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Evaluating prevailing Bitcoin valuation models – how do they work and how do they perform today?

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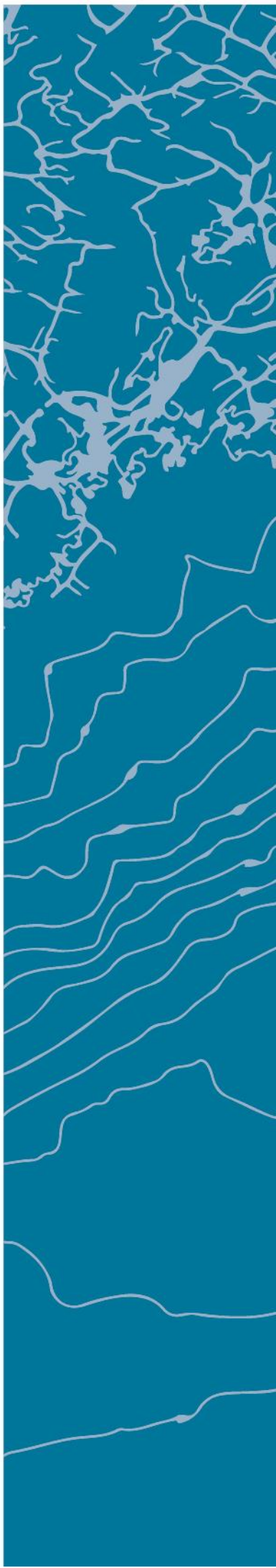

Aknowledgements

This thesis is created as part of the master's degree in Economics and Administration at the University of Agder (UiA). The project was finished in the fall of 2022.

Bitcoin, a virtual currency based on the breakthrough blockchain technology, was released in 2009 as a new way to conduct payments (Nakamoto, 2008). We decided to research this topic because of its current relevance, appeal, and the potential for the research to produce valuable results. The objective of this thesis is to offer the reader with a foundational grasp of Bitcoin, and introduce both the positive and negative implications for both the users that utilize the Bitcoin network, as well as the authorities.

In light of this, the thesis discusses how we can determine a fair value for Bitcoin based on existing models that aims to achieve this. We will present the models which are currently the most prominent ones to see if they are valuable today. In the instance that the model carries merit, we will optimize it so that it captures relevant factors that may have not been present whence the model was introduced. The work on the report has been engaging and incredibly enlightening. As a consequence of our work on this paper, we now understand that Bitcoin is more than a virtual currency for individuals with malicious intents, but rather is of great importance. We believe that the Bitcoin technology could potentially be one of the most significant innovations of our time. We hope that the report piques the reader's attention and contributes to a deeper understanding of both Bitcoin and cryptocurrencies.

Additionally, we would like to thank our close friends Sam Kronenberg, Magnus Flem Gjerstad & Tobias Bergkvist for their invaluable assistance and contributions during our process of researching this topic.

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Abstract

Bitcoin has, since the first coin was mined in 2009, taken the world by storm. Today, millions of people are embracing the digital currency, and is evident that the growth is not going to halt any time soon. The increased adoption of Bitcoin raises the question about the fair value of the asset. What is the best way to fairly value Bitcoin, if it has any fundamental value at all?

Numerous valuation models for Bitcoin have been proposed throughout the years. The majority of today's most popular models were presented between 2017 and 2019, and much has transpired since then. In this thesis, we will examine Bitcoin's underlying technology and the opportunities and challenges it brings for the contemporary world. Currently, we are discovering that digital assets and Bitcoin offer a number of opportunities that provide utility and convenience for consumers that utilize the digital asset market. To maintain objectivity, we will also discuss the issues connected with the widespread use of digital assets like Bitcoin. Finally, we will explore whether present techniques of valuing Bitcoin may be regarded as a "fair" manner of valuing Bitcoin. In addition, we will contribute to the existing research on Bitcoin valuation by suggesting improvements in the current valuation methods that we believe holds merit.

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1. Introduction

In light of the financial crisis which took place from 2007 - 2008 there was a growing distrust towards the financial sector, rating agencies, the federal reserve, as well as the current political environment which regulated these aforementioned institutions and sectors. Many argued that the current payment system and how it was regulated favored the wealthy rather than the weak in society. As a result, someone started looking in the direction of cryptography, which swiftly appeared to be an attractive solution to the political and monetary wariness around the world.

In 2008 an internet personality under the pseudonym 'Satoshi Nakamoto' published a research article called "Bitcoin: A Peer-To-Peer Electronic Cash System", which intricately described a decentralized peer-to-peer payment system (Nakamoto, 2008). In January 2009, the electronic payment system 'Bitcoin' was live, which first and foremost was a system which introduced a virtual currency which was decentralized; it can therefore not be issued nor controlled by any government or an entity. The payment system also allowed peer-to-peer transactions without the need for the involvement of third parties, such as banks or financial institutions. The payment system would allow the users to enjoy the benefit of lower transaction costs, as well as a higher level of anonymity (Nakamoto, 2008).

Bitcoin was initially picked up by curios cypherpunks and individuals with malicious intents. It was not until 2011 that Bitcoin piqued the interest of both investors and the media due to a rather expansive cycle in terms of price action (Arsi, Khelafi, Ghabri, & Mzoughi, 2021). Innovative and new technology is commonly met with comprehensive scrutiny, and Bitcoin was no exception. Several countries have gone on to ban it and countless central banks have advised consumers to avoid virtual currencies and digital assets at all cost. Renowned economists such as Warren Buffett, Charlie Munger, Nouriel Roubini and Peter Schiff have described Bitcoin as "worse than rat poison", "an evil pyramid scheme" and "a bubble that inevitably will pop for good". However, Bitcoin has slowly garnered the attention of other prominent economists and financial institutions who see it as something that can fundamentally change how we transact and store value for good. These individuals and institutions believe that there are a vast number of unexplored venues in which we would be able to leverage the underlying technology that Bitcoin provides (Arsi, Khelafi, Ghabri, & Mzoughi, 2021).

As Bitcoin flourishes and attracts the attention of prominent investors, governments, and nation-states, its nature in the context of economics remains under scrutiny. Is it an asset, store of value, medium of exchange, or a bypassing trend that soon will be forgotten? And is it possible to defend the value of Bitcoin from an economic standpoint?

2 Theory

2.1 Cryptocurrencies

Cryptocurrencies are virtual currencies which are not issued by, or given any underlying guarantee from a central bank. To be specific, bitcoin and other cryptocurrencies are currencies which are transacted in an unregulated monetary market, where money can be moved peer-to-peer without the need for an intermediary (Arslanian & Fischer, 2019). There currently exist more than 19,000 different cryptocurrencies, but other cryptocurrencies than Bitcoin are progressively accepted as a medium of exchange online, as well as in retail stores, restaurants, and cafés (Coinmarketcap.com, 2022).

2.2 Bitcoin: A Deep Dive

The enigmatic figure known as Satoshi Nakamoto is credited with the creation of both the digital asset and the payment system known as bitcoin. It is a form of virtual money that was developed with the intention of functioning as a medium of exchange and that makes use of cryptography rather than depending on a centralized authority, such as a third-party intermediary. Transactions involving bitcoin are verified by nodes on the network and the results are stored in a publicly accessible distributed ledger known as a blockchain. This makes it possible for bitcoins to be decentralized (Nakamoto, 2008).

The virtual currency that this thesis will delve into is Bitcoin, which has been the reigning cryptocurrency ever since its inception in 2008. Bitcoin is a peer-to-peer electronic cash payment system and was adopted quickly by cypherpunks (Arslanian & Fischer, 2019). The decentralized structure of bitcoin allowed people around the world to transact between one another, without having the need for a bank. By slashing the middleman of transacting, as well as implementing its decentralized underlying technology, Bitcoin was able to quickly

gain traction. The initial traction was gained through lower transaction costs, in addition to being accessible 24 hours a day, 365 days a year (Nakamoto, 2008). The transactions were also completely unregulated which made it difficult for governments and authorities to safeguard the monetary movements that were made. These are some of the intrinsic benefits of Bitcoin, which has made both Bitcoin and other cryptocurrencies into both an attractive and lucrative innovation for a wide variety of individuals, both with malicious intentions, as well as benevolent ones (Yeoh & Haynes, 2020).

Bitcoin's being seen as an alternative to fiat currency is largely attributable to its decentralization. The decentralization is a result of the numerous nodes that makes the bitcoin network accessible 24 hours a day, 7 days a week, with fast transaction rates and minimal transaction costs compared to traditional banking fees (Nakamoto, 2008). Bitcoin is frequently referred to as "digital gold" because to its parallels to precious metals. Bitcoin, like gold, cannot be generated from nothing; it must be mined. Similarly, like gold, after all bitcoins are mined, they will remain in circulation indefinitely. There will never be more than 21 million bitcoins. Thus, Bitcoin is argued to be a deflationary currency, which makes it appealing to investors seeking an alternative to fiat currencies which are inherently inflationary (Nakamoto, 2008).

Up until 2017, Bitcoin, was the dominating force in the crypto economy by having a staggering 80% of the total cryptocurrency market capitalization (Coinmarketcap, 2022). This has naturally yielded Bitcoin the most attention, both in terms of scrutiny and praise.

2.2.1 The Distributed Ledger

Bitcoin is based on a distributed ledger database, which creates its decentralized and immutable traits. A distributed ledger is a database that is consensually shared and synchronized through a network of nodes which are operated from different sites, geographies, or institutions (Anceaume, Ludinard, Potop-Butucaru, & Tronel, 2017). As a result, there is no central administrator and no centralized storage of data. This renders it practically hack-proof and transparent. In contrast to a standard database, in which a central administrator normally determines the rules for data entry and access, this database does not have a central administrator. A distributed ledger may employ a database-like design, but it employs a consensus method that enables each network participant to verify and approve

transactions (Anceaume, Ludinard, Potop-Butucaru, & Tronel, 2017). Additionally, the consensus mechanism permits each participant to keep a copy of the ledger, and all copies are updated in real time (Nakamoto, 2008).

2.2.2 Proof of work

Bitcoin's consensus mechanism is known as Proof of Work (PoW). It is the consensus technique most commonly employed in the different cryptocurrencies that are operating today. PoW is based on the concept that each network participant competes to find a solution to a mathematical problem. The miner who discovers the solution first is awarded a fixed quantity of bitcoins, depending on the current block reward. The difficulty of the mathematical issue is finely tuned, so that finding a solution takes, on average, 10 minutes. However, PoW recalibrates its difficulty relative to how many participants there are on the network. Bitcoin uses the PoW consensus process to ensure the integrity of the ledger. If someone attempted to change a transaction in the ledger, the other miners would instantly detect the fraud and reject the transaction as illegitimate. PoW has the disadvantage of requiring a great deal of energy to power the miners that compete to find solutions (Nakamoto, 2008).

2.2.3 Hash Rate

The hash rate is the number of hashes that a bitcoin miner can perform in a given amount of time and sets forth the miners whole computational capacity. The hashrate is typically measured in hashes per second (H/s) and shows the number of cryptographic hashing operations that a specific network can accomplish in a given time period. Due to the significance of hashrate as a measure, miners frequently strive to achieve the highest hashrates. They can boost their chances of succeeding and solve additioanl blocks by pooling their computational capacity. Hashrate is computed by dividing the total number of hashing operations done in a given time period by the total number of seconds elapsed during that time period. If a blockchain network processed 1,000 hashes in 60 seconds, for instance, its hashrate would be 1,000 H/s (Arslanian, 2022).

2.3 Advantages of Bitcoin

Bitcoin carries several beneficial traits, such as peer-to-peer transacting, lower transaction costs, the inherent portability, durability, divisibility and lastly, the attractiveness of the hard capped total circulating supply of 21,000,000 bitcoins (Nakamoto, 2008). This subchapter will further examine these advantageous traits of bitcoin.

2.3.1 Bitcoin as a Medium-of-Exchange (MoE)

Boyapati (2021) has identified several advantages that delves into the necessary traits that Bitcoin has that makes an appropriate medium-of-exchange, but also a store-of-value:

1. "Durability" - Bitcoin cannot vanish into thin air, and its value will not depreciate due to wear and use. Bitcoin is thus an excellent store of value and means of exchange.
2. "Portability" - Bitcoin occupies no physical space, unless the Bitcoin holder saves it on a Ledger, which occupies a small amount of physical space. Additionally, its portability prevents theft because it is more difficult to obtain. Bitcoin is consequently more transportable and secure than for example gold bars.
3. "Fungibility" - Bitcoin is fungible because it is easily distinguishable from other goods. Due to the fact that abnormalities might lead to transactional issues, fungibility is crucial; consequently, Bitcoin must be interconvertible.
4. "Verifiability" - Bitcoin is verifiable in the sense that users may rapidly validate that the medium they have received is the medium itself. This is easily verifiable using Bitcoin's underlying blockchain technology.
5. "Divisibility" - One Bitcoin can be divided into 100,000,000 parts, commonly known as Satoshis. As a result, it is possible to acquire incredibly exact units of account, making it appropriate for all types of transactions as a medium of exchange.
6. "Security" - Another benefit of Bitcoin's core technology is the protection it provides, particularly against counterfeiting. Each user is still responsible for his or her own security, and social manipulation may poses a risk.
7. "Scarcity" - In order for a commodity to serve as a store of value and a medium of exchange, it must be scarce. Gold, diamonds, and silver are all desirable because of their scarcity. Due to the fixed limit of 21,000,000 bitcoins in circulation, Bitcoin solves the issue of scarcity with relative ease. Additionally, one could argue that Bitcoin is even scarcer than Satoshi Nakamoto planned. This is because millions of

Bitcoins have been lost attributable to forgotten addresses, stolen hardware, and hacks.

8. “Established history” - Before something may become a medium of exchange, its history must be established. It is probable that the volatility of Bitcoin's price action will decrease with each passing day as the history of the cryptocurrency accumulates further consumer and investor trust.
9. “Censorship-resistant” - As a result of political and economic skepticism, which has resulted in mistrust of the current political and economic systems, the need for censorship-resistant technologies has surged drastically worldwide. Resistance to censorship refers to the extent to which a third party is able to enforce alterations on a good that result in user-end issues. These issues vary significantly, but primarily involve the ability to censor goods, the ability to ban goods, and the user's ability to retain the good. In situations when consumers are highly likely to have their possessions censored, censorship-resistant products are seen as highly valuable. For instance, consumers and investors in countries with inadequate political control, governed by regimes or dictatorships highly value these traits tremendously.

