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Trust in Bitcoin as a store of value

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Abstract

Blockchain based cryptocurrencies have the potential to disrupt a number of industries and create significant economic surplus. During the past few years different cryptocurrencies have accumulated significant market values and have become a daily topic in business media. One of the fundamentals behind cryptocurrencies is the technology that is said to enable trust between users using technologies such as hash functions, blocks and digital signatures.

This work studies the biggest cryptocurrency Bitcoin and trust in this technology. Bitcoin is still a new innovation and people are divided on whether this cryptocurrency can disrupt the financial industry. Some experts have said Bitcoin is going to become a superior store of value in the future and change how the payment infrastructure works. For any of this to happen people need to first trust this new innovation. Trust is one of the most essential factors that affect the adoption of a new technology like Bitcoin**.** This paper will study Bitcoin in the framework of trust.

Bitcoin has been often compared to gold because it shares lot of same characteristics as this precious metal. Gold is often used as a store of value by investors and sovereign countries because of its independence from any centralized authority. In this paper we research trust in Bitcoin by studying its potential as a store of value. Goal is to research how much Bitcoin is trusted as store of value and compare this to gold.

This work starts with a literature review of the essential technology behind Bitcoin infrastructure. Then it moves on to defining store of value and studying how gold and Bitcoin share some of the same characteristics. After this the main theories of trust are presented. The primary data was collected from eight interviews with finance and Bitcoin experts. The information from the interviews and the literature is combined together in the discussion chapter where we conclude how much trust Bitcoin establishes as a store of value.

Results show us that Bitcoin’s core technology establishes robust trust. The reputation of Bitcoin and regulation of the third parties that facilitate the Bitcoin market place are considered insufficient. Bitcoin already has some use as a store of value although it is still a long way from having as much trust as gold. Bitcoin would become more trusted as a store of value if it would be regulated, trusted third parties with high reputation would enter the marketplace and some technical limitations would be solved.

Keywords: Bitcoin, trust, store of value, gold, cryptography, blockchain

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1. Introduction

Cryptocurrencies have created a lot of discussion led by the biggest crypto asset Bitcoin. Many have projected that these technological innovations could disrupt the financial systems that are known today (Tapscott & Tapscott, 2016). Albeit huge market values and almost daily discussion in the mainstream media, these blockchain based technologies deserve further research. Bitcoin's market value today (February 2018) stands at 180bn$, but still today there is no consensus of the true value (Li & Wang, 2017).

Cryptocurrencies such as Bitcoin are digital, decentralized currencies that are not backed by any 3rd party institution like a bank or government. Rapid rise of cryptocurrencies into the business world has raised a lot of discussion about their reliability, anonymity and fundamental value. These technologies are rapidly evolving and their future developments and use cases are difficult to predict. They withhold a lot of potential and can disrupt entire industries. Bitcoin has been said to replace or complement fiat currencies in the payment systems and to replace or complement gold as a monetary store of value. The accuracy of these predictions will rely on multiple factors including regulation and technical functionalities. Widespread adoption of these technologies, requires that the economy starts to trust these new innovations. This paper focuses on trust which is one of the most important factors that determine the adoption of a new innovation like Bitcoin.

1.1 Research objective and motivation

In our thesis we research how Bitcoin establishes trust as a store of value compared to gold. We approach this question by studying Bitcoin's potential as a store of value. Commodities, assets or money that have value and maintain it in the future without depreciating can be considered store of values. For example gold is hold in reserves mainly because it is a good store of value. It can be used for jewelry or for some electronic products but a large part of it is kept in reserves without any intention to use it for anything else. The reason why anyone would keep huge amounts of gold just lying around in a safe without actually using it for anything else is that people subjectively trust gold having value besides its utility purposes (Pfeffer, 2017). If Bitcoin's price stabilizes in

the future and it can establish a position as a reliable store of value, it is possible that sovereign nations and investors start to prefer it as a store of value instead of gold. Bitcoin is easier to store and move than gold which had market value of 7.8 trillion USD in August 2017 (Pfeffer, 2017).

The reason why we chose store of value as our use case for studying Bitcoin is the importance of trust. To regard something as a store of value, it requires robust trust. Having an object/invention/technology to have value, it needs to be trusted by its users. Trust has often been referenced as one of the most important influencers in interpersonal behavior (Golembiewksi, 1972). This same applies to using technological objects

The second reason for taking this approach is gold's considerable financial value and multiple comparisons between gold and Bitcoin made by academics and financial experts. Bitcoin and gold share a lot of similar characteristics that have inspired discussion around this comparison. Although Bitcoin was first presented as a peer-to-peer payment system, comparisons to gold have been on the rise. From the total value of all the gold (7.8 trillion USD) about 38% is just lying around in vaults thus used as a store of value. If Bitcoin were able to penetrate this market place it would have notable financial potential (Pfeffer, 2017).

Already in 1980 Nobel prize winner Eugene Fama portrayed in his paper "banking in the theory of finance" that in the future, the term money could be forgotten and governments would introduce a nominal commodity which doesn't have any intrinsic value or physical existence. Bitcoin is a digital currency with a database that records every transaction so its fairly close to the system Fama described even though its not government backed. Bitcoin makes it possible to send online payments safely from one party to another without the need of a financial institution. Currently if payments are processed through a financial institution a certain percentage of fraud is accepted and people have to trust the counterparty to a some extent (Nakamoto, 2008). Bitcoin is said to allow counterparties to make these transactions in a safe and cost efficient way.

In monetary systems banks have traditionally been the institutions to guarantee the value, thus have created the trust. Whenever banks fail, trust in the payment systems fail as well. Without central banks backing up a currency the currency has no value and with

unstable central banks their currencies tend to inflate as seen in many developing nations. With cryptocurrencies there is no institution such as a bank backing up its value, thus trust plays an essential role. Trust has been studied a lot and the literature in this field is extensive. Literature can also be found about financial institutions and systems; papers that study gold as store of value, and what is needed for some asset to be considered as a solid store of value. We add to this literature by studying how the characteristics of trust can be found in gold and compare Bitcoin in this same academic framework of trust.

Research question: How much does Bitcoin establish trust as a store of value compared to gold?

Sub research question 1: What factors establish trust in a technological innovation like Bitcoin?

Sub research question 2: Why is gold trusted as a store of value?

1.2. Structure

This thesis is divided in four sections. First section that includes chapters three and four covers the blockchain technology and its first use case; Bitcoin. The fundamentals of the technology are necessary to understand when discussing trust in Bitcoin. Bitcoin is based on complex cryptographic algorithms which are the foundation of the cryptocurrency. In order for the reader to get an overview of what cryptocurrencies and Bitcoin are, the technological functionalities are introduced in the beginning of the paper before anything else. To present the blockchain technology behind Bitcoin we use specific set of white papers and blog posts/forums from Bitcoin experts. The blockchain technology is evolving constantly and entire books have been dedicated to analysing the technology. The objective of this chapter or this thesis is not to study the smallest details and evolutions of the Bitcoin technology but to lay the foundation for analysing trust forming in Bitcoin. After the first section the reader should have an overview of Bitcoin and the technology behind it.

Second section consists of the fifth chapter where we present our chosen use case store of value. For an asset to be considered storing value, it first requires extensive trust which was the primary reason we took this approach in our paper. Being a store of value is also one prominent use case of Bitcoin if measured in financial value and therefore it deserves further research. Gold is currently the most used non sovereign store of value. Bitcoin shares a lot of the same characteristics as gold and is often referred to as digital gold. This is the reason why we are comparing gold and Bitcoin as store of values. Also large part of the value of these two assets is based on subjective trust which is the other reason why this comparison was made. In this chapter we explore what store of value actually means in an academic context. In order to better understand why gold enjoys such a potent trust it is necessary to go through the history of gold. Finally gold's and Bitcoin's current situations as store of values are presented. This is done to illustrate how the literature presents the store of value properties of these two assets. This section uses white papers and established financial newspapers.

Our third section will cover theory of trust and in this section we will rely exclusively on peer-reviewed white papers and this consists of chapter six. The findings made in this chapter are later used to investigate how Bitcoin and gold establish trust as store of values. Most of the value that these two assets possess is based on people subjectively placing trust in them. We will use the theory of trust to build a framework where we will be able to see how gold establishes trust and compare how Bitcoin looks like in this same framework.

The fourth and final section consists of our interviews and analysis section. This section includes chapters seven, eight and nine. The seventh chapter consists of our interviews with industry experts. The interviews are used to regard various perspectives about Bitcoin and essentially see how they currently detect the composing of trust in this technology. The objective of these interviews is to support our theoretical analysis and to see if professionals comply with the findings made in the previous chapters. Interviewees were grouped in two categories; Bitcoin entrepreneurs and finance professionals. This grouping was done in order get two point of views from the two most important groups who work with gold and Bitcoin. Finance professionals were interviewed because of their knowledge about currencies, store of values and financial markets. Bitcoin entrepreneurs

were interviewed because of their knowledge in Bitcoin and the field of cryptocurrencies. The goal of these interviews is to see how these two groups of major stakeholders see Bitcoin and if these views are in line with the theories presented in previous chapters.

The eighth chapter withholds our analysis where we analyse the theory and data collected. The point of this chapter is to combine the theory and interviews presented before. After this chapter the reader should have a comprehensive picture of how trust is established in Bitcoin and how it presents itself as a store of value compared to gold.

Our ninth and final chapter will present the conclusion of this thesis and suggestions for further research along with limitations of the study. Below you can see a graph of the thesis structure.

Table 1 Thesis structure

	Section 1	**Section 2**	**Section 3**	**Section 4**
	Chapter 3 and 4	Chapter 5	Chapter 6	Chapter 7,8,9
Focus area	Blockchain technology and Bitcoin	Store of value, gold and Bitcoin	Theory of trust	Interviews, analysis, discussion and conclusion
Objective	Define blockchain and its main technological aspects	Define store of value and examine gold and Bitcoin under that scope	Research the theoretical landscape of trust. Build a framework of trust	Analyse primary data, analyse primary and secondary data

2. Methodology

“Science can be defined as a methodological and systematic approach to the acquisition of new knowledge” (Marczyk, DeMatteo, & Festinger, 2005, p.4).

This chapter presents our chosen scientific approach and our reasoning behind the made choices. With the chosen methods we aim to answer our research questions and sub research questions in the best way. Marczyk et al. (2005) present the fundamental building blocks of a scientific research. Although some variations may occur, according to Marczyk et al. (2005) the following principles are widely accepted; empirical approach, observations, questions, hypotheses, experiments, analyses, conclusions and replication. These principles were used as a guidance throughout our research.

Empirical approach

People in their everyday lives often reach conclusions based on opinions, speculation and a hope for the best. Empirical approach emphasizes the need to make decisions and conclusions based on data instead of feelings and hunches. In our research this meant to aim to analyse cryptocurrencies, trust and other concepts objectively without letting our own view on cryptocurrencies interfere.

Observations

Among other things observations refer to the process of making careful and accurate measurements during a research. This means avoiding making biased measurements based on the researchers world view for example. An important concept is “operational definition”, which means defining the concepts used in the context of the research. In our research question we have abstract concepts such as trust and store of value and in order to make accurate observations we needed to define trust and store of value. Operational definitions are important for replication and for the readers of the study to understand what exactly is the study about.

Questions

Before concluding on a research question it is crucial to think whether the question is answerable. It is important to consider whether the question can be answered using scientific methods and measurements. We tested our questions with sample hypothesis in order to test the validity of the question. Although we did not include any hypotheses in our research they proved to be a useful thought experiment to test the answerability of our research questions.

Hypotheses

Hypotheses is a educated guess about the answer of the research question, that can be tested.

Experiments

Experiment refers to the action of actually conducting the research study. In our research we collected both primary and secondary data to answer our research question. The data classes will be presented in chapter 2.2.

Analysis

Based on the scientific methods the carefully measured data needs to be analysed. In our qualitative study we transcribed, coded and analysed the interviews.

Conclusion

When writing conclusions it is important to make only conclusions that can be supported by the data analysis. Marczyk et al. (2005) considers this an extremely important one and calls it a “cardinal sin” to make conclusions that can not be backed up by collected data.

Replication

An important remark in scientific research is the ability to replicate a study. Findings from one study may merely be an error or aberration. To ensure replicability and the guidance provided by the presented principles we present our research philosophy and research design in detail in chapters 2.1 and 2.2.

2.1 Research philosophy and theory development

Saunders et al. (2016) says that the purpose of clarifying the writer's methodology is not to describe every methodological option available but to clarify the choices made in the research process. To demonstrate our research philosophy and research design choices, it is useful to observe figure x below. The research onion is a graph developed by Saunders et al. (2016) that demonstrates different stages in designing the research. We did not see useful to explain every single concept presented in the graph but we will go through each decision we made with comparing to one other concept in the same stage. For full explanations see Saunders, Lewis and Thornhill (2016).

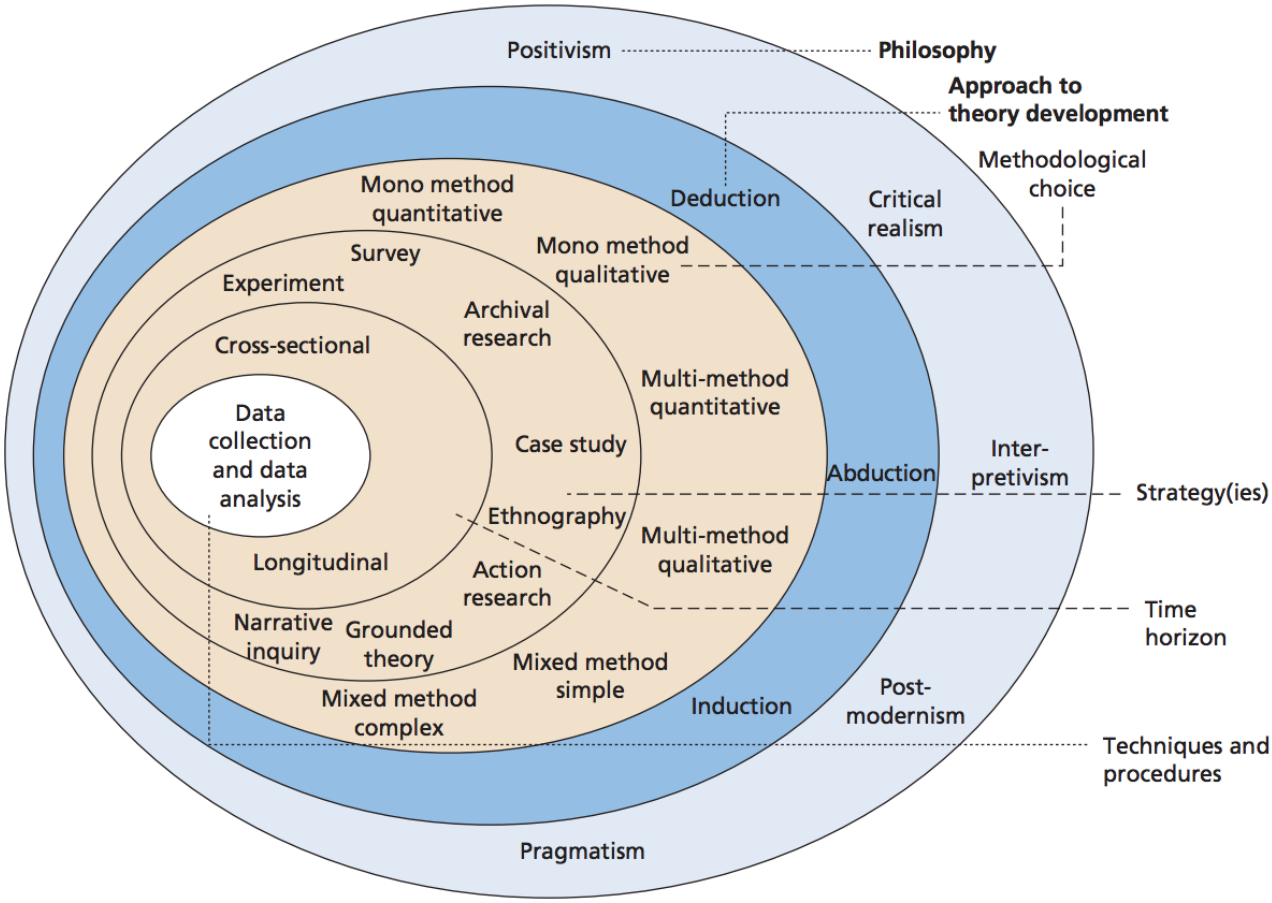


Figure 1 Research onion (Saunders et al., 2016)

The rest of the chapter will present our choices regarding each layer; research philosophy, approach to theory development, methodological choice, research strategies, time horizon and techniques and procedures.

The research philosophy describes the basic worldview of the writers of the research and it refers to a the assumptions and beliefs about the development of knowledge (Saunders et al., 2016). Our research philosophy is closest to interpretivism. In contrary to positivism where the focus is more on information that is considered to be uninfluenced by human interaction, interpretivism approaches information to be very socially constructed and context dependent (Saunders et al., 2016). And extreme positivist would see organisations and other social entities the same as physical objects, whereas we see them as more complex constructions where different people with different backgrounds might interpret them differently. Saunders et al. (2016) classify typical methods of interpretivism being “typically inductive, small sample in depth investigations, qualitative methods of analysis, but a range of data can be interpreted”.

Our theory development indeed resembles more an inductive way than a deductive one. For deductive researches the focus is on more on causality, whereas an inductive approach focuses on researching a new phenomenon or an old one with a fresh perspective. Qualitative approaches are often associated with an inductive approach and quantitative methods with a deductive one. Saunders highlights that these are not determined rules or guidance that one needs to abide. These are rather generalisations and it is entirely possible to a deductive research to use qualitative methods. In our research we chose to approach our research question with qualitative methods.

2.2 Research design and strategy

The next stage in the research onion is to define the data collection technique. An important decision in research design is to choose between quantitative and qualitative research. As one of the most important concepts in our thesis is trust, which is a very abstract concept and measuring trust in a quantitative method can be very challenging, we chose to do a qualitative research. Kothari (2004) sees qualitative research to be suitable for studying various phenomena that cannot be measured directly by statistics. According to Kothari (2004) an investigation for human behavior is a setting where qualitative measures are often used. In our research where we study how much Bitcoin can establish trust as a store of value, we decided to rely on qualitative study, although we used some quantitative data as our secondary data. In our study we are studying

complex human behavioral issues, as the concept of money and value are all rather abstract concepts as we will see later in this thesis. Qualitative methods allows for the opportunity to construct a research that produces information and findings we could have not anticipated ourselves (Kuada, 2012). This point made by Kuada is important, as our interviewees possess extensive amounts of industry knowledge and we could not have anticipated their views on our subject. Our research follows a mono-method qualitative study as we chose to construct semi-structured interviews with two focus groups. The interviewees we chose for our interviews are presented in more detail in chapter seven, but our reasoning to choose semi-structured interviews is to be clarified. One commonly used classification between interview types is to divide interviews as either structured, semi-structured or unstructured interviews. In semi-structured interviews the researches have the themes they want to cover and maybe some key questions from each theme (Saunders et al., 2016). However, depending on the interviewee and his background, the use of questions and the emphasization between themes may wary. Although our interviewees in the two groups had similarities in their backgrounds, each of them had a different path to their current positions. Semi-structured approach was needed to allow flexibility in the interview process, which could help us find the beliefs and opinions of each of our interviewee.

Next we needed to think about our research purpose. Research can be designed to fulfill different purposes, and recognizing the purpose of this paper is an important step. The purpose can be evaluative, explanatory, descriptive or exploratory. It can also be some combination of these. Our research resembles a mix of exploratory and evaluative study. Exploratory studies can be used when studying a phenomena and the questions involved are mostly open ended questions that often begin with “what” or “how”. In an exploratory research the usually unstructured interviews rely on the quality of the interviewees and the quality of the output received from these interviews (Saunders et al., 2016). In addition to a exploratory purpose our research resembles an evaluative one as well. Evaluative studies can be used when studying how well something works. In our main research question “how much Bitcoin establishes trust as a store of value compared to gold” both evaluative and exploratory purposes are present.

The common use of different types of interviews with different research purposes can be seen in the graph below (Saunders et al., 2016).

	Exploratory	Descriptive	Explanatory	Evaluative
Structured		✓✓	✓	✓
Semi-structured	✓		✓✓	✓✓
Unstructured	✓✓			✓

Figure 2 Types of interviews & Research purposes(Saunders et al., 2016)

The graph shows that our choice of semi-structured interviews is often used with studies that are exploratory and evaluative of nature.

Next we need to define a research strategy, which is the decision of how we plan to achieve our goals. According to Denzin and Lincoln (2011) research strategy is the methodological link that connects philosophy of the writer and subsequent choices of research methods. Any specific research strategy should not be seen superior to any other according Saunders et al. (2016). They emphasize that the main objective in selecting research strategies is to achieve some consistency in the research design in order to answer the research questions as well as possible.

Our research strategies are a mix of the two strategies the first being archival research, which constitutes to searching online documents, blogs and research papers. The trend of digitalisation has increased data available online. Governmental, university-based, and other documents are now available online from around the world. This is an important strategy to adopt as we are studying Bitcoin that has evolved in online discussion, forums and blogs. These data sources that in our research are classified as secondary data will be presented later in this chapter. Second strategy we are using from Saunders et al. (2016) classifications is case study, which can be defined as a research that is used when the the phenomenon being studied and the context within which is is being studied can have mercurial boundaries (Yin, 2014).

Time horizon for our study, is cross sectional instead of longitudinal. The interviews conducted were conducted during April 2018 and no follow-up interviews were done to see how their views have changed. However, it is to be noted that during the interviews different stages of time were discussed. The table below illustrates our main choices made regarding our research design and strategy.

