The Valuation and Investment Risk of Cryptocurrency: Evidence from Bitcoin and Ethereum

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Abstract. From gold standard currencies to fiat money secured by government credit, to today's cryptocurrencies, the basic form of money and mankind's perception of its value has shifted dramatically. This paper will demonstrate the value and risk assessment of the two cryptocurrencies with the highest market share, i.e., Bitcoin and Ethereum. Although the current technology of cryptocurrencies is not perfect, it will improve over time and their value will increase due to the high demand for them. This aim of the study to give first-time investors an understanding of the valuation and risks of cryptocurrencies, rather than treating them as simple financial assets for investment. According to the analysis, the value and risk of Bitcoin depend deeply on many characteristics that were initially built into it. It also has an impact on the value of other virtual currencies at the same time. On the other hand, Ether is a much more open platform, so its value and risk depend more on the various applications and contracts built into a blockchain than Bitcoin. These results shed the light on guiding the further exploration of solving the safety problem of cryptocurrencies from different perspectives.

Keywords: Cryptocurrency; Bitcoin; Ethereum; Valuation; Risk.

1. Introduction

In the past, all the currencies have an authorized issuance entity as the government [1]. In 2008, during the global financial crisis, the federal reserve started a huge quantitative easing to increase a large amount of money supply, weakening people's trust in traditional fiat money [1]. Additionally, increasing attacks and fraudulent on third-party financial systems increase cyber risks [2]. Hence, investors have the desire to seek financial systems that are trustworthy and safe. On this basis, Satoshi Nakamoto proposed the concept of Bitcoin in 2008. Instead of traditional fiat money that depends on the government's trust, cryptocurrency relies on the principles of Cryptography and allows the two parties to make transactions directly [3].

Cryptocurrencies with blockchain as the underlying technology has built a monetary system that is theoretically secure without the need for intermediaries to maintain it. The issuance method can be open and transparent, which has laid a solid foundation for its global circulation [4]. With the help of proof of work, the deceiver's computing power must exceed 51% of the overall network to deceive everyone. However, the reality is that even the largest miners have only 10% of the computing power needed for the entire system [5]. Since the beginning, Bitcoin has never had a problem with fraudulent transactions and is extremely reliable. In the beginning, bitcoin was only known and popular with a group of geeks few people recognized its value for trading.

In 2010, a programmer used 10000 bitcoins to purchase 2 pieces of pizza that are overall worth $25, which gave the initial value of $0.0025 to the bitcoin [6]. Since then, bitcoin started to be recognized by more and more people and thousands of cryptocurrencies started to appear on the market. According to Coinbase, on November 12th, 2021, the value of bitcoin and Ethereum reached $64400 and $4644 respectively, and they remained at a value of around $17000 and $1200 these days. The market value of Bitcoin is $326.3 billion while the market value of Ethereum is $154.6 billion now. Previously, there is much research on cryptocurrencies from the overall perspective of risks in the basic principles of cryptocurrency.

This article will specifically focus on the valuation and investment risks of cryptocurrency from the perspective of bitcoin and Ethereum. Section 2 mainly renders some introductions to Bitcoin and Ethereum and the analysis of their price trend. Section 3 talks about the different elements of the

valuation of bitcoin, while section 4 is about the valuations of Ethereum. In section 5, the investment risks of cryptos will be discussed from the perspective of transaction, regulatory, and account security. Limitations of cryptocurrencies and future outlooks will be revealed in section 6. In the end, the conclusion will talk about the meaning of the research on cryptocurrency.

