Understanding Price Fluctuations of Cryptocurrencies

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Master of Business Administration.

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Abstract

This research project investigated the reasons for price fluctuations of cryptocurrencies. Cryptocurrencies are digital currencies that are created over a decentralised, secure network built on the blockchain technology. The current challenges with understanding price fluctuations are that there is limited research in the field and extreme volatility in the environment.

Exploratory research was conducted using semi-structured interviews to understand and analyse the drivers of factors identified in the literature contributing to price fluctuations of cryptocurrencies. Insights were generated for the drivers of user perception, misconceptions that surround cryptocurrency security and the role of regulators in the cryptocurrency space. The research expanded the existing literature and offered propositions for future research that contribute to the theory surrounding price fluctuations of cryptocurrencies.

The findings should provoke business and management to reshape the way that cryptocurrencies are received and positioned in the marketplace. In addition, these findings are significant for those making business or social decisions regarding cryptocurrencies or those that are redefining traditional currency transactions.

Keywords:

Cryptography, blockchain, price fluctuations, regulators of exchanges, cryptocurrency value proposition

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Table of Contents

List of Figures and Tables

Figures

Tables

Chapter 1 – Introduction to the Research Problem

This document is a research thesis which performs a qualitative analysis into the reasons for price fluctuations of cryptocurrencies. The various constructs that have an influence on price fluctuations are contained in this section. The remainder of the chapter contains elements from the literature survey, description of the proposed methodology, results and discussion of the analysis.

1.1. Research Area and Problem

Cryptocurrencies can be described as transferable digital assets secured by cryptography (White, 2015). It is thus virtual currency that may be considered as an alternate to fiat currencies. In addition, cryptocurrencies have significant fluctuating exchange rates compared to fiat currencies (Peters, Panayi, & Chapelle, 2015). The origination of cryptocurrencies took place in 2009, and is built on the blockchain technology. Cryptocurrencies operate in a decentralised manner as a secure database. The cryptocurrencies are mined via the use of computers, after which payments for the computing power in the form of a digital currency are made. Since cryptocurrency transactions occur online all types of cyber-attacks and related ethical considerations apply.

The introduction to cryptocurrencies by Nakamoto (2009) presents the Bitcoin, which is developed in relation to the gold commodity. It is thus expected that Bitcoins follow the same pattern in terms of price fluctuations, however this is not the case. The Bitcoin price, as recorded by Coindesk (2017) since 2014 has been depicted in Figure 1, where the extreme volatility is evident. With the aid of the literature it was possible to isolate certain factors that could contribute to price fluctuations of cryptocurrencies, detailed in Figure 2.
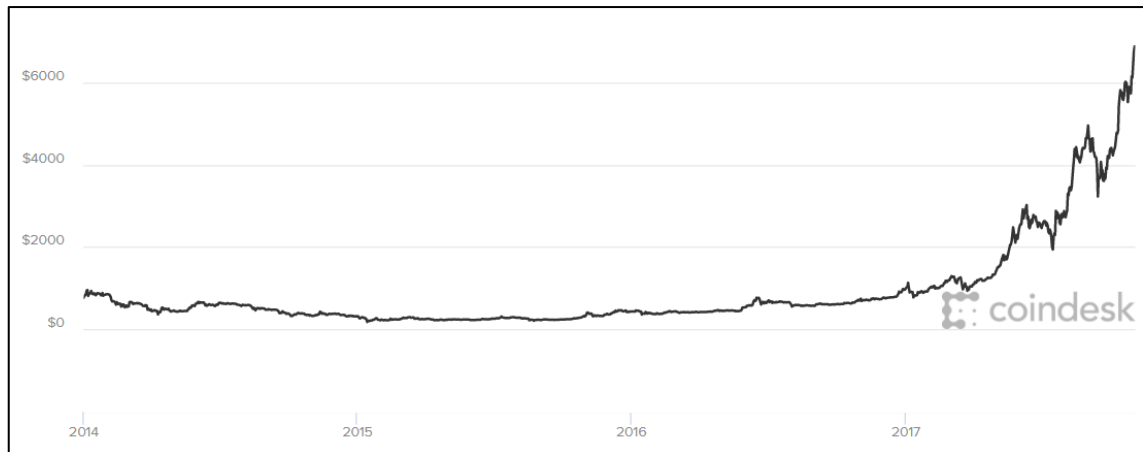
Figure 1 - Bitcoin price since 2014 (Coindesk, 2017)

According to Polasik *et al*. (2016) Bitcoin economics lack significant comprehensive empirical research. By extension the lack of research applies to cryptocurrencies and emphasises the relevance of the price fluctuation investigation on which this research project was focused. The supply and demand had been investigated to determine whether there are implications of the economic factors on market conditions and ultimately the price fluctuations. There are two studies related to supply and demand covered in the literature review; the first is by Sauer (2016) that integrates Bitcoins into the monetary policy and presents a model for supply and demand, and the second is a study by Iwamura *et al*. (2014) that presents the supply and demand curve for cryptocurrencies.

During four years ending 2014, the monthly number of transactions using Bitcoin increased from 12,000 to 2.1 million. (Polasik, Piotrowska, Wisniewski, Kotkowski, & Lightfoot, 2016). This implies a compound annual growth rate of 265 percent, which indicates the exponential growth, and as per the same study can be extended to indicate an increase in popularity.

Popularity can be considered a driving factor for competition amongst currencies. According to Hayek (1990), competitive forces play a major role in keeping fiat currency prices stable. By extension, competitive forces may influence the volatility of cryptocurrencies. Understanding the existing landscape and what the future entails for these cryptocurrencies could result in a competitive advantage for an organization that wishes to enter or grow in the cryptocurrency industry. The barriers to entry are low in that the technology is open source.