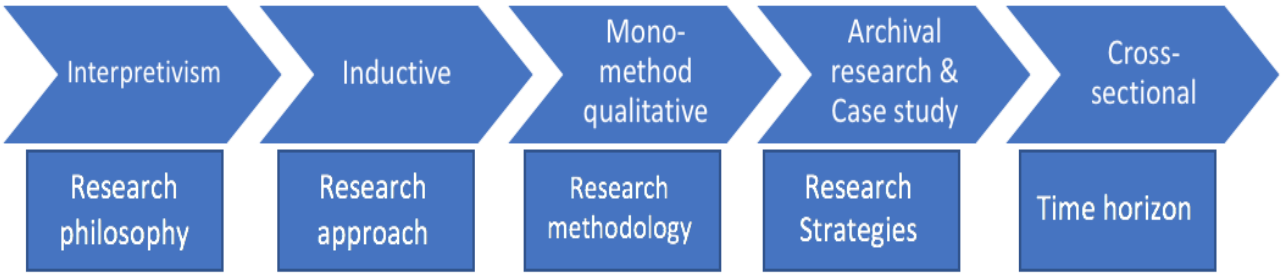


Figure 3 Research design

In our thesis we used several sources of data and it is called for to present these data sources. Our primary data consisted of eight interviews with four Bitcoin entrepreneurs and four finance professionals. These interviews lasted from 30 to 70 minutes and were done in April 2018. Seven of the interviews were conducted in-person and one over Skype. All interviews were recorded and transcribed. These interviews are analysed thoroughly in chapter seven as we could not add the interview transcriptions due to sensitive information revealed in the interviews, this issue is explained further in chapter seven. In addition to primary data we used books, articles, online sources and cryptocurrency blogs as our secondary sources. The cryptocurrency blogs we used were recommended by one of our Bitcoin entrepreneur interviewees which is why we considered them relevant information sources. In addition we used a few confidential papers that we received from our interviewees. In the table below we demonstrated what data sources were used to cover each of our main topics.

Table 2 Data sources

Topic	Primary Data	Secondary Data
Blockchain technology and Bitcoin		Articles, books and cryptocurrency blogs
Store of value	Interviews	Articles, books and online sources
Theory of trust		Articles and books
Trust in Bitcoin and gold as store of values	Interviews	Books, articles and online sources

3. Technical background

This chapter introduces the basic technical functionalities behind Bitcoin. The technical foundation was first laid in 2008 by an unknown man/woman/group called Satoshi Nakamoto. In his paper “Bitcoin: A Peer-to-Peer Electronic Cash System” he describes digital signatures, blockchain and proof of work consensus mechanism (Nakamoto, 2008). Although these innovations existed in some form before Nakamoto’s paper, he/she was the first one to combine these methods in such way. These functionalities are all based on cryptography which is the building block of blockchain technology. Fundamental technologies behind blockchain based cryptocurrencies are essential to understand when reading this paper further.

3.1 Cryptography

Security behind Bitcoin is closely linked to cryptographic algorithms thus the name cryptocurrencies (Dwyer, 2014). These algorithms for example prevent users from spending twice the same coins or make sure that the privacy of all the counterparties is protected. “Cryptography is the practice and study of techniques for secure communication in the presence of this parties called adversaries” (Waghmare, Sikhwal, Nimje, & Pawar, 2017, p.1*)*. This means studying and developing protocols that prevents an unwanted third party from intercepting private communication. Waghmare et al. (2017, p.1) continue in their paper “various aspects in information security such as data confidentiality, data integrity, authentication and non-repudiation are central to modern cryptography”. All of these aspects are present in Bitcoin. First this chapter introduces hashing which is the basis of almost all cryptography. Then it moves on to the blockchain which is the immutable transaction ledger behind Bitcoin. After presenting the transaction ledger this chapter introduces public and private keys. Every time users want to send transactions to blockchain they use private and public keys and each transaction include signatures that makes it possible to identify and verify users in the blockchain. Finally this chapter clarifies the concept of distributed consensus which makes sure that the data in the blockchain is correct.

3.11 Hashing

Point of hash functions is to conceal data that shouldn't be available for everyone and make sure that the blockchain is immutable. Hash functions generally take an input data of any length and return certain type of data determined by a mathematical function "h" (Rudlang, 2017). For example a hash function could take a string of any length as an input and return a string of predetermined length determined by the deterministic function "h". There are many different types of hashing algorithms for different purposes. Bitcoin uses a hashing algorithm called SHA-256 that takes any type of string as an input but returns a hash of a predetermined length (Rosic, 2017). Below is an example of SHA-256 hash when input string is "abc":

Input: abc

SHA-256 hash:
9e83e05bbf9b5db17ac0deec3b7ce6cba983f6dc50531c7a919f28d5fb3696c3

Changing the input, by even one letter or number can change the hash entirely. Cryptographic hash functions have certain requirements so that they would work as intended. Following properties of a hash function "h" are being introduced by Merkle (1990):

- The principles of hash function h should be publicly known so everyone can run it with same results
- The input data X can be of any length but the length of the result h(X) is fixed. The result comes from hashing the input data X with the hashing function h
- If we know h and X the result h(X) should be easy to calculate
- Hash functions should be one way. What that means is that if we know a result Y that was hashed with h it is hard/impossible to find a input data X that would result to h(X)=Y. Also if we know h(X) it should be hard/impossible to find a input data X* that would result to h(X*)=h(X)
- Hash functions should be collision resistant which means that it is hard/impossible to find to different inputs which have same results when hashed.
- Rosic (2007) also adds that small changes in the input X should change the result h(x) significantly.

Building a strong and secure hash function is difficult even though the basic principles of hashing are relatively easy to understand. Computers are able to brute force many of the hashing algorithms which makes developing a secure one hard. Brute forcing means that a computer tries different combinations by finally finding the correct input or output. Although no hashing algorithm is 100% secure, an attack on Bitcoin is made so costly that no individual or group should have incentives to do that.

3.12 Blockchain

It is possible to hash the input X multiple times which results to a hash list. This makes it possible to use the same input data in multiple different occasions without revealing its content (Rudlang, 2017). Blockchain is fundamentally based on a hashed list. For example if the same input X is hashed three times the output looks like the one below:

$$h(h(h(X)))=h^3(X)$$

Blockchain is essentially a database that contains records called blocks. Each block contains a header, a hash pointer to the previous block, transactions/records and a merkle root (Rudlang, 2017). Transactions can be for examples requests to move certain amount of Bitcoins from Bob to Alex or they can be records of account balances. All the blocks in the chain are linked to each other with pointers. Pointers contain addresses of other variables and in Bitcoin's case the pointer contain the address of the previous block. In the blockchain all the blocks have hashed pointers to the previous block's. This is where the hashed list introduced comes into play. For example the first blocks header is chosen randomly but the header of the second block contains a hashed pointer to the first block's header. The third block again contains a hashed pointer to the second block's header and a hashed list is formed. Below is an example of a blockchain structure:

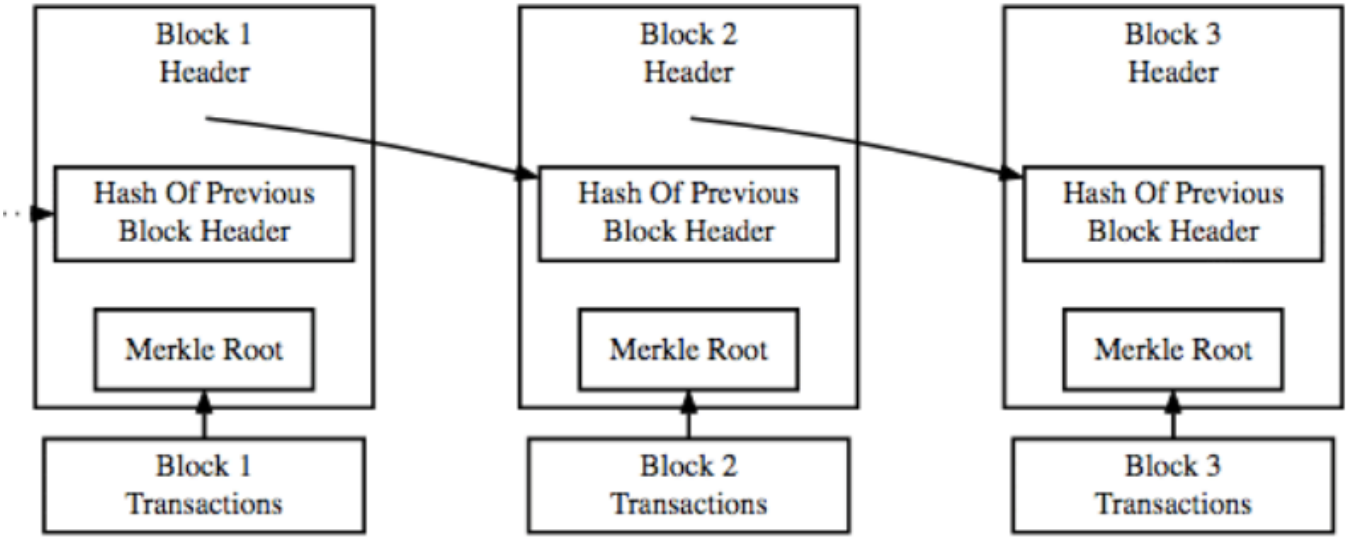


Figure 4 Blockchain (Rosic, 2017)

Like we saw previously even a small change in the input X changes the hash output entirely which is the reason why it is hard to tamper with the data in blockchain. For example if I wanted to tamper with the data in block number one that would result the hashes of all the next blocks changing. Small changes alter the hashes of next blocks, which is why tampering with the blockchain is difficult. This means that when a community has validated a certain block it becomes immutable and all the network administrators save this latest version of the chain to their computers. For example if the validated block had a transaction of Bob sending 20 Bitcoins from an account that originally had 50 coins, this state is saved in the chain and Bob has a balance of 30 going forward. If someone tampers with the old blocks after they have been validated by the community, all the network administrators can see this since the chain that the malicious administrator tries to broadcast contains different hashes than the correct chain thus the network doesn't accept this chain In summary hashed lists makes tampering with the blockchain infeasible. Security of Bitcoin blockchain is discussed more in the next chapters.

3.13 Private and public key, digital signatures

Everytime someone wants to send coins to another person, they send a request to the blockchain. Normally this is done through a cryptocurrency exchange or a wallet since a

regular user doesn't have enough technical competence to access the network just by herself. After this the administrator/miner adds this request to the blockchain and the network votes to see if the record is actually correct. Sending and receiving transactions in the Bitcoin networks rely on private and public keys. When A sends a transaction to B, A actually sends it to B's public key with a digital signature.Signature is a hash of sender's public key, private key and the transaction message. The digital signature is included in the transaction and it is formed so that the recipient can check its validity by comparing the signature to the sender's public key. If they match, B can be sure that the transaction was actually sent from A and B can access the transaction with her own private key. Transactions that are send to B's public key can only be accessed with B's private key. Public key, private key and the signature authenticating the transaction are all mathematically related but solving someone's private key based on the public key is close to impossible (Coindesk, 2018).

The private key is a random integer between one and 10^77 and the user cannot choose what her private key looks like. The practically infinite number of private keys is one of the essential building blocks of technical trust in the network. If there would be a computer that could count one trillion private keys per second, it would take a million times the age of the universe to count them all (Apodaca, 2017)**.**

The graph below shows how Nakamoto imagined the flow of transactions. "We define an electronic coin as a chain of digital signatures. Each owner transfers the coin to the next by digitally signing a hash of the previous transaction and the public key of of the next owner and adding these to the end of the coin" (Nakamoto, 2008, p. 2).

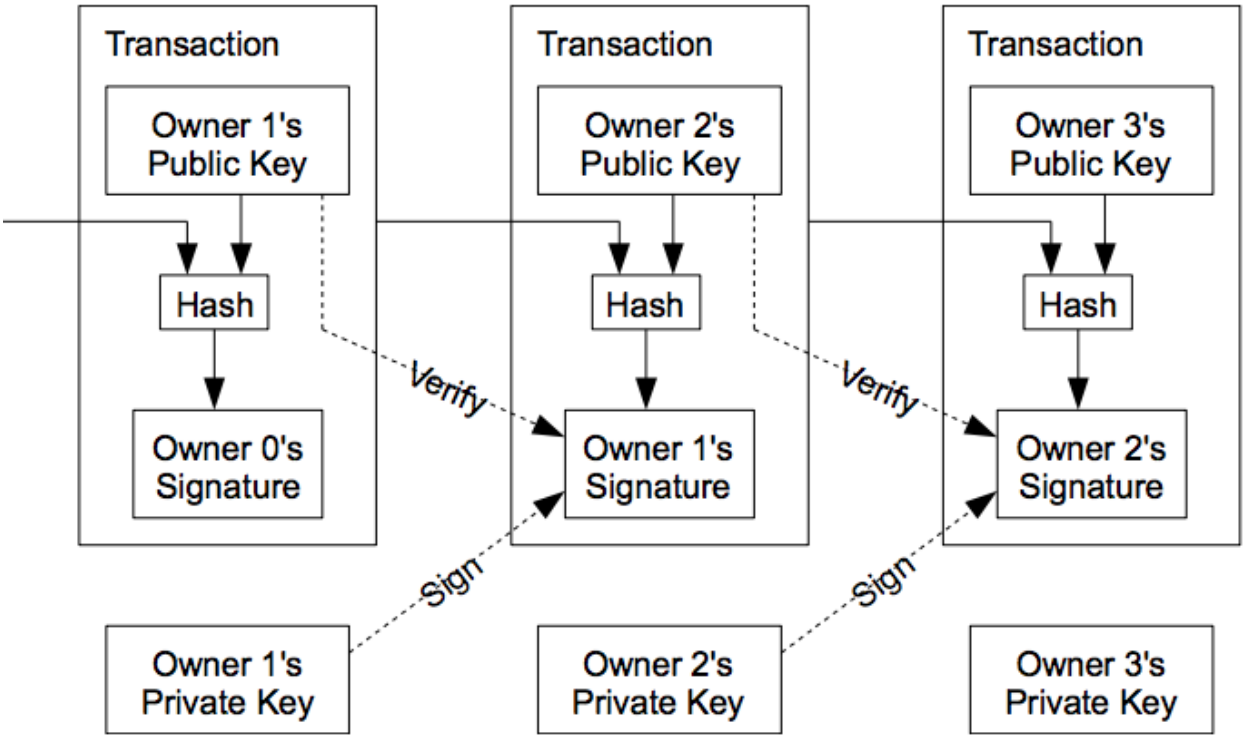


Figure 5 Flow of transactions (Nakamoto, 2008)

This method ensures that only the holder of the private key can send funds from her wallet.

3.2 Distributed consensus

One of the key functionalities of the blockchain is that the network and its users collectively agree about the information in the blockchain. Everytime someone adds something to the blockchain, the information has to be correct, otherwise it gets rejected by the community. For example it shouldn't be possible to transfer Bitcoins to someone else if your account balance is zero. Also the system should be built in the way that the administrators have no incentives to insert false data. Usually corporations have been the validator of information and kept the data stored in a centralised location. In the blockchain the information (blockchain) is stored by all the nodes in the network and can be downloaded by anyone. Nodes are the computers that verify all the information

inserted to blockchain. Nodes have various incentives to perform this activity and they are discussed further in the chapter dedicated to Bitcoin. As all the nodes have copies of the blockchain ledger, everyone needs to have a consensus about the information in the ledger in order for this method to work. If there are multiple versions of the true state about transactions, people lose trust in the system. Like seen in the previous chapter, a small change in the previous blocks might change the hashes of following blocks drastically. Since all the nodes have the blockchain saved they notice quickly if someone tampered with the previous blocks that are already approved by the network of nodes. There are several types of methods how this consensus is achieved, called consensus algorithms. Consensus algorithms ensure the validity of the blockchain and prevent any hacking attempts. Two of the most common consensus algorithms are proof of work and proof of stake. Bitcoin is using proof of work, but proof of stake is presented shortly for comparison as it is considered the second most used method. Lot of the new ICO's (initial coin offerings) use proof of stake (Castor, 2017).

Proof of work

In proof of work every computer/node that is tasked with the objective of maintaining the network (called miners in the Bitcoin network) compete to solve a mathematical problem. They are trying to find a hash of the previous block's header that returns a value of predetermined length. This is a process which requires large resources of computational power. When the solution is found, the transactions are added to the new block which the miner just found and the process repeats. The first one to solve the problem is rewarded a predetermined amount of Bitcoins. Then a new computational race begins as miners are competing to add the new block to the chain. If one miner goes rogue and tries to alter the transaction block for his benefit, other miners will not include that fraudulent block into the blockchain. The underlying principle is that it is expensive to add a new block of transactions to the blockchain, but verifying the correctness in previous blocks is made easy. Thus if a fraudulent block is added, the other miners will not add that block into their blockchain and the chain will continue with the correct transactions. All the miners have the correct chain saved in their computer so they can see if the hashes of the of previous already correctly voted blocks change. The reason why all the network administrators agree and verify if another miner solves the mathematical equation faster

than them is trust in the system. If miners would stop acknowledging the fastest solution, the chain wouldn't progress anymore and nobody could get their transactions approved. Administrators/miners normally have significant Bitcoin stakes of their own and if they would deviate from the rules, the value of the coin in question would decline and thus the same would happen to their own net worth (Rosic, 2018).

Proof of work is basically a one CPU one vote system (Nakamoto, 2008). It is possible that the blockchain diverges into two chains sometimes since information reaches miners at different times. These kind of situations only last for short times since one chain eventually becomes longer and all the miners devote their power into this longest chain. In order to "hijack" the blockchain a miner would need to possess 51% of the computational power in order to keep the fraudulent blocks in the blockchain. Even though someone might theoretically succeed in this extremely difficult task it would work against their benefit. Such a breach in the blockchain protocol would decrease significantly the trust in Bitcoin, hence it value would diminish and the assets they stole would be worthless.

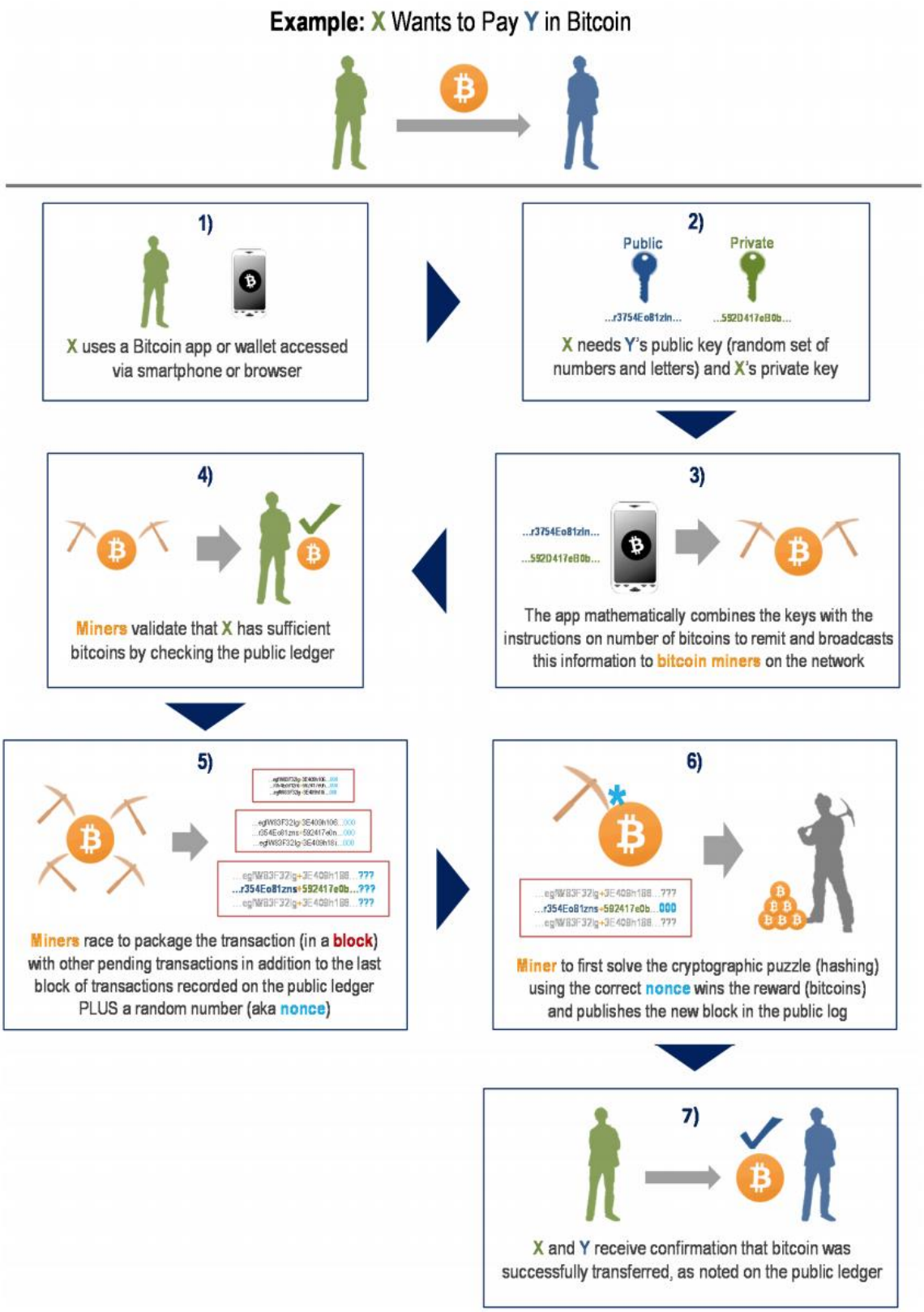
Proof of stake

Proof of work is currently highly energy consuming and inefficient method of maintaining the blockchain. Another proposed solution to keep the blockchain secure and operational is a method of proof of stake. Comparing to PoW where the hashrate (miner's computing power) determines the probability of how likely a miner is to add a block to the blockchain and earn the newly minted Bitcoins as a reward, in Proof of Stake it is determined by the miner's coin stake, which resembles a lottery. The "winner" is determined by chance, but the more coins a miner has the higher her probability. Compared to proof of work, this method is not relying on high levels of energy usage and one can act as miner without high computational power. Currently in order to be a Bitcoin miner one would need special chips designer for Bitcoin mining, as the standard chips are not efficient enough.

Both of these methods are consensus algorithms that aim to ensure the validity of the blockchain by maintaining a legitimate ledger of the occurred transactions. While the methods how the legitimacy of the blockchain can vary between cryptocurrencies they have the same fundamentals. The goal in different consensus algorithms is to reward

from honest behaviour and make the dishonest behavior difficult and financially unlucrative.