2. Description of Bitcoin and Ethereum

Bitcoin is quite different from traditional fiat money trading. People who trade directly from one to another without a third party will broadcast their trading to all other nodes to let somebody record this. At every end of the money, people will trade according to what is recorded in the account. However, there is a problem if somebody tries not to broadcast his transaction for his own interest. Bitcoin uses a proof-of-work system to solve this problem. It means people will always trust the longest blockchain which means the largest work in the system. Miners with the largest arithmetic power are most likely to calculate the hashes of 256-bit numbers with the first few tens of bits being zero through the SHA-256 hash function. In this way, this miner will be able to build the next block and get his reward for a few bitcoins and broadcast 2400 transactions to every other node in the system every 10 minutes [7]. If anyone wants to deceive everyone in the system, he needs to continuously build more blocks on the wrong chain. From a probability point of view, there is indeed some possibility that he could do this in the beginning. Nevertheless, the cost of doing so would be unacceptably high owing to the strong arithmetic power required. In the long run, if he is not able to reach more than 51% of the total bitcoin computing power, he will not be able to keep maintaining the longest chain to cheat everyone. Hence, in this model based on computing power, the safety of bitcoin can be ensured [8].

In 2015, another kind of system appeared called Ethereum. Ether is more like a payment system where people can run smart contracts on top of the virtual machine of Ethereum without third-party intervention. The system resources consumed are paid for with the system's Gas. Gas cannot be purchased through the currency of each country, but through the Ether inside the Ether. Moreover, when miners or verifiers mine or verify a new block, they can get 5 Ether as a reward. Ethereum allowed miners to add the block much faster than bitcoin, which is only 15 seconds. Compared to only 7 transactions per second, Ethereum allowed 30 transactions per second. Hence, unlike Bitcoin, which is the central part of the system, Ether is only considered a supporting part in the operation of Ethereum. The largest problem with Bitcoin is the proof of work system depends largely on the ability to calculate the next hashes. Hence, miners who would like to increase the probability to find the next number are likely to gather and form several mining pools. This makes the blockchain system to be more centralized instead of the previous initiation of decentralization. Furthermore, the process of solving another hash will consume a huge amount of electricity. Every single transaction of one bitcoin will need electricity up to 1449 kWh to complete, which could supply power for an average American household for 50 days. Therefore, the proof of work system in bitcoin does not show to be a high-efficiency system and wastes much energy. Thus, the developers of the Ethereum community used another system called proof-of-stake. Here, instead of using the miners, Ethereum could use the validators to validate whether a block is not a fraud. The validators should save some money in the network and those who save more money will have a higher possibility to become a validator [9]. Validators can only get the transaction fee after the networks are sure that they do not make any deceiving. Otherwise, validators will lose some part of their stake which is larger than the transaction fee they could gain.

3. Valuation of Bitcoin

Besides people’s expectations can determine the price of cryptocurrencies. The valuation of cryptocurrencies will determine their value in the long run. First, the total supply of bitcoin is fixed at 21 million and it is impossible to change because, after every 21000 blocks which are about 4 years,

miners could only gain half the reward than previous. At first, the reward is 50 BTC and now it has decayed to 6.25 BTC. Hence, the demand for bitcoin is worth more discussion to determine its value [2].

There is a huge demand for bitcoin because people want to avoid a third party between the transaction which will censor the information of trading. Traditional fiat money might be affected by several factors including a tremendous increase in the money supply, hyperinflation, civil wars, and territorial conflicts. People tend to seek a secure place for trading to avoid all of these. These demands might be under the shadow and cannot trade in public. Bitcoin gives these demands a chance to transfer the value in its system without losing the information of traders. Illicit trading in the black market also uses bitcoin for the exchange of drugs or human organs or even weapons [2].

Moreover, bitcoin has huge power to expand around the world. Since different governments need currencies to apply to their national market, it is unlikely that people in the different markets use the same currency. Moreover, the power of the dollar has already influenced the whole world. However, in the process of deep globalization, some problems are increasingly severe. For example, in 2008, when the United States increase its money supply significantly, the huge demand from America for importing products from other countries drove up the price outside of them. Additionally, when America increases its interest rate to a higher level, people from other countries tend to save their money for the United States. In this way, capital outflow will be severe in other countries [1]. Furthermore, global sanctions completely make an economy to be isolated and will also make the value of bitcoin to be more salient. It is proved that there is an increasing desire for global currency for international trading. Hence, the demand for bitcoin will rise.