The popularity and total number of transactions have been said to influence the returns of cryptocurrencies (Polasik *et al.,* 2016). Popularity is largely influenced by perception,

2

with trust at the base of perception as per Lucassen's (2013) trust model. The security issues influence the perception of cryptocurrencies, which has been considered as another factor that contributes to price fluctuations. The perception surrounding security is a major concern for cryptocurrencies; in August 2016, the serious security issues that affected cryptocurrency institutions were exposed. For example, hackers from Hong Kong-based exchange Bitfinex stole 72 million USD (United States Dollar) in bitcoins (Newton, 2016). The perception surrounding the security of cryptocurrencies has been validated and identified as a concern, however there is limited literature in the field.

Political factors or regulation that could be influenced by market conditions (namely supply and demand) has been isolated as a factor that could influence cryptocurrency price fluctuations. Government regulations surrounding cryptocurrencies have an influence on their substitutive (replacement of fiat currencies) use, as policies that promote or prohibit the use of cryptocurrencies can be passed. The limited supply of cryptocurrencies allows for the demand to fluctuate which creates the expectation of a high fluctuation in prices (Sauer, 2016). There is also limited research in terms of the political or regulatory aspects surrounding cryptocurrencies.

1.2. Purpose and Significance of Research

This research project aims to provide reasons for the price fluctuations of cryptocurrencies, while addressing the shortage of literature in the field. The constructs that have been identified through a literature survey as potentially affecting the price fluctuations are depicted in Figure 2. The following factors were drafted as possible influences: supply and demand, competition (which depends on perception and security), and political issues.

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                    Cryptocurrency price fluctuations


    Supply and Demand        Competition          Political issues


                        Perception    Security
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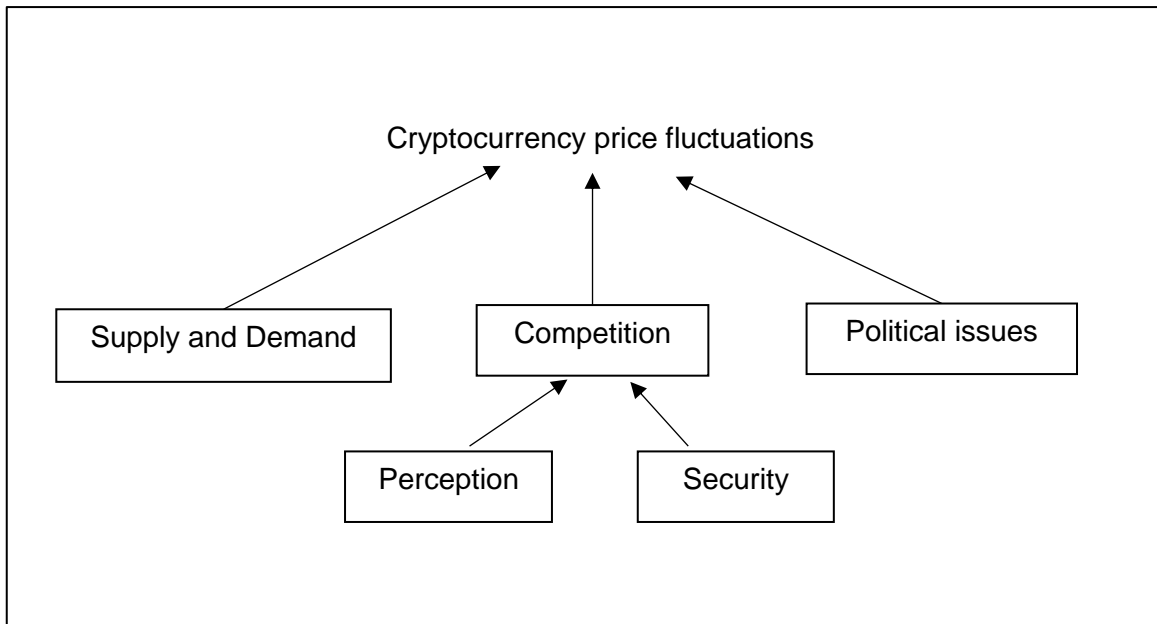
Figure 2 - Research constructs

A qualitative research method was used to investigate these factors, which has been described in Chapter 4. The main reason for selecting a qualitative research methodology was the lack of literature in the field and the desire to extract and contextualise meaningful insights and experiences from the interviews.

The supply and demand of cryptocurrencies, related to the macroeconomic view, has been explored, the results documented in Chapter 5 and analysed in Chapter 6. For specific cryptocurrencies, the supply is fixed and the demand has room to fluctuate. The primary driver of demand is perception, which can be understood using Lucassen's (2013) trust model that has been elaborated on in Chapter 2.

The presentation of results documents the responses of the interviewees in relation to the factors that have been highlighted as potential causes of price fluctuations. The link between perception and security to competition has been explored. The theme of adoption and perception is significant, and it was discovered that contrary to what Zhao (2015) believes, competition does not solely depend on perception and security. The findings show that competition does not rely on perception and security as much as it depends on the value proposition of cryptocurrencies. The unique offerings and time to market of cryptocurrencies are the distinction for competition.

The perception surrounding security came across as being a misconception, hence the limited literature for this aspect of the field. The security is not a major concern with the blockchain network, however it is a concern when storing information (e.g. identification keys for the currency) outside the network. Politics and regulations were suggested as

4

significant players in influencing the perception however not as important for influencing the technology, since it functions in a decentralised manner. There is no room for regulations within the blockchain network, however there is a need for security and regulations at the exchange level. The exchanges are where the private keys are housed and have previously been hacked.

1.3. Research Scope

The research determines what levers should be considered in order to produce a value proposition surrounding the creation of a higher adoption rate for cryptocurrencies. Understanding the factors that cause price fluctuations enables an understanding of how better to create stability in the cryptocurrency space.

The study also aimed at providing insight into the aspects of security and regulation that were lacking in the literature review. It demonstrates an understanding of the cryptocurrency environment and serves as a contribution for further research.