All of these building blocks of the technology result in a process that builds the security and anonymity of the system. Below is a graph constructed by the bank J.P Morgan in their research paper studying Bitcoin (J.P Morgan, 2018). The graph shows the role of the previously presented technologies and how they work with each other. It is a simplification of a basic transaction made between two people.



Source: J.P. Morgan

Figure 6 Basic Bitcoin transaction (J.P Morgan, 2018)

4. Bitcoin

This chapter presents the most popular use of the above mentioned technologies. Despite its young age Bitcoin has experienced a lot and discussion around its functionalities and overall future is diverse. J.P Morgan (2018) in their research paper identify few important factors that a cryptocurrency market needs to succeed. “In order for a cryptocurrency ecosystem to thrive, CCs (cryptocurrencies) must be created, stored, exchanged and processed. We divide these four tasks into four subsectors;

(1) Miners that create cryptocurrencies

(2) Wallets that store CCs;

(3) Exchanges that serve to trade CCs for other CCs or national currencies; and

(4) Processors that enable merchants to accept CCs as a payment tender” (J.P Morgan, 2018).

This chapter presents the first three tasks and the institutions involved in these procedures. The fourth subsector is not discussed further since the payment infrastructure is not the main focus of this paper. We start with an overview of Bitcoin and present few important concepts that are present in the rest of this research. Next Bitcoin’s history and some important milestones are presented. 3.3 presents the concept of digital wallets and exchanges that have evolved around the cryptocurrencies. Finally, the concept of Bitcoin mining is presented in its own subchapter as it is has an important role in the infrastructure and is relevant for the comparison with gold.

4.1 What is Bitcoin?

Bitcoin is the first decentralized peer-to-peer cryptocurrency founded in 2009. It’s main features are relatively secure payments, anonymity, irreversible low cost transactions and the limited supply of coins (Dinic, 2014). As the technical functionalities on which Bitcoin relies were presented in the earlier chapter this chapter focuses on the history, recent developments and main characteristics of Bitcoin. Bitcoin as a term means essentially two things: Bitcoin can refer to the Bitcoin-token which is a snippet of code that proves

ownership of the digital currency, Bitcoin can also refer to Bitcoin-protocol that maintains the open ledger that keep balances of the Bitcoins owned and the transactions made (Acheson, 2018). In this thesis we will use these terms consistently and will make clear the use of these terms if there is a risk of confusion.

Combining cryptography, hashing and digital signatures the way Nakamoto (2008) did, brings multiple intriguing characteristics to Bitcoin. Though it is often cited as a digital currency it differs in many ways from a traditional currency. Among other things it is decentralised, the supply is limited and once a transaction is made it is immutable (Acheson, 2018). With fiat currencies these characteristics do not exist in the same way. Fiat currencies are monitored and supplied by a third party, supply is theoretically unlimited depending on the monetary policy of the country, banks and governments can access bank accounts, freeze funds and make transactions invalid.

4.2 History and major developments

Although Bitcoin is considered a new innovation, it has been around in since 2008. Nakamoto published the Bitcoin white paper in 2008 to a mailing list about cryptography and on January 3rd 2009 the genesis block was mined. The first Bitcoin transaction happened 10 days later, when the pseudonym Nakamoto sent 10 Bitcoin tokens to a cryptography enthusiast Hal Finney. Finney mined few blocks himself as well and traded e-mails with Nakamoto reporting some early bugs in the blockchain. Early years of Bitcoin development were relying on interested voluntary participants such as Hal Finney and was relatively low volume business. First transaction that happened in the real world was a purchase for two pizzas. Those pizzas were worth 25$ and they were paid with 10,000 Bitcoins (Price, 2017) today priced at 100 million dollars. Lazley Hanyecz, a programmer and Bitcoin user posted on twitter that he would pay with 10 000 Bitcoins to anyone that would purchase and deliver him two pizzas. Someone accepted the offer and thus the first real world transaction with Bitcoins occurred. Similar stories are common in the history of Bitcoins as it was grown by individual developers who saw the technology intriguing.

Even though Bitcoin and the industry around it has evolved since, its main premise is still its lack of a third party controller. Maintaining the network relies on the developer community and active cryptocurrency enthusiasts. The fact that there is no third party backing up Bitcoin is perceived the very thing that makes it valuable and for some it is the factor that makes it unreliable.

One of the big promises of Bitcoin protocol is its security and unhackability. However, the reputation about a secure technology has experienced some bruises due to big exchange robberies. Mt. Gox is a Bitcoin exchange that operated between 2010-2014 and it was the target for one of the most famous robberies of Bitcoin tokens. Although the accurate description of what happened in the robbery remain somewhat unclear, all the signs are pointing that the blame was in Mt. Gox not the Bitcoin protocol itself (Norry, 2017; Bollock, 2018; Song, 2018).

More than 700,000 thousand Bitcoins were stolen and although circa 200,000 were later found, the majority remain lost. These Bitcoins were stolen over few years from Mt. Gox's online wallet where they stored their users private keys. As the wallet was compromised, the hackers were able to empty the accounts at the exchange. The incident gained a lot of publicity as around 70-80% of Bitcoin transactions were occurring via Mt.Gox. During february 2014 as the seriousness of the hack was revealing itself the Bitcoin price fell by almost 50% (Roberts, 2017).

Figure 7 Bitcoin price after Mt. Gox (Roberts, 2017)

Coincheck is another hack that gained a lot of media attention. The method is argued to be the same as with Mt.Gox in 2014 where the coins were stolen from the exchange's online wallet, although this time the hackers gained access to one wallet that stored a significant amount of cryptocurrencies. Even though Bitcoins were not the target of this attack, Bitcoin fell 3.4% after the hack was revealed. NEM, the cryptocurrency that was the target of the theft fell over 10% (BBC, 2018).

Though no straight attacks on the Bitcoin protocol have been successful, the lack of security of these exchanges raise concerns towards the functionality of the blockchain based cryptocurrencies. This can be seen by the decline in their valuation when these attacks happen. Notably, even though the coincheck attack was larger in value than the one back in 2014 with Mt.Gox, the valuation drop was not as drastic. The longer these cryptocurrencies exist the better they seem to be weathering the storms.

4.3 Exchanges and wallets

In addition to the blockchain technology and Bitcoin's history, the wallets and exchanges are an important part of the equation when studying how the public will trust Bitcoin. Digital wallets and exchanges are the touchpoint how majority of users interact with Bitcoin. Part of the popularity of Bitcoin can be attributed to the cryptocurrency exchanges (Decker & Wattenhofer, 2014). They allow the larger public to interact with cryptocurrencies which increases the value and functionality of these currencies. Exchanges also provide the current market value for a given cryptocurrency by keeping the trade books public and letting the market define a value for any given currency (Decker et al., 2014).

Cryptocurrency exchange acts a lot like a normal exchange. Exchanges allow the conversion between fiat currencies and different cryptocurrencies. When you operate with a cryptocurrency exchange you could lose part of the anonymity that is a key element of Bitcoin. Most of the exchanges or wallets require an individual's identification information in order for you to open an account. After this the third party service that you use has a clear record of the person owning the coins so part of the anonymity is lost. It is also possible to buy or sell Bitcoins without an intermediary but that would take a lot of technical knowledge of the Bitcoin ecosystem. This is the most secure way to stay anonyme but uncommon. Bitcoin protocol is very difficult to understand so it is easier to buy or sell coins with the help of a third party. Exchanges also sometimes work as a wallet and store the user's cryptocurrencies, but with less security than a digital wallet that specializes in keeping the funds secure. Both Mt.Gox and Coincheck were centralized exchanges that were later analysed to be poorly managed companies (Bollock, 2018). One of the key attributes of cryptocurrencies is their decentralized nature, thus their immutability, but these exchanges do not necessarily share the same

attributes. Mt.Gox for example, held the private keys in a “hot wallet” referring to its connection to the internet. As the hackers managed to hack this centralized database they were able to steal a substantial amount of Bitcoins. Exchanges are easy to access and makes operating on the blockchain easier and more efficient. Although when keeping the assets at a third party exchange, the user gives up lot of the security as the exchanges are not under any formal regulation. This is similar how a user trusts banks or stock exchanges with their dollars or holdings, but unlike the New York Stock Exchange that is regulated under the SEC (Securities and Exchange Commission), Mt.Gox and Coincheck were under no formal regulation. Although regulation is often deemed unwanted in the cryptocurrency field that trouts itself as Nakamoto (2008) said a trustless system, regulation and insurance would protect investors from similar thefts. In the case of Mt.Gox the investors had no institution to turn to and could only accept that their Bitcoin was stolen.

4.4 Regulation

Regulation around Bitcoin is not the focus of this thesis, nor will it be analysed in depth. However, a considerable discussion around Bitcoin and its future focuses around its regulation and a basic understanding of the current situation of regulation is needed in order to analyse the establishment of trust. Theoretically there can be three areas that could be regulated (Sotiropoulou & Guegan, 2017). The Bitcoin protocol itself, the uses of Bitcoin (such as selling, investing etc) or the people using Bitcoins. Regulation of the procol itself would be extremely difficult as there is no central authority maintaining or supervising the network. On the other hand regulating illegal uses of Bitcoin could be more achievable. In addition, regulation could have effect on the members of the Bitcoin exchange such as wallets and exchanges.

Sotiropolou et al. (2017) identify different factors that makes Bitcoin regulation challenging. Firstly, is the “definitional challenge”. Different countries classify Bitcoin differently. There is no consensus whether Bitcoin should be regulated as a investment asset or as a currency. France’s central bank declared it cannot be considered a currency under the current French law. There can be differences in regulation even within one country. In the United States the FINcen (financial crimes enforcement network) define cryptocurrencies as money whereas CFTC (commodity futures trading commision) define

cryptocurrencies as commodities, which brings confusion to Bitcoin users(Michaels, 2017; Cheng, 2018; McKenna 2017). Different definitions between authorities would mean different tax rates. Lately there have been attempts to coordinate the regulation in US, but for now different countries have different set of classifications for cryptocurrencies (Cheng, 2018).

Second challenge is the difficulty of regulating the use of Bitcoins. In a pseudonym network it can be difficult to accurately identify the true identity of the user, or that user's purpose in the system. Bitcoins have been used in illegal transactions for example when buying drugs. It used to be the primary currency used in an online black market site "silk road" due to the anonymity the technology provides.

If you enter the field of cryptocurrencies through an exchange or a wallet service they might need you to identify yourself. After this the third party has a record of everyone who own Bitcoins through their service. It is possible to regulate these third parties which again makes it possible to have less anonymity in Bitcoin network. One of the biggest crypto wallets coinbase just recently made a deal with the US tax authority IRS to release information about some of its users so the IRS could tax them properly for capital gains (Coinbase, 2018).

Thirdly, Bitcoin network's capability to potentially transfer money within seconds across national borders pose unique difficulties and these challenges are made even more complex due to the lack of unified regulation in this asset class. A final challenge identified by Sotiropolou et al. (2017) is about the decentralized nature of Bitcoin. Traditional regulatory models are fit to situations where a central authority is the target of the regulation. The decentralized nature of the network makes sanctions such as asset seizing more difficult. Currently in the cryptocurrency scheme the majority of digital wallets and exchanges that operate in the field have established themselves without any legal procedure that checks their authenticity.

The discussion around regulating Bitcoin remains vivid, as financial institutions and government authorities are thinking how to react to this rapidly evolving industry. Some argue that aggressive regulation would tamper down the benefits of the blockchain, and on the other hand examples such as the Mt. Gox theft have shown some weaknesses in

the lack of regulation as people were left with no insurance. In the future, regulation might evolve and be one of the factors determining the future of Bitcoin.

4.5 Mining

The voluntary coders that run the distributed Bitcoin network are often referenced as miners, and the work they do is called mining. The use of that word comes from the processes similarities to gold mining. Like gold exists underground, Bitcoin exists in the protocol. Mining both gold and Bitcoin requires effort and resources and eventually a limit will be met. Bitcoin's limit is set to 21 million Bitcoin-tokens and the limit is estimated to be achieved around 2140. Miners are rewarded with the newly minted Bitcoins for their work of maintaining the blockchain. This work includes creating blocks of validated transactions and adding them to the blockchain. Unlike in mining gold where mining refers to the resource being extracted from the ground, Bitcoin mining happens in the digital work. Miners complete to solve a mathematical problem and the fastest one to solve the function receives a predefined amount of Bitcoin tokens. As of March 2018 the block reward is 12.5 Bitcoin tokens that had the value of 115 000 USD in May 2018. In the protocol the block reward of mining halves every four years. However, the mining process is complex and resource consuming. The miners are trying to find a number that when combined with the data in the block and put through a hash function, results in a value that is within a certain range. The miners guess the unknown value, and combine the guessed value and the data in the block. They add the combination to the hash function and the resulting hash needs to have a certain amount of zeros in the beginning. The difficulty of the puzzle is adjusted (changing the number of zeros in the beginning) so that solving each hash takes about 10 minutes. This time frame was chosen by the community as they estimate this flow to be a reasonable flow of new Bitcoin-tokens released into the Bitcoin network. The problem is solved with a brute force method, meaning that the miner needs to try each value randomly before finding the right one. This process requires extensive computing power and resources and the competition among miners is becoming more and more competitive. The more computing power the miner possesses the more guesses he can perform in a second thus his probability of solving the hash improves. The second the miner solves the puzzle, he broadcasts the

solution to the network and gets the right to add the next block to the chain. Other miners will acknowledge this solution and move on to trying to mine the next block. The miner who solves the problem first gets the right to decide which transactions go in to the block.

Currently the Bitcoin block size has a limit of 1mb which means that it can only handle a certain amount of transactions. This might cause scalability problems in the future because if the user base increases rapidly the network might not be able to include enough transactions in the blocks and the time to process transactions grows significantly. Light nodes are being developed currently in order to solve this problem. Instead of nodes saving the whole chain, light nodes query parts of the chain from the full nodes. This would speed up the transactions and save storage since all the nodes didn't have to save the whole blockchain (Rudlang, 2017). Some of the Bitcoin experts claim that the light nodes will solve the scalability problem since it allows transactions to be confirmed very quickly.

It is possible to include transaction fees to incentivize miners to include your transaction to the block they mined. By including a transaction fee you can improve your chances of getting the transaction approved faster. Currently the miners require small fees in addition to the Bitcoins they receive from mining the block. This transaction fee might grow in the future when all the Bitcoins are closer to be mined since the miners won't receive the Bitcoins anymore from mining.

Since mining is done by solving algorithms utilizing huge amounts of computing power the proof of work consensus algorithm consumes a lot of energy. According to Digiconomist (2018) the energy consumption of Bitcoin is close to 66 TWh per year which is more than the country of New Zealand uses in a year. If Bitcoin is to grow and have a mass adoption this energy consumption would grow larger and have significant impact on climate change.

It is also possible that the miners and developers of a cryptocurrency don't agree on all the functionalities a coin should have. For example some of the miners in the Bitcoin community considered the scalability mentioned before a considerable problem and wanted to increase the Bitcoin block size to 8mb in order to include more transactions in

one block. In Bitcoin's case there were many these type of issues that eventually became too big for miners to agree on (Rosic, 2017). These disagreements resulted in soft and hard forks.

If miners don't come to a conclusion about which features should be removed or added to a coin, the situation might lead to a soft or hard fork. This means that the blockchain separates to different chains. The miners that agree on some features start to mine the other chain together and the miners that agree on the other features focus on the other. In a soft fork situation it is possible to use the existing chain with the old features while some of the users and miners use the new features. Rosic (2017) gives an example of a case where you have MS Excel 2005 in your computer and it is still possible to open spreadsheets that were built on MS Excel 2015. Although the updates that are available only on 2015 version can't be used in 2005 model. In a hard fork situation there is no possibility to go back to the old version if you decide to join the new one. This means that the two forks are completely separated and have different features that are not compatible with each other.

In August 2017 Bitcoin went through the type of hard fork explained before. This meant that some of the miners continued to mine the chain that is today known as Bitcoin and the other miners that didn't like the current Bitcoin infrastructure forked to mine a coin that is currently known as Bitcoin cash (Pfeffer, 2017). These type of forks can be complicated since they send mixed signals to coin holders if the core developers disagree on what should be included in the technology. If people don't know how the coin actually works because some of the miners promote different features, it can be difficult to comprehend**.** Normally all the current owners of the coin receive the same amount of the new coin that they currently have before the fork is born. Right after the hard fork you have the same balance of both coins. After that the protocols are different and the coins mined or bought only add to the particular coin.

In late 2017 Bitcoin has also experienced a few smaller hard forks known as Bitcoin gold (BTG) and SegWit2x (B2X). All the forks Bitcoin experienced in 2017 can be seen from the picture below. The green one in the middle is the original chain which trades under the ticker BTC.

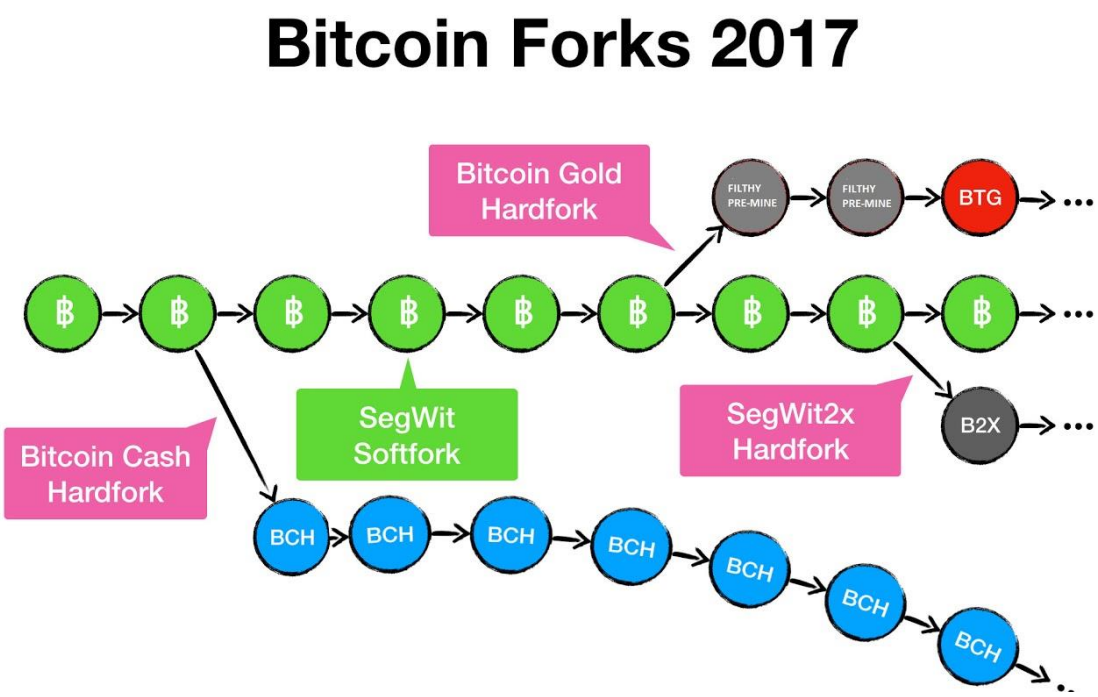


Figure 8 Bitcoin forks (Reddit, 2017)

Mining started out with personal computers and has slowly moved towards more and more efficient CPU's. Today, specifically for Bitcoin mining designed CPU's are sold and entire companies have evolved around Bitcoin mining. These specialized computers are called ASICs (application specific integration circuits) and nowadays it is practically impossible to mine Bitcoins without these type of machines. One of the things Bitcoin developers are afraid of is that the mining will be concentrated to only a few big mining rigs since it is economically more efficient to concentrate mining power under big rigs. Mining rig means that many computers operate under a one company to mine Bitcoins. The more hash power one rig has the more likely it is for them to solve the mathematical equation and win the next block. The hard fork that resulted in Bitcoin gold aims to solve this problem by offering an ASIC resistant protocol so the mining could be done without such a large investment. If mining can be done without huge rigs it is more likely that the mining will stay decentralized. As the mining industry gets more and more competitive and the Bitcoin reward for mining a block halves every four years, the lucrativity of mining depends largely on the value of a Bitcoin-token.

5. Store of value

5.1 Definition

Lowes, Davis and Pass (2015) define store of value in the following way “store of value is an attribute of money, enabling people to hold on to money to finance some future purchase of a product or asset without loss of purchasing power in the interim. More generally, any other asset that can be held and converted into money at the same price as its purchase price can serve as a store of value”. Commodities, assets or money that have value and maintain it in the future without depreciating can be considered store of values. Commodities such as gold are great store of values because they can be stored for almost forever without the asset losing its physical properties. On the other hand milk is an impractical store of value since it spoils in about a week even though stored properly in a fridge. Preserving wealth is essential for all the economies to run properly. People work and want to be rewarded by units that store value for future use. It should be possible at least to a some extent predict that these units have stable demand in the future. In most of the advanced economies the local currencies can be considered excellent store of values since they maintain value in the future and have great liquidity so they can be exchanged fast. On the other hand in worst case scenarios when the economy busts or the central bank prints excessive amounts of money, the value of local currency can depreciate fast. This effect is not uncommon and has been seen multiple times throughout history. Precious metals like gold are often great assets to hold their value when something unexpected and negative happen in an economy thus we analyse gold’s safe haven characteristic as part of its functionality as a store of value.

Before economies had assets that stored value for a long time, the value of an asset was derived directly from its utility. For example you could trade barley for strawberries because strawberries taste good. Of course this interaction is dependant on the fact that the person who is willing to trade barley for strawberries actually likes them. This “double coincidence of wants” is a rare occurrence in economies that produce specialised products (J.P Morgan, 2018). It is a problem if the other person is willing to trade strawberries for barley but can’t do the trade because the counterparty doesn’t enjoy the taste of strawberries. The counterparty could also have strawberries at the moment and is not willing to do the trade because she knows that they spoil faster than she has time

to eat them thus strawberries doesn't store value (Asmundson & Oner, 2012). Now the person specialized in collecting strawberries can't make the trade and receive barley because the needs of the counterparties don't meet at the moment.

