyberattack in May of 2017, ransomware infection spread across more than 100 countries. Those affected were told to pay $300 worth of bitcoins to unlock the files for each affected computer.

Given the growing popularity of digital currencies and linkages to criminal activities, the U.S. Representative Kathleen Rise (NY) proposed a bill to study the link between terrorism and cryptocurrencies in May 2017. The U.S. House of Representatives also held a hearing to discuss national security implications of virtual currencies on June 8, 2017.

Another risk associated with digital currencies is their high volatility. It is not unusual for bitcoin or other cryptocurrencies to fluctuate in value by more than 20% in a very short period of time. As one of the more dramatic examples, in December 2013, the Chinese government announced that it would prohibit financial institutions from using bitcoins. In response, bitcoin's value plummeted from a peak of 1,130 on November 29 to 552 on December 6. In 2016, bitcoin's value increased by over 70% from 442 on May 23 to 762 on June 16. Market participants theorized that the increase was attributable to heightened demand in China as well as Brexit fears. In comparison to the U.S. dollar

and equity markets, bitcoin's price volatility is extremely high. Specifically, bitcoin's annualized volatility since July 2010 is 137%.[2] The trade-weighted U.S. dollar's volatility is 4.9% over the same time period; the S&P 500's volatility is 13.5%.

Cryptocurrencies Gaining Traction

Despite the risks, some countries are taking steps to make bitcoin more universally accepted. For instance, the Japanese government passed a law that enables it to regulate digital currency exchanges under anti-money laundering rules and classifies virtual currencies as a legal payment method. This law went into effect on April 1, 2017.

On July 1, 2017, the Australian government will begin treating digital currencies as legal tender. These currencies will also be exempt from goods and services tax; previously they were double taxed.

Bitcoins and other cryptocurrencies are also very popular in South Korea. In November 2016, the country's Financial Services Commission announced that it will introduce digital currency regulations in the coming year.

Other governments are devoting more resources to understanding cryptocurrencies. The Russian government has told the press that it is exploring ways to regulate virtual currencies. The Indian government established a committee to further explore cryptocurrencies given the growing adoption of them in the country.
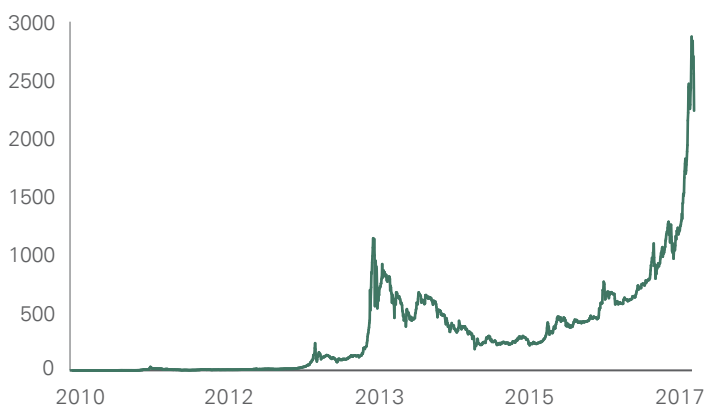
Since bitcoins are not considered a legal tender in China, Chinese residents are able to purchase bitcoins and other cryptocurrencies to bypass the current capital control regulations that limit how many renminbi can leave the Chinese economy. Current regulations allow Chinese nationals a foreign exchange quota of $50,000 per year. The Chinese government has intervened in China-based bitcoin exchanges to control capital outflows. This has contributed to price fluctuations in bitcoin in the past.

Big Mover

Year-to-date, bitcoin is one of the best-performing assets with a return of over 130% (Exhibit 2). Most of this increase has occurred over the past few months. There are several reasons behind the rise. As mentioned, digital currencies are now being recognized as legal tender in Japan and Australia; South Korea and India are expected to follow suit. Additionally, geopolitical instability has increased and is arguably making cryptocurrencies appealing for residents in unstable economies with capital controls, and the Securities and Exchange Commission (SEC) is currently reviewing a bitcoin ETF proposal. That said, this rise has also been coupled with some relatively intense price swings. Bitcoin's

Exhibit 2: Bitcoin Historical and Year-to-Date Performance versus the U.S. Dollar

2010 to Present

Year-to-Date

As of June 8, 2017.