The future research revolves around analysing what the future of adoption could look like, and monetising the value that could result from developing more users. Another avenue is to research the unique offerings of alternate cryptocurrencies and determine what is desirable or identify unused uniqueness that could be implemented as a 'super' cryptocurrency.

This chapter provided an overview of the research project, the main literature in the field, research methodology, highlights in the findings and scope for the research. There is value in the research as mentioned above, implying that the research apart from being interesting, is also necessary as it contributes to the evolution of this field. Chapter 2, which follows details the literature survey, with an overview of blockchains and cryptocurrencies, followed by a survey of the constructs identified in Figure 2.

Chapter 2 – Literature Review

Research in the form of a literature survey is required to understand the cryptocurrency landscape and the reasons for price fluctuations. The enablers of the constructs that have been identified in Chapter 1 play an important role in establishing the influences that exist on the volatile cryptocurrency market.

A theoretical view of cryptocurrencies is presented in this section, where the constructs identified in Figure 2 are described and linked to one another. A description of money and the technology of cryptocurrencies is followed by a focus on the supply and demand in terms of the market conditions. The speculation of cryptocurrencies, where a trust model is described is followed by literature that references the remaining constructs, which are competition, perception, security and political issues.

2.1 Money

The act of paying for acquired goods is most often done via money; Tullock (1975) highlighted that the reason there is a want to acquire money is due to others having a desire for it. There are in general two main types of currencies; commodity backed currencies and fiat currencies (Eurosystem, 2012). The following characteristics should be present for something to be considered money (Tomlinson, 2003):

- Medium of exchange: an instrument that is used to facilitate a purchase or sale.
- Store of value: reliability in terms of saving, storing and retrieving the currency. It should remain stable over time, as in the case of gold which most money is linked.
- Unit of measurement of exchange of value: used as a measurement for value, with three important characteristics: divisible, fungible and countable.

The concern with fiat currencies is that currency units can be created (paper money), which will have a reduced value through inflation. Digital currencies can alleviate this concern, where there is a fixed supply. The terms used for digital currencies are 'virtual', 'digital' and 'crypto', however the implementation that the currency follows are different. The focus of this research is on cryptocurrencies, which are digital currencies that are secured using cryptographic methods.

An explanation of where cryptocurrencies fit into the framework of money is considered in the following section.

2.2   Cryptocurrencies

Cryptocurrencies have been described as an unregulated digital currency and fall into the virtual currency category in Figure 3. These currencies can be traded in the online space as an alternative to electronic or bank money and therefore follow a different pattern of events as compared to physical currencies. Some examples of cryptocurrencies are as follows: Bitcoins, Litecoin, Dash.
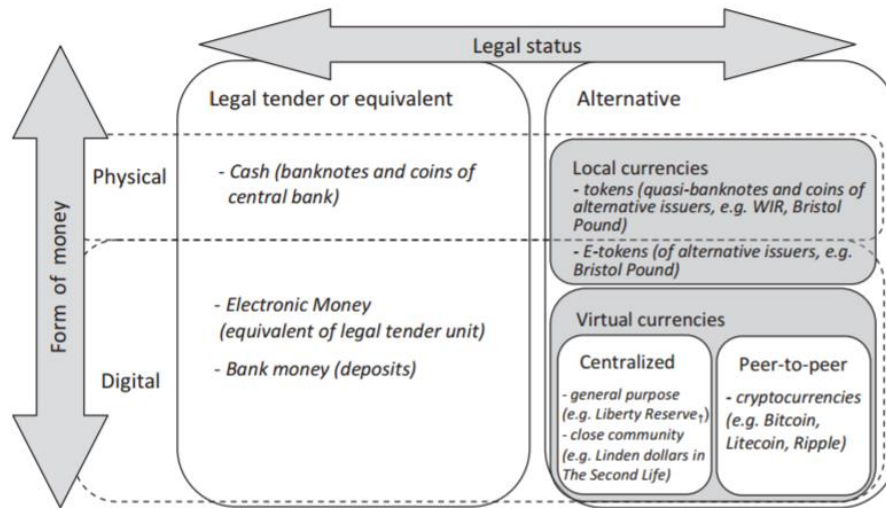
Figure 3 - Categories of Money

Satoshi Nakamoto (2009), the pseudonymous inventor of cryptocurrencies, published a white paper that details the peer-to-peer transfer of digital currencies. The speculation is that Nakamoto became disillusioned with central banking during the financial crisis, which motivated for the development of a currency that could not be manipulated by regulators. According to Tschorsch and Scheuermann (2015), the Bitcoin idea was developed by Nakamoto via the use of research conducted on the following:

-    ECash by Chaum (1998),
-    AAEC (Autonomous, auditable electronic cash) by Sander and Ta-Shma (1999),
-    HashCash by Back (2002),
-    BitGold by Szabo (2008),
-    and the reusable proof of work by Finney (2004).

Bitcoins are decentralised, pseudonymous, peer-to-peer, and secured by cryptography, using the blockchain technology (Nakamoto, 2009). For Bitcoins, new currency is generated through an algorithm by individuals that are willing to use their computing resources, where the reward is the digital currency.

7

During the first four years, the Bitcoin price fluctuated from below 0.01 USD to over 250 USD (Ahamad, Nair, & Varghese, 2013). As a result, the Bitcoin has become attractive for the purposes of investment. The Bitcoin software is open source and can be used as a base to develop alternate currencies. The study mentioned above by Ahamad *et al.* (2013) explains that the Litecoin ('silver standard' of cryptocurrency) is the second most adopted cryptocurrency and came into existence to have transactions complete faster than Bitcoins. Alternate coins can be considered as amendments of either Bitcoin or Litecoin; examples are Feathercoin, Terracoin, P2PCoin, BitBar, ChinaCoin, BBQCoin (Ahamad, Nair, & Varghese, 2013). These examples span a range of cryptocurrencies, however there are many more.