Since strawberries seemed to be a insufficient as a store of value it is reasonable to research what makes a good store of value. According to Smith (2018) values of assets that make a good long term store of value tend to fluctuate quite strongly in a short term. Assets like stocks or real estate experience fairly large short term volatilities but in the long run tend to increase or at least maintain their value. The US dollar can be considered fairly bad store of value because it depreciates at the rate of inflation which tends to be close to 2 percent a year (Smith, 2018). Although U.S dollar depreciates, the statement that dollar is not a good store of value is not completely accurate since people know that their dollars should be depreciating at this rate which makes it predictable. For example U.S federal reserve clearly states their inflation target of 2 percent (FED, 2017). This makes it possible for people to predict how much they will be getting with their savings in the future. Predictability is one of the key factors when considering an asset that stores value. Even though almost all the local currencies experience inflation they are considered storing value (although fairly bad) because of this predictability and the fact that central bank supports the currencies they issue.

Even though currencies are sometimes used as a store of value, many are skeptical about central banks and their ability to control money supply. Investors and governments often turn to gold as an alternative store of value. Yermack (2013) points out that different kinds of fiat currencies have been around for thousands of years but almost all of them have become worthless and disappeared because governments printed money excessively due to strained finances. Investors' and governments' view towards fiat currencies doesn't even have to be very skeptic to justify use of gold since the hedging capabilities of gold against the dollar and inflation have been pointed out in many studies like for example Capie, Mills and Wood (2004) and Bampinas and Panagiotidis (2015). To illustrate the importance of gold, at the end of 2017 U.S government's total gold reserves were worth little bit over 350 billion (Fiscal Treasury, 2018).

Bitcoin is said to possess many of the same characteristics as gold; It is not backed by a government, it is mined the same way as gold, and has similar hedging capabilities. The

next two chapters studies further why gold and Bitcoin could be used as a store of values. The next chapter takes a look at gold and explains why investors and governments hold gold in such a large extent. Then it moves on to Bitcoin and studies why it has been speculated that Bitcoin could be a store of value as well.

5.2 Gold

5.2.1 History of gold

Former president and general of France Charles de Gaulle once said that “there can be no other standard than gold”. Gold indeed has a long history of being a commodity that is considered valuable. It is the most recognized valuable metal in human history (Bampinas et al., 2015).

First uses of gold date back to more than 6000 years ago (Dowd, 2016). It was discovered in streams and caught the attention of people because of its beauty. Until year 1500 BC gold was mainly utilized for jewellery and artifacts. Egypt was the first country to make gold an official medium of exchange when they created a shekel that had a standardized weight of 11.3 grams and could be used in payments. After this at many points in history different types of gold coins have been minted. At first in addition to the central authorities, people were able to mint homemade coins in many countries. This lead to a problem since homemade coins were easier to counterfeit (Dowd, 2016). It was also hard to standardize the coins used in payments since they were irregularly shaped. Problems with minted coins lead to adoption of paper money and fiat currencies. Countries wanted the paper money they issued to be backed by something real and tangible which gold was perfect for.

As seen above the problems with minted gold coins created a demand for alternative monetary system. This lead to a system known as the international gold standard. According to Cooper, Dornbusch and Hall (1982) the international gold standard dates back to 1870s. Even though the standard was abandoned during the two world wars it can be considered finally ending in 1971 (Dowd, 2016). Gold standard was defined by a famous American expert Arthur Bloomfield in the following way: “The national monetary unit was defined in terms of a given quantity of gold; the central bank or treasury stood ready to buy and sell gold at the resulting fixed price in terms of the national currency;

gold was freely coined and gold coins formed a significant part of the circulating medium; and gold could be freely exported and imported" (Bloomfield,1981, p.452). This was also supposed to enhance predictability since exchange rates between countries on the gold standard were closed to fixed. Exchange rates were fixed because if the rate between two countries changed too much from the equilibrium a possibility of gold arbitrage emerged (Cooper et al., 1982). This arbitrage possibility quickly stabilized the rates back to the fixed level. Point of this system was to limit inflation since countries could only print money as much as they had gold in their reserves. Under the gold standard strong inflation and hyperinflation were really not possible because money supply can only grow the same rate as the supply of gold. Mining of gold is a process that takes significant amounts of labor and time which limits the supply and makes it scarce. This reasoning is based on Quantity Theory of Money which according to Weber (2016) defines the inflation in the following way:

$$\Delta P = \Delta M - \Delta Y + \Delta V,$$

Formula 1 Quantity theory of money (Weber, 2016)

In the equation ΔP (the rate of inflation) has to equal ΔM (the rate of money growth) minus ΔY (the rate of real output growth) plus ΔV (the rate growth of velocity). Under the gold standard ΔM is limited to country's gold reserves. By the end of the nineteenth century almost all the developed countries had backed their currencies with gold thus joined the gold standard.

There are discussions about the price stability that can be achieved with the gold standard even though theory suggests fairly stable price levels. Cooper et al. (1982) illustrated that gold standard didn't really provide short or long run price stability. He arguments this by comparing the volatilities during and after the gold standard. On the other hand Lewis (2016) claims that academics often compare prices under the gold standard to modern consumer price index which is similar to comparing apples to oranges. Indexes like the modern consumer price index (CPI) didn't exist before 1919 so these types of comparisons are not useful to make. In the end Cooper concludes that instead of comparing prices under the gold standard to the CPI index we should compare them to commodities indexes since the price index before 1919 consisted of only

commodities. When doing so he found out that prices were more stable during the gold standard than today.

So why was the gold standard abandoned even though it seems at least to an extent being able to provide the function of price stability and prevent governments from printing money excessively. One reason is that gold standard is just a promise made to keep supply of money anchored to gold. If countries betray peoples trust and break this promise, the trust to the gold standard fades away too. Hartley (2014) gives an example how light this kind of promise was. In 1933 Roosevelt ordered to return all the coins and gold denominations that exceeded 100 dollars, back to the government. U.S government offered a fixed price of 20.67 dollars per ounce for all the gold coins that were called back. In a year after this the price of gold was increased to 35 dollars per ounce which obviously increased the worth of all the gold in Federal Reserve's balance sheet. Like seen before under the gold standard money supply is linked to the amount of gold in FED's balance sheet so now FED was able to increase the money supply excessively. Result of this was a considerable price inflation.

Other occasions where governments have diverted from the gold standard promise have been the two world wars. During the wars governments suspended the gold standard in order to print money and finance the military expenses. In addition to the lack of trust in gold standard, economist started to consider that government should be able to stabilize economic conditions with active monetary policy. Under the gold standard during recessions governments are not able to stimulate the economies by printing more money and on the other hand when economies are booming it is harder to shrink the money supply. In addition, gold standard has been speculated to limit the amount an economy can grow since if a country's production capacity increases, government could be unable to supply more money if the gold reserves doesn't pick up with the growth (Dowd, 2016).

After the second world war gold standard was implemented again in the Bretton Woods conference in 1944. It was organized in the way that US pegged its dollar to gold by offering a fixed price of 35 dollars per ounce and all the other International Monetary Fund members pegged their currencies to the dollar. In the following decades US was very active in financing global trade which eventually lead the States having a large external deficit. This meant that other sovereign countries had more dollars than US had

gold reserves. The back bone of the gold standard started to collapse since other countries didn't trust that US was able to convert their dollars to gold. This started a small panic since France, Italy and Netherland all wanted to convert a part of their dollars to gold at the same time (Schenk, 2013). Lack of trust in the system eventually lead to demonetization of gold and thus the end of gold standard. In 1971 USA announced that dollar can't be converted to gold any longer (Schenk, 2013).

5.2.2 Current use of gold

Since gold is not used as a basis for monetary system any longer, it is mainly used in jewellery, industrial products and as a store of value/investment by investors and sovereign countries. During the history of gold it has held its purchasing power fairly well in terms of goods which is the reason why it has established such robust trust. It is also often used as a hedge against other investments like equity and debt because of its low correlation to previously mentioned asset classes (Bredin, Conlon, & Poti, 2015).

Warren Buffett (2013) claims that gold is a huge favourite among investors that are fearful towards almost all the other asset classes and especially paper money. He acknowledges that gold has some decorative utility but doesn't favor the asset class himself since it doesn't have any intrinsic value. This means that if you own an ounce of gold now, you will still have the same amount in the future even though you would hold it for eternity. For example stocks can be considered having intrinsic value through the fact that they pay dividends and bonds having this same value because they pay interest rate. Buffett likes to own assets like stocks or bonds that have intrinsic value which is why he doesn't really invest in gold. He argues this with the statement that the only way to profit from investing in gold is to speculate that other people will be more fearful in the future than when you bought gold. When investors become more fearful, gold's price go up and you can pocket the difference so these profits can result only from speculation and not intrinsic value like dividends or interest rate, although gold has been an excellent investment after year 2000 as we can see from the picture below.

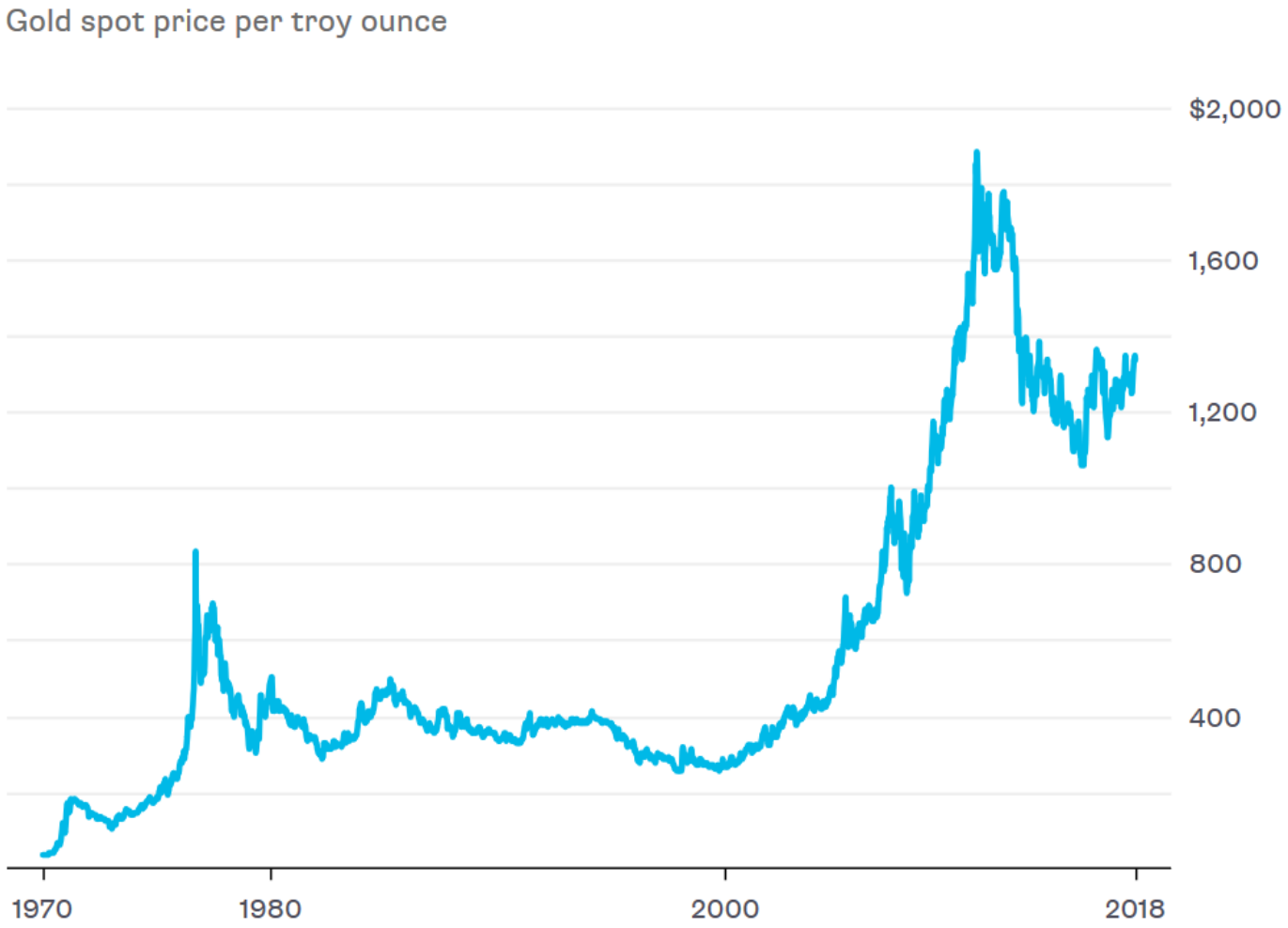


Figure 9 Gold spot price (Smith, 2018)

Even though Buffett doesn't prefer gold, it has been shown to be a good hedge against sudden negative events like the September 11, 2001 or the collapse of Lehman Brothers in 2008 (Baur & McDermott, 2015). Another reason why gold is so popular is simply that a lot of people still don't trust fiat currencies and think that gold will emerge as the global currency. They believe that payment systems as we know them today we'll collapse in the future and by buying gold they are hedging against this scenario. The fact that at the end of 2017 U.S government's total gold reserves were worth little bit over 335.5 billion USD proves that gold still establishes a lot of trust (Fiscal Treasury, 2018).

5.3 Bitcoin as a store of value

Like mentioned before in this paper Bitcoin is said to possess many of the same characteristics as gold; It is not backed by a government, it is mined the same way as gold so that any centralized party can't control its supply and it has similar hedging capabilities. This chapter draws on Bitcoin's history and technical details that were introduced in chapter four to study why Bitcoin could be a store of value like gold.

Bitcoin is a virtual currency with no centralized party who would be able to control its supply. Bitcoin's are mined by computer's that solve deterministic algorithms (see chapter four) and new blocks are created at almost constant time which is six per hour and one every ten minutes. It is decided that the creation of Bitcoins is reduced geometrically with 50% in every four years. All the Bitcoins that can be mined is set 21 million. From the cap of 21 million almost all the coins are mined in 2040 (ECB, 2012). After this the mining will continue approximately till 2140 although at a very slow pace. Below is a graph that illustrates the supply of Bitcoins.

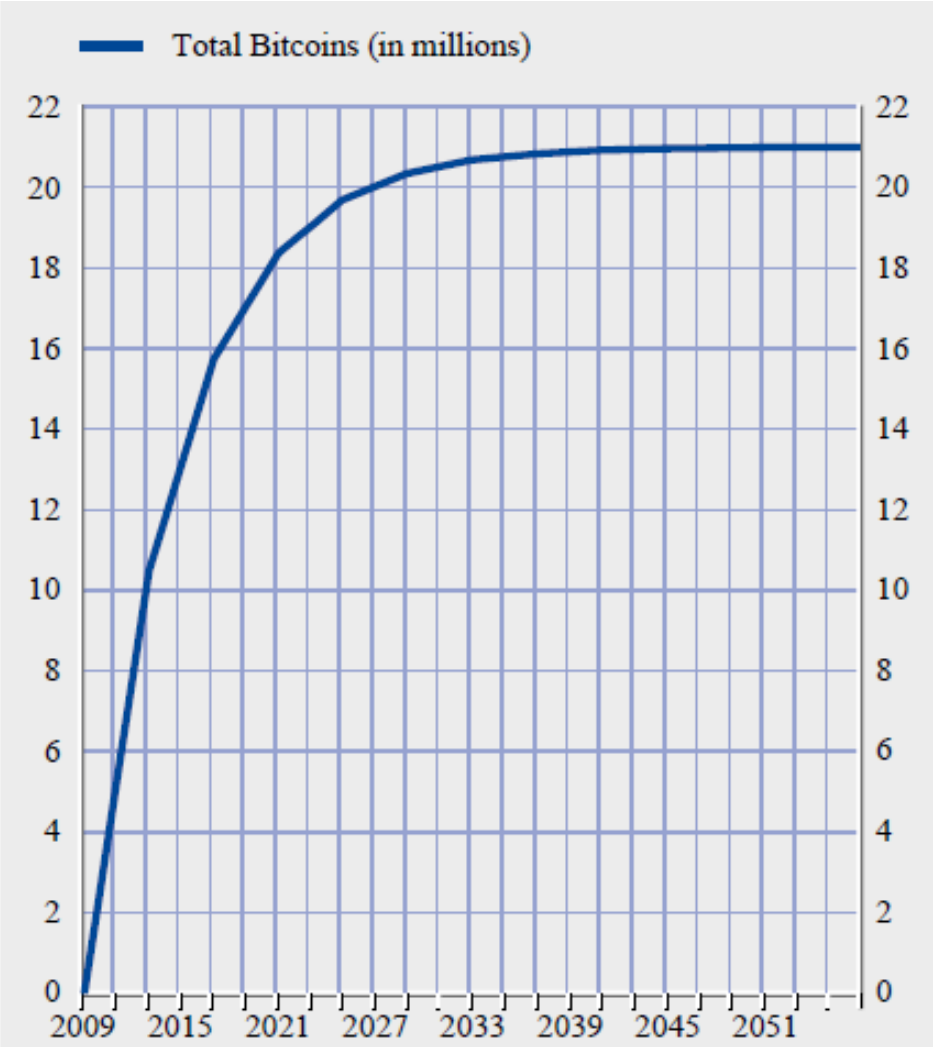


Figure 10 Total supply of Bitcoin (ECB, 2012)

The fact that the supply of Bitcoins is predictable and not controllable makes it relatively safe from inflation, according to the quantity theory of money that we saw in the previous chapter. This is a feature that could make Bitcoin a solid store of value in the future, since central banks are not able to inflate the currency's value. Lot of the fiat currencies in the history have gone pretty much worthless because governments have printed money excessively due to strained finances. However Bitcoin might suffer from deflation when all the 21 million Bitcoins are mined. If Bitcoin's user base grows fast when general public starts to trust and adopt this technology, currency can appreciate in relative to prices of goods in the long term. This will happen if the velocity of Bitcoins won't increase in proportion with the users. It would also require lot of goods to be priced in Bitcoins.

Other reason why Bitcoin could be seen similar to gold is its low correlation to other major asset classes. When stocks, bonds or real estate move up or down, gold usually stays fairly stable. Wu and Pandley (2014) found out in their research that Bitcoin possesses this same kind of low correlation to other major asset classes. They did this by comparing daily returns of Bitcoin with indexes constructed from stocks, bonds, real estate and commodities. They also compared volatility index (VIX) with Bitcoin but further explanation of this index is out of scope of this thesis. The sample period contained daily returns between July 2010 and December 2013. As we can see from their results below gold and Bitcoin have similar low correlations with other asset classes. Besides different asset classes, Wu and Pandley (2014) also compared returns of Bitcoin to other major currencies and got similar returns as below.

Table 2B: Correlations among Returns from Bitcoin, Major Asset Classes, and the Volatility Index

	Bitcoin	Stock Index	Bond Index	Real estate Index	Gold	Commodities Index
Stock index	0.07*					
Bond index	−0.04	−0.44**				
Real estate index	0.10**	0.84**	−0.21**			
Gold	0.07*	0.06	0.11**	0.06		
Commodities index	0.06	0.50**	−0.26**	0.39**	0.27**	
Volatility index (VIX)	−0.07*	−0.81**	0.36**	−0.68**	−0.10**	−0.39**

Notes: * and ** indicate statistical significance at 5% and 1% level, respectively.

Figure 11 Correlations of returns (Wu & Pandey, 2014)

Although Bitcoin has similarities to gold like mentioned before, Gurdgiev (2017) illustrated that Bitcoin's volatility is still very high compared to gold. This indicates that Bitcoin is currently too volatile to be considered a strong store of value. Below is the volatility comparison between gold and Bitcoin made by Gurdgiev (2017).

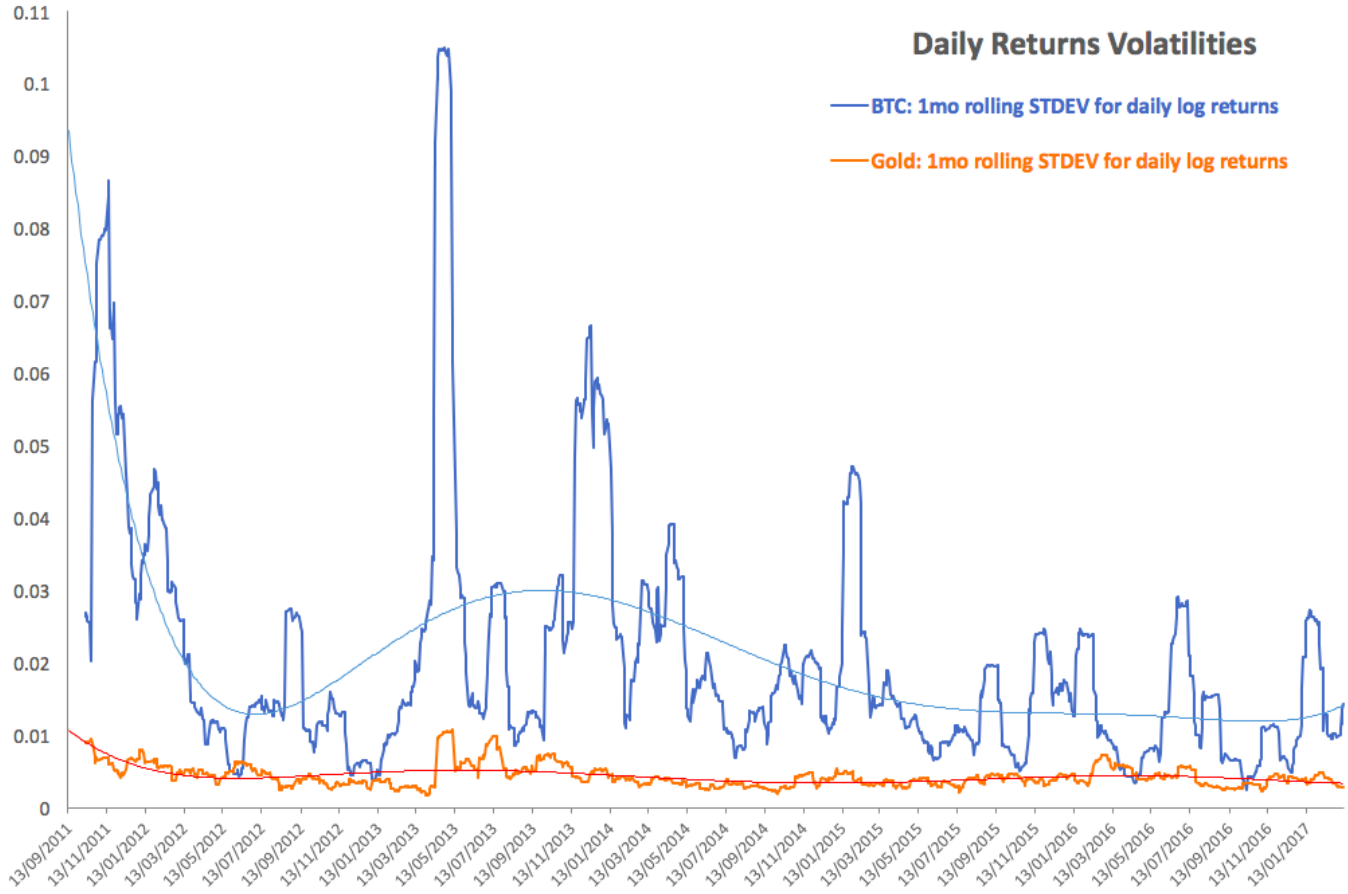


Figure 12 Daily return volatilities (Gurdgiev, 2017)

Finally blockchain is claimed to be immutable and secure ledger. This means that the record of you owning 1 Bitcoin should be there 10 or 20 years from now. If Bitcoin is to operate as a store of value in the future, it is necessary that owners are able to prove the ownership of their Bitcoins at any time. Like we saw in chapter four lot of Bitcoin's are stored currently in electronic wallets so the security aspect is not fully limited to the blockchain technology itself. It is possible that the blockchain technology itself is 100% secure but if the wallets experience security breaches, the Bitcoins disappear and the trust in the whole technology might deteriorate. Bitcoin has a strong claim to be a very secure ledger but it hasn't been really able to earn the trust of investors and sovereign countries yet. The extremely high volatility seen before illustrates that people are still very uncertain that this technology can deliver what it promises.