2.3.2 Time & Costs Relating to Transacting

The most prominent advantage that Bitcoin carries is the costs of transacting. The lowered transaction cost is made possible by the peer-to-peer system which Bitcoin utilizes. Individuals who choose to use Bitcoin can therefore avoid transaction costs and other fee’s which would otherwise be imposed on them by third parties, such as banks. In practice, sending a transaction with Bitcoin is rather inexpensive, and has therefore been able to establish itself as an attractive way of transacting, particularly for larger amounts. However, the fees are considerable if an individual are transacting smaller amounts.

2.3.3 Decentralization and anonymity

Individuals that employ Bitcoin to its fullest degree would also be able to transmit cross-border payments without incurring the fees associated with third-party cross-border transfers (Nakamoto, 2008). These cross-border payments through a third-party intermediary have

been heavily scrutinized for their high transaction costs and lengthy turnaround times. As there are a large number of working immigrants who benefit considerably from the cross-border option that Bitcoin provides, these factors aid Bitcoin's adoption tremendously (Nakamoto, 2008).

2.4 Risks for Bitcoin & Cryptocurrencies

This subchapter will take a closer look at the challenges that may be a disservice to the adoption of Bitcoin and cryptocurrencies. Relevant risk factors will be discussed and fragmented why they pose as a liability. These risk factors mainly entail political-, macroeconomic-, technological and ESG-related factors (Arsi, Khelafi, Ghabri, & Mzoughi, 2021).

2.4.1 Politics and regulation

How governments and politicians around the world will respond to regulation in the long run is of the utmost importance for the future of Bitcoin and other cryptocurrencies. One of the primary problems with Bitcoin and other cryptocurrencies is that decentralization poses a challenge in the eyes of governments, and it is unlikely that governments would embrace the reality that the future of money will be decentralized (Yeoh & Haynes, 2020). Therefore, prominent figures in the crypto economy, including as Sam Bankman-Fried, Anthony Antonopoulos, Vitalik Buterin, and Michael Saylor, have stepped forward to educate and assist governments and politicians in facilitating this new financial chapter. Improper and uneducated regulation of Bitcoin and cryptocurrencies could be its demise; consequently, political support is vital for the scene to continue its prosperous journey (Houben & Snyers, 2018).

The bitcoin and cryptocurrency community, as well as the prominent figures therein, are fully cognizant of the fact that the current political situation dictates the short-term, and potentially the long-term evolution of the space. Since the inception of Bitcoin there has been an abundant number of occasions where governments around the globe have intervened in the crypto economy, and as a result, the cryptocurrency space have been impaired by those actions in the short-term (Yeoh & Haynes, 2020). This type of political intervention makes it

clear that Bitcoin and cryptocurrencies is still in its early stages due to the volatility that governments and politicians can inflict on the market and its growth.

Various governments have responded to the development and growth of the crypto economy by engaging their central banks in developing their own domestic digital currencies. Numerous central banks have also stated that they are either looking into, or are already developing their own digital currency (Arslanian & Fischer, 2019)**.** If the central banks are able to develop competing digital currencies, then that may result in the deterioration of the crypto economy as we know it, but the key that the central banks will not be able to provide is the attractive decentralization that cryptocurrencies provide.

Politics and legislation will have a significant effect on the overall expansion of the cryptocurrency economy. However, it is currently hardly possible to predict how the regulation will develop. Certain nations are receptive to the concept of a thriving crypto economy and see the promise of blockchain technology and decentralized virtual currencies (Yeoh & Haynes, 2020). Meanwhile, other nations, such as China, have cracked down on the usage and mining of cryptocurrencies, sending shockwaves throughout the crypto-space and creating an uncertain regulatory future for cryptocurrencies (Arslanian, 2022). Clearly, we are not near to achieving general acceptance of cryptocurrencies, but a multitude of factors indicate that its acceptability is growing in the right direction.

2.4.2 Societal acceptance

Social acceptance on a worldwide scale is vital to the rate of Bitcoin and other cryptocurrencies' adoption. Initially, Bitcoin was adopted by cypherpunks and criminals, who either considered the concept of a peer-to-peer transaction system to be incredibly intriguing or had malicious intentions while using the Bitcoin network. Throughout the years, both Bitcoin and cryptocurrencies have progressively garnered additional acceptance and adoption. This has an occurred as a result of worldwide political unease, central banks that are implementing unsustainable monetary and fiscal policies, which in turn promotes inflation. Given that these occurrences are likely to persist, it would provide a perfect runway for cryptocurrencies to reach considerable societal acceptance and adoption (Schaupp & Festa, 2018).

2.4.3 Macroeconomic conditions

When analyzing Bitcoin and Bitcoin mining, macroeconomic variables have a crucial role. Governments and politicians from all over the world are reacting to its growth, both in terms of the financial sector as a regulated asset and the mining operations. As indicated in section 2.3, governments around the world have reacted to cryptocurrencies in a variety of ways, ranging from forbidding its usage and mining to fully accepting it and promoting cutting-edge innovation that could alter the way we exchange and store wealth (Corbet, Larkin, Lucey, Meegan, & Yarovaya, 2020). A few nations have promoted innovation and investment in cryptocurrencies by exempting investments linked to cryptocurrencies from taxation, so as to encourage further development in the world of virtual currencies and assets (Qureshi & Xiong, 2018).

2.4.4 Hacking

The risk of hacking is a prominent negative influence for Bitcoin and other cryptocurrencies. The Bitcoin and cryptocurrency community has been subject to a variety of malicious acts. Blockchain technology is exceptionally resistant to attacks, yet hacking exchanges, user wallets, phishing attacks for user private keys, and rug pulls occur frequently. Concerning this difficulty is the fact that a significant percentage of exchanges do not protect their users' bank deposits or cryptocurrency holdings. A significant number of bitcoin investors do not take the essential precautions when storing their cryptocurrency outside of exchanges. This issue has prompted an increase in the number of exchanges that offer fully insured deposits for both cash and cryptocurrency. Multiple actors have also emerged to assist individuals who wish to keep their cryptocurrency off exchanges.

2.4.5 ESG-related problems

A topic which has garnered attention in the last few years is Bitcoins energy consumption. As a result, Bitcoin has been scrutinized laboriously by politicians, governments and respected scientists as an unsustainable operation which needs to be regulated and controlled. Make no mistake, the Bitcoin network requires an immense amount of computational power, as well as electric consumption in order to endure, and each transaction carries an enourmous carbon footprint (Holthaus, 2017). Despite the ESG-related problems that Bitcoin brings about, the

Bitcoin community is actively workings towards solving the unsustainability of its energy usage. Additional innovation within the Bitcoin community is therefore likely to relieve the current scrutiny related to energy usage (Boyapati, 2021).

2.4.6 Criminal activity

The cryptocurrency space has long been accused of being a venue for criminal activity to take place. When Bitcoin and cryptocurrency first garnered media attention, it was slashed for enabling transactions related to drugs, terrorism and money laundering. These speculations initially tainted Bitcoin and cryptocurrencies reputation, which resulted in delayed adoption and usage thereafter, as it quickly became the "virtual currency that people with malicious intents use" (Foley, Karlsen & Putnins, 2019).

With the years Bitcoin and cryptocurrencies has matured, and so has the belief that virtual currencies are mainly used in mischievous ways. Many researchers have dived deep into this previously held belief and have found that a fraction of Bitcoin and cryptocurrency that is being transacted is involved with drugs, financing terrorism and money laundering (Foley, Karlsen & Putnins, 2019).

2.4.7 Gartner hype cycles, "a bubble" and popularity

Throughout the last decade, Bitcoin, as well as cryptocurrencies have progressively garnered widespread attention across multiple platforms. The accelerating attention is a result of increasing cryptocurrency adoption combined with relatively attractive price action for risk-on investors (Baek, Hong & Lee, 2018). As a result, Bitcoin has gone through several Gartner hype cycles, in which Bitcoin has reached several peaks of inflated expectations, which has resulted in many prominent investors and economics deeming it as a bubble (Boyapati, 2021).

Gartner hype cycles can be described as a cycle in which the "peak of inflated expectation" is where the asset / commodity / real estate reaches a point to which the demand has been exhausted. This stage can also be defined as "maximum bubble territory", in which investors are certain to lose money after reaching this point. After the demand for the asset / commodity / real estate has been exhausted, the buyers are not able to push back against the

sellers and as a result you have a steep drop of in the price of the asset. After the drop you reach the trough of disillusionment, in which the sellers have been exhausted and the buyers enter the stage as the asset is likely over-sold (Boyapati, 2021).

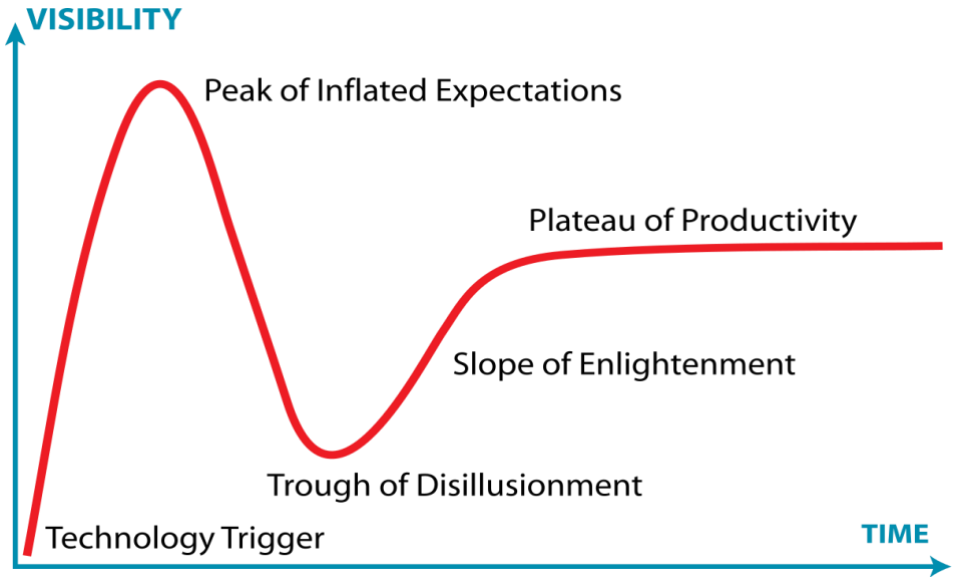


Figure 1: Gartner hype cycle

Notable peaks in Bitcoins several hype cycles occured in July 2011 ($30), December 2013 ($1,100) and December 2017 ($19,600). However, bitcoin has emerged from all its previous peaks of inflated expectations and is steadily reaching mainstream adoption (Boyapati, 2021).

2.5 Mining

Since its debut in 2009, bitcoin mining has experienced exponential growth. Today, bitcoin mining is a multi-billion-dollar industry that utilizes specialized processors and hardware built for optimally mining cryptocurrencies. Some claim that bitcoin mining is a crucial driver of innovation and economic growth, whilst others argue that it poses substantial environmental and social hazards. Mining is the process of adding transaction records to Bitcoin's public transaction ledger (and a "mining rig" is a colloquial metaphor for a single computer system that performs the necessary computations for "mining"). This ledger of prior transactions is known as the blockchain because it consists of a series of blocks, in which the transactions are recorded on. The blockchain serves to confirm to the rest of the network that transactions have occurred. Bitcoin nodes use the blockchain to determine whether the Bitcoin transactions is valid which solves the potential for double spending. In

addition to transaction fees, miners receive newly produced coins as a reward when solving a block. This fulfills both the objective of distributing new coins in a decentralized manner and the purpose of encouraging users to contribute system security through mining.

2.5.1 Mining Rewards

Mining rewards are payments paid to cryptocurrency miners for validating and completing blockchain transactions. In the majority of instances, these benefits are distributed in the form of the cryptocurrency being mined. For instance, Bitcoin miners are compensated with Bitcoin for their efforts on the network. The payout is often decreased over time and is defined by the protocol of the cryptocurrency being mined. The mining benefits are halved every 210,000 blocks, or approximately every four years (Ciaian, Kancs, & Rajcaniova, 2021).

- In 2009, the block reward was 50 bitcoins
- In 2012, it was halved to 25 bitcoins
- In 2016, it was halved to 12.5 bitcoins
- In 2020, it was halved to 6.25 bitcoins

The reduction of mining rewards in half serves two primary goals. First, it aids in regulating the supply of the cryptocurrency, as mining becomes less economical over time as fewer coins are produced. Second, it encourages miners to continue validating transactions even when their payouts decrease, assuring the network's security. As a result, mining incentives play a significant part in a cryptocurrency's economy and are one of the most crucial aspects that determine its long-term viability. As stated previously, the total supply of bitcoins is hard capped to 21 million units. When the 21 millionth bitcoin is mined, the protocol will achieve its maximum capacity, and no additional bitcoins will be created. Miners will continue to be compensated for their efforts, but only through transaction fees (Ciaian, Kancs, & Rajcaniova, 2021).

2.5.2 Why is mining difficulty increasing?

As an increasing number of individuals have devoted their time to mining bitcoins, the challenge of locating a valid block have grown tremendously. As more miners join the network, the mathematical issues that miners must solve get increasingly difficult. Bitcoin's

network dynamically modifies the complexity of the problems such that if more miners join the network, the math problems will become more difficult, and it will take longer to discover a valid block (Zhang, Qin, Yuan, & Wang, 2018). As a result, miners started utilizing optimized mining equipment and started to operate mining pools to increase their hashing power and mine Bitcoins more efficiently. In 2009, a standard desktop computer could mine several bitcoins every day. Today, miners have had to invest in more powerful mining equipment with substantially higher hashrates in order to keep up with the increasing mining difficulty. Miners have transitioned from using personal PCs to specialized mining rigs with high-end GPUs. The issue with using GPU rigs to mine bitcoins, however, is that GPUs consume a great deal of electricity and hence require not only power, but also considerable cooling. This led to the development of Application specific integrated circuits (ASIC), which are microchips designed specifically for mining bitcoins (Arslanian, 2022). Since the inception of Bitcoin, the computing power or hash rate has increased dramatically. Around 2018 bitcoin mining quickly became a vast industrial activity, resulting in mining farms equippiping themselves with cutting-edge technology (Zhang, Qin, Yuan, & Wang, 2018).

The need for more power led to the establishment of bitcoin mining farms in countries with substantially better mining environments, both in terms of price of electricity, as well as the potential for optimized cooling of the mining equipment. Countries such as China, Iceland, and Kazakhstan experienced a considerable flow of mining farms being established during the transition from mining rigs at home to a booming and profitable industry. Bitcoin mining farms are enormous warehouses in which rows of computers mine bitcoins around the clock. In 2017, with the introduction of ASICs and mining farms, bitcoin's value experienced its first significant increase which received worldwide attention. With the increasing Bitcoin price, the mining industry experienced booming competition which sparked a crucial debate concerning the environmental impact of bitcoin mining.