Source: Bloomberg

[2] Bitcoin is measured as bitcoin per U.S. Dollar. The U.S. Dollar is measured using the U.S. Trade Weighted Broad Dollar Index. Volatility is annualized and based on weekly price changes from July 23, 2010 to June 9, 2017 using week-end data points. Time period is based on data availability.

price decreased by over 15% in the days following an outage of one of bitcoin's largest exchanges, Coinbase, on June 12, 2017, due to increased traffic and high trading volume.

Despite the recent rise in bitcoin's value, Bessemer believes the risks far outweigh the benefits in terms of investing. However, the underlying blockchain technology provides some interesting opportunities from which current portfolios may benefit.

Applications for Blockchain Technology

Blockchain technology has many applications beyond cryptocurrencies. Many businesses are taking note of its value and partnering with technology companies to implement solutions using blockchain. Below we highlight some examples.

- In the shipping industry, hundreds of transactions take place to transport one container. For instance, Maersk stated that one shipping container going from East Africa to Europe requires paperwork involving 30 different people and totals 200 or more interactions. Maersk has partnered with IBM to improve this process using blockchain technology that allows all participants in the supply chain to track the shipment from start to finish. The goal is to reduce the amount of paperwork and enable customs officials and clients to track where the products are at all times.

- Walmart partnered with IBM to test the use of blockchain to track its produce. More specifically, like many retailers, Walmart was finding it difficult to notify its consumers of product recalls or when a consumer becomes ill from a product. The hope is that blockchain will solve this issue by creating a centralized database to record the entire transaction history of a product including its suppliers, how and where the food was grown, and who inspected it. This data would be retrievable through the consumer's receipt, enabling Walmart to strategically remove only the contaminated items and quickly identify the sources of foodborne outbreaks, like E. coli.

- Blockchain is also being explored as an option to significantly cut down on cash settlement times. The U.S. cash equities market is the largest and most active market in the world, totaling an average of 7 billion shares with a notional value of $277 billion traded per

day as of 2015. Exchanges, like NASDAQ and NYSE, broker-dealers, custody banks, and Depository Trust Company (DTC) are all involved in the process.

The cash settlement process takes around two days to be completed, and each of the parties involved in the process has their own system for processing the transaction that can result in disagreements on trade details. Blockchain technology can improve the cash settlement process by reducing trade errors, since all records require verification among all nodes in the network. The reduction in trade errors would also reduce the headcount and number of platforms and systems in back and middle offices. Lastly, a reduction in the settlement time would improve the efficiency of the capital market systems and reduce some market risk.

- Along with IBM, Microsoft has positioned itself as a top player in blockchain technology. Microsoft's Azure developed Blockchain as a Service (BaaS) to provide a platform for businesses to utilize blockchain technology via a cloud computing platform. Ethereum and Hyperledger, which are both public blockchains, are supported by Microsoft Azure. In essence, Microsoft's goal is to offer companies an open platform supporting different blockchain developers to allow them to select the best technologies for their business application.

Microsoft is also a member of the Enterprise Ethereum Alliance. This consortium's goal is to develop more business-oriented solutions using Ethereum's open-source blockchain technology and includes tech giants, such as Intel and Microsoft; large financial firms, such as J.P. Morgan, Credit Suisse, UBS, and BNY Mellon; and start-up firms.

Conclusion

While we recognize the value of cryptocurrencies, we do not invest in them. At this time, there are too many outsized risks and other investment opportunities with more attractive risk-adjusted return prospects. The blockchain technology behind these currencies, however, is potentially transformative and disruptive to many industries. We do have indirect exposure to blockchain technology in our equity mandates through investments in companies that are utilizing or plan to utilize the technology to improve their business practices.

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