6. Theory of trust

Researches from multiple fields embrace the importance of trust. Trust is a widely studied concept across disciplines and has resulted in a diverse set of definitions and frameworks (Shultz, 2006; Kracher, Corritore, & Wiedenbeck, 2005). Researchers define trust differently depending on context. Despite the vast field of definitions Russeu, Sitkin, Burt and Camerer (1998) try to find a widely accepted meaning of trust that all the different disciplines could agree on. Drawing from his meta-analysis on trust research Russeu et al. (1998) defined trust as ".. a psychological state comprising the intention to accept vulnerability based upon positive expectation of the intention or behavior of another" (Russeu et al. 1998, p. 395). There has been a lot of discussion around Bitcoin and its technical functionalities, but the essential building block in widespread adoption is trust. In the UBS research paper (2016, p. 12) it is argued that "trust is one of the main prerequisites of a functioning society". They continue arguing that if people were completely and totally honest with each other banks would essentially be superfluous (UBS, 2016). Koehn (1996) argues that trust has economic value, because without trust there would be no exchange taking place and within successful e-commerce trust has been positioned as the most important element. This chapter starts with definitions of trust and presents how different academic disciplines see this widely acknowledged concept. Then we move to distinguish the differences in definitions between online and offline trust. Finally we build a framework of the essential characteristics of trust that help us compare how Bitcoin and gold establish trust as store of values.

6.1 Definitions of trust

Trust has been studied in various disciplinary fields in the course of history due to its relevance in human interaction, society, business and politics. Before exploring how trust is established in Bitcoin and gold, it is important to define what trust actually is. Trust literature is very widely spread and one universal definition hasn't been agreed on yet which is why this paper introduces several definitions made by different disciplines. All of these disciplines have slightly different approaches to trust. The reason why there is so many different views of trust is that it is quite abstract concept and often mixed up with

credibility, reliability or confidence (Wand & Emurian, 2004). Lewis & Weigert (1985) also points out that trust is multi-faceted which means that it is constructed from behavioural, emotional and cognitive parts. This means that a researcher usually needs to take a specific approach when studying trust. Because of this fact it is necessary to introduce how different major disciplines define trust. This paper doesn't try to define one universal definition of trust but instead draws on the definitions made by different disciplines. The reason for this approach is to build better understanding of trust. First this chapters opens up the four basic characteristics that define trust in general. The following three subchapters illustrates examples from three different schools namely psychology, philosophy and sociology.

6.1 1 Basic characteristics

Wang and Emurian (2004) define the following four as the basic characteristics of trust:

1. Trustor and trustee. All the situations of trust require some entity (trustor) to trust in something (trustee). These two parties can be persons, organisations, computers or products. This relationship of trust is built from the trustee's ability to behave in the best interest of the trustor and the level of trust the trustor gives to the trustee.
2. Vulnerability. Trust is not required in the relationship between two entities if it doesn't involve any vulnerability. Trustor needs to be exposed to a risk where the trustee is in control of something valuable to the trustor and there is a possibility that the trustee exploits this vulnerability. In other words trust requires risk and uncertainty.
3. Produced actions. Trust is followed by actions. This means that if trust is placed in something it is followed by a some type of action. The type of action is very much context based and can range from loaning money to riding a cab. Loaning money requires trust in the form that other person pays back the loan and riding a cab requires trusting the driver to drive safely.
4. Subjective matter. Individual characteristics and previous experiences have direct effect on trust. Some people trust more eagerly while others require a long time to establish trust. Trust is also dependant on the context so it might be established differently when the context changes.

6.1.2 Psychology

Psychology doesn't focus on looking for general definition of trust but instead studies the differences between contexts and individuals. Lewicki and Bunker (1995) points out that currently theories about trust made by psychologists are very fragmented without any effort to link them together. School of psychology acknowledges that trust is a very complex subject to study and it is often mixed with other concepts like altruism and cooperation. In early research of trust Rotter (1971) defines trust as an expectancy made by individuals or groups on how much verbal or written statement of another could be relied on. Even though research has gone further, this statement is still very much appraised. The split between verbal and written statements emphasize the importance of communication. This illustrates that the way something is said or presented can affect the level of trust. Rotter (1971) also indicates that trust is one of the fundamental building blocks of societies and how people interact with each other.

Probably the most cited model of trust was introduced by Shapiro, Sheppard, and Cheraskin (1992). They suggest that trust should be divided into three main types which are: Calculative based, knowledge based and identification based. First calculative trust is based on individual or group trying to predict and calculate how the trustee reacts to rewards and punishments. This type of trust is rational since it assumes individuals will react to rewards and punishments in a certain way. Secondly, knowledge trust is based on repetition and history. When you know that the object of trust reacts in a certain way in a certain situation, you base your trust in "knowing" what will happen. For example if you have not met the person you are interacting with before, you first start trusting by calculating how the person would behave. Then after several successful reference experiences you begin to know the person and base your trust more on the knowledge than on the calculation of all the possible aspects. In the third identification based trust both the trustor and the trustee have common goals and values so both of the parties trust the other to act according to these values. It is also pointed out that individuals differ in the way they trust other people. For example someone might need more time to give up the calculative based trust and start "knowingly" trust someone.

6.1.3 Philosophy

Compared to trust research in psychology, in the discipline of philosophy the goal is to understand the fundamental nature of trust. (Solomon & Flores, 2001). In this field philosophers try to understand the general meaning and types of trust instead of studying how different individuals trust. The essence of trust was contemplated already by the philosophers of the ancient Greece. Bailey (2002) claims that most of the philosophers in ancient Greece that studied trust tried to understand the fundamentals of human nature. The view of trust was very practical at that time which is illustrated by their notion that people trusted others only if they knew that the trustee feared punishment enough to prevent them from doing harm.

Currently Annette Baier can be considered one of the most influential people in modern understanding of trust in the context of philosophy. Baier (1986) claims trust as the "accepted vulnerability to another's possible but not expected ill will toward one''. She emphasizes that trust consists of three pieces (A trusts B with a valuable thing C). In this situation B has an ability to control the thing C and A has to trust and take a risk that B doesn't abuse this power. This fundamental of trust is then divided to the situations of moral and immoral trust.

Moral trust means that counterparties share the same motives and goals and thus trust each other to act in a certain manner because they share these values. On the other hand in immoral trust the motives and intentions of counterparties might differ but there are economic structures like punishments that maintain the trusting relationship. Moral and immoral trust are born under different conditions and thus require different definitions. Moral trust can be considered being very close to the identification based trust introduced in previous chapter and the immoral closer to the calculative based. Although it should be remarked that calculative trust is not necessarily immoral.

Koehn (1996) claims that Baiers definition of trust lacks clarity, since it is unclear who defines what is considered good will or ill towards one. If it is not clear in the beginning of the trust relationship what is considered good will, the relationship of trust might break in the future when these discrepancies emerge. For example A might trust B to clean the house but if cleaning the house means different things to A and B this trust won't last. Koehn (1996) suggests that pure trust should be defined as continuing good will since we

don’t expect that good will to happen in nanoseconds. This definition is better according to Koehn (1996) since it removes the unclarity of the good will because the relationship should last for the foreseeable future. This also puts responsibility to the parties to explain their good will in clear terms if they want to establish robust trust.

6.1.4 Sociology

Like in the previous two categories also sociological research agrees that trust can’t be defined by one general definition. Even though the literature in the discipline of sociology is fairly diverse, almost all think that trust is more or less defined in social relationships. One of the major notions of trust in this field is that people trust each other because the society runs better this way. Barber (1983) presented one of the most respected theories of trust in the field of sociology. He divides trust into three main categories which are: Continuity of natural order, technical competence of actors in roles and fiduciary obligations of actors. Continuity of natural order ensures that we have some things in life that we can take for granted. Like for example you trust that you can still use your credit card to buy goods tomorrow. Human’s have a tendency to create routines and reduce complexity. Life wouldn’t be manageable if you would have to analyse the trustworthiness of basic things every day, so we trust others in order to function as a society. The second category is technical competence which means that you trust in something because it can perform a certain function better than you. You trust a doctor to prescribe you the correct medicine or a plumber to clean your pipes. The last category fiduciary obligations of actors counts that in some situations other people put your interests before their own. For example it is assumed that politicians would put the interests of citizens before their own.

Sociologist usually make a division between personal trust and trust into a societal structure. Example of a societal structure could be money. When people trust money they don’t trust a single person but the whole societal structure of money. Trust in these type of structures could be considered to be the backbones of societies. Misztal (1996) has a very practical take on trust and claims that it is used mainly to enhance efficiency in society by making coordinated actions possible.

Game theory can be also considered a part of sociological research of trust. Game theory examines the actions of individuals and groups when punishments and rewards are involved. It assumes that individuals and groups choose the action that benefits them the

most and then it analyzes the effect of these decisions to the society. Problem with game theory has been the assumption that individuals and groups are rational decision makers and thus are able to weigh all the alternatives perfectly. In reality these decisions are sometimes made under a lot of uncertainty where it is hard to consider costs and benefits sufficiently.

6.2 Trust in online and offline context

Shankar, Urban and Sultan (2002) argue that offline and online trust differ slightly. The fundamental building blocks are the same, but some adjustments are called for when studying trust in an online setting (Wang et al. 2005). In an offline context the trustee is usually an organisation or a person and easily identifiable. In contrary in an online context the trust is targeted more towards the technology and the organisation behind the technology (Friedman, Kahn, & Howe, 2000)**.** Majority of the study of trust is done in an offline environment but Corritore et al. (2005) argue that the importance of trust is duplicated in an online environment. In online environments the truth is harder to reveal. Considering buying physical products with physical money, the buyer knows he is getting the products he wants and the seller knows he is getting the money right away. In an online setting there are delays in the exchange and the true identities are not revealed (can't see faces). Characteristic like these make online interaction more complex and more trust is needed for successful economic transactions. As Bitcoins are mainly used in an online environment we drew our framework from a paper that studies how trust is established online.

6.3 Comparative framework

(Friedman et.al Trust Online)

Friedman et al. (2000). analyse trust in an online setting. They present ten factors that help to analyse how agents can establish trust online. One of the reasons why we chose this paper for our trust framework is that Friedman et al. (2000) study trust in an online context and takes a specific approach on how people trust technology. In addition to introducing the standard definitions of trust from history, the paper by Friedman et al. (2000) acknowledge that online interactions represent a complex combination of humans

and technical systems. Since Bitcoin is a technical system involving human users we considered this approach great for analysing trust in Bitcoin. They also notice that trust is very hard to define by any single definition and thus propose ten separate factors that enhance trust in online setting. We noticed that trust is quite differently defined by philosophy, sociology and psychology which is why it would create more depth for our analysis to have concrete factors to measure trust with. From the ten factors presented by Friedman et al. (2000) we chose three dimensions to analyse trust in Bitcoin and gold. We combined anonymity and accountability under one dimension since we considered it beneficial. The more anonymity one has the less accountability and the other way around so we thought they could be researched together. All the ten factors presented in the paper by Friedman et al. (2000) can be seen in the picture below.

Table 3 Characteristics of trust (Friedman et al., 2000)

Characteristic of trust	**Chosen for the framework**
Reliability of the technology	Yes
Knowing what people online tend to do	No
Misleading language and images	No
Disagreement about what counts as harm	No
Informed consent	No
Anonymity	Yes
Accountability	Yes
Saliency of cues in the online environment	No
Insurance	No
Performance history and reputation	Yes

Since Bitcoin exists only in the virtual world and gold has a tangible form, it was difficult to find factors that we could use to compare these two. We chose only three factors from the ten presented in the paper because we considered that these would be the most relevant for our comparison in question. We didn't think that other factors like misleading language, images and saliency of cues in the online environment, knowing what people online tend to do or informed consent would be applicable to gold and thus wouldn't be informative for our comparison later in the thesis. Also some of the factors like insurance or disagreement about what counts as harm were close to anonymity and accountability so we didn't think including them would add any extra value. The three we finally chose were best to address both technological and non-technological objects. We chose reliability and security, performance history and reputation and lastly anonymity and accountability. These factors help us analyse Bitcoin and gold from different point of views. Bitcoin is often praised about its highly innovative and advanced technology, but trusting is more complex than only the functionality of the technology. Friedman et al. (2000) argue that even in a online setting people trust people, not only technology although the technological side can't be ignored. In our analysis we look into Bitcoin and gold from the three point of views and try to identify how trust is built towards these two assets.

The first observable dimension; reliability and security of the technology. Here we observe the underlying technology behind Bitcoin and compare this with gold. The analysis does not only limit to the Bitcoin protocol itself or in gold as physical metal. What needs to be observed as well are the members in the community, the third parties that facilitate the marketplace and the security of storing the asset. When assessing the security of Bitcoin, it is relevant to give attention to exchanges and wallets that are essential to the majority of the Bitcoin users. Even though gold is not exactly a technological innovation it is possible to evaluate the security of the third parties that facilitate the marketplace for gold and the security of storing physical gold.

Secondly performance history and reputation assess the problem in similar way. Both the reliability and history of Bitcoin protocol and its surrounding institutions are observed. This includes Bitcoin's valuation, which has fluctuated rather dramatically. In addition, this section observes how Bitcoin has been used throughout its history. The literature

review revealed a lot of writings how Bitcoin especially in its early days was used for illegal commerce such as drug dealing. With gold, gold standard and how gold has been valued in the past are of interest.

Finally, anonymity and accountability can be compared together. The more there is anonymity the less there is accountability and vice versa. In case of an accident or theft it is important for users to know what kind of compensation is promised. An individual is more willing to trust something if he knows that even in worst case scenarios her losses will be compensated. Anonymity is one of the key features of Bitcoin and in the framework it is researched what are the effect of this for trust.

Table 4 Comparative framework of trust

Dimension	**Disciplines and theories**
Reliability and security of the technology	Sociology (technical competence) Psychology (calculative based trust)
Performance history and reputation	Sociology (continuity of natural order) Psychology (calculative based trust, knowledge based trust, identification based trust)
Anonymity & Accountability	Psychology (calculative based trust, knowledge based trust, identification based trust) Sociology (fiduciary obligations of actors)

7. Interviewing stakeholders

This section compares the theoretical findings and frameworks with industry experts. Our interviewees come almost exclusively from Finland where both of the writers are from. In addition to experienced finance professionals and Bitcoin entrepreneurs from Finland we conducted one interviewee with a finance professional gone Bitcoin entrepreneur from Japan. The interviews were conducted to find out how experienced finance and cryptocurrency professionals see the state of Bitcoin at the moment and in the future. As a foundation for the interviews we used our literature review about Bitcoin and theory of trust. We formed our questions around themes that are based on the comparative framework presented in chapter six. In addition to the three dimensions in the framework, we discussed how each interviewee see Bitcoin in their own profession and work environment. However, our focus was to conduct semi-structured interviews, which meant that each interview had a slightly different emphasis depending where our respondents took the direction of the interviews. In all of our interviews the future use cases of Bitcoin came up which is why we considered relevant to add a future dimension to encapsulate what each of the interviewees said about Bitcoins future. All of our interviewees elaborated that important factor in their current trust in Bitcoin is its potential in the future which is why it came up so often. Despite different approaches and point of views our interviews brought up similar opinions from professionals across industries.

7.1 Interviewees

Eight interviews were conducted throughout April and May 2018. We interviewed people from mainly two groups and classified our interviewees as either Bitcoin entrepreneurs or finance professionals. This classification was done in order to get two different point of views. The prerequisite for our interviewees was a deep knowledge of either Bitcoin/blockchain or the financial markets including banking and investing. We chose these two groups because of our use case store of value. Currently the biggest owners of gold are investors and sovereign countries so finance professionals are an important group to interview for our use case. The finance executives were chosen in order to see

how Bitcoin is currently seen at the top of the financial organisations. Bitcoin entrepreneurs on the other hand were chosen because of their extensive experience with Bitcoin. We wanted to see if there is a gap on how these two major group of stakeholders see Bitcoin and what factors they would emphasize in a semi structured interview situation.

In getting interviewees from high corporate positions we decided to focus in Finland where our networks are most extensive. To get an international point of view we arranged an interview with one Bitcoin entrepreneur from Japan. We managed to get eight interviewees from relevant positions. In our group of finance professionals, we targeted senior executives in order to capture the current state of Bitcoin from the decision makers in organisations. Short introductions of our interviewees is in order to enlighten their position and experience and to show their relevance for the study.

Mike Kayamori is the co-founder and CEO of Quione. Quoine is one of the leading Blockchain/ Cryptocurrency companies in the world and is already the largest crypto exchange in Asia (excluding China). Its first product is a crypto currency exchange which currently has a transaction volume of over 100 million USD per month. In addition, they have their own cryptocurrency QASH, which at the time of the writing is valued at 300M USD (coinmarketcap.com). His company is a very well established institution and recognized by the Japanese government. In the future they are planning to expand to payments, remittances, and financial services. His previous experience includes management positions in Softbank, Globespan Capital Partners and GungHo.

Jeremias Kangas is one of Finland's most recognized Bitcoin entrepreneur. He founded local Bitcoins in 2012, when Bitcoin was still circling around 20$ per coin. According to Mr. Kangas back then the site was more like a hobby than a business. In 2013 it started to develop and started to look more like a business and has experienced steady growth ever since. The service allows users to exchange Bitcoins for their local currency or some other asset with another user. The site is a platform that allows users to plan and execute the changes. The exchanges are made directly with another person and localBitcoins.com is only acting as a service provider. 10 million dollars on a daily basis goes through their site according to the founder. Theis business model relies on the 1% free they take from each exchange.

Yichen Wu is a Bitcoin entrepreneur with a banking and consulting background. Before founding WhaleLend he worked for BCG, Microsoft and Nordea. Whalelend is a service that allows margin lending with cryptocurrencies and it is officially launching during 2018. This means that you can deposit your cryptocurrencies to the WhaleLend system and the site loans your coins to traders who want to borrow Bitcoins. Traders pay interest rate for loaning these coins. The interest rate is determined purely by the demand from the traders. At the time of the writing his company has gone through some initial beta testing and has received A-round funding. WhaleLend lets an investor get exposure to the cryptocurrency market via margin lending.

Mika Honkasalo is a crypto investor and a partner in a Finnish digital wealth management firm Babylonia Capital which is focused on the digital assets, cryptocurrency and blockchain space. They have raised approximately million euros for their first fund and are currently investing these assets. Honkasalo has himself been investing in Bitcoin and cryptocurrencies since 2013.

Jorma Alanne is an experienced banking/finance executive who has had management positions in multiple respected financial organizations in Finland. Currently he serves as an investment director at Taaleri. Taaleri is a Finnish asset management company with 5,6 billion euros under management. Before coming to Taaleri he worked as head of markets and baltic banking at OP financial group. Now he is responsible for representing Taaleri in boards of companies they have invested in. Taaleri just made their first investment in a company that operates in the space of cryptocurrencies and Jorma acts as an advisor for this company.

Kari Vatanen is an investment professional specialized in the quantitative investment strategies, derivatives and in the investment risk management. His trading experience includes equity, bond, FX, commodity, volatility and dividend derivatives in different markets. Now he is the head of cross assets and allocation for Varma Mutual Pension Insurance Company which had 45,4 billion euros under management at the end of 2017.

Perttu Kiviniemi is a branch manager for Nomura’s office in Finland. Nomura is a Japanese investment bank with approximately 426 billion USD under management which makes it one of the largest in the finance industry. In Finland Perttu is responsible of

offering Nomura's services to Finnish customers which are mainly large pension funds. His previous experience consist of derivatives sales for Societe Generale and Skandinaviska Enskilda Banken. Perttu has extensive experience of different asset classes from global investment banks.

Timo Ruotsalainen is the Head of Treasury and Investor Relations in a Finnish bank called Aktia which had 7.3 billion euros under management at June 2017. In addition to retail banking Aktia offers asset management, insurance and real estate services. As the Head of Treasury Timo is responsible for risk management which consists of for example managing the interest rate risk, liquidity risk and currency risk. He is also responsible of investor relations which consists of securing external funding and making sure that investors' and bank's interests meet.