According to Polasik *et al.* (2016), there are four main aspects of cryptocurrencies:

- technological issues,
- public and legal issues,
- political, sociological and ethical implications and
- economic issues.

Technological issues include cryptography problems, security of computer systems and the potential of an attack arising from the digital nature of cryptocurrencies. The public and legal aspects examine how cryptocurrencies are treated in the legal domain. The regulations and policies surrounding cryptocurrencies are of concern as there are competing private irredeemable monies (White, 2015). There are ethical issues that stem from the digital nature of cryptocurrencies because these currencies can easily be used in the deep web. The economic issues are linked to the supply and demand and relate to exchange rates of fiat currencies.

In order to create more cryptocurrency, miners use digital machines to process cryptocurrency blockchains and they are rewarded with cryptocurrency. This is in the form of fees that are collected using a peer-to-peer network (Ahamad, Nair, & Varghese, 2013). A study by Eyal and Sirer (2014) shows that the Bitcoin mining protocol is not compatible with incentives. In the study an attack is proposed that enables colluding miners to obtain higher revenue, which can attract Bitcoin miners to mine for selfish reasons. The ethical aspects of cryptocurrencies can be developed from this, which is beyond the scope of this research.

To investigate the changes in pricing, correlations between exchange rates and the Bitcoin value need to be researched to find if a relationship exists (Gandal & Halaburda,

2015). The main factors considered that may have an impact on the price of cryptocurrencies are market conditions, competition, and political issues.

In the following section, the blockchain technology that underpins the Bitcoin cryptocurrency is discussed in order to provide a clearer understanding of blockchains and the possible use cases.

2.2.1 Blockchain Technology

The blockchain is the distributed database (or ledger) that stores bitcoin transactions. Due to the decentralised nature of the technology, it is essential that there be multiple identical copies of the blockchain across the network (Spasovski & Eklund, 2017). This implies that should the system be hacked, it will replace one part of the blockchain, which will not match the blockchains stored at the other points in the network. The technology is thus resistant to a single point of failure.

The blocks contain information about the current transaction and all previous transactions, forming a write-only database. The data from preceding transactions are stored via cryptographic functions, namely the hash, which enables saving on overhead by calculating a smaller block than the original that can be traced to the latter.

Some of the use cases for the blockchain technology in the banking industry are listed below (Fintech Network, 2017):

- Reduction of fraud
- Know your customer
- Trading platforms
- Payments

2.2.2 Acquiring Cryptocurrency

Cryptocurrency may be acquired by one of two methods; mining or via an exchange. With the former, the user becomes part of the blockchain network and can create cryptocurrency. With the latter, the user purchases the cryptocurrency from an authorised distributor.

Mining requires tremendous computing resources and is a method to earn cryptocurrency (Hari, Sai, & Venkata, 2015). The blockchain algorithm is required to be complete, providing an opportunity to improve the protocol or use modified hardware to compute at a faster rate.

Exchanges are available for purchase of cryptocurrencies, where users are able to purchase cryptocurrencies via the use of fiat currencies. These exchanges either purchase or mine their own cryptocurrencies.

In either case, it is necessary to store private keys (cryptography term used to describe the part of a pair of software keys that remain private to the user) to claim ownership of cryptocurrencies on the network. This is usually done via the use of an electronic wallet. Electronic wallets, due to the digital nature, as per Feder and Gandal (2016) are susceptible to software threats and can be hacked. In the same study the impact of security risks are studied; this makes reference to the Mt. Gox attack that ended in 2013.

2.3. Market Volatility

The literature provides two major themes when considering market conditions: supply and demand and competition (Iwamura, Kitamura, Matsumoto, & Saito, 2014). These factors cannot be considered in isolation, since economic factors (e.g. inflation) contribute to the volatility in the market. The supply and demand aspect of cryptocurrencies is addressed below. This is followed by a discussion of the competition in the market.

2.3.1. Supply and Demand

Economic conditions such as the possibility of deflationary pressure in cryptocurrency networks has been studied (Peters, Panayi, & Chapelle, 2015); this is when there is intense deflation, which can lead to the collapse of the currency. The same study considers the chartal view for cryptocurrencies, in which the value of Bitcoins are maintained.

To expand on the view, a study by Sauer (2016) has integrated Bitcoins into monetary theory by modelling the supply and demand of the cryptocurrency. The assumption is that the market is in equilibrium, as per standard Keynesian theory. The money market is modelled as follows:

$$M = L_T(Y) + L_S(i) \tag{1}$$

Here, M represents the money supply, $L_T(Y)$ represents the demand for the transaction in relation to the national income (indicated as Y), and $L_S(i)$ represent the demand for speculation purposes, which depends on the interest rate, i. This model can be used to demonstrate the changes that take place when supply and demand change.

The stability of the supply and demand is of concern for price fluctuations. Ametrano (2014) argues that it is a misconception that bitcoins become more stable with an increase in adoption. The argument lies in the fact that adoption is not sufficient as even fiat currencies require monetary actions for stabilization. This could be due to scarcity related to the supply and demand, thereby establishing a link between adoption and price fluctuations. Hayek (1990) proposes a scheme in which banks issue competing private currencies and offers a deep analysis of the theory and practice of concurrent currencies. This can be extended to cryptocurrencies due to the decentralised nature. In the same work, according to Hayek (1990), these currencies that suffer from price instability will lose customers to the currencies that are able to maintain price stability. This has not been the case with Bitcoins, which could be a result of first mover advantage. Hayek also recommends that competing currencies be introduced simultaneously to avoid the first mover advantage, which is not experienced in the cryptocurrency environment.

Sams (2015) discussed that unpredictable changes in demand could be attributed to a change in price, which results in volatility of the cryptocurrency. The same study presents an argument for the next generation of cryptocurrencies, which is recommended to include an elastic supply rule to amend the quantity of supplied coins.