2.5.3 Negative and Positive Effects of Mining

The growth of Bitcoin mining has had both positive and negative outcomes. The mining of Bitcoin and cryptocurrencies has spawned a new industry that is currently being valued in the billions, and this new industry has created employment opportunities for a large number of individuals. Additionally, Bitcoin mining has contributed to the creation and innovation of more efficient computer hardware, such as ASICs, and software. However, Bitcoin mining

has also resulted in a variety of negative outcomes. The impact on the environment is one of the most significant of these consequences. As previously discussed, Bitcoin mining consumes an enormous amount of energy, which contributes to global warming (Mora et al., 2018). Moreover, the emergence of large-scale mining farms has led to the centralization of power in the hands of a few businesses, which may have a detrimental effect on the Bitcoin principle of decentralization (Mariem et al., 2020).

2.6 ESG

Prior to several countries introducing crackdowns on mining, the majority of bitcoin mining occurred in China, which has been criticized for its sub-par environmental standards. In addition, bitcoin mining consumes a vast amount of energy, with estimates indicating that it utilizes more electricity than several countries each year. This excessive energy consumption not only contributes to climate change, but also strains local power infrastructures and raises electricity costs for consumers around those areas. The most recent instance occurred in Kazakhstan, which accommodated multiple Chinese bitcoin miners during their migration, after the crackdown in China. The government of Kazakhstan subsidized fossil fuel-based power plants for the benefit of bitcoin miners. However, when the country's power system got overwhelmed and crashed due to energy demands, the government reversed its policy and closed the doors to the newly migrated bitcoin miners (de Vries, Gallersdörfer, Klaaßen, & Stoll, 2022).

Bitcoin's massive electricity use is the primary issue from an ESG standpoint. There are two perspectives on this issue. First, bitcoin mining consumes more electricity than certain nations, which unquestionably is unsustainable in the long run. However, the majority of this electricity comes from renewable sources, thus the environmental impact is not as severe as it may appear (de Vries, Gallersdörfer, Klaaßen, & Stoll, 2022). It is more feasible for miners to invest in renewable energy sources because the payback period is shorter and the operating expenses are lower over the long term. In countless instances, miners have actively supported social causes through their mining activities, and as ESG investing grows more prevalent, it is arguable that bitcoin mining will become more socially responsible and environmentally friendly over time. This can be argued due to the fact that there are multiple benefits of sustainable cryptocurrency mining, which can help ameliorate the current distress that the mining operations are bringing forth.

2.7 The Lightning Network

The Bitcoin network has one of the most expensive fees within the cryptocurrency ecosystem, which is why many users prefer to utilize other cryptocurrencies instead of Bitcoin. Lightning network is a technology that aims to address the limits of bitcoin in terms of small-value transactions, hence reducing fees and accelerating transactions.
The Lightning Network is a Bitcoin-based decentralized network that enables immediate payments via peer-to-peer channels. Lightning suggests that the inscription on the block chain be used solely to oversee the opening and maintenance of bidirectional payment channels. Payment channels are a form of transacting outside of the chain of blocks, in which parties pledge and pay each other. The network scales and accelerates the blockchain, eliminating some of Bitcoin's present constraints. However, these transactions are settled off-chain, which can ultimately skew the results of multiple models that are trying to fairly value Bitcoin.

3 Literature review

Bitcoin is without doubt the most dominant asset in the world of cryptocurrencies, with a current market share above 45 % (CoinMarketCap, 2022). More than 1 trillion USD are, as of May 27th, 2022, tied up in different cryptocurrencies, with approximately 560 billion of those in Bitcoin. Where traditional valuation methods and currency models fails to explain and back up on the price evolution, the need for alternative methods and models has risen. The question of what drives Bitcoin value, and the debate over whether the digital asset has any underlying value at all, is widely discussed in digital forums, medias and in research literature. This section provides an overview of what literature that has been done on the field.

There are a lot of studies conducted within the area of Bitcoin- and crypto asset valuation, and many studies points in different directions of what models to use, and if valuation is at all possible or necessary.

3.1 Volatility, speculation, and bubbles

The question regarding whether and why Bitcoin has any intrinsic and fundamental value are highly discussed themes. As a result of the historical volatility of Bitcoin, the debate regarding its underlying value has risen (Beneki, Koulis, Kyriazis, & Papadamou, 2019). On one side of the debate there are authors and economists questioning the actual value of cryptocurrencies and if Bitcoin and other crypto assets has any value at all. Recognized economists like Warren Buffet, Charlie Munger, Nouriel Roubini and Peter Schiff have all publicly criticized Bitcoin and denied its fundamental value. Descriptions of Bitcoin that has arrived from these economists are for example "rat poison squared", "an evil pyramid scheme" and "a bubble that inevitably will pop for good". Also, Nassim Taleb, the author of the book "The Black Swan", which addresses unexpected, rare events and extreme impacts (Taleb, 2007), has recently classified Bitcoin as a disease, called it worthless and denied that it can be used as a "hedge against anything".

The view and beliefs of the mentioned economists has backing in literature. Many authors classify Bitcoin as a speculative investment product, drawing parallels to previous price bubbles that has occurred. A price bubble is a phenomenon in which investors believe that asset prices are influenced by variables that have no bearing on fundamental market conditions (Diba & Grossman, 1988)

Cheah and Fry (2015) investigates if the Bitcoin price is based on speculative bubbles and the fundamental value that lies behind the asset. As a result of the study, the authors conclude that *"Bitcoin price is prone to speculative bubbles"* and that there are substantial bubble components contained within the Bitcoin price. Also, Dowd (2014) reports a Bitcoin market consisting of a bubble-burst cycle because of the variation in demand. Corbet et al. (2018) has a similar perception, that the Bitcoin price in 2017 showed tendences of what could remind of a bubble but fail to prove clear evidence of a bubble being present in the Bitcoin price. Still, the authors conclude that prices might be incorrect due to absent, statistical indicators. Moreover, Geuder, Kinateder and Wagner (2019) searches for bubbles in the Bitcoin price and finds that it consists of speculative behavior and bubble periods. Yermack (2015) point out that the volatility of Bitcoin draws it in a direction of a speculative asset rather than a medium of exchange, store of value or unit of account, as it fails to fulfill the requirements of the mentioned features of currency. Somewhat similarly, Baur and Dimpfl

(2021) studied the role of Bitcoin as a currency. The author´s conclusion is that Bitcoin´s volatility makes it unsuitable as a unit of account and as medium of exchange, both within short and longer time horizons. They do mention, however, that Bitcoin can be utilized as a long-term store of value.

Many of the authors who criticize Bitcoin´s bubbly-like behavior and the speculativeness surrounding it agree that the fundamental value of Bitcoin is nowhere close to the market value. Cheah and Fry (2015) conclude that Bitcoin has no fundamental value at all, while other authors argue that too many users of digital currencies are uninformed, and that they don´t see other value in Bitcoin than a speculative investment that can generate high profits (Glaser, Zimmermann, Haferkorn, Weber, & Siering, 2014).

Bitcoin and other currencies are by many authors compared to other mediums of exchange, like current fiat currencies. A study done by Miglietti, Kubosova and Skulanova (2020) compares Bitcoin and Litecoin to Euro. Their conclusion is that Bitcoin is less volatile than Litecoin, but still highly volatile to Euro, warning investors about the risk related to cryptocurrencies. Baur and Dimpfl (2017) estimated Bitcoin volatility to be 30 times higher than other general currencies like Euro, US Dollars and Chinese Yen, but more recent studies shows that the high volatility is decreasing over time as information is getting better, acceptance and adaptability is increasing and the general understanding on the field is improving (Kayal & Balasubramanian, 2021). Also, when adjusting for extreme event days, the authors are not able to find any signs of excess volatility in the Bitcoin price for the previous three years. There have also been conducted studies based on Bitcoin´s exchange risk to USD compared to the same conversion rate of Euro and gold (Molnár, Vagstad, & Valstad, 2014). They conclude that the exchange rate of Bitcoin price to USD is riskier and more volatile than both EUR/USD and the USD price of gold, making Bitcoin a less attractive payment solution than for example EUR.

3.2 Support of Bitcoin valuation

Even though several authors argue that Bitcoin has no intrinsic value or classify Bitcoin as nothing more than a speculative investment, there are still practical reasons for why we need ways to fairly value crypto assets (Johnson, Bufton, & Daniel, 2019). The current demand and the growing acceptance for Bitcoin and other crypto assets puts a light on the need for

generally accepted models of valuation. As the retail-industry and companies in general adapt cryptocurrencies, valuation will be necessary for tax-related purposes as well as financial reporting. It is also necessary for investment purposes, both for private investors as well as institutional actors.

Over the years of cryptocurrencies, the subject of why there is a value, and how to accurately measure it, has been widely discussed. What underlying value does Bitcoin and other crypto assets have that supports its market value? The most common argumentation in favor of Bitcoin value is based on the demand and supply of Bitcoin (Kayal & Rohilla, 2021). Among the ocean of criticists of Bitcoin function and value, Granot (2018) provide several answers to common attacks on Bitcoin value. The author replies to well-addresses critics like that argument that Bitcoin value is not backed by anything, the alleged crime related to Bitcoin and the volatility. As a reply to mentioned critics, the author argues that there have existed money that has not been backed by either a government or by a commodity, the alleged crime is overrated, as transactions are traceable, and that current Bitcoin volatility is decreasing and is only a sign that it's still in the early stages (Granot, 2018). Dwyer (2015) states that the technology and innovation regarding Bitcoin generates value. For instance, the author mentions that the double-spending problem, that Bitcoin is able to solve, is a factor generating value to the network. The double-spending problem is related to people using the same money, or the same coins, several places at the same time (Karame, Androulaki, & Capkun, 2012). Dwyer (2015) also points out that the demand for Bitcoin, combined with its limited and capped supply, is a generator of value. Similarly, Kristoufek (2015) and Ciaian, Rajcaniova and Kancs (2015) finds supply as a factor driving Bitcoin price in the long run, with the former also concluding that the current price level and the traded volume of Bitcoin has an impact on the traded price. Other studies conducted by Fousekis and Grigoradis (2021), Fousekis and Tzaferi (2021) and Bouri, Lau, Lucey and Roubaud (2019) finds relationships between Bitcoin price and trading volume. Pagnotta and Buraschi (2018) tries to model Bitcoin value based on an equilibrium between the demand for Bitcoin and the supply of Bitcoin hash rate. Also, network effect and numbers of users on the network has been studied by the adaption of Metcalfe´s Law (Peterson, 2018; Van Vliet, 2018; Alabi, 2017), with Peterson (2018) and Alabi (2017) presenting different ways of interpreting numbers of usert, and Van Vliet (2018) as a response to Peterson´s (2018) model. The law states that the value of a network is proportional to the squared number of user and will be discussed further in the next section (Metcalfe, 2013). Other studies looking at the technical aspect are Wang

and Vergne (2017) and Bhambhwani, Delikouras and Korniotis (2019), with the former classifying cryptocurrencies as technology, and the latter stating that the blockchain itself generates value to Bitcoin.

There are also authors focusing on the Bitcoin price based on the cost of mining. An argument related to that is that the Bitcoin price will be no lower than the cost of mining at the given time. as otherwise it would not be beneficial to maintain mining (Hayes, 2016; 2019; Garcia, Tessone, Mavrodiev, & Perony, 2014). Chico-Frias (2021) shares the same opinion, concluding that due to the increased mining difficulty, and so on increased cost of mining, the minimum price of Bitcoin will increase over time.

3.3 Bitcoin in the light of the regression theorem for money

The subject if Bitcoin and cryptocurrencies has value has also been discussed regarding the regression theorem, first presented by von Mises (1912). The theorem states that the value of money can be linked back to the time before it became a medium of exchange and its original objective value and is a highly valued idea in the Austrian money theory (Rothbard, 1976). In the book, von Mises states that "an object cannot be used as money unless, at the moment when its use as money begins, it already possesses an objective exchange-value based on some other use" (von Mises, [1912] 1953, p. 110). The relevance of the regression theorem in the case of Bitcoin has been discussed by Luther (2018). He states that if Bitcoin were to be intrinsically worthless, the regression theorem would not be valid. Furthermore, if Bitcoin were to have some sort of non-monetary value, the idea of the regression theorem would be far less relevant than what is thought of it until now. Luther´s (2018) conclusions are challenged by Pickering (2019), as he claims Luther has misunderstood the idea behind the regression theorem, and what it is meant to identify. He states that Bitcoin´s objective pre-monetary use is of no importance as Luther claims, as long as it has a value that individuals can relate to (Pickering, 2019). Also, Pickering (2019) expresses that Luther misinterprets the overall goal of the theorem, which he claims to be to explain the purchasing power of money rather than to identify which prospective commodities that in the future can serve as a medium of exchange.

3.4 Valuation models

Over the years there have been done several attempts to find models for estimating current Bitcoin value and predict future prices. This section provides an overview of different ways of valuing Bitcoin.

3.4.1 Stock to Flow

The Stock-to-Flow model is a Bitcoin valuation method that was introduced in the article *Modeling Bitcoin Value with Scarcity*, by the anonymous user "Plan B" in 2019 ("Plan B", 2019). With the fact in mind that Bitcoin is a scarce resource, "Plan B" suggests that Bitcoin value can be estimated based on the current circulating Bitcoin, and the production of new Bitcoin. Although this has been a highly appreciated model by many users for the last couple of years, the academic society has not yet gone out and embraced it. Actually, Morillon and Chacon (2022) claims to be "the first paper to analyze the S2F model in an academic setting" (Morillon & Chacon, 2022).

The model bases its estimation on the historical relationship between the Stock to Flow-ratio and the market cap of Bitcoin to be able to make long-term predictions of how Bitcoin price will evolve in the future. The Stock to Flow-ratio is calculated by dividing the total circulating supply of Bitcoin (Stock) to the yearly growth in supply (Flow). The ratio tells us how many years it would take to reproduce the current supply, had it not been for the capped supply of Bitcoin. The fact that Bitcoin has a maximum supply, the current circulating Bitcoin is known and the future increase in supply is known, makes the model suitable for long-term forecast of Bitcoin price.

Although the model since its introduction in 2019 has shown good precision estimating price, the model has also been a subject for criticism. The theory that Bitcoin price is entirely based on supply, with no regard for demand, contradicts previous literature and research done (Pagnotta & Buraschi, 2018; Dwyer, 2015; Kristoufek, 2015). And since future growth can be predicted, an increase in price based on allready available information does not make much sence. Also, the Stock to Flow-model is not able to count for any decrease in price, as the growth rate is ever decreasing, meaning the model will be forever increasing (Morillon & Chacon, 2022).

3.4.2 Metcalfe´s law

Another model of Bitcoin valuation that has been tested for Bitcoin valuation is Metcalfe´s Law (Metcalfe, 2013). The law states that "The value of a network grows as the square of the number of its users" (Metcalfe, 2013).