Table 5 Interviewees

Name	**Organisation**	**Title**	**Group/perspective**
Mike Kayamori	Quione	Founder & CEO	Bitcoin Entrepreneur
Jeremias Kangas	LocalBitcoins	Founder & CEO	Bitcoin Entrepreneur
Yichen Wu	WhaleLend	Founder & CEO	Bitcoin Entrepreneur
Mika Honkasalo	Babylonia Capital	Partner	Bitcoin Entrepreneur
Jorma Alanne	Taaleri Asset Management	Investment Director	Finance Professional
Perttu Kiviniemi	Nomura	Managing Director	Finance Professional

Kari Vatanen	Varma Pension Fund	Head of Cross Assets and Allocation	Finance Professional
Timo Ruotsalainen	Aktia Bank	Head of Treasury and IR	Finance Professional

We transcribed the interviews from our audio recordings, but chose not to include the transcriptions due to the sensitive information revealed in the interviews. The interviewees mentioned occasionally during the interviews not to include certain information or sentences they said to our paper. If we would have added the transcriptions without all of the sensitive comments they would have appeared illogical. In addition, the structure of the interview was semi-structured and often the conversations jumped between topics. We were handed internal documents by the companies and these documents were discussed in the meetings. In addition, our interviewees exemplified or backed up their opinions with specific cases from their companies so asked us not to reveal all information spoke in the interviews. As we could not include the transcriptions as appendix this chapter is essential to reveal the main findings of the interviews. In the following analysis we aimed to capture our interviewees beliefs and thoughts about Bitcoin without adding any sensitive detailed information. Below is a table illustrating the most important concepts that each of the interviewee linked with different characteristics of trust in our framework. The concepts were drawn from the transcripts of our interviews and we summarised what the interviewees said of each of the characteristic. Saunders et al. (2016) explains the main idea behind summarising interviews being the capturasiation of main sense of what was said or sensed in the interview. This was done to illustrate the initial standing that each of the interviewees had before explaining in detail what each of them said. Future category is not shown individually in the table below since it affected the answers of all of our interviewees indirectly and wasn't part of the original framework. For example current reputation is the sum of past, current and the future which is why reflecting all of these time frames separately wasn't considered necessary in the coding table below. However, when going through interviews in detail in the next chapter we added a separate future chapter in

order for the reader to get an overview when the interviewees especially talked about the future and how it affects their current notion about Bitcoin.

During our coding process we noticed that within each characteristic of trust each interviewee had slightly different opinions and emphasized different things. However, within each area we found some common themes. In performance history and reputation came up thefts, volatility and use cases. In anonymity and accountability the relation between anonymity and regulation. In security and reliability of technology came up scalability, energy consumption and the security of exchanges. The views on these concepts are summarised in the table below. After the table the interviews are analysed in more detail.

Table 6 Concept mapping

Associated concepts with each characteristic of trust

Interviewee	Performance history and reputation	Anonymity and accountability	Security and reliability of technology
Kayamori	Thefts always part of new tech development. Volatility relative	Anonymity equally important with regulation. Big institutions already involved.	There will be always issues with security, problems with scalability and energy usage will be solved
Kangas	Thefts always part of new tech, reputation getting better by time	Lack of trusted 3rd parties might be a problem for general public	Unrealistic to assume fast mass adoption only based on good tech
Wu	Thefts always part of new tech	Will be regulated (too anonyme at the moment)	Not a major factor for mass adoption, importance of trusted 3rd parties is higher
Honkasalo	Thefts not a problem, Volatility relative,	Regulation would speed up adoption, some anonymity will always stay	Very secure and reliable

Alanne	Regulation, needs better markets, currently high volatility, no intrinsic value	Needs more regulation, more trusted 3rd parties. At the moment too anonyme, KYC principles needed	Excessive energy usage and bad scalability
Vatanen	Instrument for drug trafficking, high volatility, no intrinsic value, frauds	Needs more regulation, more trusted 3rd parties, too anonyme, KYC principles needed	Interesting technology, excessive energy usage
Kiviniemi	High volatility, positive standing from Nomura, no intrinsic value	Anonymity is an important part of Bitcoin	No comments
Ruotsalainen	Interesting technology, high volatility, possibilities if the markets crash	Needs more regulation, more trusted 3rd parties, too anonyme, KYC principles needed	Very interesting technology, bad scalability, problems with consensus

7.2 General perception

Each of our interviews started with a general discussion around our thesis topics; Bitcoin, gold and trust. Majority of our interviewees found the approach intriguing and were generally interested in having a discussion around these topics. For many Bitcoin was the reason they got into studying cryptocurrencies and blockchain. As Mr. Ruotsalainen from Aktia Bank said “Bitcoin’s rapid rise in valuation got me asking what is actually going on in this industry”. For our interviewees with a banking background this was a common theme. For many of them the rapid rise of the valuation and numerous news articles drew them into researching the industry. For the Bitcoin entrepreneur interviewees the story is slightly different. They got drawn into the industry usually slightly earlier and said to have been following the cryptocurrency industry from its early days.

Despite how early our respondents got into the industry all of them had some level knowledge and they all admitted whether you believe in Bitcoin’s future or not, it can not be overlooked. Many bankers realised the potential blockchain technology could have in

their industry and some admitted being in blockchain based discussions with other banks. According to the finance professionals, some basic knowledge of Bitcoin is even required if you work in a bank, as many will ask about their opinions about it. They admitted not knowing the technology on an expert level, but were following closely accredited business and finance journals to be on track about what is currently going on in the cryptocurrency industry. Bitcoin entrepreneurs again had a slightly deeper understanding of the technology and its development. They thought the discussion is too polarised and is being simplified by the media. Often two opinions are presented in the media; Either Bitcoin is a bubble and going towards zero or it is portrayed to be the primary payment method in 20 years. Mr. Kangas from LocalBitcoins said “usually the truth lies somewhere between these two very binarised statements”.

7.3 Performance history and reputation

When discussion was around performance history and reputation certain themes came up consistently. Volatility, Bitcoins use cases and criminal activities. Our finance professional respondents shared lot of the same opinions about these issues. Mr. Vatanen who represented the pension fund Varma, was the most sceptical one. Although he acknowledged Bitcoin to be a new financial innovation that one needs to stay on top of, he said that pension funds like Varma are still very far away from getting involved in this space. At the moment he saw too many question marks in Bitcoin’s history and reputation. He sees it too volatile at the moment to be a store of value.

However, Varma’s Vatanen pointed out that volatility is subjective depending on the use case. The volatility is high but he did not consider this as a problem if the objective is just to trade since it could be classified as a risky instrument. After this it is just a matter of position scaling like also Kiviniemi pointed out**.** Scaling positions means that you manage your risk by investing smaller or larger amounts, thus manage your risk. Nomura’s Kiviniemi shared Vatanen’s view on volatility as well. He said that the current volatility is too high for himself to get involved in the cryptocurrency market. He considered that the high volatility combined with not knowing enough of Bitcoin technology, makes it unattractive for him to invest.

Even though Kiviniemi himself didn't see Bitcoin that attractive he mentioned that Nomura's executives stand on cryptocurrencies and Bitcoin is actually quite positive and there is ongoing discussion around cryptocurrencies in the company. Kiviniemi added that he doesn't believe that Nomura is going to be trading cryptocurrencies very soon but thinks that they could operate as a broker in the near future.

As a finance professional Alanne from Taaleri saw the performance history similar to Vatanen and Kiviniemi. He considers that the volatility should go down for the currency to be considered storing value. He said that more improved markets might drive the volatility down. By this he means that Bitcoin could be used to buy goods, make investments and borrowed easily.

Kiviniemi and Vatanen, Alanne pointed out the need for intrinsic value. They consider that Bitcoin should pay interest rate in order to be considered more attractive investment and store of value. Alanne thinks that Yichen Wu's company Whalelend could provide this type of value to Bitcoin. This would drive the market of cryptocurrencies forward and provide more liquidity. Although he points out that Wu's service requires there to be traders that want to speculate with Bitcoin so he doesn't consider this exactly intrinsic value. Kiviniemi also pointed out that it is not really investing when you buy Bitcoin since it doesn't have any intrinsic value. If you currently trade Bitcoin it is purely speculation because you can't expect any return like interest rate from currencies or dividends from stocks.

Aktia's Ruotsalainen agreed with other financial experts and considered it yet to be very speculative and the high volatility concerned him. Ruotsalainen was concerned about that usually a currency has a central bank guaranteeing the value of a currency and this factor is still lacking with Bitcoin, which from a banker's point of view raises a lot of questions. However, he admits he might be interested in allocating a small amount to Bitcoin, but would not trust his pensions to be invested in it. It seemed like the financial professionals considered Bitcoin's current volatility currently too high to be storing value which is in line with the literature. We also saw that the lack of intrinsic value was troubling for finance professionals in the same way as Buffett described in chapter five.

Mr. Kayamori, the founder of QUIONE saw things vastly different, and was perhaps the most confident about Bitcoins performance. When discussing about volatility, that the bankers deemed extremely high, he brought up different volatilities from current fiat currencies and highlighted the fact how JPY (japanese yen) had changed in value over 50% when compared to USD. Five years ago one US dollar was worth of 79 Japanese Yen. Two years ago it had risen to 132 japanese yen for one dollar. And this happened in one of the biggest economies in the world. He continued by stating that you can really only trust the stability of a fiat currency if you live in a G7 or G20 country. That leaves out a significant amount of nations with a unstable fiat currency, Kayamori says. Comparing his views on volatility to the views of the financial professionals, Kayamori's opinions were drastically different.

Another crypto entrepreneur Honkasalo from Babylonia Capital pointed out the volatility is going to be high for Bitcoin also in the future and continued that this is perfectly normal for a new innovation. He thinks that even though volatility is currently quite high Bitcoin has possibilities to be a store of value in the developing countries. Opportunities in developing countries seemed to be rising up as a common theme in our interviews.

Second big theme around performance history and reputation, was criminal activity. Famous cryptocurrency exchange thefts such as Mt.Gox and Coincheck did not raise any alarming concern among our respondents. Mr. Wu admitted that thefts like these are a public image hit but he did not think it as a major issue and brought up the point how such public image hits are not uncommon with any new technology. New technologies or innovations all face similar hits, but without few exceptions no big changes in the core technology follow these thefts.

Mr. Kangas expressed similar opinions and reminded how banks face thefts and downfalls as well, but they're not usually followed by any major changes in the way the system works. Thefts and hacks reveal security problems, which are later quite effectively fixed, says Mr. Kangas. He continues by stating that these type of thefts are becoming increasingly rare as the players in the industry are becoming more competent by time.

Honkasalo from Babylonia Capital had similar standing as Bitcoin entrepreneurs Kangas and Wu when it comes to the big thefts in cryptocurrency exchanges. He acknowledges

that they are bad for the reputation but doesn't consider them that harmful for trust. He added that the industry has now developed so far that these individual thefts can't shake the trust in the industry in a large extent.

Kayamori has been building his career in Tokyo where both of these thefts occurred. He reflected on Mt.Gox and how that lead to regulation in the japanese cryptocurrency markets. According to him the Japanese government made the decision that anything similar should not happen again. A similar attack happened in 2018 with coincheck, which only has strengthened the efforts, Kayamori reveals. However, thefts like that are part of any new technology, he concludes. All of our Bitcoin entrepreneurs seemed thus share this "business as usual" view about the large exchange thefts. This is a different image than the image we received based on researching news articles about the thefts. Interestingly, criminal activities such as drug purchases on the network did not come up with our Bitcoin entrepreneurs when discussing performance history.

First thing that came to Mr. Kiviniemi's mind when we discussing thefts was his friend whose cryptocurrency account was totally wiped out. His friend friend had received a malicious email that disguised itself coming from the custodian his friend was using. It had a link and after clicking it cryptocurrency started to transfer from his account to someone else. He also pointed out that his friend held his private key in a paper format which is supposed to be the most secure form of holding it.

Vatanen doesn't see Bitcoin transparent enough. He thinks that there is a lot of drug money moving around in Bitcoin, which is a common theme represented in many news outlets. For a pension fund like Varma to get involved in Bitcoin, it should be much more transparent. The reputation of Bitcoin is not even close to being good enough for an investor like Varma. He concludes by pointing out bad reputation being one of the biggest problems with Bitcoin.

7.4 Reliability and and security of the technology

When we discussed the core technology and security behind Bitcoin it seemed to be on a strong level. Both the finance professionals and Bitcoin entrepreneurs seemed to trust the blockchain and distributed ledger. However, some interesting remarks came up. Although the technology was trusted, our interviewees questioned its importance in building trust in users. WhaleLend's Wu emphasized that the technology is not the major factor that is going to lead to Bitcoin's major adoption. He clarified that it might be a difference maker for the early adopters but not for the majority of users and referenced to the Technology Acceptance Model (Appendix 2). He continued by stating that the majority of the adopters will not care about how the blockchain works nor do they have the expertise to analyse the pros and cons behind the technology. Wu said that the majority of the adopters will care about convenience and will need a third party they could trust. He said that currently people trust for example Nordea's logo when they conduct banking operations and emphasized that Bitcoin needs same type of trusted third parties. He exemplified this by comparing Bitcoin to the adoption of internet. He claims that the main reason for widespread adoption of the internet was not due to the technology but the invention of a simple application such as e-mail and the companies behind this.

Mr. Kangas had similar notions. He pointed out that due to his engineering background he realises that other users might see the potential of Bitcoin differently than he does. He wonders whether the assumption of technological adoption is a bit too optimistic. He questions whether it is realistic to assume that everyone would use complex digital wallets that are at the moment required to get exposure to Bitcoin. A basic user has accustomed himself to use services provided to them by recognizable institutions such as banks, Mr Kangas says. Essentially it is a question about convenience. He brings up the concept of "be your own bank" that is often used by early Bitcoin enthusiasts. By setting up a digital wallet and keeping count of your public and private keys, you could in theory run your financial matters without having a bank involved, thus the term "be your own bank". Kangas finds this discussion partially unrealistic.

On Bitcoin's core technology Mr. Kayamori was very trustful. His opinions about technology can be divided into two sub areas. First we discussed about the security side of the technology and the surrounding infrastructure such as the exchange QUIONE he

runs. To the security of the infrastructure, Kayamori very explicitly said that it is like cancer “an incurable disease”, and that it is a part of every new technology and it is the biggest single thing that keeps him up at night. He reflects to the year 2004 when Bill Gates said that spam emailing will go out of business in a few years. Indeed spamming is now is higher than ever he says. It is in its historical highs and its much more intelligent and can take over your hard drives. “Anything that is online and is digital, security will continue to be a problem” Kayamori says. He clarifies that he is not talking about blockchain itself but more about how an individual manages the keys (public and private keys presented in chapter 3.13). As long as people manage their keys in a hot wallet, it will always be vulnerable to attacks, Kayamori says. Similar hot wallet storing was the cause to Mt.Gox and Coincheck thefts. The number of people who forget their passwords or lose their keys is astonishing Kayamori says. And not only for an “average Joe, but even for a sophisticated Mike” he elaborates. Due to a lot of issues in that area, they used to have a custom where they ask for a selfie and ID whenever, a user requests a new password. Now their exchange has moved to use a two-step verification process. Any given day they get a significant amount of password reset requests. “There will always be security issues”, Kayamori concludes his thoughts about the security side of Bitcoin.

Discussion about decentralising the exchanges came up with Kayamori and Honkasalo. Honkasalo claimed that when the field of cryptocurrencies was just starting out the exchanges and wallets didn’t realize how professionally the security questions should be addressed. Now he thinks that the third parties operating in the marketplace are much more secure and robust when it comes to security. He adds that he doesn’t believe any type of major thefts like Mt.Gox would happen in the future and points out that for example Coinbase’s security is handled so professionally that it is impossible to break.

Finance professional did not possess the same deep knowledge of the technology as our Bitcoin entrepreneurs, but in general they were trustworthy towards it. Here two things came up. Firstly, the mining cap was considered an interesting trait that might build trust as a store of value and secondly scalability, transaction costs and high energy consumption came up as negative aspects.

One of Bitcoin's functionalities that gives it scarcity and limit inflation is the limited supply of 21 million Bitcoins. When we brought up the question about the limited amount of coins Kangas stated that it would never change as it would need such a strong consensus in the network that it could not be achieved. Smaller changes in the network that have been proposed have been overturned so he sees it nearly impossible to change the limited coin cap. What problems the limited supply brings later, he is not sure. He admits that it brings interesting characteristics when considering Bitcoin as an investment asset.

Alanne pointed out the scalability of Bitcoin as a problem when we discussed about technology. If Bitcoin is to be used a lot in future, the infrastructure needs to be able to process transactions a lot faster than currently. In addition to this he thinks that the Bitcoin's proof of work protocol takes too much energy at the moment. Varma's Vatanen also mentioned the problem of energy usage in the Bitcoin consensus mechanism. Vatanen and Alanne share the same view that the energy consumption of Bitcoin is unsustainable. The high energy usage and scalability were also presented as problems in the literature and finance professionals (Alanne, Vatanen) seem to agree with this.

Aktia's Mr. Ruotsalainen had few concerns about the technology. He was skeptical about what happens with efficiency when the blockchain gets very long and the computing power required to process transactions gets very high. He was not also sure what would be the consequences when the mining cap is reached in 2140. These concerns are somewhat similar to Vatanen's and Alanne's concerns about energy consumption and efficiency. Ruotsalainen raised concerns about the fundamental principle behind Bitcoin as well. Bitcoin's technology relies on the developer community and the strong consensus it needs to make some protocol changes and often it is perceived as a strength. Ruotsalainen wonders who is there validating these changes in the software. He raises the question whether there is anyone really authenticating the protocol changes such as FED in the banking industry.

Mr.Kiviniemi couldn't say anything about the security or reliability of the technology itself. He said that he follows the biggest news about Bitcoin and price development but doesn't know enough to say anything about the underlying technology.

Issues that came up constantly with finance interviewees such as scalability and transaction costs, did not concern Kayamori. Of all our interviewees he was perhaps the most confident in technology's ability to solve these issues. According to him, internet experienced the exact same skeptical analysis about how the bandwidth is not enough or there are not enough IP addresses. Kayamori emphasized that technology will eventually solve all of these issues. Either through improvement in current protocols or some other variation of Bitcoin will manage to solve these issues more efficiently. The bottom message behind Kayamori's opinions about Bitcoin was that technology will solve the issues regarding scalability and transaction costs.

7.5 Anonymity and accountability

When we asked about anonymity and accountability of Bitcoin the interviewees tended to steer the discussion towards regulation. A clear outcome from our interviews was the consensus that regulation is entering the space and the bifurcation between regulators and crypto enthusiast does not seem to exist. Media often portraits an image that regulation would hurt the future of cryptocurrencies as one premise of the innovation is the anonymity and decentralised nature.

The Bitcoin entrepreneurs we interviewed did not accept this image and they were quite welcoming towards regulation. Mr. Kayamori said that regulation is already coming and in many countries it already exists. Not only in Japan but even in European countries like Switzerland, Luxembourg and Malta there are efforts to become centers of European cryptomarkets Kayamori says. He argues that it is not a question whether institutions are getting involved. Institutions are already involved with high stakes according to him, and this trend is only going to grow. Mr. Wu had similar notions as he said about regulation that it's not a matter of "if" but rather a matter of "when".

In this matter the finance professional shared the views of Bitcoin entrepreneurs. Alanne considered that effective regulation is needed for Taaleri to become more involved in the space of cryptocurrencies. He has heard that crypto entrepreneurs have problems of getting loans from the banks. This is due to the fact that Bitcoin and cryptocurrencies are very anonym while banks require know your customer (KYC) principles when moving

money around. Taaleri can't take risks that they would operate with an unknown party which is why he thinks that Bitcoin and other cryptos should be more transparent. He is afraid that there is too much so called "gray" money in the cryptocurrencies. He hopes that Bitcoin would self-regulate in the future which means that the participants and developers would themselves include KYC principles in the ecosystem and so attract bigger institutional investors that require these principles.

Vatanen was very clear about the need for regulation. He claimed that Bitcoin needs to be regulated if it is ever going to be used in payments in a large scale. For a highly regulated pension fund like Varma to get involved in the space of Bitcoin it also needs to fulfill certain regulatory requirements. Varma is responsible of knowing where all the money they invest go so they cannot get involved in an instrument where the counterparty is not known. He adds that for small investors regulation is not a necessity but if Bitcoin wants to find its way into the portfolio of large investors, it needs obtain some regulatory guidelines. Vatanen pointed out that world's leading derivatives market place CME group started offering Bitcoin futures in the beginning of the year 2018 and as a trader Vatanen considers this as an extremely important stamp of trust since CME is a highly respected marketplace.

Kiviniemi expressed opinions that differentiated from our other interviewees. When we discussed regulation with Mr.Kiviniemi he said that he doesn't think Bitcoin should be regulated. He considers current regulation of the financial markets so strong that banks are not able to provide functions that they should efficiently enough. He acknowledges that regulation is important but too much regulation can damage the financial markets. He thinks that anonymity is one of the fundamental promises of Bitcoin and it should stay this way in order for this cryptocurrency to grow larger. He thinks that there is going to be a need for anonymity for completely legal businesses which Bitcoin might be good for.

Mr. Kangas from LocalBitcoins did not have a strong stance on this area. He did not see an immediate need for regulation or authority in the cryptocurrency industry, but admitted that the lack of a trustworthy third party might be a problem for some. Mr. Wu agreed with Mr. Kangas that even though technology enthusiasts and liberals might not need a authority in the space, it might be essential for the majority of the consumers who are not that familiar with the underlying technology. He argues that majority of the consumers are

not ready to familiarise themselves with the technology behind a service or product they use, but need a established party that they would trust and bring convenience.

Babylonia Capital's Honkasalo had quite similar opinions with Kangas. He consider that regulation would attract large institutions and thus speed up the process of Bitcoin adoption. Although he mentioned that he doesn't think regulation will be a necessity for Bitcoin to become more widely used. Since the ledger is decentralized nobody can't really stop Bitcoins from moving around regardless of regulation. Without regulation it will just take longer time for Bitcoin to realize its potential. He pointed out that big institutions are already showing extreme interest in getting more involved with cryptocurrencies but the lack of regulation and liquidity has been a problem. Even though Honkasalo sees some regulation welcome in order to speed up the adoption process of Bitcoin, too much regulation can be bad. He elaborates this by pointing out that Finnish tax authorities already have some laws put in place that are slowing down the growth of the crypto market.