In a study by Iwamura *et al.* (2014) a supply and demand curve for Bitcoin that considers inflation was provided, and is depicted in Figure 4. This can be extended to other cryptocurrencies with finite supply.
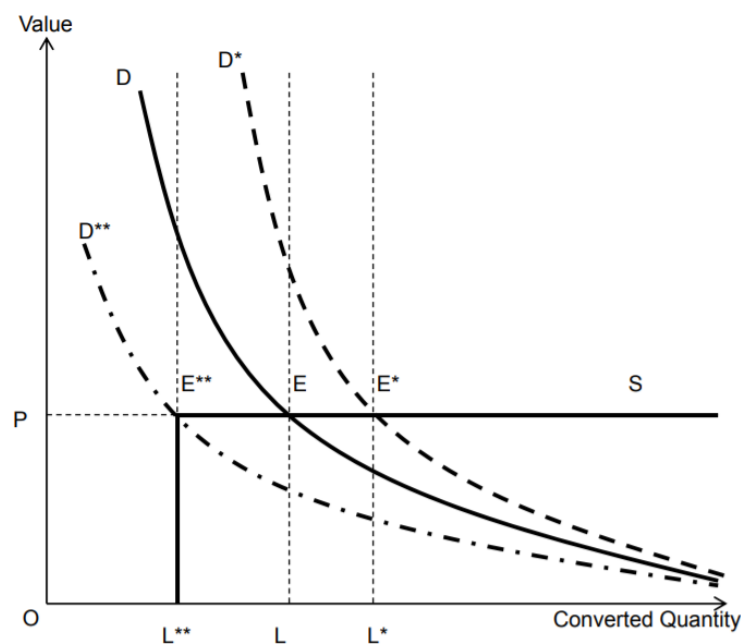
Figure 4 - Supply and Demand of Bitcoin: Amended supply curve to incorporate inflation (Iwamura, Kitamura, Matsumoto, & Saito, 2014)

With reference to Figure 4, when inflation increases the purchasing power and demand (D) decreases, illustrated by a shift from L to L** and equilibrium point shifts from E to E**. The supply (S) remains fixed, as does the equilibrium price (P). This indicates the price stability that could exist once all Bitcoins are in circulation.

The demand has been presented as a factor that is influenced by economic conditions. The supply remains fixed for the leading cryptocurrencies, hence creating market conditions that are different to fiat currencies. The other aspect that creates volatility in the market is competition, which is described in the following section.

2.3.2. Competition

Competition is considered favourable in a traditional market as it enables lower prices and provides variety for users. Two avenues of competition are considered for cryptocurrencies: competition among cryptocurrencies and competition between cryptocurrencies and fiat currencies.

When analysing competition among cryptocurrencies, the alternate currencies should be considered. There were more than a hundred cryptocurrencies in the market (Iwamura, Kitamura, & Matsumoto, 2014), as indicated in 2014, which has risen to over nine hundred in present times. The following list describes the most prominent cryptocurrencies apart from Bitcoin in the market currently:

- Litecoin: was created in 2011 by Charlie Lee, and uses the blockchain technology with "scrypt" (Franco, 2015) as a proof of work. The advantage as compared to Bitcoin is that it is faster and can be used by an increasing number of merchants.
- Ethereum: launched in 2015, uses a decentralised network that enables smart contracts and distributed applications to execute without influence by a third party. Ethereum's market capitalisation is second after Bitcoin at present. Ethereum was split in 2016 to Ethereum and Ethereum Classic (Bajpai, 2017).
- ZeroCash: launched in 2016, and built on the Bitcoin network offering privacy and selective transparency of transactions. It offers users the choice of 'shielded' transactions (Ben-Sasson, et al., 2014). This can be considered as Bitcoin with higher security.
- Dash: Launched in 2014 and built on the Bitcoin network providing greater anonymity; the decentralised network is designed to make transactions almost untraceable (Duffield & Diaz, 2017). Dash became popular in a short space of time, indicating users' desire for privacy. Extending on the point of popularity, the world's first Dash cryptocurrency conference was held in 2017 (DashPay, 2017).

12

- Ripple: Released in 2012, built on the decentralised network that enables low cost international payments (Armknecht, Karame, Mandal, & Youssef, 2015). It is different to Bitcoins and the abovementioned cryptocurrencies in that mining is not required (Bajpai, 2017).

Each of the cryptocurrencies mentioned as alternatives in the cryptocurrency space are able to provide a unique offering, thereby providing its differentiation and competing power with each other and Bitcoin. Due to the Bitcoin technology being open source, these alternate currencies can continue being produced at an exponential rate.

Bitcoin dominates the market and out performs competition of other cryptocurrencies. From the study by Iwamura *et al.* (2014) it was argued that Bitcoin was able to become a dominant currency as it was the first broad cryptocurrency, which had not emerged out of cryptocurrency competition. Gandal and Halaburda (2016) supported the idea by arguing that the Novacoin is higher quality than Bitcoin but was introduced much later (in 2013) into the market. Bitcoin therefore has been reaping the rewards of first mover advantage.

In the abovementioned study by Iwamura *et al.* (2014), it was stated that through this competition new technological and security innovations may emerge. This is evident from the list of alternate currencies, each with their own offering and innovation built on the Bitcoin model.

Ngai (2014) reports that recently digital currency is emerging as a payment system in competition with fiat currency. Ametrano (2016) describes Bitcoin as digital gold more than a currency, thereby providing an association with a commodity. Fiat currencies have an associated value, and since cryptocurrencies are gaining value that is comparable to fiat currencies, it can be considered as an alternative currency.

Broadbent (2016) argues that cryptocurrencies can in some ways be considered as the descendants of the "free banking" supporters from the 19th century. The blockchain technology can be viewed as a technology that can cause the central banks to review their role in ledgers.

There are two concepts that are described as important in cryptocurrency competition in a study by Zhao (2015): popularity and security. A suggestion that resulted from this study is that a greater circulation of fiat currencies should be allowed as this will expand acceptance and gain popularity. The factors of popularity (in terms of perception) and security are expanded on in the following sections.