The law is based on the assumption that the total value of the network is the sum of all possible connections. If all these connections are of equal value, then the total value of the network is:

$$V_{Network} = \frac{n(n-1)}{2}$$

In essence, Metcalfe (2013) asserts that the greater the size of a network, the greater its value. A clear illustration of this concept would be if only one person on earth owned an iPhone. Then it would not be a network and would be without value. But if everyone had access to an iPhone, the network's value would soar. There is a natural propensity for networks to expand exponentially, which may be described by the law of returns given that the network's present feedback loop is net positive. Each new network member increases the network's worth. The enhanced value of the network increases the likelihood that other members will be drawn to that network, resulting in exponential network growth. The idea that this law could be used for Bitcoin valuation emerged after the revenues of Facebook (Metcalfe, 2013) and Chinese company Tencent (Zhang, Liu, & Xu, 2015) were tested with success (Peterson, 2018; Alabi, 2017).

The cryptocurrency ecosystem can be viewed as an illustration of how once-small coins attracted new intellectuals to create new cryptocurrencies. This invention increased capital, increased opportunities, and attracted more talented individuals to the Bitcoin industry's "network." As a result of ever-increasing profits within the cryptocurrency network, the cryptocurrency ecosystem currently has a total market capitalization of $1.3 trillion (CoinMarketCap, 2022).

For Metcalfe´s Law to be applied to Bitcoin and cryptocurrency valuation, the number of users on the network must be measured. Academic in the field has been based on some different assumptions. Peterson´s (2018) estimate of the number of active users are the total amount of wallets on the network. The same goes with Van Vliet (2018) which model is built upon Peterson´s, with a few suggestions for improvement. Both Peterson (2018) and Van

Vliet (2018) reported good fitting models in their studies, with the latter reporting an even better R^2 in his attempt to improve the model of the former.

Alabi (2017) also explored the applicability of Metcalfe's law to the blockchain and cryptocurrency ecosystem. By utilizing Metcalfe's law, Alabi (2017) was able to demonstrate that the law was validated by analyzing various blockchain networks and demonstrating that the value of the network could be estimated as a function of the daily active addresses on the network, unlike Peterson (2018) and Van Vliet´s (2018) total number of wallets. To cope with short-term fluctuations in the network activity, Alabi (2017) did adapt a 30-day moving average to his model.

3.4.3 Network value to transaction ratio (NVT)

Network Value to Transaction-ratio (NVT) was first presented by Woo (2017). The idea of the model is to get a ratio comparable to the Price-to-Earnings (P/E) ratio that is often used to value companies. The goal is to be able to evaluate whether Bitcoin is overvalued, undervalued, or accurately valued at any particular time. Bitcoin is not a real corporation and has no direct earnings, hence the approach differs from the P/E ratio. According to Woo (2017), in the case of Bitcoin, the entire transaction value (USD) can be utilized as "profits" in the model, resulting in a ratio of network value (market cap) to transaction value. The ratio indicates that the total value of all transactions currently flowing over the network is an approximation of the network's utility. A high NVT-ratio indicates that Bitcoin is overvalued, as the total network value differs significantly from the total value that passes through the network. Woo (2017) further claims that the model can be used to identify possible Bitcoin market price bubbles.

3.4.4 Cost of production

Another method that has been discussed in the literature is a model regarding cost of production, or cost of mining. Garcia et al. (2014) were the first to suggest and publish a research article which argued that Bitcoin fundamental value must at least equal to the total costs of its production through Proof-of-work. The authors suggested that the total value of the energy spent on its production could be used as a lower bound on the fundamental value of Bitcoin. In order to do so, they decided to divide the accumulated energy spent per day by

the number of mined bitcoins per day to get the total number of hashes, which was required in order for the miners to mine a single Bitcoin. They then proceeded to find the average energy requirement related to mining, before calculating cost of mining.
In more recent times, Hayes (2016; 2019) developed a more precise way to formulate Bitcoin' cost of production model. Hayes argues that Bitcoin miners would decide to not mine if the price of energy would surpass the value of the total Bitcoins mined, as market participants are rationale agents. These agents would then incur monetary losses.

3.4.5 The Fulcrum Index – an insurance against fiat for fixed-income investors

The Fulcrum Index is a model of valuing Bitcoin that was presented by Canadian economist and former hedge-fund manager Greg Foss (2021). His idea is that Bitcoin, which in the article is mentioned as "anti-fiat", can be seen as an insurance against credit default swaps (CDS), and that fair value might be calculated thereafter. The base of the model is that the value of debt and obligations of the G-20 countries are multiplied by their respective spread in CDS . From this assumption, a valuation model is created based on the author´s consideration of possible Bitcoin adaption in the future Including in the model is the probability of Bitcoin default, the mentioned insurance against CDS and the possibility that Bitcoin may overtake market share of other assets, like gold (Foss & Sansone, 2022).

4 Methodology

The methodology part contains an overview of the methodology behind the current valuation models that are addressed in this thesis. It provides information about the strategy and design of the research as well as the methods that are used in the calculation of the models. We also address some changes that might be beneficial for the models.

4.1 Current valuation models

4.1.1 Stock to Flow

The ratio can be found by dividing the total circulating supply of Bitcoin to the estimated annualized growth in supply:

$$Stock\ to\ Flow - ratio = \frac{Stock}{Flow} = \frac{1}{Supply\ growth\ rate} \qquad (1)$$

The estimation of future Bitcoin price levels is done using a two-staged least squares model (Morillon & Chacon, 2022). This model consists of two steps, where the first step is used to measure the regression coefficients. This is done by using a test-sample, with actual, known values, and make a regression to find the regression coefficients. The two values in the first regression analysis are the logarithmic values of Bitcoin market capitalization and the Stock to Flow-ratio. The calculation is given by:

$$Ln(Market\ cap.) = \beta_0 + \beta_1 * \ln\,(StF)_t \tag{2}$$

From this equation, the regression-coefficients, β_0 (the intercept) and β_1 (slope) is obtained. These values are then used to estimate future Bitcoin prices. The price of Bitcoin can be given as the total market capitalization divided by the total supply at a given time, t. This means that the price of Bitcoin at a given time in the future, t+1, can be given as:

$$\widehat{Price}_{t+1} = \frac{Market\ cap_{t+1}}{Total\ supply_{t+1}} \tag{3}$$

To be able to estimate future prices, one must include the coefficients estimated in Eq. (2). The estimated market cap at time t+1 can then be found by:

$$Market\ cap_{t+1} = e^{\ln\,(Market\ cap_{t+1})} = e^{\widehat{\beta}_0 + \widehat{\beta}_1 * \ln\,(StF)_{t+1}}$$

Combining the already calculated equations, the formula for estimated Bitcoin price at a future time, t+1, can be given as:

$$\widehat{Price}_{t+1} = \frac{Market\ cap_{t+1}}{Total\ supply_{t+1}} = \frac{e^{\widehat{\beta}_0 + \widehat{\beta}_1 * \ln\,(StF)_{t+1}}}{Total\ supply_{t+1}} \tag{4}$$

4.1.1.1 Annualized growth

The Stock to Flow-ratio is calculated based on the yearly estimated increase in supply. The increase in Bitcoin supply is measured by annualizing the daily increase. In their model of Stock to Flow, Morillon and Chacon (2021) base the increase in flow on the annualized historical increase from day to day.

$$b_d = circulating\ supply_t - circulating\ supply_{t-1} \tag{5}$$

where b_d is the daily increase in Bitcoin supply from one day to the next. From there, the increase is annualized, resulting in an annualized growth, b_y, given by:

$$b_y = b_d * 365\ days \tag{6}$$

The frequency of new Bitcoin added to the supply does not follow an exact, fixed pattern. As a result of this, the annualized increases might also differ a lot from day to day. Furthermore, if the model should be used in price forecasting, the Stock to Flow-ratio need to be known, meaning one must be able to estimate future supply growth. Therefore, in this thesis, we have chosen to estimate the increase in Bitcoin supply based on the average time it takes to solve a block, which is approximately every 10 minutes. The historical rewards for solving one block are available on the Blockchain, and there is also possible to give a rough estimate of when future halves will occur, as it is halved every 210 000 block. Multiplying the block reward at a given time by 144 (10 minutes x 6 x 24 hours) results in an average daily increase in supply. Daily growth is then multiplied by 365.25 to get an annualized growth rate at the given time. Even though change in Bitcoin supply can vary significantly from day to day, we believe that this gives us a good estimate of the yearly growth.

Time	Reward pr block	Daily growth	Yearly growth
Jan. 9, 2009 – Nov. 27, 2012	50	7 200	2 629 800
Nov. 28, 2012 – Jul. 8, 2016	25	3 600	1 314 900
Jul. 9, 2016 – May 10, 2020	12,5	1 800	657 450
May 11, 2020 – Mar. 2, 2024*	6,25	900	328 725

Table 1: Halving dates and change in supply (Deltec Bank, 2022)
** Projected*

4.1.1.2 Smoothing

The Stock to Flow-ratio is directly calculated from the relationship between current circulating supply and new Bitcoins created. If not adjusted for, the Stock to Flow-ratio will immediately double at the time of halving. To adjust for these abrupt changes, a 365-day moving average is applied as a smoothing factor.

"Plan B" is in his model using data from December 2009 to February 2019. Morillon & Chacon (2021) base their calculations on data from January 2011 to December 2020, using the first 365 days (Dec. 2009 to Dec. 2010) serving as the smoothing period. We have gathered historical price data from Nasdaq (Nasdaq, 2022). As Bitcoin prices were measured to approximately $0 for the most parts of 2010, we have chosen to exclude year 2010 from our calculations, beginning the model at Jan. 1, 2011. From there we use the first 365 days, Jan. 1 – Dec. 31, 2011, as the smoothing period, meaning the test sample will begin no earlier than 2012.

4.1.1.3 Test sample and Look-Ahead bias

As stated by Morillon & Chacon (2021), "Plan B´s" Stock to Flow model is often visualized by including the test sample in the comparison of estimated and actual price. This causes Look-Ahead Bias, which means that events are taken into consideration that is yet to happen. For example, in many visualizations, the regression coefficients are calculated based on all available data until the day of making, leading to a closer relationship between historical prices and the model than what is realistic. This means that the coefficients used to predict prices in for example 2017 is calculated by using market cap until 2019. To adjust for the Look-Ahead Bias, Morillon and Chacon (2021) comes up with some suggestions. First, the test-sample should not be shorter than 4 years. As a result, the test is never based on a period where no halves have occurred. Further on, they suggest two possible ways to use test samples to calculate the regression coefficients. The first one is to concentrate the test sample to a 4-year period (t-3 to t), and from there predict the price for t+1. This continues in a rolling pattern, discarding older periods from the test sample when estimating another year. The other suggestion is to include all available data in the test sample. The smallest test sample is still 4 years, but here data is added to the test sample as time goes by, and no data is discarded/excluded. In both methods of calculating Stock to Flow, the regression coefficients are recalculated at the end of every year, so that the following year can be estimated using the most recent data. Also, the models become free of Look-Ahead Bias, as expected price is calculated using only data that is gathered before the given year.

4.1.2 Metcalfe´s law

Given the idea of Metcalfe (2013) that a network´s value is proportional with the square of the number of users, Peterson (2018) states in his study that if Metcalfe's own proportionality factor, A, is included in the equation, fair value of Bitcoin can be expressed as:

$$V_{BTC} = A\frac{n(n-1)}{2}x\frac{1}{b_t} \tag{7}$$

where b_t is the number of circulating Bitcoin. Peterson uses Gompertz growth model for the circulating Bitcoin.

$$b_t = b_{t-1}\, x \ln\left(\frac{B}{b_{t-1}}\right) \tag{8}$$

Van Vliet (2018) has also testes Metcalfe´s Law, which builds on Peterson´s (2018) already conducted model. Van Vliet (2018) proposes a couple of changes to the model. First, he suggests a different approach to total circulating Bitcoin. The idea is that the number of Bitcoin follows a bounded exponential pattern, capped at 21 000 000 (Van Vliet, 2018).

$$\hat{b}_t = B(1 - e^{-\eta t}) \tag{9}$$

Furthermore, the number of users is estimated in a way that might enable forecasting. Van Vliet (2018) also sets a cap of total number of users, so that the function will not grow infinite.

$$\hat{n}_t = \frac{N}{1 + \phi e^{-\nu t}} \tag{10}$$

From this, a regression of the logarithmic market cap is presented by:

$$\ln(V_t) = 0 + \beta \left(\frac{\ln(\hat{n}_t)}{\ln(\hat{b}_t)} \right) \tag{11}$$

Both Peterson (2018) and Van Vliet (2018) reported good fitting models in their studies, with the latter reporting an even better R^2 attempt to improve the model of the former.
Alabi (2017) also explored the applicability of Metcalfe's law to the blockchain and cryptocurrency ecosystem. By utilizing Metcalfe's law, Alabi (2017) was able to demonstrate that the law was validated by analyzing various blockchain networks and demonstrating that the growth of the blockchain network was a result of the number of unique addresses, unlike Peterson (2018) and Van Vliet´s (2018) total number of wallets. Alabi (2017) proposes a somewhat similar model of network growth as Van Vliet (2018):

$$N(t) = \frac{p}{1 + e^{-\nu(t - tm)}} \tag{12}$$

Where N is a function of the total number of users, and p is the capped number of users. N is moving towards p as t increases. The factor t_m represents the point in time where the network

growth rate is at its highest, which leads to *N(t) = p/2* (Alabi, 2017). Further, the formula of network value, related to the network size, is given as

$$V(N) = Ce^{\lambda \bar{N}^m} \quad (13)$$

In this model, the network value is applied a 30-day moving average filter, $\bar{N}$, to cope with short-term fluctuation in network activity.

4.1.2.1 Improvements

To check whether these models are valid today, a few years after their inception, we conduct the same analyses as the above-mentioned authors. When conducting the model of Van Vliet (2018), the optimized parameters in Eq. X and X must be recalculated, as his findings are based on monthly data instead of daily data, which we have opted to use in our optimization of the model. The new fit was obtained using the problem solver add-in in Excel. The numbers models were fitted using least squares, and the obtained parameters were η=0,0005, ϕ=1575,0364 and v=0,0011.

For Alabi´s (2017) model, we look at the potential impact that the evolution of the Bitcoin Lightning Network might have on the model. The Lightning Network is not part of the registered daily active addresses, but the transactions happening there is still a part of the overall Bitcoin network. The number of nodes on the lightning network was added to the function and fitted in as an extra factor to the function in Alabi´s (2017) study.