Aktia's Treasury manager Mr. Ruotsalainen had concerns especially about anonymity. He thinks the open ledger behind Bitcoin is good but finds it to be conflicting as it is very hard to determinate who is doing transactions with whom. For banks this kind of anonymity is challenging, Mr Ruotsalainen says. He argues that full anonymity eventually affects trust in such systems. He sees that although the blockchain innovation might be good, there is still too much abuse and illegal activity in the network, which harms the widespread adoption of Bitcoin. Especially the media seems to bring up constantly very negative sides of Bitcoin into publicity, which inevitably affects the public opinion about it, Ruotsalainen says. However, he continues stating that the immutability of the ledger is an intriguing feature and that banks are investigating the technologies behind this and how they could implement similar innovations in their own systems. So there is some good features in Bitcoin's technology, but unfortunately the negative aspects of it are too risky at the moment, Ruotsalainen concludes.

7.6 Future

Although commonalities and similar themes were found among our interviewees the future prospects for Bitcoin seem to be very diverse and no clear consensus exists. Wu answered the question about Bitcoin's future by raising a fundamental problem he sees in Bitcoin. Wu argued there is no consensus about what Bitcoin actually is. He listed the three main uses of Bitcoin; Bitcoin as a payment method, Bitcoin as a store of value and Bitcoin as an investment instrument. Although Wu doesn't believe Bitcoin to become a widely used payment method, he adds that in order for that to happen the technology would need to evolve and become more scalable. One thing that would help that objective would be the lightning network. Secondly, for Bitcoin to become a relevant store of value, the volatility would need to go down. He continues not knowing what would really drives down Bitcoin's volatility. "It's too chaotic of a thing for me to make a judgement", Wu stated. The last one Wu sees as the most promising which means that he is not taking it as a currency used in payments or as a store value but an investment asset.

Wu's final remarks were about the complexity of the uses cases of Bitcoin. He states that where dollar is a currency, iron ore is a commodity and gold used to be a currency but now only a store of value, Bitcoin's use cases remain unclear. He asks the question that what happens when you mix all of them. When you have multiple elements that are codependent on each other it becomes very difficult to analyse. Defining what it really is becomes a philosophical questions because it really is all of them.

Mr.Kiviniemi emphasized that he starts to trust Bitcoin more when it can be actually used to pay for goods. He considers this as the most important function of Bitcoin. When we asked about Bitcoin as a store of value he claimed that Bitcoin should first have value through the use of it in payments before it can be considered storing value. He believes that cryptocurrencies are going to be used in some form in the future but doesn't think it is necessarily going to be Bitcoin that will emerge as the mostly used. He also points out that news about Bitcoin used for arms and drug trafficking might be one of the biggest threats for this currency in the future. Also Vatanen and Alanne thought that Bitcoin should be first a medium of exchange before it can be a store of value.

Alanne had a similar view as Kiviniemi about Bitcoin's future. He thinks that the technology behind the currency is very interesting but doesn't think it is going to be Bitcoin that emerges as the most acknowledged one. He believes that a currency which protocol doesn't consume as much energy as Bitcoin would be more successful in the future.

Varma's Vatanen shares Alanne's and Kiviniemi's views that some cryptocurrency might be used widely in the future but finds it hard to believe that it would be especially Bitcoin. He claims that the first step for Bitcoin to become even considered by institutional investors like Varma starts with regulation. This would result in better reputation and trust. Like Alanne also Vatanen sees a need for the improvement of the market. For him this means that all the major banks should be somehow involved in the Bitcoin market and exchanges should be completely default free. He sees that Bitcoin has potential as a store of value for the developing countries where the central banks tend to inflate their local currencies. Although currently in these type of situations they normally switch to US dollar so this would require Bitcoin to be for some reason more reliable than the US dollar.

Kangas had no opinion about what the primary use case would be in the future, but made the remark that the scalability issues should be fixed. During November and December when the demand spiked there were some problems in the network as the transaction costs skyrocketed. However currently he sees there is no problem with the costs as the demand has plateaued. He continued by stating that the value provided by Bitcoin is different in different environments. For example in Africa bank runs are relatively common and Bitcoin could have more use in those kinds of settings. Local Bitcoins have one employee working in Kenya and according to him, local banks might experience serious issues like very strong inflation every two years. He sees in these countries there might be more use in upcoming years.

Ruotsalainen thought that the future of Bitcoin is intriguing, but a more rapidly evolving adoption would need two things in his opinion. Firstly, the finance industry needs to research the technology more and have a more comprehensive understanding of the potential of these innovations. He believes currently these technologies are not understood well enough. Second potential factor that could increase adoption is a crisis in

the current systems. “Big crisis is always an opportunity for someone” Ruotsalainen thought. He elaborated on these thoughts and said that currently there are some serious question marks in the financial sector. According to him, equities are being positioned in places where they don’t belong and they are being valued inaccurately. Ruotsalainen clearly had serious concerns about the state of the financial markets and was wondering whether the industry can calmly relieve pressure or will it collapse suddenly like in 2008 leaving long lasting effects. An economic crisis usually starts from the banking/financial sector and this time it might work for Bitcoin’s benefit.

Honkasalo claimed that if Bitcoin is to become a store of value, the road is going to be bumpy and Bitcoin is still to face many ups and downs. He sees lot of potential for Bitcoin as a store of value but is still very careful about his predictions. He always warns his investors in the cryptocurrency market that there is a notable possibility that your investment is going to be zero in a few years but it is also possible that the investment is going to be extremely lucrative. The technology behind Bitcoin is revolutionary and it is going to be used in some form in the future, Honkasalo concludes..

Where Ruotsalainen saw a crisis could benefit Bitcoin Kayamori thought there is already room for Bitcoin in the current world. Kayamori saw Bitcoin’s starting point in 2009 interesting as it was led by anti-regulation ideologists who after the financial crisis, saw the need for a decentralised currency. Still in 2014 Bitcoin’s market cap was around 6bn according to Kayamori , but now it's already over 150bn and it is not led only by ideologists anymore. Kayamori saw Bitcoin’s future and the future of cryptocurrencies highly promising. Regulation is already there and acknowledged institutions are entering the space in an increasing pace. Kayamori told how some bids in his service are exceeding extraordinary numbers, which he sees as a sign of growing interest. He sees the future of the world in a decentralised way where the future is cross-border and borderless and speculates whether majority of the banks can keep up with the tempo. According to him, the change is already happening and led by millennials. He emphasizes how in Asia the interest is already there. Finally he concluded that in the developing countries Bitcoin is already used as a store of value to an extent.

8. Discussion

In this chapter we are going to discuss how much trust is established in Bitcoin as a store of value compared to gold. We do this by reflecting on the literature and interviews presented in previous chapters. We argue that trust in some object is based on past, present and the future which is why each of these dimensions are discussed in this section. When you are thinking about trusting in something you inevitably think about its future and how it has worked in the past.

8.1 Comparison

Our choice to compare trust in gold and Bitcoin as store of values proved to be an interesting one. Although our analysis revealed that gold is not a perfect store of value, it certainly has had trust throughout history. Our initial purpose was not study Bitcoin as a payment method, but when studying Bitcoin as a store of value, its other functionalities inevitably come into discussion.

8.1.1 Reliability and security of the technology

When comparing reliability and technology between Bitcoin and gold we approached this question by considering them both as technologies. Even though gold might not be considered exactly a technical innovation this approach illustrates the differences of how trust is formed in these two assets.

Till today Bitcoin's core technology has never been hacked successfully. This means that the immutable ledger and hashing have worked as they should and haven't experienced any problems. Immutable ledger keeps the records of all the transactions and shows how many Bitcoin's everyone has. The immutable ledger has thus been able to effectively prove ownership. Bitcoin has existed since 2009 so the core technology has already been running for nine year without hacks. To prove your ownership of gold you can just walk in the location where the gold is kept and recognize it is really there. Physical gold ownership is proved by the fact that it is held in a location owned by you, you are currently carrying it with you or you have a record that the gold in a particular location belongs to you. Since gold is tangible and possible to steal it has to be protected with costly manners with guards, high security vaults and it needs to be moved around in

armored vehicles. During the history it has been shown that it is possible to steal physical gold which is why these costly manners are necessary to protect the ownership of gold .

If Bitcoin's core technology continues running without any hacks we argue that it is a much cheaper and effective way to prove ownership of value than owning physical gold. You don't need to pay practically anything to protect your Bitcoin's since the algorithm itself provides the security. On the other hand with gold you need to pay for storing it and it has been shown possible to steal.

Even though it seems like Bitcoin is a cheaper alternative to store value than gold, there are other factors to consider. It is possible to buy gold with contracts which mean you don't really have to own gold physically. Although Bitcoin's core technology is secure it doesn't really guarantee your ownership to be safe. Currently if you don't know any Bitcoin miners directly you have to buy your coins through an exchange and hold you coins in a wallet. These third parties provide liquidity to the Bitcoin market by connecting buyers and sellers and providing access to the Bitcoin ecosystem for most people. Even though the core technology hasn't been hacked, it is a different story with the exchanges. One of the most famous was the cryptocurrency exchange Mt.Gox where approximately 700 000 Bitcoins were stolen. Since normal users cannot get direct access to the Bitcoin ecosystem the security of the exchanges need to be on a high level for them to trust in Bitcoin. These exchanges haven't been operating for nearly as long as Bitcoin itself and thus are not as trustworthy as the core technology. When buying gold contracts you also do this with a third party so the story is similar to Bitcoin's. Gold contracts are handled by third parties that have been operating for much longer time than Bitcoin exchanges so the technology of these third parties seem more trustworthy than young Bitcoin exchanges.

During our interview Varma's Vatanen mentioned that when the CME group, which he sees as an extremely trusted derivatives market place, started offering Bitcoin futures (contracts) Bitcoin's trustworthiness increased. This same CME group is also offering gold futures and has done this for a long time. He also mentioned that all the big banks should be somehow involved in Bitcoin for him to place more trust in this innovation. From these comments made by Vatanen and other finance professionals, we can see that the security of Bitcoin's core technology is not enough for it to establish trust. One of the reasons why gold is trusted more, is that lot of big institutions that have operated for a

long time are facilitating the gold market. If Bitcoin wants to operate as a store of value and have more trust it would need these strong and old institutions getting involved in the marketplace. For finance professional a Bitcoin broker like Coinbase can't offer the same type of trust as for example Nordea or CME group. Wu emphasized this by pointing out that people need a logo of a third party they can trust. In a long time horizon it might be enough that the core technology would remain secure and the current Bitcoin exchanges and brokers continued to facilitate the trading. If Bitcoin wants to get quickly closer of enjoying the same type of robust trust as gold, it needs to get more big banks and institutions involved with it fast.

One of the problems with Bitcoin's technology is that the proof of work consensus algorithm consumes a lot of energy. According to Digiconomist (2018) the energy consumption of Bitcoin is close to 66 TWh per year which is more than the country of New Zealand uses in a year. Many of our interviewees were also showing concerns about Bitcoin's high energy usage. If Bitcoin is to grow and have a mass adoption, this energy consumption would grow larger and have significant impact on climate change. Another problem in the core technology is the speed of transactions. The transaction time changes with the demand, since the block size is limited. The more transactions are in queue, the longer the processing time since all the transactions don't fit in the current block and have to wait for the next one to be mined. Below are the average transaction confirmation times between 28th of March and 25th of April.

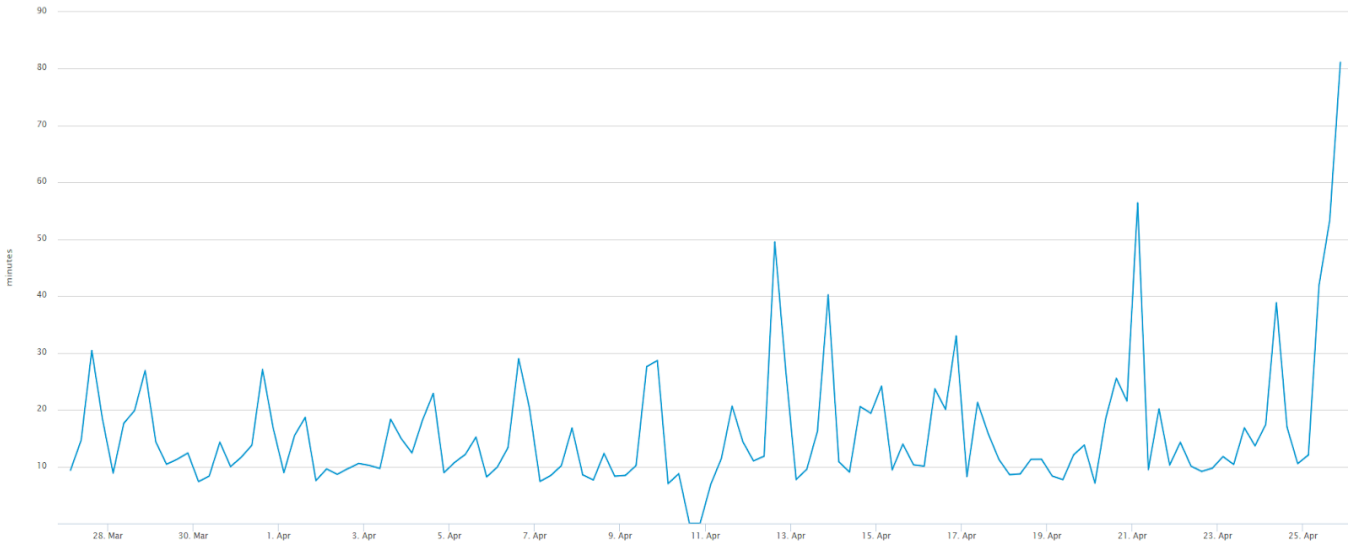


Figure 13 Average transaction times (Blockchaininfo, 2018)

As we can see this will be a problem if Bitcoin users base grows and more transactions need to be processed through the system. Bitcoin developers are solving this problem by building so called light nodes which would speed up the transactions process.

Some technical characteristics of Bitcoin received positive opinions from our interviewees. In terms of being a good store of value, Bitcoin's mining cap was thought to be helpful accomplishing this task. The amount of Bitcoins that can be mined is limited to 21 million coins, and Mr. Kangas said that this functionality would be almost impossible to change. In literature we saw some opinions that this coin cap could change if 51% of developers would agree on the change. In theory it is a correct statement. However, according to Kangas who has been a developer in the Bitcoin community since 2012, getting that 51% consensus is nearly impossible.

In the Bitcoin protocol the miners validate the new blocks and confirm that the current blockchain is accurate. When a new block is mined it is broadcasted to the network for the other miners to confirm. They compare this to the chain they have saved in their computer and if the majority agree that the new block is correct the new block is verified. If Bitcoin miners would pool together computing power so that they would own 51% of all the mining power they could in theory broadcast whatever type of chain they wish and the system would break down resulting in the end Bitcoin to become worthless. The 51% of

the miners could vote their own blocks to be correct even though in reality that wouldn't be the case. This is a problem since the Bitcoin community markets itself as being an algorithm to trust but in the end you have to trust that the miners behave in a certain way. Most of the Bitcoin miners have huge stakes of their net worth in Bitcoin which makes it irrational to perform this kind of activity since it would drive down Bitcoins price and thus their own net worth. This could be compared to the US central bank suddenly trying to sell all of their gold reserves in the open market. At the beginning they could probably get some of the gold sold before the players in the marketplace would start to wonder what is going on and the liquidity would dry up. After this if the markets would find out that United States doesn't consider gold valuable beyond its utility purposes, other countries might follow the example and try to get rid of gold. This would drive gold's market value down to the point where it is valuable only because of its utility. United States or the Bitcoin miners wouldn't most likely profit from this kind of activity since the assets value would be driven down. These are both very abstract and irrational scenarios which is why we don't consider the 51% attack a notable threat for Bitcoin at least at the moment. There has been cases where the Bitcoin miners divide larger pools into smaller ones in purpose so they wouldn't grow too large and lose trust from the Bitcoin community. This enforces the fact that the Bitcoin core technology is very trustworthy.

The miners/developers also vote for changes on how the protocol should operate. History of Bitcoin tells us that miners don't always agree on developments made on the Bitcoin protocol which has resulted to hard forks (new cryptocurrencies) like Bitcoin gold. The problem with decentralized innovation is that there is no central party defining how the chain should be run. If the developers end up having disagreements time and time again about the nature of the blockchain, the main chain will fork to a number of different cryptocurrencies like the Bitcoin gold. This will happen because one group of miners that agree on some changes start to mine their own coin and the other group another coin. This would eventually lead to too many different coins since no single one would have enough mining/hashing power behind it. This would result in very slow transaction confirmation times. Since many of our interviewees think that Bitcoin should first work in payments before it can be a store of value, the slow confirmation times resulting from too many forks would most likely stop it from ever becoming a strong store of value.

Wu from WhaleLend didn't think Bitcoin can be everything at the same time if it wants to enjoy robust trust. It is not just the definition that people can't agree about but even the technical execution divides opinions. In Bitcoin's arguably strongest feat, the blockchain, there seems to be a lot of disputes of the right way of managing Bitcoin. This is in practice seen by the multiple hard forks that have occurred. Bitcoin cash, Bitcoin gold and segwit 2x are results of such forks. Our interviewees thought that this might confuse the users as by owning Bitcoin, you would automatically get Bitcoin cash as well if you owned it when the hard fork happened. It is hard to understand for a person who is not so familiar with Bitcoin's technology why they suddenly have all these different coins, even though they bought just Bitcoin in the first place. However, Mr. Kangas thought this trend would be only present now in the early years, and will steady down in the upcoming years.

One of the reasons why gold is trusted more than Bitcoin as a store of value is that gold is just much more simple. In our interviews we noticed that especially the finance professionals hadn't really put a lot of time in understanding the technology behind Bitcoin. The basics are fairly easy to understand but the complex cryptography behind the blockchain technology takes a high knowledge of computer science to grasp fully. Even though the technology behind Bitcoin is hard to understand, so is the coding behind the technical systems that the stock markets utilize. All the traders and central bankers don't understand the programming code behind the fully functioning stock market and they still trade and buy assets listed on these marketplaces. The technological functionalities under Bitcoin might be already mature and 100% secure but it needs trusted third parties like the stock markets currently have. Big companies like Nasdaq have already shown lot of positive signs of entering the crypto market place and we believe that it is these type of firms that take the trust in Bitcoin to the next level (Rapoza, 2018).

8.1.2 Performance history and reputation

We found that gold's performance history was significantly more trustable than Bitcoins. The result itself is not surprising, but the reasons behind the results give some interesting insights. Gold has a longer track record and its history being widely used by governments and institutions for centuries still plays a role today. Under the gold standard it was once

used to back almost all the money issued in developed countries and thus was the basis for the monetary systems. Gold standard was abandoned almost fifty years ago so currently lot of its value is just based on its long history as being valuable. Gold's track record as a store of value is not perfect, but it certainly has more credibility than Bitcoins. The long track record of gold being used as a store of value and it being a valuable metal is certainly one of the main reasons why gold is enjoying such a robust trust. When former United States Chairman of the Federal Reserve Ben Bernanke was asked why US holds gold in their reserves he answered that the reason is simply tradition (Perry, 2011). Bernanke claims that gold's characteristics as a safe haven against economic downturns or inflation are not as strong as they are claimed. This is why he thinks that the only reason gold is still held in such a large extent is because our ancestors considered it valuable. When it comes to payments and especially assets that store value it takes a very long track record for people to build trust and gold has exactly that.

Even though it can be said that gold has a strong track record of being trusted it has also lost some during the last decades. During the gold standard era it was trusted more due to to the fact that nearly all the money in developed countries had to be backed by gold. Since one of the gold's "technological" functionalities is its scarcity it has a built in mechanism to limit inflation. Lustig and Nardi (2015) found out that Bitcoin users prefer so called algorithmic authority to conventional institutions. By this they mean that open source code/algorithm is more predictable compared to big institutions that can be hard to read. This leads these users to rather trust algorithms like Bitcoin. Gold's scarcity could be considered this same type of algorithmic authority. People know approximately how expensive it is to mine gold and how fast it can be done. This created an algorithm (gold standard) that people trusted more than central banks just printing money freely.

Although while this gold's "inflation limiting algorithm" was free for everyone to see, it wasn't as secure as people thought. In chapter five we saw that in the case of financial distress governments were quickly to drop the gold standard and just print money excessively. Another example is the case in 1933 when Roosevelt inflated the value of US dollars while they were under the gold standard. Even though gold was supposed to be a fairly secure mechanism to limit inflation, it had so called "back doors" in the algorithm. By these back doors we mean that governments could still inflate their

currencies just by deciding not to follow the algorithm (gold standard). The last example that eventually led to the demonetization of gold was when US ended up in large deficit. This lead to other sovereign countries questioning whether US had enough gold to pay their debts (see chapter five). The fact that governments didn't play along with this "gold algorithm" led to a decrease of trust in gold standard. This is one of the reasons why gold doesn't enjoy the same trust anymore as it did under the gold standard. It is possible that our current financial system has these same type of back doors that we just don't recognize yet. Ruotsalainen from Aktia bank pointed out in our interviews that a new financial crisis might open up a lot of opportunities for Bitcoin. If a new financial crisis actually occurs like Ruotsalainen speculated, investors and sovereign countries might look for alternative store of values like Bitcoin.

Reputation and public image plays a big role in forming trust. Bitcoin's reputation in relation to thefts does not seem to be a major issue for Bitcoin's future. In literature there are two major thefts that are often brought up, Mt.Gox in 2014 and Coincheck in 2018. Mt.Gox received a lot of publicity and was widely acknowledged by our interviewees as was the Coincheck theft. Worth noting is the fact, that cryptocurrencies in general took less damage in terms of valuation in the 2018 theft, although the theft was larger than with Mt. Gox. While in 2014 the stolen coins were Bitcoins and in 2018 they were NEM coins, in 2018 the cryptocurrencies recovered a lot faster. This could be attributed to longer track record cryptocurrencies had, and people saw after Mt.Gox that the ecosystem survived although it took a big hit. Mr. Kangas, Mr. Wu and Mr. Kayamori all said thefts and breaches are part of every system and no system or company is bullet proof. All of them highlighted that it is more about the big picture and how companies or technologies recover from such breaches. According to literature sources and Mr. Honkasalo, both Mt.Gox and Coincheck were poorly managed companies and the developer community knew this long beforehand.

When it comes to Bitcoin's track record it is still very short. It has been operating only for approximately nine years so compared to gold it is still in its infant stages. Against our own initial beliefs Bitcoin's lack of credibility was not due to big exchange thefts but more due the strong unpredictable volatility and poor functionality as a payment method. Gold

thefts have occurred as long as it has been found valuable, but it has not been the reason for any significant value drops, because its history otherwise is strong.