Besides, bitcoin is quite different from traditional fiat money which is only used for transactions. Many people who own bitcoin consider it to be a financial asset. This type of financial asset is completely safe without any typical risk like the other asset. First, transactions will never be successful if people behind the public key do not have enough amount of money. This can reduce the counterparty risk. In addition, among traditional corporate bonds, the semi-annual coupon is constantly discounted to find present value; and stock dividends also affect the value of the stock. These traditional risks are minimized or even not presented in Bitcoin. Hence, people will increase their demand in this way.

Figure 1. The price evolution of Bitcoin.

However, there are still some bad factors that affect the value of bitcoin. The most significant one is volatility. Bitcoin's value is 41 times more volatile than the exchange rate between USD and EUR. As a result, one would be skeptical of the ability of bitcoin to store value. One can see from the price trend of bitcoin in Fig. 1 that the price fluctuation in 2021 is extremely huge and if investors enter

from the highs, then their assets will be devalued by three quarters. In addition, the impact of social media on the fluctuation of Bitcoin's value should not be underestimated. Elon Musk tweeted about his views on bitcoin in 2021, which led to huge fluctuations in the price of bitcoin. The rapid spread of gossip on social media can also lead to speculation about the value of bitcoin, which can cause undeservedly large fluctuations in the value of bitcoin [10]. In addition, the value of bitcoin can also be greatly affected when an investor enters or withdraws a large amount of money. For example, Tesla's purchase of $1.5 billion worth of bitcoin is what caused the value of bitcoin to rise dramatically.

4. Valuation of Ethereum

When one attempts to evaluate the value of Ether, the value of bitcoin is impossible for us to bypass the change of value in bitcoin. Here is the price of Ethereum. It also reached its highest price of nearly $5000 in 2021. Hence, according to the data from Yahoo Finance, this study computes the correlation between the price of bitcoin and the price of Ethereum and found that is 0.92 (Pearson correlation coefficient), which shows a strong relationship between them (seen from Fig. 2). From this perspective, the rise in the price of bitcoin does not negatively affect the price of Ether. Hence, the market for cryptocurrencies is still in expansion, as people tend to see the value of cryptocurrencies together. When the bitcoin value increase, people will expect the value of the Ether to rise as well.

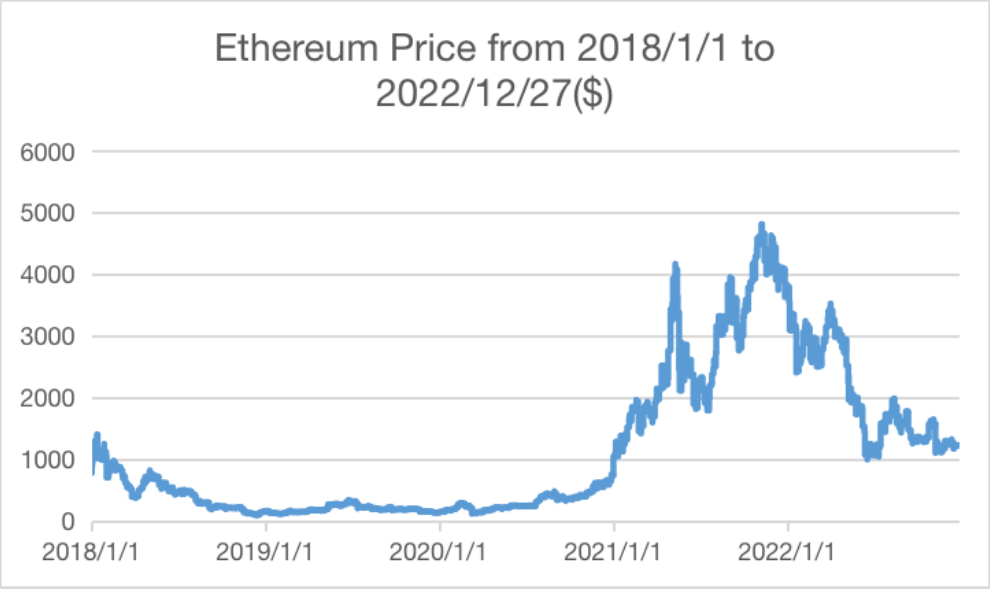

Figure 2. The price evolution of Ethereum.