4.1.3 Network value of transactions ratio

Woo originally presented the Network Value to Transaction (NVT) ratio model (2017). This model's foundation is comparable to the Price-to-Earnings (P/E) ratio that is often used to value companies. The goal is to be able to evaluate whether Bitcoin is overvalued, undervalued, or accurately valued at any particular time. Bitcoin is not a real corporation and has no direct earnings, hence the approach differs from the P/E ratio. According to Woo (2017), in the case of Bitcoin, the entire transaction value (USD) can be utilized as "profits" in the model, resulting in a ratio of network value (market cap) to transaction value. The ratio indicates that the total value of all transactions currently flowing over the network is an

approximation of the network's utility. A high NVT-ratio indicates that Bitcoin is overvalued, as the total network value differs significantly from the total value that passes through the network. Woo (2017) further claims that the model can be used to identify possible Bitcoin market price bubbles.

The model is computed by dividing the Bitcoin Market capitalization (M) by the total daily trading volume (V) (T). However, NVT does not account for exchange transactions because these transactions are only speculative. Consequently, these transactions serve no purpose for the network and are excluded.

In this instance, the NVT ratio will help us measure the relative utilization of the Bitcoin network over time. To calculate the NVT of the Bitcoin network, we must divide the current value of the network's utility by the daily volume of Bitcoin transactions on the blockchain. In a technical sense, the formula provided by NVT is an expression of negative monetary velocity. NVT is depicted by the following formula:

$$NVT = \frac{M}{T} \tag{14}$$

Regarding the aforementioned calculation, M is the current market capitalization of Bitcoin and T is the current dollar volume of daily transactions. Because both M and T are reliant on time, NVT is also dependent on time. NVT can be used to determine whether Bitcoin is overpriced or underpriced. If the NVT is large, it is evident that the Bitcoin network's value exceeds the current value being transacted on the network. Typically, this occurs when Bitcoin is experiencing a period of rapid growth, which is driven by speculators and investors who view it as a high-risk investment with the potential for larger returns. In addition, high NVT values might arise when the present market environment is at the peak of a Gartner Hype Cycle.

Given the aforementioned information; how can we use the NVT ratio as a valuable tool regarding Bitcoin valuation?

As discussed previously, when the NVT ratio is high, investors might deduce that the current value of Bitcoin is overvalued, and risk-averse investors should consider reducing their

exposure to the asset. Numerous occurrences of high NVT ratios have occurred, such as in 2011 and 2014. During these periods of high NVT ratios, the markets are valuing Bitcoin at an unsustainable level relative to the value of the Bitcoin network's transaction volume. In these situations, we have typically been in a "bubble." However, one may argue that Bitcoin's significant price gain during its "bubble" periods indicates that investors and the market are valuing the cryptocurrency based on its potential future utility. This is comparable to what we observe with Price-to-Earnings ratios in traditional markets, when these markets evaluate companies that are in their infancy but have enormous potential. Consequently, investors can use NVT ratios as a tool to spot and identify bubbles in the Bitcoin ecosystem, but the ratio will not aid in detecting these possible bubbles beforehand. Nonetheless, it is a trustworthy instrument for determining whether a sharp correction is likely or whether the asset is in a period of consolidation.

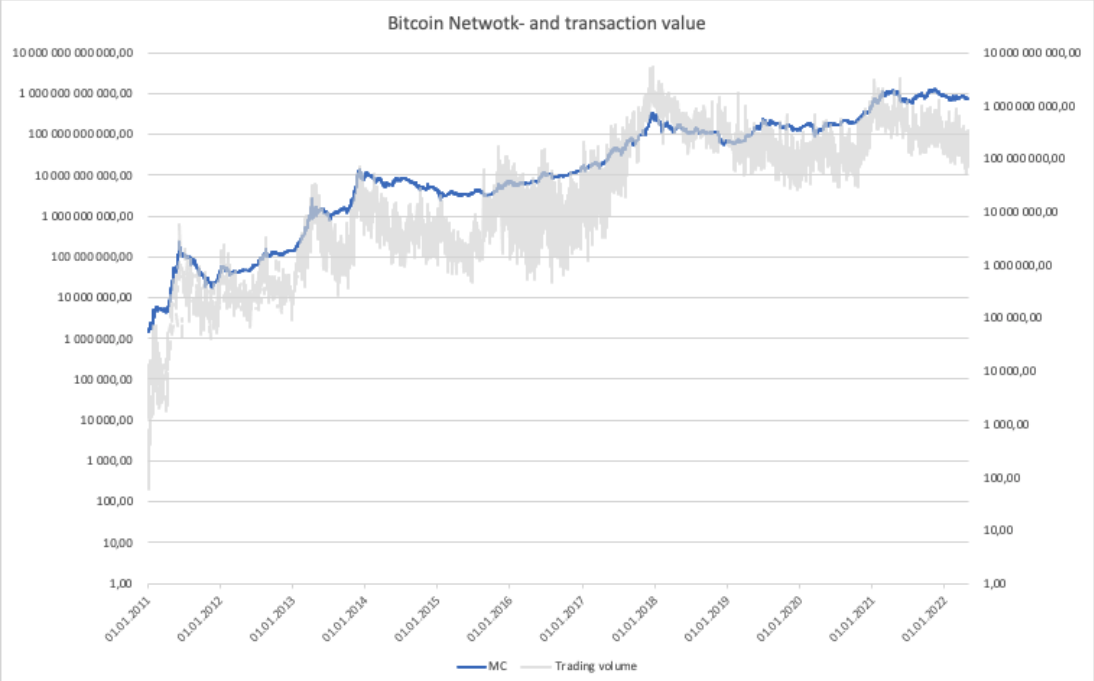


Figure 2: Bitcoin NVT ratio

4.1.4 Cost of Production method

The main theory about the cost of production model is that is creates a floor for the Bitcoin price that it will not enter below (Hayes, 2019). Hayes (2016; 2019) argues that Bitcoin

miners would decide to not mine if the price of energy would surpass the value of the total Bitcoins mined, as market participants are rationale agents. These agents would then incur monetary losses. As a result, 5 assumptions were introduced to the model by Hayes.

- The costs of electricity per kWh in cents
- The current market price of Bitcoin
- The current complexity of the bitcoin algorithm
- The current block reward (current block reward is 6.25 BTC per block)
- Energy consumption per mining unit in watts per gigahash/second

In a competitive market environment, a rationale agent would start the process of mining given that the marginal cost of energy consumption per day would equal to or less than the value of their average number of bitcoins mined per day multiplied by the current Bitcoin price.

$$Rationale\ Agent\ Mining\ = Total\ cost\ of\ mining\ < Avg.\ BTC\ per\ day\ \times BTCprice$$

Hayes (2015) argues that given the speculation surrounding Bitcoin, as well as its properties which carry likeness to money, for example as a medium of exchange or store of value, can certainly affect objectivity in the sense that agents apply their subjective opinions when valuing the current Bitcoin price. However, the current marginal cost of production, as determined by the current use of energy, can certainly serve as a lower limit of Bitcoins value, near which rationale agent are forced to stop their mining processes. As such, Hayes' (2015; 2016; 2019) methods predicts whether a miner should or should not decide to mine Bitcoins, where the inputs are current Bitcoin price in dollars, current energy consumption, and average bitcoins mined per day. The daily cost of Bitcoin mining is in the model given by:

$$E\ per\ day = \left(\frac{\rho}{1000}\right)\left(\frac{\$}{kWh} x \frac{W}{GH/s} x24\right) \tag{15}$$

In the model, E/day represents the daily costs of a Bitcoin miner and p is the computational power (hashpower). Proceeding with the model, the next step is to estimate the amount of Bitcoin that a miner can expect to receive in a day, BTC/day.

$$BTC\ per\ day = \left(\frac{\beta\rho\ x\ 3600}{\delta\ x\ 2^{32}}\right) x\ 24 \tag{16}$$

where β is the reward per block in terms of Bitcoin, ρ represents the hashpower and δ being the mining difficulty. With both cost per day and expected reward per day calculated, the expected cost per Bitcoin, and as the model states, the lower limit of Bitcoin price, can be calculated:

$$Price_{Low} = \frac{E\ per\ day}{BTC\ per\ day} \tag{17}$$

4.1.5 The Fulcrum Index

Foss and Sansone (2022) proposes a valuation model based on what he calls the "Fulcrum Index". The model is based on the theory that Bitcoin can be an insurance against credit default swaps, and that value can be estimated thereafter. Actually, the model is a product of five assumptions, with four of those being individual valuation models, and the expected return on the given methods, given its probability to succeed. The first assumption in the model is that Bitcoin is going to default, and this is given a 75 % chance. They state that they believe the risk of that is lower, but they descale it to give it a fair estimate. Second, and the first "individual" valuation model is the mentioned Fulcrum Index, that Bitcoin will work as an insurance to CDS. This is given a 15 % chance. The expected market value based on this model is measured by the total value of debt and obligations of the G-20 countries, multiplied by their respective spread in CDS. Next is that Bitcoin gain the same market cap as gold has today, which is given a 7 % chance. The two last models says that Bitcoin gains a value of 5 % and 10 % of global assets, given a 2 % and 1 % chance respectively. The expected value at each level is calculated based on the calculated returns and the probability to succeed.

5 Results

In this section we take a look at the results that has come from our calculations. The methods described in the previous section are taken into use to see if there are room for performance for some of the mentioned valuation models.

5.1 Stock to flow

We calculated the Stock to Flow-ratio based on Morillon and Chacon (2021), making a few adjustments to the model. Figure Xa shows the Stock to Flow-model with a 4-year rolling

average and recalculation of regression coefficients by the end of each year. Figure Xb shows the model using all available data, also here recalculating coefficients every year. Both models are compared to the original Stock to Flow-model presented by "Plan B".

Figure 3: Stock to Flow - 4 year rolling

Figure 4: Stock to Flow - all available

Both the model using 4-year rolling average and the one using all data available are tested against each other, the original model, and the actual price in the testing period of 2016 to early 2022. All models do show strong relationship with the actual price in the period, with the model using all available data performing best with a R^2 of above 90% (Table X).

R2	Actual price	4-year	All available	Original
Actual price	1	0,8931	0,9024	0,8961
4-year	0,8931	1	0,9752	0,9546
All available	0,9024	0,9752	1	0,9963
Original	0,8961	0,9546	0,9963	1

Table 1: Relationship between Stock to Flow-models

We also tested the separate model's ability to predict prices. Table X shows price prediction for the different models at the end of the given year.

Year	Est. Price at t+1 (4-year)	Est. Price at t+1 (all data)	Est. Price at t+1 (original)	Actual price t+1
2016	2 667,08	2 667,08	1 948,80	958,12
2017	3 591,10	6 312,03	5 826,70	14 165,58
2018	3 339,70	5 175,66	6 431,65	3 791,55
2019	6 266,70	6 532,13	7 032,27	7 219,60
2020	41 616,66	37 785,48	40 143,68	28 856,59
2021	70 159,47	68 942,34	80 071,49	47 132,96

Table 2: Price predictions Stock to Flow

5.2 Metcalfe´s value

When estimating how well Peterson´s (2018) model for Bitcoin Price based on Metcalfe´s Law performs today, we use the same conditions as Peterson used in his paper in 2018. Using Peterson´s (2018) model and excluding data from 2013 and 2014, we continue the 61-day cycle until the beginning of 2022. The results we get shows us that Peterson´s (2018) model fits quite good up until 2018, but since then the estimated Bitcoin price based on Metcalfe´s Law is nowhere near the actual prices that Bitcoin has been traded at throughout these past years (Figure X).

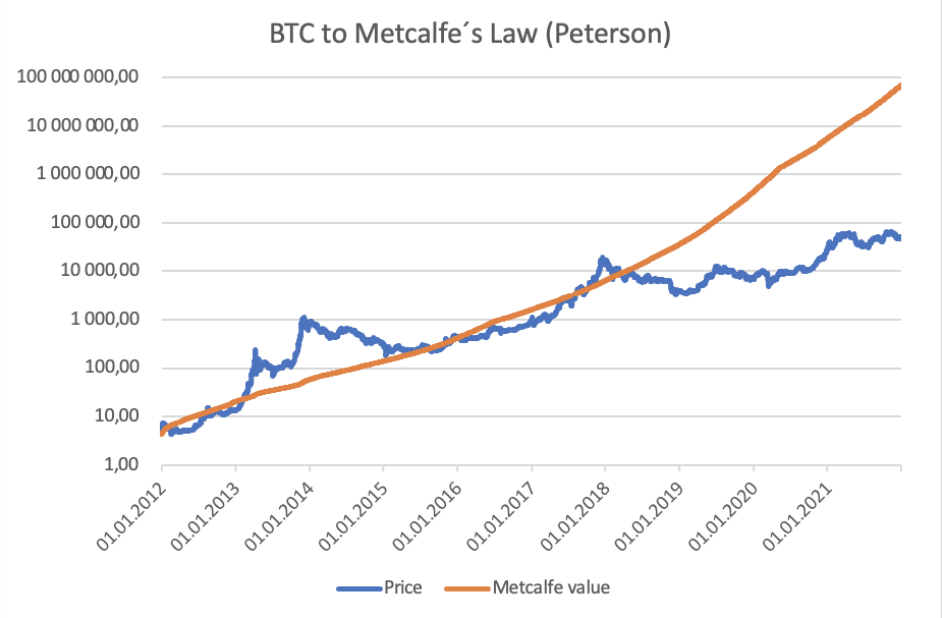


Figure 5: BTC to Metcalfe´s Law (Peterson)

The difference can also be spotted in figure X. The R^2 for the model for to 2018 is the same as Peterson (2018) reported, but the R^2 in the period from 2018 is significantly lower. The

numbers for the overall model, for the entire period, to the actual Bitcoin price is even lower, with an R^2 at 0,582.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,920[a]	,847	,840	1242,80426

a. Predictors: (Constant), Metcalfe price -2017

Table 3: Peterson´s Metcalfe -2017

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,793[a]	,629	,628	10822,8858

a. Predictors: (Constant), Metcalfes value 2018-

Table 4: Peterson´s Metcalfe 2018-

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,763[a]	,582	,573	10754,7039

a. Predictors: (Constant), Metcalfe price all

Table 5: Peterson´s Metcalfe - whole period

Testing Alabi´s (2017) model we see that the potential growth he calculated for the Bitcoin network failed. The growth function of the network value presented in his study predicted a continuous increase in growth until mid-2017, and then for the growth to decay over time. The reality has shown that the number of users on the network peaked in late 2017, before experiencing a decrease (Figure X).