Currently Bitcoin's track record is filled with too many question marks. Bitcoin's road to becoming a store of value might not need to follow the same path and be a payment method first before it could be trusted, but it would need some regulation and institutions recognizing it. Most of all it needs time as with financial instruments people need a track record in order to find it trustworthy, and that cannot happen in few years.

Although Warren Buffett (2013) and Varma's Vatanen in our interviews disregarded gold as a great investment, it has a track record of offering safe haven characteristics when financial crises occur. Even though it has been shown that Bitcoin has this same type of low correlation to other major asset classes as gold, it hasn't gone through a financial crisis which would prove the safe haven characteristics. Reputation was one of the factors building trust in the framework presented in chapter six and gold has a reputation of offering security against economic downturns. Lot of investors and sovereign countries use gold as a hedge when trust in the markets shake. Below is an example of gold's safe haven characteristic during the financial crisis of 2008. In the picture gold is compared to S&P 500 which is a stock index consisting of 500 large cap US companies. It is seen as the best indicator of the performance of large American companies.

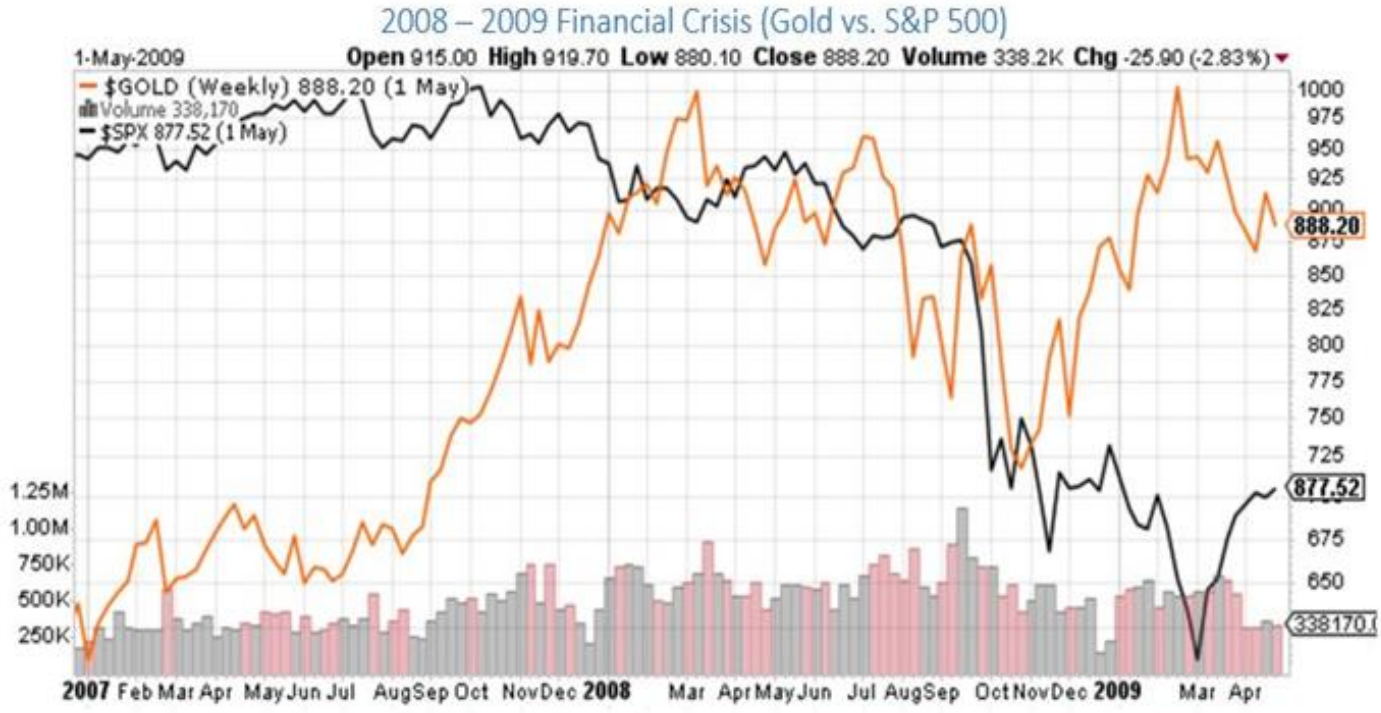


Figure 14 Gold and S&P 500 (Preciousmetals, 2017)

Bitcoin's reputation divides opinions. On one hand it is considered innovative, technologically genius and industry changing. On the other hand, for example Varma's Vatanen considered technology behind Bitcoin smart but Bitcoin itself only to be a payment method to buy drugs. All of our finance professional interviewees had similar notions and were afraid of the gray money moving around with Bitcoin. Although Bitcoin's ledger is encrypted, all transactions are permanently stored and can be examined. However, if one buys illegal merchandise with a gold bullion, the transaction is close to impossible to track afterwards. Jawaheri, Boshmaf, Al Sabah, & Erbad (2018) researched transactions made with Bitcoin in the dark web market "silk road" and could track multiple drug purchases directly into the buyers name and address. This research raised the question whether Bitcoin really is the best way to buy illegal merchandise and how anonymous it really is. Debate around this topic is still vivid and regulation might add some industry changing characteristics, but Bitcoin's anonymity is something that is deep in its technology and has many defenders in the Bitcoin community. For example

Honkasalo pointed out that some anonymity will always be a part of Bitcoin, even though it would be regulated.

We argue that if gold is mainly hold because of a tradition it is possible for these traditions to change. Next generation of decision makers may not value gold in the same way anymore. They have grown with technology and might value technical innovations more than just placing trust on a metal because it has always been done. Bitcoin is cheaper to store and easier to move around which means it could be a better alternative store of value than gold. In the future central bankers and investors still want to hedge their portfolios with some alternative assets in case local currencies are inflated and Bitcoin might do this better than gold because of its functionalities. Like seen in the previous chapter, Bitcoin might first need to become a medium of exchange and in that case it would in turn require the problems with scalability and energy usage to be solved. Bitcoin entrepreneur Mike Kayamori was surprisingly optimistic that technology will solve these problems in the future. He was very confident that these issues are to be solved in the future one way or another. Our other interviewees were more worried about the problems with scalability and energy usage why we consider these still problems that don't have a clear solution and need to be solved if Bitcoin wants to better operate as a store of value.

If these problems would be solved and Bitcoin would really become a medium of exchange, our interviews revealed that its first, most attractive use cases could be in the developing countries. In these countries the local currencies are inflated from time to time and it's hard to find an asset that would store value during these times. As Varma's Vatanen mentioned that currently many of these countries turn into US dollars in these type of situations. If Bitcoin would want to establish its position as a store of value in these countries it should somehow be more convenient and easy to get than the dollar. This is not a simple task and according to Joe Weisenthal from Bloomberg not really that revolutionary innovation either (Bloomberg, 2018). He thinks that regular mobile banking is going to establish itself in these developing countries before people start buying and selling these type of "magic" coins.

However, the potential for developing countries highlighted by Kayamori and Ruotsalainen seems to exist. In the graph below IMF has gathered data about different

inflation rates per country in the year 2018. It shows the rather unstable nature of many national currencies.

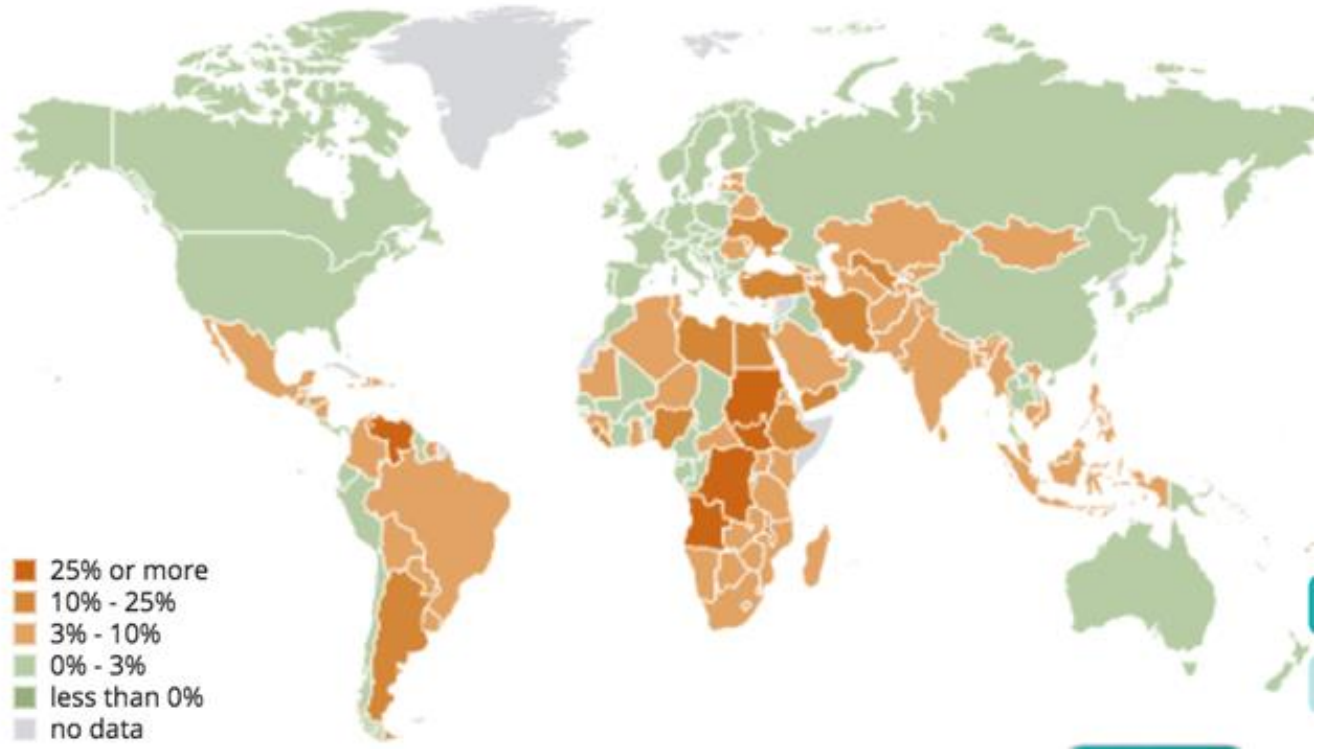


Figure 15 Inflation rates (IMF, 2018)

It is still not known how big the transaction costs in Bitcoin network will be when they are all mined and how fast the transactions can be processed. Also lot of our interviewees pointed out that it is unlikely that Bitcoin is the one cryptocurrency that emerges as the winner from the pool of all the cryptocurrencies. Since it is still highly speculative what Bitcoin's actual value comes from, we argue that its potential use cases don't establish a lot of trust at the moment.

One of the reasons why gold is trusted is the fact that it already has some utility value through the use in jewellery and electronic products. Currently Bitcoin doesn't really have any utility value. In our interviews we discovered that many think that Bitcoin should first be a medium of exchange (Kiviniemi, Vatanen, Alanne) before it can be trusted as a store of value. This would require the problems with transaction processing and energy usage

to be solved. Gold doesn't have this type of problem since it has already established some utility value thus has more trust. This provides a limit for how low gold's value can go since even though it wouldn't have any subjective trust it is still used in jewellery and electronic products which gives it some demand.

8.1.3 Anonymity and accountability

Anonymity and accountability are connected with each other as the more anonymity a technology has the harder it is to clarify who is accountable for potential damage. Literature showed us that anonymity is clearly appreciated because of the growing privacy concerns online. The balance between these two dimensions is critical in affecting trust. Users appreciate privacy to a some extent, but without any knowledge about who the user is dealing with, trust is harder to establish. For an individual user anonymity might not be problem but for a large institutions it is. This area produced a lot of opinions, and our finance professionals showed consistent concern over the anonymity in the network. Banks have their own KYC (know-your-customer) regulations, and it is understandable for an experienced banker to see the conflict between these two factors. It seems to be an issue that is not entirely thought through. Our finance professionals were afraid about money laundering in the network because of the anonymity. Bitcoin entrepreneurs were leaning towards regulation, although did not name money laundering specifically. However, both parties saw how anonymity might be a crucial component for some of the users. None of them had a clear picture how that regulation should look like. This is in the line with the literature as we could find many journals and news articles calling for regulation, but only a few papers that demonstrate concrete measures that could be taken. With gold such anonymity can not be found, at least not in the same depth. To buy gold one need to register herself in a recognized marketplace. In addition, when investors store physical gold or buy gold contracts there is a clear agreement who is accountable if that gold/contract were to be stolen. However, it is in order to point out that gold is used for money laundering as well (FATF & APG, 2015). According to the report made by Financial action task force gold is often used to money laundering due to the fact that it is hard to track its origin. Still we argue that the criminal usability is not as strongly present in gold as it is in Bitcoin. Fiat currencies are also used to break the law

and avoid taxes, but methods to tackle these issues exist. Problem with Bitcoin at the moment is that there is no consensus on how to tackle the anonymity problem. We see that here gold manages to evoke more trust than Bitcoin. If Bitcoin wants to find its way into the portfolios of central banks and big institutional investors it needs to be regulated somehow. Even though regular individual users might not be so concerned about the anonymity, we argue that it is hard to for Bitcoin to become a medium of exchange or a store of value with this type of anonymity. We came to this notion because the interviews emphasized the requirement of regulation and less anonymity for big institutions to get involved. We believe that Bitcoin won't be used as a medium of exchange or a store of value before big trusted institutions get involved with it which is the reason why anonymity hurts trust in Bitcoin. A scenario where Bitcoin would only be adopted by individual users and establish itself as a store of value that way, is possible in theory, but for us it's hard to see a future where an item would be a recognizable store of value without a lot of major institutions involved in it.

Since most of the users access Bitcoin ecosystem through exchanges and wallets they are probably the next logical step for more regulation. Most of these third parties require you to identify yourself and after this the third party has a record of everyone who own Bitcoins through their service. One of the biggest crypto wallets coinbase just recently made a deal with the US tax authority IRS to release information about some of its users so the IRS could tax them properly for capital gains (Coinbase, 2018). According to Coinbase's statement they gave up information on anyone who made Bitcoin related transactions valued over 20,000$ in one year between 2013-2015. IRS wanted to find out whether some capital gains were left out from tax returns. Coinbase fought the court demand for a long time, but eventually had to comply with demands made by IRS. The data request included ID's, names, addresses and complete transactions records made by an individual, the very same thing that Bitcoin's cryptography algorithms aim to hide from a third party. The effect of such demands is a complex element to consider. Institutional point of view is arguably positive towards such efforts as for them anonymity is a trust diminishing factor. On the contrary for an individual user the case could be the opposite. If governments fiercely tackle down on the anonymity of Bitcoin, the very premise of being a non-sovereign anonymous store of value becomes under questioning.

9. Conclusion

Our research objective was to study how much Bitcoin establishes trust as a store of value compared to gold. First we had to research how Bitcoin actually works and how store of value is defined. Secondly, we had to discover what factors establish trust in the first place. After this we interviewed industry professionals to see how much they trust Bitcoin at the moment. Finally we drew the literature and interviews together to answer the research question.

Bitcoin establishes trust with its technology that has been unhackable so far. It is arguably its strongest feat. If Bitcoin's core technology continues to stay secure it is a cheaper and easier way to prove ownership of value than gold. Gold bullions are heavy and expensive to store which makes Bitcoin a more competitive alternative in this case. In addition, transporting gold is expensive due to the security requirements.

Although Bitcoin's core technology has been secure its credibility as a strong technology has suffered due to unregulated poorly managed third parties such as Mt.Gox. Getting access to cryptocurrencies without these marketplaces is still hard and they are vital for bringing liquidity to the market. For Bitcoin to establish more trust, there needs to be control and regulation over these exchanges. This may damage anonymity in the network, but based on our analysis it would not hurt its functionality as a store of value, but rather it is a prerequisite for large institutions to get more involved. Almost all the major banks are somehow involved in the marketplace of gold which makes it possible to buy and sell gold through a dependable, regulated third party.

The former chairman of Federal Reserve Ben Bernanke said that the main reason gold is still used is tradition which demonstrates the importance of gold's long history. Bitcoin on the other hand has operated only since 2009. When it comes to store of values and money, people are extremely careful in what they trust. Bitcoin is still new and it takes time for investors and central banks to start trust this technological innovation. If Bitcoin were regulated and were able to get large institutions like Nasdaq somehow involved, the process of becoming a store of value might happen a lot faster.

The core technology of Bitcoin, although secure, is difficult to understand which is one of the reasons why gold is still found more trustworthy. To fully grasp the cryptography

behind Bitcoin and the security of blockchain it would require extensive computer science knowledge.

Gold already has some utility value due to the use in jewellery and electronic products. This makes it easier to trust gold to store value, since it has some practical use. Some of our interviewees claimed that Bitcoin needs to first operate as a medium of exchange before it can be a store of value. Using something as a payment method which value is highly unpredictable and based on nothing but demand and supply, is highly risky. It is also unclear how substantial the transaction costs will be in the network when all the coins are mined. It might be that it is not a more economical alternative to traditional banking systems when the mining cap is reached. It seems like Bitcoin is already used to a some extent as a store of value in developing countries where the local currencies tend to experience inflation and access to the banking systems is limited. One of the most likely early use cases of Bitcoin is thus in the developing countries.

Even though Bitcoin has opportunities in the developing countries it is still unclear how Bitcoin will solve the problems with scalability and energy usage, although our Bitcoin entrepreneurs showed extensive trust towards technology's ability to solve these issues. The industry in cryptocurrency field is still young and at the early stage. Bitcoin at the moment dominates approximately a third of the market cap of all cryptocurrencies. This can be interpreted as a sign of trust towards Bitcoin when compared to other cryptocurrencies. However, our interviewees ranged from skeptical to neutral when discussion moved to whether Bitcoin would be the "winner of cryptocurrencies". Majority of our interviewees had the opinion that some cryptocurrency could become widely adopted, but that Bitcoin would not necessarily be the one. In addition to the technical limitations some believed that Bitcoin's reputation was too blemished by illegal activities and this reputation would be very hard to clean up. Since there is a lot of uncertainty about how Bitcoin would work in the future its use cases don't establish sufficient trust yet as a store of value.

In the future Bitcoin's use cases need to become more clear in order for Bitcoin to have more trust as a store of value. In addition to this the involvement of large trusted third parties would accelerate this process. Currently it seems like an overstatement to be calling Bitcoin the gold 2.0. A lot of problems need to be solved for Bitcoin to become

trusted to the same extent as gold as a store of value. However, if the previously mentioned technical problems will be solved in the near future, regulation is implemented and trusted third parties enter the Bitcoin marketplace, Bitcoin might not be so far from being a trusted alternative store of value.

9.1 Limitations and future research

Literature around cryptocurrencies is evolving, but is still in its early phases. We chose to do a qualitative research instead of quantitative one due to the following reasons, one of them being Bitcoin's young history, strong price fluctuations and technological developments which effect the validity of statistical analysis. Secondly we found some studies that researched Bitcoin's correlations between other assets, or how Bitcoin correlates with google searches. We used these papers in our work, but chose not to do a quantitative research because we felt we could not add enough value with such method. We got curious to know why Bitcoin divides experts so clearly into two different groups and wanted to understand this phenomena better. Some of the experts claim that Bitcoin will disrupt the whole financial world while the others call it a bubble.

We feel that we found some interesting insights into Bitcoin as a store of value and the very high importance of trust in this picture. However, some limitations are present in our study. Our interviews consisted of eight people, which we chose carefully based on their leading positions in finance and crypto industry. These interviews revealed opinions and point of views of financial professionals as well as crypto entrepreneurs. Excluding one interviewee, everyone was from Finland, which is important to note. The situation with cryptocurrencies may be seen differently in various countries. Finland is a small nation, usually relatively quick to adopt a new technology, so the views of our interviewees might be different than those of experts in other countries. In addition, we noted that Mike Kayamori, the founder of QUIONE, seemed to possess a lot of industry knowledge, especially from Asia where cryptocurrency usage is on a different level. His opinions tended to be consistently more optimistic when comparing to the finance professionals we interviewed.

This thesis does not account to how the general public sees Bitcoin as we did not interview a large amount of people with random sampling. Our interviewees arguably have an above average understanding about the financial markets and cryptocurrencies. In order for something to become widely adopted as a store of value, it would be useful to study the public opinion about Bitcoin.

Our study was about Bitcoin's trust building and how it operates as a store of value compared to gold. The goal was to find out how Bitcoin and gold establish trust under the same framework. The technological side of Bitcoin seems to be comprehensively studied and there seem to be a consensus at some level that there will be a need for blockchain and it is a good innovation. However, there are some big question marks in the field for Bitcoins future. For industry experts regulation and questions around anonymity seem to be a major factor that prevents them for trusting Bitcoin. Further research is still needed on how Bitcoin could be regulated in a way that does not compromise the functionality of it. In addition, Bitcoin in developing countries rose up as an interesting topic. Both in literature and from our interviews we drew the conclusion that Bitcoin's possibilities in the developing countries should be studied further. Many see Bitcoin solving a problem that does not exist in highly developed nations, but it could have a problem to solve in countries that lack strong financial institutions.

10. Appendices

Interview questions:

Introductory questions, personal/professional questions

- *Can you describe yourself shortly and what do you do?*
- *Present thesis subject and goal.*

General

- How much time have you invested in getting to know cryptocurrencies and especially Bitcoin? If you haven't really studied this innovation why?
- How do you see the current state of Bitcoin and how do you see it in your profession?

Performance history and reputation

- What do you think about Bitcoin's history including the biggest thefts (Mt.Gox) and their effect on the public image?
- What do you think about Bitcoin's strong historical volatility? Do you think it will stabilize in the future?
- What do you think about the comparison between Bitcoin and gold?
- How do you see Bitcoin as a store of value?

Reliability and security of the technology

- What do you think about the current state of security in Bitcoin infrastructure? In other words how secure do you think it is? Any major issues?

Anonymity & Accountability

- What do you think about Bitcoin's anonymity?
- Should Bitcoin be regulated? If so how do you think it should be regulated?
- What do you think about the decentralized nature of Bitcoin?

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