Moreover, technology is quite important in determining the value of Ether. There is increasing demand for the Internet of Things that connects everything in our life together. If it is possible Ethereum system unlocks the door of an apartment or sends deliveries to people in the future, Ethereum will be more welcomed. Hence, with the increasing development of the Internet of Things, demand for Ethereum must be larger in the future. IBM believes that blockchain is the future of the Internet of Things: each manages its roles and behavior, resulting in an Internet of Decentralized, Autonomous Things and thus the democratization of the digital world. Moreover, the Ethereum system has great flexibility in developing contracts and programs. In the decentralized system without a third party, contracts designed here could be freer and more personalized across different territories [11]. Hence, demand for Ether as a payment method for running these contracts will be higher and its value will also be higher.

The supply of bitcoin will determine the value of a single Ether. Unlike bitcoin which fixed its supply to be fixed at 21 million, Ethereum will give rewards to miners or validators fixing at 5 Ether for each block. Hence, the increase in the supply of Ether is predictable. Besides, it is more reasonable

than Bitcoin which had an upper limit for Ethereum to use this model because Ethereum of course is in its expansion in the scale of Ethereum users. Hence, in the long run, the price of Ether tends to be more stable than Bitcoin.

The system of proof of work and proof of stake can also affect the valuation of the currencies. Ethereum tended to transfer from the proof of work system into the proof of stake system. This system will save a lot of energy in calculating the next hashes for each block compared to proof of work. Hence, there is less waste of energy in this system with higher efficiency. Since more and more people join the mining pool, people with ordinary computing power are very less likely to gain the chance of building a block, and proof of work makes the system to be more centralized. Hence, people with small computing power or less technology knowledge but wealthier might change toward Ethereum.

The value of Ether will be related to a smart contract working on it. The DAO is a digital decentralized autonomous organization which a smart contract built on the Ethernet network, launched by Slock. it on April 30, 2016. It works like an investment fund, where project funds are locked within the blockchain, used, and distributed through a pre-built smart contract code. When more people choose to use the DAO for their investment, the value of DAOs will be higher. However, when the smart contract is at risk, like somebody stealing 3.6 million Ether which was worth 50 million dollars on June 16, 2016, the safety of Ethereum will be questioned and the value is lower [12].

Finally, another notable thing to mention is Non-fungible token (NFT), which is a digital identifier stored in the blockchain of Ethereum that shows somebody owns a file like music, drawing or videos. Despite other people can still find the same music or videos from other places, NFT only recognizes one unique owner who purchases it like a physical painting owned by somebody at home. This was once considered by many people as the future form of collection, as its value grew a huge amount in the year 2021, which was also the same year that the value of Ether was at its highest position. However, in 2022, people's recognition of NFT was broken and the value of NFT dropped largely as well as its sales decreased by 90%. At the same time, the value of Ether also decreased by a large amount from 2021 to 2022. Hence, Ethereum's value is affected by the NFT market [13].

5. Investment Risk of Cryptocurrencies

In fact, there are some investment risks for cryptocurrencies. First, the account safety of cryptocurrencies cannot be ensured in some conditions. A crucial one in them is 51% problem no matter whether the working system is proof of work or proof of stake. If one power gains 51% computing power or stake, the system will not be safe anymore. BTC.com, AntPool and SlushPool have an accumulative computing power of over 51%. If they take a step forward to monopoly the mining resources and make fraud, it is impossible to discover the problem. One person or a group of people needs 79 billion dollars to reach 51% of the stake in the system to make themselves a validator. They could make fraud in the system in this way. Additionally, people who have a larger stake in the network have a larger possibility to gain more rewards and put them further into the system to increase their stake [5]. Hence, a wealthy person can increase their possibility to get the opportunity of being a validator.