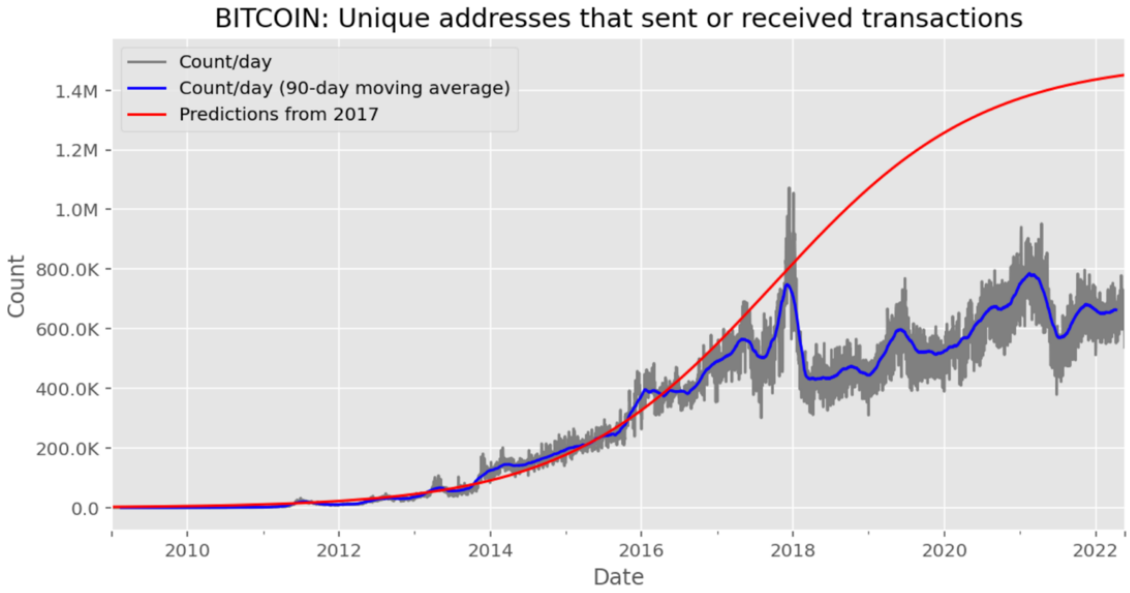


Figure 6: Estimated DAA vs. actual DAA

A contributing factor to the decrease can arguable be asserted to the adoption of the lightning network. The transactions which are taking place here occur off-chain and as a result, does not register transaction on-chain and is therefore not a part of the pool of daily active addresses. However, it is a crucial part to include the current growth of active node channels in the lightning network in order to evaluate a fair value for Bitcoin. By adding the number of active node channels on the Lightning Network to the function and refitting the model, we end up with a model which better fit the current price action of Bitcoin, which takes the off-chain transactions into account which is presented below.

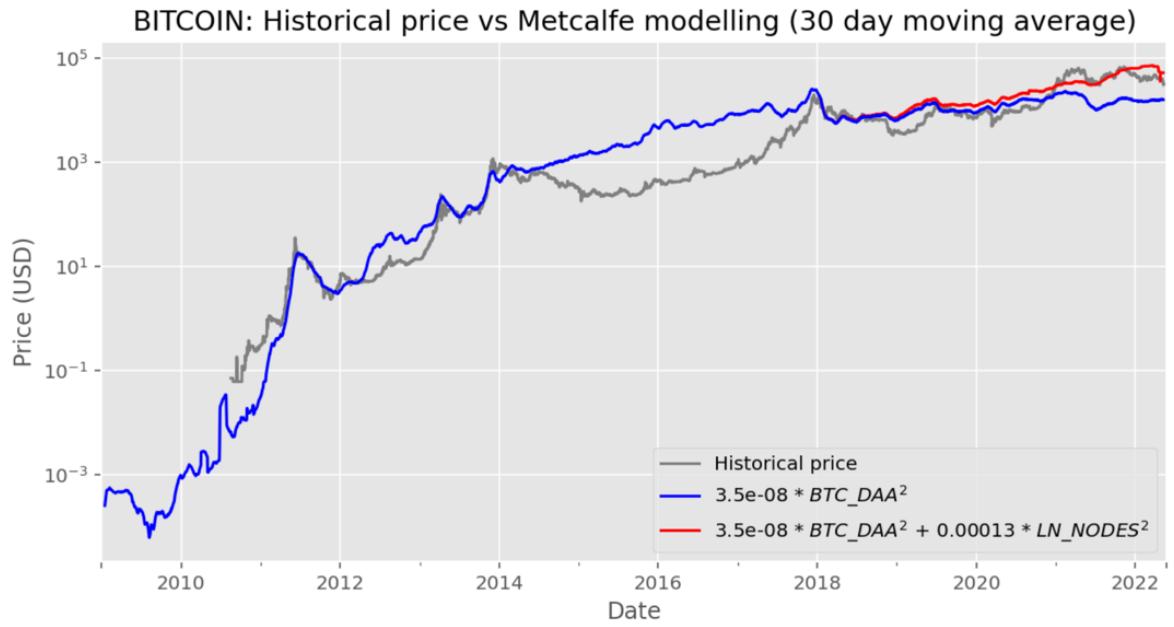


Table 6: Alabi´s Metcalfe included Lighning Network nodes

5.3 Fulcrum Index

The model is based on the five assumptions that Bitcoin will default, that Bitcoin will work as an insurance to CDS, that Bitcoin will exceed the market cap of gold and that it will reach 5 % or 10 % of total global assets (Foss & Sansone, 2022). The calculated returns given the different scenarios are given as follows.

Outcome	**Bitcoin price**	**Probability**
Bitcoin default	$0	75 %
Fulcrum Index (insurance against CDS)	$215 000	15 %
Bitcoin vs. gold	$475 000	7 %
5 % of total global assets	$2 100 000	2 %
10 % of total global assets	$4 300 000	1 %

Table 7: Fulcrum Index

6 Discussion

The global economic system is currently undergoing a period of profound transformation, and the cryptocurrency ecosystem and its respective markets are likely to continue thriving. The In the coming years, the number of cryptocurrency activity will expand significantly. In recent years, there has been a growing interest in the valuation of cryptocurrencies and crypto assets for many reasons, mostly because there are authors who assert that bitcoin has no value and compare it to the scenarios such as the tulip- and dotcom bubble

Hayes (2015) have quantitatively demonstrated that these types of claims are false, by excluding the possibility that the value of bitcoin could ever be zero. Since the cost of production is greater than zero, as demonstrated by the cost of production model which he presents. The mining industry promotes a global mining activity that exponentially strengthens the Bitcoin network in cybersecurity terms, and he concludes that the minimum value or floor of the main cryptocurrency is determined by the application of this production cost.

However, we would argue that the model that Hayes (2015) brings forth, does not adequately take the growth of the Bitcoin network into account. More specifically, one cannot have the one without the other, and it therefore creates a causality dilemma. If the network continues to grow, then one can assume that the number of miners will grow in numbers as well, and it works both ways. As such, the cost of production simply reflects the current attractiveness of mining, and struggles to provide any basis for an actual bottom floor for the Bitcoin price. We have therefore concluded that it there will be no merits in carrying out or optimizing the

cost of production model, as there are relevant data and factors that are not being accounted for.

Metcalfe's Law, on the other hand, asserts that the value of a network increases exponentially as its user base grows. However, we believe that both Alabi (2017) and Peterson (2019) are not able to properly capture the growth of the Bitcoin network given the parameters that they are utilizing. Additionally, we discovered multiple faults with Peterson's model and as a result decided to not proceed with his interpretation of Metcalfe's Law. For instance, in Eq, 8. when circulating supply in t-1 reaches around 7,7 million, b_t will start to decrease over time as $Ln(B/b_{t-1})$ goes below 2,72, and hence the value goes below 1. In order to optimize these parameters, we have decided to build upon Alabi's work as we believe that his interpretation of Metcalfe's Law in relation to projecting Bitcoin prices is what carries the most value.

There are billions of individuals around the globe who are currently suppressed by their governments in such a way that they cannot preserve their money regardless of how hard they work, simply because their governments consistently inflate the value of their currency. The ongoing political and economic turmoil have sparked increased adoptions in those countries that are riddled with these aforementioned situations, such as Venezuela, Nigeria and El Salvador. Now that bitcoin has been created, governments are unable to censor and control it completely and it provides individuals with a perfect opportunity to decide for themselves where their wealth should be stored.

Some of the recent fluctuations in bitcoin are undoubtedly speculative, but the rise in value is due to the expansion of a completely new technology and its inherent network, which still can be considered to be in its infancy. Additionally, bitcoin's value has climbed substantially over time, a trend that is anticipated to continue heading up according to the models that have been presented in this thesis. The long-term BTC/USD sentiment should be optimistic owing to greater adoption and central banks continuous quantitative easing, as well as poor monetary and fiscal policy.

6.1 Suggestions for future research

With the current growth that the Bitcoin and cryptocurrency ecosystem is experiencing it is paramount that additional research is conducted in the field of fairly valuing Bitcoin, as well

as other digital assets. It would be valuable to investigate whether the S2F model can be tuned more finely in order to cater to those who considers purchasing Bitcoin, as it currently carries robust value in terms of determining future prices for Bitcoin. It would also be beneficial for future models to take a closer look at how the risk of regulation affects the fair price of Bitcoin.

7. Conclusion

Bitcoin is undoubtedly valuable; however, we are still in the early days of this new-found technology which sets forth a difficult landscape to tackle when it comes to fairly valuing Bitcoin. At the present time we have found that some models carry substantial value, while others conduct their models with a faulty approach when carrying out their valuations. As a result of our thesis, we would encourage people to utilize the stock to flow model that has been proposed by Plan B, as well as implementing our optimized version of Alabi's (2017) interpretation of Metcalfe's law, in which we have incorporated the current growth of the lightning network, which is quintessential when justifying a fair value for Bitcoin, and its expected future growth.

8. References

Alabi, K. (2017). Digital blockchain networks appear to be following Metcalfe's Law. *Electronic Commerce Research and Applications*, *24*, 23–29. https://doi.org/10.1016/j.elerap.2017.06.003

Anceaume, E., Ludinard, R., Potop-Butucaru, M., & Tronel, F. (2017). Bitcoin a Distributed Shared Register. *Lecture Notes in Computer Science*, *10616*, 456–468. https://doi.org/10.1007/978-3-319-69084-1_34

Arsi, S., Khelafi, S., Ghabri, Y., & Mzoughi, H. (2021). *Cryptocurrencies: Key Risks and Challenges*.

Arslanian, H. (2022). Bitcoin and Crypto Mining. *The Book of Crypto*, 259–276. https://doi.org/10.1007/978-3-030-97951-5_14

Arslanian, H., & Fischer, F. (2019). The Rise of Bitcoin. *The Future of Finance*, 95–111. https://doi.org/10.1007/978-3-030-14533-0_9

Baur, D. G., & Dimpfl, T. (2017). Realized Bitcoin Volatility. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2949754

Baur, D. G., & Dimpfl, T. (2021). The volatility of Bitcoin and its role as a medium of exchange and a store of value. *Empirical Economics*, *61*. https://doi.org/10.1007/s00181-020-01990-5

Beneki, C., Koulis, A., Kyriazis, N. A., & Papadamou, S. (2019). Investigating volatility transmission and hedging properties between Bitcoin and Ethereum. *Research in International Business and Finance*, *48*, 219–227. https://doi.org/10.1016/j.ribaf.2019.01.001

Bhambhwani, S., Delikouras, S., & Korniotis, G. M. (2019). Do Fundamentals Drive Cryptocurrency Prices? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3342842

Bouri, E., Lau, C. K. M., Lucey, B., & Roubaud, D. (2019). Trading volume and the predictability of return and volatility in the cryptocurrency market. *Finance Research Letters*, *29*, 340–346. https://doi.org/10.1016/j.frl.2018.08.015

Boyapati, V., & Saylor, M. (2021). *The bullish case for bitcoin*. United States: Vijay Boyapati.

Cheah, E.-T., & Fry, J. (2015). Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. *Economics Letters*, *130*, 32–36. https://doi.org/10.1016/j.econlet.2015.02.029

Chico-Frias, A. (2021). *Bitcoin, Intrinsic Value, and Herd Effect*. DLSU Business & Economics Review. Retrieved from DLSU Business & Economics Review website: https://www.dlsu.edu.ph/wp-content/uploads/2021/08/DLSUBER.2021.July_.5frias0729.pdf

Ciaian, P., Kancs, & Rajcaniova, M. (2021). *Interdependencies between Mining Costs, Mining Rewards and Blockchain Security*. Retrieved from https://arxiv.org/abs/2102.08107

Ciaian, P., Rajcaniova, M., & Kancs. (2015). The economics of BitCoin price formation. *Applied Economics*, *48*(19), 1799–1815. https://doi.org/10.1080/00036846.2015.1109038

CoinMarketCap. (2019). Cryptocurrency Market Capitalizations | CoinMarketCap. Retrieved from CoinMarketCap website: https://coinmarketcap.com

Corbet, S., Larkin, C., Lucey, B. M., Meegan, A., & Yarovaya, L. (2020). The impact of macroeconomic news on Bitcoin returns. *The European Journal of Finance*, *26*(14), 1–21. https://doi.org/10.1080/1351847x.2020.1737168

Corbet, S., Lucey, B., & Yarovaya, L. (2018). Datestamping the Bitcoin and Ethereum bubbles. *Finance Research Letters*, *26*, 81–88. https://doi.org/10.1016/j.frl.2017.12.006

de Vries, A., Gallersdörfer, U., Klaaßen, L., & Stoll, C. (2022). Revisiting Bitcoin's carbon footprint. *Joule*, *6*(3). https://doi.org/10.1016/j.joule.2022.02.005

Deltec Bank & Trust. (2022, February 28). Bitcoin Halving 2024. Retrieved June 1, 2022, from Deltec Bank & Trust website: https://www.deltecbank.com/2022/02/28/bitcoin-halving-2024/?locale=en

Diba, B. T., & Grossman, H. I. (1988). Explosive Rational Bubbles in Stock Prices? *The American Economic Review*, *78*(3), 520–530. Retrieved from https://www.jstor.org/stable/1809149

Dowd, K. (2014, June 17). New Private Monies: A Bit-Part Player? Retrieved June 1, 2022, from papers.ssrn.com website: https://ssrn.com/abstract=2535299

Dwyer, G. P. (2015). The economics of Bitcoin and similar private digital currencies. *Journal of Financial Stability*, *17*, 81–91. https://doi.org/10.1016/j.jfs.2014.11.006

Foss, G. (2022). Why Every Fixed Income Investor Needs to Consider Bitcoin as Portofolio Insurance. Retrieved May 31, 2022, from https://rockstarinnercircle.com/wp-content/uploads/2021/04/Why-Every-Fixed-Income-Investor-Needs-To-Consider-Bitcoin-As-Portfolio-Insurance.pdf