13

2.4. Perception

To understand why there is adoption of cryptocurrencies, it is important to fundamentally understand how users perceive the idea and understand the various concerns. The perception is described from a theoretical perspective, followed by the views of various researchers in the field.

Lucassen (2013) has formed a layered model of trust to describe how information is processed. This model is developed on the notion that each layer consists of a bias that influences the following layer. When a person's reasoning lies in the innermost layer, it depicts that the information source is trusted and there is no bias. A more descriptive method to assist in understanding speculation can be drawn from Lucassen's (2013) model in Figure 5. In terms of cryptocurrencies, the trust in source and medium can be related to the brand of the cryptocurrency and the security perception aspects.
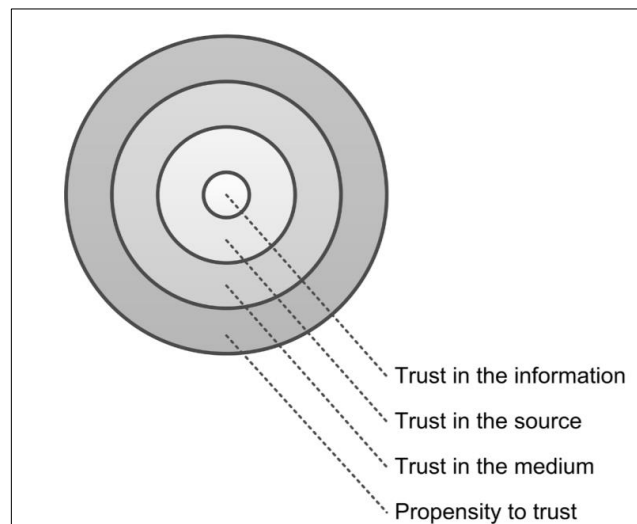
Figure 5 - Layered Trust Model (Lucassen, 2013)

Speculation is largely based on perception and trust in the information. A benefit of speculation is that it contributes to innovation. Businesses thrive on speculation to raise funds or increase their worth. Speculation can have a stabilising, as well as a destabilising effect on price, depending on the period of investment (Tobin, 1947).

The danger with speculation occurs when one's investment exposure exceeds available resources, possibly due to a false feeling of safety or quick high growth profits/wealth. There have been guidelines for cryptocurrency speculation provided by Horder (2016), where diversifying options and investing in coins that have a good reputation are recommended. It is also evident that the strength of the substitution and reinforcement

14

effects of cryptocurrencies is driven by the general interest in cryptocurrencies, not the interest in a particular cryptocurrency (Gandal & Halaburda , 2016).

According to Craggs and Rashid (2016), it is significantly important for Bitcoin adoption to increase that there be the creation of media awareness (via the use of news reports/adverts). By extension this creation of speculation applies to cryptocurrencies. In the same study the authors consider the compatibility of the speculation decision making process with a trust model, linked with reporting information. It may be linked to the psychological perspective to indicate bias playing a critical role in how people evaluate information. Wyszyński (2015) has addressed the future shape of the global monetary system, while highlighting the importance of considering the increasing popularity of digital currencies (thereby cryptocurrencies). The popularity could stem from the high returns and advantages that surround the online capability, like immediate access to multiple markets.

Another concept related to speculation is hoarding. This is when currencies are bought and held, placing pressure on the supply resulting in a limitation in currency on a holistic level. Both speculation and hoarding have an impact on the supply and demand of the cryptocurrency. The high short term gain contributes to an increase in speculation, and further contributes to the price instability.

It is interesting to consider the people that are interested in cryptocurrencies in order to better understand the perceptions surrounding cryptocurrencies. A study by Yelowitz and Wilson (2015) was the first to analyse the characteristics of those interested in Bitcoins; the results of the study found that an interest in Bitcoin is driven by programming enthusiasts and illegal activity. Furthermore, the support for political and investment motives are limited. This gives rise to the ethical issues surrounding cryptocurrencies and its use. In addition, it is important to highlight the anonymous characteristic of cryptocurrencies that enable its misuse on the deep web; illegal goods, weapons, and drugs are some examples of misuse. This can create a negative perception surrounding cryptocurrencies.

2.5. Security

The cryptocurrency methods use cryptography to secure the network, and is designed to ensure that only the owner can use the cryptocurrency. The first issue is the network safety of the currency and the second issue is the anonymity of the user (Bucko, Palova, & Vejacka, 2015). The blockchain technology allows for the user to be anonymous via a

pseudonym. Since there is no central authentication process in place, the use for money laundering increases.

The security of cryptocurrencies is naturally of concern due to the digital nature that enables cyber attacks (Bucko, Palova, & Vejacka, 2015). The algorithm used for the popular Bitcoin is continuously being updated since it is open source, and this means that solutions to hacks and more hacks can constantly be developed. A study by Alqassem and Svetinovic (2014) highlight the flaws and improvements in the architecture, and include the security aspect. The security issues have been addressed through an alternate coin offering, which is considered more secure than Bitcoin, called Zero Cash (Ben-Sasson, et al., 2014). This cryptocurrency has however not been able to supercede Bitcoin.

The blockchain technology makes use of cryptography to ensure that users are anonymous, via the use of a pseudonym. This protects the privacy of users while allowing for tracking of transactions in the network.

Cryptocurrency security seems to largely influence the perception, and by extension its popularity. It is thus interesting to investigate the effect of these constructs of perception and security on the larger aspect of price fluctuations.

2.6. Political Factors

According to a study conducted by Stratfor Analysis (2016), if cryptocurrencies are to be widely trusted and accepted the regulations surrounding them need to be clear. The study emphasises that it is often a key factor to determine how quickly an emerging technology is adopted, and in this case perceived. The political factors and regulations surrounding cryptocurrencies are addressed in the next section.