Even though it is hard to make the whole system crash, it might be not so hard for people to steal bitcoin from a single node. Hackers often plant viruses on node systems to illegally obtain cryptocurrency and distribute the income to multiple accounts. Additionally, due to the trading of cryptocurrencies being anonymous, it is quite costly to track these cases. James Zhong is a person who was arrested in 2021 in the United States because he hides 50676 bitcoins in his devices. Also, there are many frauds that had not been discovered. In May 2016, 2 million dollars were stolen from a platform called Gatecoin. Gatecoin then afford these losses for its customer. However, in August 2016, there are $75 million was stolen from a platform called Bitfinex [14]. All the customers in this case afford the loss together.

Moreover, there are several risks in the transactions of cryptocurrencies. It is hard to achieve peer-to-peer transactions. Mostly, people still need a transaction platform to finish the transactions. The existence of these platforms makes the bitcoin market to be centralized again. They gain their profits from transactions for fees, proprietary trading, account custody, participation in mining, handling transfers, developing, and operating related derivatives, and other ways. Whereas, platforms are different from the traditional exchange market. They are owned by a private person and the related rights and obligations lack clear regulations. Moreover, the credit risk of platforms is also high as many of them go bankrupt easily. Some of them claim that they are attacked by hackers, some of them misappropriate investor assets, and some of them just directly disappeared from the market. In the year 2019 alone, more than 40 trading platforms go bankrupt around the world [15]. Besides, when people have transactions in the blockchain, there may be computing delays in the blockchain as the transaction period can exceed one week. Meanwhile, OTC (over-the-counter) is required when converting to fiat currency, and there are risks of money laundering and untrustworthy transactions [15].

Furthermore, regulations are an important issue. in western countries (e.g., the United States), the United Kingdom, Canada and Germany, governments tend to encourage the trading of cryptocurrency, while in countries (e.g., China and Egypt), it is illicit to use cryptocurrency [16]. Because cryptocurrency only displays the public key between two traders, it is impossible to know who is behind those public keys. Without a centralized authority in charge of currency issuance, each government is forced to manage cryptocurrency on its own. Anonymous accounts and different regulations in different countries for cryptocurrency transactions make it cannot be well-regulated by the government.

Moreover, there are not enough tools for risk management in the cryptocurrency market. In traditional financial investment, investors could deliberately find different ways, e.g., communicating with the rating agencies, asking issuers to provide guarantees, or using different kinds of derivatives to diversify the risk. However, cryptocurrencies do not have any rating agencies for them, and people have very few ways to diversify and hedge the risks of investment [17]. Additionally, since cryptocurrencies have little relationship with the real running conditions of a company, it is hard for investors to quantify the exact risk in their investment.

6. Limitations & Prospects

Nevertheless, this study has some shortcomings and defects. To be specific, it includes only the valuation of the cryptocurrencies from the evidence of Bitcoin and Ethereum. There are thousands of cryptocurrencies on the market, whose valuations cannot be concluded with only two types. If there is further analysis on cryptocurrencies, each cryptocurrency should be analyzed on a case-by-case basis. Additionally, ascribed to space limitations, the article does not explain too much about the specific principles of Bitcoin and Ether. It simply contains the principles of Bitcoin and Ether that need to be used to value Bitcoin and Ether later in the article. In addition, this article has always used dollar denominations when explaining the value of cryptocurrencies. This would lead the reader to believe that most cryptocurrencies are purchased outright. In fact, cryptocurrencies are in many cases, people first buy Tethers that are directly tied to the US dollar and then exchange them for other kinds of cryptocurrencies through Tethers. Finally, because the topic of this paper is limited to factors that assess the value of Bitcoin and Ether and the risks of investing in cryptocurrencies, this paper does not use a lot of quantitative analysis. Nevertheless, in papers on other topics, such as analyzing the price correlation between various cryptocurrencies or the impact of the number of nodes and node relationships on the security of cryptocurrencies, extensive quantitative analysis is essential for reaching a conclusion.