Foss, G. F., & Sansone, J. (2022, March 30). Bitcoin Portfolio Insurance: BTC Valuation Models. Retrieved June 1, 2022, from Bitcoin Magazine website: https://bitcoinmagazine.com/markets/exploring-bitcoin-valuation-models

Fousekis, P., & Grigoriadis, V. (2021). Directional predictability between returns and volume in cryptocurrencies markets. *Studies in Economics and Finance*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/sef-08-2020-0318

Fousekis, P., & Tzaferi, D. (2020). Returns and volume: Frequency connectedness in cryptocurrency markets. *Economic Modelling*, *95*. https://doi.org/10.1016/j.econmod.2020.11.013

Garcia, D., Tessone, C. J., Mavrodiev, P., & Perony, N. (2014). The digital traces of bubbles: feedback cycles between socio-economic signals in the Bitcoin economy. *Journal of the Royal Society Interface*, *11*(99), 20140623. https://doi.org/10.1098/rsif.2014.0623

Geuder, J., Kinateder, H., & Wagner, N. F. (2018). Cryptocurrencies as financial bubbles: The case of Bitcoin. *Finance Research Letters*, *31*. https://doi.org/10.1016/j.frl.2018.11.011

Glaser, F., Zimmermann, K., Haferkorn, M., Weber, M. C., & Siering, M. (2014, April 15). Bitcoin - Asset or Currency? Revealing Users' Hidden Intentions. Retrieved from papers.ssrn.com website: https://ssrn.com/abstract=2425247

Granot, E. (2018). On the Origin of the Value of Cryptocurrencies. *Blockchain and Cryptocurrencies*. https://doi.org/10.5772/intechopen.79451

Hayes, A. (2015, March 19). A Cost of Production Model for Bitcoin. Retrieved May 29, 2022, from papers.ssrn.com website: https://ssrn.com/abstract=2580904

Hayes, A. S. (2017). Cryptocurrency value formation: An empirical study leading to a cost of production model for valuing bitcoin. *Telematics and Informatics*, *34*(7), 1308–1321. https://doi.org/10.1016/j.tele.2016.05.005

Hayes, A. S. (2018). Bitcoin price and its marginal cost of production: support for a fundamental value. *Applied Economics Letters*, *26*(7), 554–560. https://doi.org/10.1080/13504851.2018.1488040

Johnson, R., Bufton, J., & Daniel, J. (2019). *The valuation of crypto-assets Minds made for shaping financial services*. Retrieved from https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/emeia-financial-services/ey-the-valuation-of-crypto-assets.pdf

Karame, G. O., Androulaki, E., & Capkun, S. (2012). Double-spending fast payments in bitcoin. *Proceedings of the 2012 ACM Conference on Computer and Communications Security - CCS '12*. https://doi.org/10.1145/2382196.2382292

Kayal, P., & Balasubramanian, G. (2021). Excess Volatility in Bitcoin: Extreme Value Volatility Estimation. *IIM Kozhikode Society & Management Review*, *10*(2). https://doi.org/https://doi.org/10.1177/2277975220987686

Kayal, P., & Rohilla, P. (2021). Bitcoin in the economics and finance literature: a survey. *SN Business & Economics*, *1*(7). https://doi.org/10.1007/s43546-021-00090-5

Kristoufek, L. (2015). What Are the Main Drivers of the Bitcoin Price? Evidence from Wavelet Coherence Analysis. *PLOS ONE*, *10*(4), e0123923. https://doi.org/10.1371/journal.pone.0123923

Luther, W. J. (2017). Is Bitcoin Intrinsically Worthless? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3000068

Nakamoto, S. (2008). Bitcoin: a Peer-to-Peer Electronic Cash System. In *bitcoin.org*. Retrieved from https://bitcoin.org/bitcoin.pdf

Mariem, S. B., Casas, P., Romiti, M., Donnet, B., Stutz, R., & Haslhofer, B. (2020). All that Glitters is not Bitcoin – Unveiling the Centralized Nature of the BTC (IP) Network. *NOMS 2020 - 2020 IEEE/IFIP Network Operations and Management Symposium*. https://doi.org/10.1109/noms47738.2020.9110354

Metcalfe, B. (2013). Metcalfe's Law after 40 Years of Ethernet. *Computer*, *46*(12), 26–31. https://doi.org/10.1109/mc.2013.374

Miglietti, C., Kubosova, Z., & Skulanova, N. (2019). Bitcoin, Litecoin, and the Euro: an annualized volatility analysis. *Studies in Economics and Finance*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/sef-02-2019-0050

Mora, C., Rollins, R. L., Taladay, K., Kantar, M. B., Chock, M. K., Shimada, M., & Franklin, E. C. (2018). Bitcoin emissions alone could push global warming above 2°C. *Nature Climate Change*, *8*(11), 931–933. https://doi.org/10.1038/s41558-018-0321-8

Morillon, T. G., & Chacon, R. G. (2022). Dissecting the stock to flow model for Bitcoin. *Studies in Economics and Finance*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/sef-10-2021-0409

Nakamoto, S. (2008). Bitcoin: a Peer-to-Peer Electronic Cash System. In *bitcoin.org*. Retrieved from https://bitcoin.org/bitcoin.pdf

Pagnotta, E., & Buraschi, A. (2018). An Equilibrium Valuation of Bitcoin and Decentralized Network Assets. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3142022

Peterson, T. (2017). Metcalfe's Law as a Model for Bitcoin's Value. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3078248

Pickering, G. (2019). The Relevance of Bitcoin to the Regression Theorem: A Reply to Luther. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3492642

PlanB. (2019, March 22). Modeling Bitcoin's Value with Scarcity. Retrieved from Medium website: https://medium.com/@100trillionUSD/modeling-bitcoins-value-with-scarcity-91fa0fc03e25

Qureshi, S., & Xiong, J. (2018). Global Financial Inclusion and Human Development: The Bitcoin Effect. *GlobDev 2018*. Retrieved from https://aisel.aisnet.org/globdev2018/8

Rothbard, M. N. (1988). Timberlake on the Austrian theory of money: A comment. *The Review of Austrian Economics*, *2*(1), 179–187. https://doi.org/10.1007/bf01539305

Schaupp, L. C., & Festa, M. (2018). Cryptocurrency adoption and the road to regulation. *Proceedings of the 19th Annual International Conference on Digital Government Research Governance in the Data Age - Dgo '18*. https://doi.org/10.1145/3209281.3209336

Taleb, N. (2007). *The Black Swan*. W.F. Howes.

Valstad, O. C. A., Vagstad, K., & Peter, M. (2014). A bit risky? A comparison between Bitcoin and other assets using an intraday Value at Risk approach. *83*. Retrieved from http://hdl.handle.net/11250/266806

Von Mises, L. (1954). *The Theory of money and credit*. New Haven: Yale University Press.

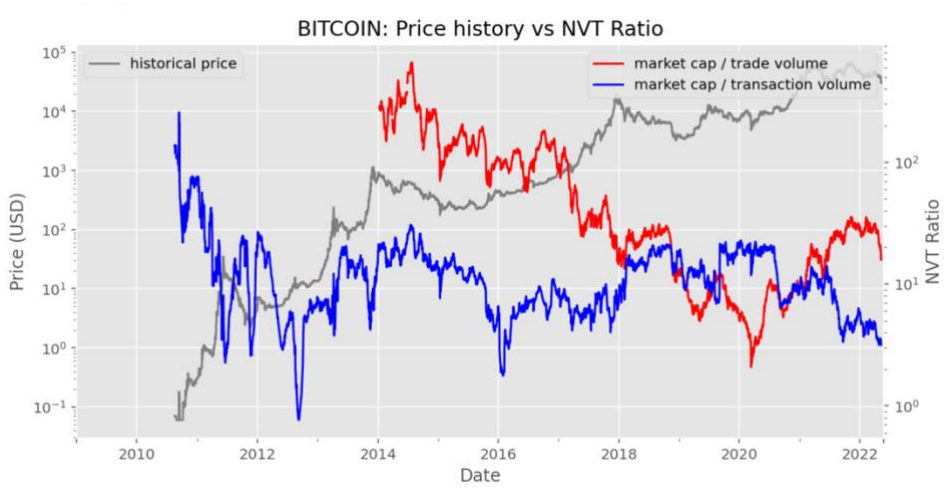
Wang, S., & Vergne, J.-P. (2017). Buzz Factor or Innovation Potential: What Explains Cryptocurrencies' Returns? *PLOS ONE*, *12*(1), e0169556. https://doi.org/10.1371/journal.pone.0169556

Yeoh, P., & Haynes, A. (2020). *CRYPTOCURRENCIES AND CRYPTOASSETS : regulatory and legal issues.* S.L.: Crc Press.

Zhang, X., Qin, R., Yuan, Y., & Wang, F.-Y. (2018). An Analysis of Blockchain-based Bitcoin Mining Difficulty: Techniques and Principles. *2018 Chinese Automation Congress (CAC)*. https://doi.org/10.1109/cac.2018.8623140

Zhang, X.-Z., Liu, J.-J., & Xu, Z.-W. (2015). Tencent and Facebook Data Validate Metcalfe's Law. *Journal of Computer Science and Technology*, *30*(2), 246–251. https://doi.org/10.1007/s11390-015-1518-1

9 Appendix


BITCOIN: Price history vs NVT Ratio
historical price
market cap / trade volume
market cap / transaction volume
Price (USD)
NVT Ratio
Date
2010
2012
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2022

Discussion Paper
Master's Programme in Business Administration

Frikk H. Vermedal

As per the requirements set forth by our supervisors, and the counsel governing the masters programme in business administration, I am tasked to write in what way my Masters thesis, written together with Tormod B. Wang, is connected to the ceoncept of "internationalism". I will start this paper by introducing the master thesis that Tormod & I are currently writing, then explain how this relates to the current international trends and forces. I will openly discuss how our master thesis relates to the concept of "international", and as a result the discussion paper is mostly my own thoughts, which have been built throughout the months of writing this thesis.

Introduction of our master thesis

Together with Tormod, I am writing a paper on the subject of the value of cryptocurrencies, notably Bitcoin, which is the most well-known cryptocurrency. The majority of our master's thesis focuses on the most common methods of valuation for Bitcoin, which is the most dominant cryptocurrency. In our master's thesis, we investigate the effectiveness of the most common techniques to valuation in relation to the most recent shifts in Bitcoin's price. We also propose an improved version of the method that is currently being used to value Bitcoin in order to arrive at what we refer to as a "fairer" price. We feel that our research is very applicable to this new category of assets, and that this new asset class deserves a great deal more attention than it has received up until this point.

How our thesis relates to the current international trends and forces

Bitcoin is a digital asset and a payment system invented by a mysterious personality known as Satoshi Nakamoto. It is a cryptocurrency designed to work as a medium of exchange that uses cryptography to control its creation and management, rather than relying on central authorities. Transactions of bitcoin are verified by network nodes through cryptography and recorded in a publicly distributed ledger called a blockchain. This allows bitcoins to be

decentralized i-e it is not controlled by any central authority or Central bank (Nakamoto, 2008).

Bitcoin's transformation as an alternative to fiat currency is largely attributable to its decentralization, which allows it to bypass central authority, such as a third party intermediary (Nakamoto, 2008). Being decentralized and built on numerous nodes makes the bitcoin network accessible 24 hours a day, 7 days a week, with lightning-fast transaction rates and minimal transaction costs compared to traditional banking fees. Bitcoin is frequently referred to as "digital gold" because to its parallels to precious metals. Bitcoin, like gold, cannot be generated from nothing; it must be mined. Similarly, like gold, after all bitcoins are mined, they will remain in circulation indefinitely. There will never be more than 21 million bitcoins created. Thus, Bitcoin is a deflationary money, which makes it appealing to investors seeking alternatives to fiat currencies (Nakamoto, 2008).

In this discussion paper, I will not get into the specifics of how Bitcoin operates, therefore I will exclude the technical features of the cryptocurrency in question. Nonetheless, it is an intriguing topic to examine in relation to the topic of "international". Today, we are slowly but surely realizing the need for a decentralized currency; nevertheless, the question of whether or not this currency should be Bitcoin is altogether separate. Regardless, it is undeniable that Bitcoin has paved the way for digital assets and currencies to play a significant role in liberating citizens of certain countries from potentially controlling regimes and dictatorships, as well as providing an opportunity for citizens of third world countries to become "banked" in the sense that they can trust that their values will be stored securely on the blockchain, as opposed to having to rely on the given politico-economic system. Countries such as El Salvador, Venezuela, Ukraine and Russia come to mind (Arsi, Khelafi, Ghabri, & Mzoughi, 2021). These are the nations whose residents have elected to place their faith in the decentralized characteristics of cryptocurrencies in order to maintain confidence in their wealth.

In our master's thesis, we drew conclusions based on current valuation methodologies that could serve as tools for citizens in the aforementioned nations to determine if the price of the most popular cryptocurrency, Bitcoin, is overvalued or undervalued. Given that our models indicate a present level of undervaluation; it may potentially serve as an excellent tool for these citizens to choose whether or not they should invest in Bitcoin. In the event that it is

undervalued, our models allow them to determine whether or not it is reasonable to retain their national currencies, such as the Venezuelan Bolivar, the Russian ruble, or the Ukrainian hryvnia.

In terms of the concept “international”, it is particularly necessary to discuss the current situation in Ukraine. Russia has declared war on Ukraine. Cryptocurrencies, such as Bitcoin, have offered the residents of Ukraine and Russia with a means of preserving their wealth amidst the political instability caused by the conflict of war. One could argue that this method of wealth preservation is ineffective, but at least they have a choice, which we consider to be quite precious. It gives the world's population an opportunity, should they ever find themselves in a similar scenario to that of Ukraine and Russia. Moreover, cryptocurrencies have provided a route for spectators to send funds to Ukraine in their powerless state (Arslanian, 2022). Millions of people from across the world have backed Ukraine by sending cryptocurrencies, such as Bitcoin, and the Ukrainian government has extensively adopted this method of donating money to them, paving the path for further countries to utilize this method of donating in the future, given that they find themselves in the dire situation of war. We believe it would be exemplary for the international community to support a country whose entire economic and political structure is being disrupted by a nation-state with malign intentions. Consequently, offering them a helpful answer when they need it the most.

Both Tormod and I also believe that there is an inherent need for a decentralized currency, in spite of the fact that this is heavily debated topic. In relation to the concept of “international”, we believe that Bitcoin and cryptocurrencies are of utmost importance. This is because cryptocurrencies behold the characteristics of how we define “international”. With recent advancements in technology, such as the extensive use of smartphones and the internet, the world is getting considerably more globalized by each day that passes. In relation to this, why is there not a global currency which is not riddled with the factors of political intervention? This is why we believe that this topic is most certainly relevant to research and discuss, as we believe that this is a topic that is going to be gaining signficiantly more traffic with time. Given the current political situation around the world, there is no doubt that there is a growing mistrust regarding political control. Therefore, a decentralized currency, which is not controlled by an authority or institution is quintessential in the current globalized development that we are experiencing.