Cryptocurrencies can either be issued by central authorities or have no link to a central authority. Bitcoin for example, does not have a central authority. There are no taxes or interest, therefore there is no monetary policy in existence. According to Jeong (2013), all Bitcoin monetary policy has been hard-coded into the protocol. The peer-to-peer nature of cryptocurrencies decrease the ability to control the money supply by central banks. It is also important that these currencies consider implications for illegal transactions.

The issue of tax laws in the virtual economy can be considered. There is limited influence of the law on the online systems through which cryptocurrencies operate. The aspect of cryptocurrency miners that receive the revenue earned by issuing the currency is also of economic concern for the country. These miners may choose to occupy permanent

16

employment while mining bitcoins, without having to pay any taxation on the latter. The question of whether mining is indeed profitable in countries with high electricity costs is also a factor to consider. Akins, Chapman and Gordon (2014) consider this further where recommendations are presented for the treatment of tax and addressing the transaction compliance issues.

Further to political issues is the aspect surrounding banking regulations. Should there be pressure surrounding fiat currencies in terms of regulations, cryptocurrencies can be seen as an alternative (Ahamad, Nair, & Varghese, 2013). There is a gap in terms of literature relating to the regulations surrounding cryptocurrencies, and an aim of the research is to assist in filling the gap and providing themes that exist in relation to regulations/politics.

The literature provides a review of the aspects that have been identified as factors that influence price fluctuations. Cryptocurrencies are digital money and are transmitted via a digital medium and secured via cryptographic functions. The very nature of cryptocurrencies makes it different to fiat currencies, and thus appeal to a different audience. The factors that could influence price fluctuations are indicated as market conditions (supply and demand and competition), perception, security and political factors. Therefore, the aim of the research is to determine if these factors do indeed influence price fluctuations, and if so then to determine the drivers.

Chapter 3 – Research Propositions

The purpose of the research was to explore the reasons for price fluctuations of cryptocurrencies. The objective is to enable understanding of the levers that affect price fluctuations for a value proposition of cryptocurrencies to be created. In order to do so, the research propositions that were established are presented in this chapter. These propositions aim to provide insight into the reasons for price fluctuations of cryptocurrencies and possibilities for understanding or predicting their behaviour in the future.

3.1.1 Proposition 1

Part 1: Perception influences cryptocurrency competition

Part 2: Security influences cryptocurrency competition

The related questions aim to establish the perception of cryptocurrencies that currently exists and the profile of adopters. The literature revealed concern of the security of cryptocurrencies and questions were asked in relation to the effect of security on perception. The aim was to determine the effect of perception and security on competition, and to determine if there was a link to price fluctuations of cryptocurrencies.

3.1.2 Proposition 2

Competition of cryptocurrencies influence price fluctuations.

The competition of cryptocurrencies was questioned from both among cryptocurrencies and between cryptocurrencies and fiat currencies. The aim is to determine the competition landscape and the dynamics of competition amongst cryptocurrencies and fiat currencies. The idea of cryptocurrencies serving as a substitution for fiat currencies was also explored. The reasons for price fluctuations caused by competition would be the ultimate outcome for this proposition.

3.1.3 Proposition 3

Supply and demand of cryptocurrencies influence price fluctuations.

The aim of the questions was to determine if supply and demand and perception (speculation) had a contribution to price fluctuations. The literature concluded that demand could be influenced by perception. This proposition relates price fluctuations to broader macroeconomic factors.

18

3.1.4 Proposition 4

Political factors related to cryptocurrencies influence price fluctuations.

The effect of government regulations and politics on cryptocurrency price fluctuations was the aim for this proposition. Governments either positively or negatively influence the adoption of cryptocurrencies, by either supporting it or not.

The factors that were highlighted in this chapter have been derived from the literature as possible causes of price fluctuations of cryptocurrencies: supply and demand, perception, security, competition and political factors. The propositions have been tested using the methodology described in the next section.

Chapter 4 – Research Methodology

The aim of the study was to identify the causes of price fluctuations of cryptocurrencies by conducting a study of views presented by experts in the cryptocurrency environment. This chapter details and justifies the methodology used to collect and analyse the data; qualitative analysis description, population, sample description and unit of analysis. The analysis process and limitations are documented.

4.1. Research Design

The research had two main objectives. The first was to understand the cryptocurrency landscape and explore how certain levers affect the price fluctuations of cryptocurrencies. The second was to understand the relationship between the levers that are responsible for affecting the price fluctuations.

The lack of literature was a challenge, and to address this Creswell (2014) recommended the use of qualitative methods to explore where there is little that is known. The qualitative method was also recommended by Koerber and McMichael (2008), in order to generate insights into unknown phenomena in another industry.

The qualitative approach was believed by the author to provide a variety of knowledge regarding experts' experiences. An added advantage is the interactions with the participants; as this provided insight into the personalities of cryptocurrency experts and allowed for opportunities of informal but relevant conversations focusing on mutual interests in the technology space.

The aspects of the research process in terms of philosophy, approach, strategy and technique are explained below (Saunders, Lewis, & Thornhill, 2009):

- *Philosophy*: Pragmatism. Here, the research question and objective are the important determinants of the adopted research philosophy (Saunders & Lewis, 2012). There were semi-structured interviews, which can be considered as positivism philosophy.

- *Approaches*: Induction. Saunders and Lewis (2012) describe induction as a 'bottom up' approach, where the aim is to develop some speculative hypothesis that can be investigated. This research made use of an inductive approach due

to the fact that there is not a vast amount of theory currently associated with cryptocurrencies.

- *Strategy*: Grounded theory. This is where theory is developed using data generated from interviews/observations. Saunders and Lewis (2012) points out that there is an element of deduction to this strategy. As per the reason for induction above, this approach is necessary due to the limited theory available in the field.