In future research on the valuation of cryptocurrencies, some factors like social media effects or news could be researched deeper. The value of cryptocurrencies is very likely to be affected by a more vocal persona or some biased news. Some people even released biased news to deliberately

control the price of cryptocurrencies. Hence, this topic needs further research. Another topic that deserves to be explored is the impact of people's knowledge of virtual currencies on their valuation of cryptocurrencies. Lots of investors do not really understand the principles behind cryptocurrencies, and they just treat them as a kind of financial asset. They just try to find whether the value of cryptocurrency will increase or decrease to make a profit. It is a question worth to be investigating whether people will change their expectations of the value of cryptocurrency if they know more about them. In addition, the extent to which the technology of cryptocurrencies has advanced to be accepted by consumers is also a topic worth studying. Although the technology of cryptocurrency is becoming more and more developed and more people are learning about the concept, the role of it in trading has not yet been developed in our daily life. This is related to the fact that the technology of cryptocurrency is still not mature enough for people's acceptance. Furthermore, the problem of cryptocurrency theft deserves to be studied. Currently, cryptocurrencies are very expensive to track for stealing when accounts are anonymous. It is worthwhile to find a method to reduce the cost of tracking. Finally, the most difficult and worthwhile topic is the 51% problem. If one day the company with the highest computing power or the person with the highest stake in the system make a monopoly together to complete the fraud, it would be a huge strike on the system. These problems are worth studying to improve and even overcome.

7. Conclusion

In summary, this article provides background on the birth of cryptocurrencies and basic information on their use. In addition, this paper describes how Bitcoin and Ether work respectively and how the two cryptocurrencies differ. In the valuation section, one sees that the factors that influence the value of bitcoin are the supply of bitcoin, the demand for escape from censorship, the demand for international trade, the demand for investment and finally the volatility of bitcoin. In addition, the demand for medical Ethereum from the different contracts in the Ethereum system that are gradually penetrating people's lives and the fact that Ethereum payment purchases do not require a third party make the process in Ethereum more personalized. Finally, since Ethereum uses proof-of-stake rather than proof-of-work, this saves a lot of energy consumption and gives some groups who are richer despite their lack of computing power to participate in the verification process. Hence, it is possible to see that cryptocurrencies are generally worth investing in over time.

Afterwards, this article discusses some of the risks of investing in cryptocurrencies. The first and foremost is the 51% problem, when any miner or verifier has more than 51% of the entire system in terms of arithmetic power or investment, fraud on the entire system can turn out to be able to happen. In addition, although hackers cannot hack the entire system, they can still make a significant profit by using Trojan horses to attack individual exchanges. Such things have happened, and on account of the anonymous nature of cryptocurrencies, tracking costs are very high, and only the trading platform can compensate for this, or the platform customer can bear all the losses themselves. In addition, trading platforms themselves are not well regulated as well as capable of safeguarding platform customers and often simply disappear from the market for various reasons. Finally, since cryptocurrencies have just emerged, there is a lack of risk diversification tools or risk hedging tools, and there are no rating agencies to assess the risks of various types of cryptocurrencies, so investors should think twice before investing.

Indeed, this article has not been able to fully explain the principles of cryptocurrencies owing to space limitations nor evaluate the value and risks of more cryptocurrencies ascribed to the limitations of the topic. For future research, the relationship between people's understanding of cryptocurrencies and their value expectations, the relationship between advances in cryptocurrency technology and people's acceptance of them, and how to optimize and solve the 51% problem and theft problem ought to be investigated. These results offer a guideline for first-time investors with a basic understanding of cryptocurrencies' valuation and risks.

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