Nonetheless, it is vital to discuss the environmental impact that the mining of cryptocurrencies has, particularly when discussing the "international" concept, as this is an issue that affects all nations. There are a large number of nations that have cracked down on Bitcoin mining. Which is the process that maintains the Bitcoin network and enables the network's present users to extract any utility from it. There have been a multitude of instances in which Bitcoin mining has occurred in countries where the mining was not viable. Due to environmental concerns, these nations have enacted rules and legislation that either prohibit or restrict the mining of cryptocurrencies.

Regarding the concept of "internationalism," however, how much CO2 is produced by maintaining the present value of several currencies, such as the US dollar? This is a relevant question, but the subject is far too wide to be handled in this introspective discussion paper. Regardless, it is a pertinent topic to raise in order to elicit subjective perspectives on the matter, especially in regards to the topic “international”.

Both Tormod and I believe that international trends and forces are conducive to the success of cryptocurrencies. However, we cannot infer that Bitcoin will be the dominant cryptocurrency over an extended period of time. Nonetheless, we believe that Bitcoin has opened the eyes of a great number of people to the possibility of the blockchain and keeping transactions on a public ledger, which in no way gives anonymity to the user of the service that cryptocurrencies provide. In terms of monetary expansion and monetary politics, it is unquestionably evident, especially to Tormod and me, that the world will continue to develop in this manner. Notable economic heavyweights such as Charlie Munger and Warren Buffet have issued numerous warnings and compared the situation to "rat poison." Many might argue that these arguments are 'fair,' but when it comes to the notion of 'international,' we feel it to be the exact opposite.

Based on the research that Tormod and I have undertaken, it is rather evident that Bitcoin and other cryptocurrencies offer individuals who choose to utilize these networks the ability to protect and potentially raise the value of their current wealth. Even if we are not the “right” people to provide them with the framework of whether or not this will raise or diminish their wealth the long run, we can at least offer them with a framework for assessing their existing cryptocurrency ecosystem and market sentiment. We are confident that these decentralized currencies will retain their value, particularly in terms of the concept "international" in the

long run. Since the start of Bitcoin in 2008, the cryptocurrency business has been nothing but an enticing channel for talented intellectuals to become a part of (Arslanian & Fischer, 2019).

Given the current stream of talented people that are joining the ecosystem we are discussion, both Tormod and I believe that this stream will not be discontinued in the short term or the long term. This is a channel that provides people of all kinds of background with a vast amount of opportunity, and we certain that our research helps these individuals.

As aforementioned, the current political and economic situation sets the stage perfectly for a peer-to-peer electronic cash system to be introduced. The current global situation encompasses as to why we are in critical need of a monetary system which is not construed by politicians and central banks. Tormod and I cannot give an answer to whether or not cryptocurrencies are going to be widely adopted by the general population around the globe. Nonetheless, the purpose of our research is based on the fact that we believe that there is a inherent need for a monetary system that is not controlled by a centralized authority, such as a central bank. Our main reasoning for this statement has been mentioned previously in this discussion paper, we do however believe that it is essential to restate it. Political and economic control have been abandoned throughout the recent years. As economists, we have full understanding as to why the central bank of the United States of America had to implement quantitative easing, as well as a reduction in interest rates.

Tormod and I agree that the way forward, particularly with regard to the term "international," is to completely introduce and adopt the economic model behind decentralized currencies. This is due to the fact that it enables the residents of the world to protect their money, if their country is in a dire position, but it also diminishes the influence of the central banks and politicians worldwide.

We are well aware that the adoption rate of cryptocurrencies would take a considerable amount of time, but it would help and create more security for the world's citizens, as they would no longer have to worry about their domestic currencies suddenly decoupling completely, as they would always have a designated place to store their wealth in the event of massive political unrest.

In the event that politicians decide to entirely outlaw cryptocurrencies, will this create a safe atmosphere for the country's citizens? Tormod and I feel that this is a circumstance in which the residents of the country in question would conclude that there is more political unrest, due to their concern that the adoption of decentralized currencies would disrupt the country's current financial and monetary policies.

In conclusion, we believe that countries under the control of regimes, dictatorships, and those countries with a high level of political corruption deserve a potential "out"; by "out," we mean a way for them to convert their currency to a decentralized currency that could potentially provide both security and assurance. This is why both Tormod and I believe that this is a paramount topic to research, as we could potentially aid those of misfortune with some slight fortune.

Sources:

Arsi, S., Khelafi, S., Ghabri, Y., & Mzoughi, H. (2021). *Cryptocurrencies: Key Risks and Challenges*.

Arslanian, H. (2022). Bitcoin and Crypto Mining. *The Book of Crypto*, 259–276. https://doi.org/10.1007/978-3-030-97951-5_14

Nakamoto, S. (2008). Bitcoin: a Peer-to-Peer Electronic Cash System. In *bitcoin.org*. Retrieved from https://bitcoin.org/bitcoin.pdf

Arslanian, H., & Fischer, F. (2019). The Rise of Bitcoin. *The Future of Finance*, 95–111. https://doi.org/10.1007/978-3-030-14533-0_9

Discussion Paper

Master's Programme in Business Administration

Tormod B. Wang

All students enrolled in the Master's Programme in Business and Administration are obliged to submit a discussion paper in which they present their Master's Thesis and tie it to the concept of "international". I will assume that the council that governs the Master's programme in Business Administration is open to interpretations of this, and as such, I will write this discussion paper on the concepts of "international", that I am currently co-writing with Frikk H. Vermedal.

Discussing our master thesis relative to the concept of “international”

The master's thesis that I am writing alongside Frikk H. Vermedal and is being supervised by Ilan Alon introduces modern valuation techniques that attempt to correctly and fairly value Bitcoin. Frikk and I have both been told that this endeavor is "impossible" owing to the fact that cryptocurrencies do not offer us a cash flow. This point has been raised on multiple occasions due to the fact that well-known valuation methodologies in traditional finance do not adhere to the norm when applied to cryptocurrencies. This is due to the fact that no cryptocurrency creates a cash flow, not even Bitcoin. Therefore, traditional financial experts believe it is difficult, or even impossible, to assign a value to Bitcoin, as they argue that it provides zero value.

Frikk and I disagree with this evaluation due to the vast quantity of knowledge an information that can be acquired about cryptocurrencies, especially Bitcoin. The purpose of our master's thesis is to summarize the information and raw data that we have collectected, in order to forecast a fair value for Bitcoin today, the most prominent cryptocurrency that has maintained its dominance since its inception.

Discussion

“International” is without a doubt a quintessential discussion topic as of this day and age, and despite being a broad term, it relates rather nicely to the subject of cryptocurrencies. Frikk and I have chosen to write our thesis on this topic since cryptocurrencies are steadily gaining worldwide attention due to the benefits and characteristics of the issue in question, namely cryptocurrencies.

Frikk was the one to introduce the topic to me, and it has undoubtedly opened my eyes to the potential and the probability of the prevalence of cryptocurrencies in future. In my undertaking of this subject, I have realized that this industry most certainly will be a part of my future, and for that I am grateful. Additionally, these circumstance which I have been a witness of most certainly relates to the topics of trends in regards to the concept "international".

Throughout the last five months we have delved deep into the ecosystem of cryptocurrencies, and have realized as to why this decentralized currency carries a wide variety of positive characteristics. I have a come across a wide variety of situation in which cryptocurrencies have proven itself to be a worthwhile asset, which I previously would not have considered. The main reasoning may be because I have been through several valuation courses, and my initial skepticism arose as cryptocurrencies does not generate any positive cash flows, which is in direct contradiction to what I have been learned throughout my years of studying.

Regardless, my co-writer, Frikk H. Vermedal has been involved in the cryptocurrency ecosystem, especially Bitcoin, for several years, and as a result I have realized that this newly introduced virtual currency will have a drastic impact on the financial world as we know it.

I would first like to discuss the situation in Ukraine. Russia's invasion of Ukraine is unjustified, there is no doubt about that. In any case, I've witnessed a widespread embrace of cryptocurrency by both the Ukrainian people and their administration. When the country in question is facing an unfair military attack, it has been liberating to withness the opportunities that cryptocurrencies have created. If I am not mistaken, this is the first time in history, when the world is suffering such a wide variety of political and governmental difficulties, that any citizen on the planet can personally donate a sum of money, facilitated by the cross-border payment system provided by cryptocurrency. It is quite remarkable, especially in terms of "international" and "internationalism," that we can provide direct relief to a country in need, 24 hours a day, seven days a week, without relying on a bank or other intermediary (Nakamoto, 2008). I consider the technology that cryptocurrencies provide to be truly groundbreaking. However, it is understandable that this subject is being heavily scrutinized (Arslanian, 2022).

Regarding scrutiny, I believe it is pertinent to discuss the current scrutiny that cryptocurrencies, particularly Bitcoin, are facing. There are a substantial number of people who believe that the main aim of cryptocurrencies is to enable the transactions of those with malicious intents. However, research indicates the contrary, and as such, cryptocurrency transactions are mainly utilized to transact, preserve wealth, escape regimes and provide a net positive for the world as a whole (Nakamoto, 2008). It has been proved again and again that cryptocurrencies most certainly are not being utilized to facilitate an international drug trade, and that fiat currencies are the primordial antagonist in this scene (Glaser, Zimmermann, Haferkorn, Weber, & Siering, 2014).

Given the information mentioned above, I believe it is natural to anticipate that the acceptance of cryptocurrencies will not only continue to rise, but will surge once consumers and investors discover the full potential of cryptocurrencies. The maintenance of monetary and financial policy is currently the responsibility of our legislators and central banks. Obviously, this is a crucial aspect of maintaining a prosperous economy in any given nation. However, considering the current political unrest around the world, consider the scenario in the United States while Donald Trump was in office; individuals retaliated, causing grave concerns about the future of the United States and how the federal reserve (FED) operated.

Politicians and legislators must examine cryptocurrencies in order to ensure a regulated market, as the existing cryptocurrency market is undoubtedly unregulated due to the industry's decentralization. Nonetheless, it is crucial that this industry has the appropriate legislation and regulations in order to flourish, as it looks to be a requirement for numerous people around the world. Several nations are currently facing significant inflation, and the citizens of these nations need an alternative, which cryptocurrencies provide.

There are several examples of countries around the world in which their citizens have utilized the underlying technology of cryptocurrencies in order to create a safety net for themselves, so that they do not have to continuously worry that their wealth will be eradicated by their government or central bank. Venezuela has experencied this type of inflation; as a result, citiznes of venzuela have been eager to place their wealth in cryptocurrencies such as Bitcoin and Ethereum. The main reason being that they no longer trust the way their government is operated, and cryptocurrencies have allowed them to unwind this wariness. These characteriscis most certainly encompasses the concept of “internatonal”.

I do believe that it also is necessary to talk about the topic of globalization, which I believe is inherently relation to the topic “international”.

There is no doubt that globalization is accelerating with each passing day. Unquestionably, individuals around the globe are getting increasingly interconnected. As a result of growing globalization and the concept of "international," humans are becoming increasingly interconnected. We use the same social media channels, including Facebook, Instagram, YouTube, and TikTok. The proficiency of the global language, namely English, is rapidly increasing. We are simply sharing a greater deal of relationships and language. Currently, the only thing missing is a payment method that is recognizable to everyone. Although its adoption may take a considerable amount of time. Frikk and I both believe that the payment system will be a decentralized one, but not necessarily Bitcoin.

Cryptocurrencies elicit a massive political debate, which is understandable, but we continue to think that with the present political and economic mistrust that politicians and central banks are struggling with will set the stage for cryptocurrencies to thrive as a monetary system in the long term (Yeoh & Haynes, 2020). There are simply too many instances of global political disruptions that will foster the growth of a decentralized system, particularly a monetary one.

A decentralized political system is an entirely separate concept; yet, notable members of the cryptocurrency community, as well as the politic environment have brought it up. Incorporating such a system, however, would take an appalling amount of time, and I would suggest that it would not be possible due to the potential time consumption it would take to execute, as well as the political reprisal that would ensue if such a political approach were adopted. Nonetheless, it is an imperative argument to introduce in this discussion paper. I believe it is imperative due to the fact that it is likely that politicians around the globe are going to try to implement virtual currencies. However, they will not be able to make it a decentralized one due to the fact that they are the ones that would create it, which is completely asymmetrical relative to the cryptocurrency's community. Such a project is likely going to be scoffed at by the public, and is likely to fail, unless there are introduced severe measures in order for it to receive societal acceptance (Yeoh & Haynes, 2020).

Another interesting topic to talk about in light of the concept “international” is the evergrowing interest in reducing CO2 emissions . Cryptocurrencies have been received heavy scrutiny from economists, scientists, politicians and prominent figures all around the globe (Mora et al., 2018). This is due to the fact of the enermous energy use which cryptocurrencies require in order to sustain themselves. However, we are seeing a vast amount of cryptocurrency miners resorting to only use renewable energy such as wind and solar in order to power their mining rigs. There are also instances where miners have found ways to utilize the heat that these mining rigs produces. Take for example a cryptocurrency mining company in Norway which are using the excess heat to dry wood, which in turn makes the turnover time for the wood shorter (Mora et al., 2018).

It will become increasingly interesting to see how the international trends and factors affect the cryptocurrency industry in the long run, and I believe that cryptocurrencies are going to become increasingly relevant to this concept in the long run, and I am excited to see it all unfold in the years to come.

Sources:

Arslanian, H. (2022). Bitcoin and Crypto Mining. *The Book of Crypto*, 259–276. https://doi.org/10.1007/978-3-030-97951-5_14

Glaser, F., Zimmermann, K., Haferkorn, M., Weber, M. C., & Siering, M. (2014, April 15). Bitcoin - Asset or Currency? Revealing Users’ Hidden Intentions. Retrieved from papers.ssrn.com website: https://ssrn.com/abstract=2425247

Nakamoto, S. (2008). Bitcoin: a Peer-to-Peer Electronic Cash System. In *bitcoin.org*. Retrieved from https://bitcoin.org/bitcoin.pdf

Mora, C., Rollins, R. L., Taladay, K., Kantar, M. B., Chock, M. K., Shimada, M., & Franklin, E. C. (2018). Bitcoin emissions alone could push global warming above 2°C. *Nature Climate Change*, *8*(11), 931–933. https://doi.org/10.1038/s41558-018-0321-8

Yeoh, P., & Haynes, A. (2020). *CRYPTOCURRENCIES AND CRYPTOASSETS : regulatory and legal issues.* S.L.: Crc Press.