- *Techniques and Procedures*: Semi-structured interviews. Subject matter experts (SMEs), institutions that are involved with cryptocurrencies, academics and cryptocurrency start up owners were interviewed for the research. In terms of inductive research, Migiro & Magangi (2011) suggest that the following approaches can be used in data collection; open–ended questions, closed–ended questions, observation, text and image analysis, interviews and focus groups. Semi-structured interviews were used to offer room for expanding the scope and addressing alternate themes that arose. A helpful technique that was used to formulate themes was mind mapping research techniques (Crowe & Sheppard, 2012).

4.2. Choice of Methodology

Research has been described by Saunders and Lewis (2012) as being one of three types: exploratory, descriptive and explanatory. The research project is exploratory as there is insufficient research on reasons for price fluctuations in cryptocurrencies. The idea is that this qualitative approach allowed for testing proposed reasons for price fluctuations through expert opinion. According to Jervis and Drake (2014) qualitative research may be used as a substitute for classical quantitative profiling methods or to powerfully support quantitative methodology. Robson (2002) illustrates that exploratory research that should be used for developing new insights, which according to Saunders and Lewis (2012) allows flexibility but does not mean the nonexistence of direction to the enquiry. The research findings became narrower as the project progressed, and was an indication to stop interviewing, as a point of saturation was reached where no more insight can be gained.

Given the qualitative nature and the objectives of the research, an exploratory study was considered appropriate for gathering information and insights. According to Saunders and Lewis (2012), two methods that are usual for exploratory research are consulting

academic literature and interviews. The latter approach was used to gather data for analysis in the research.

The interview method was selected for the following reasons:

- Flexible data gathering method that allows participants to contribute openly and freely (Saunders & Lewis, 2012)
- The interview method is interactive, thus allowing the interviewer to gain more in-depth insights into how price fluctuations occur and what are the responsible levers in cryptocurrencies.

The interview technique is thus appropriate for this research project.

4.3. Universe

4.3.1. Population

The population consisted of those involved with cryptocurrencies. Cryptocurrency start up owners, subject matter experts, those institutions that are involved with cryptocurrencies and academics researching in the field and related industries. The number of years of experience in the field was not a requirement, however more participants had more than five years of experience, making the population experienced since Bitcoins came into effect eight years ago. In terms of geographical location, the participants were from South Africa. There was an informal discussion held with a renowned individual in the cryptocurrency environment in San Francisco, however no interview was conducted. In South Africa, there is a larger number of cryptocurrency companies situated in Cape Town than Johannesburg, however the interviews held were with more Gauteng based individuals.

The participants were from various backgrounds: academic, MBA student, economist, asset manager and start up owner. This assisted in shedding light on the role that various institutions and the economy play in cryptocurrency price fluctuations, as the population was from a variety of backgrounds. The start-up owners formed a large part of the population for the interviews. It was an advantage for the interviewees to have diverse backgrounds as it made the research and analysis more holistic, providing a more diverse view. Access to the start-up owners were a concern; however, it was noted that once tapping into their network it was easier to motivate for time for an interview. The backing of Gordon Institute of Business Science when arranging the interviews proved to be of great benefit.

4.3.2. Sample

According to Koerber and McMichael (2008), there are three main categories of sampling for qualitative research: convenience, purposeful, and theoretical. Purposeful sampling occurs in an instance where the researcher is looking for participants who have certain characteristics or traits (Harsh, 2011). This method was chosen based on the fact that it is a non-probability sampling method, where the participants are selected on their expertise and ability to influence the field. There was also an element of convenience with non-probability sampling, which allowed for the selection of the most accessible participants. This was required due to the difficulty in sourcing individuals that are knowledgeable in the cryptocurrency space.

The interviewed individuals were selected for the research based on their experience and expertise. There was anticipation that a snowball technique would have needed to be employed where reference to additional participants is made until saturation has been achieved.

It was important to bear in mind that snowball sampling had the limitation of bias and that purposeful sampling was more effective. In terms of geographical area, there were no limitations considered as there is limited knowledge of cryptocurrency within South Africa. Alternative means, for example Skype, a VOIP (voice over internet protocol) medium were employed in such cases.

4.3.3. Unit of Analysis

The unit of analysis that was used for this research is the perceptions of experts and practitioners toward the selected constructs in fostering price fluctuations for cryptocurrencies. It was important to ensure that the interview perceptions were not influenced, hence the questions were structured accordingly.

4.4. Data Collection Methods and Research Instruments

The data collection method aimed to generate primary data from detailed interviews with experts in the cryptocurrency environment. Creswell (2014) provided the following approaches to data collection for qualitative research:

- Unstructured, open-ended interviews supported by notes or audio recordings and transcriptions
- Semi-structured interviews supported by notes or audio recordings and transcriptions

- A combination of different types of interviews: face-to-face, e-mail, focus groups and telephone interviews

The questionnaires were structured in a 'semi-structured' manner, where a list of predefined topics or questions based on the literature was used as a guide. This left room for further investigation and questions; the questions were initially broad and allowed for the focus to progressively narrow and flexibility to steer the conversation as the research progressed. According to Saunders and Lewis (2012), this semi-structured approach allows for more topics to be covered.

The list of questions needed to be pre-tested once passed by the ethical committee. The ethical committee approval letter is included in Appendix A. The interviewees were asked to consent to voluntary participation in the interview and were reassured that their confidentiality will remain protected – all interviewees consented in writing. A technique to adhere to this in the research report is to refer to respondents using numbers. The pre-test was conducted with a potential interviewee and allowed for further refinement and focus of the questions. Since the interview was successful and no refinement of questions required, it was included as an interview for data collection. An estimated minimum number of ten interviews were to be conducted or until saturation is reached (Saunders & Lewis, 2012). This research consisted of interviews with nine participants, after which saturation was reached.

4.4.1. The Interview Process

The semi-structured interviews took place in various locations such as meeting rooms at workplaces, Gordon Institute of Business Science and private tutoring facilities. There were two interviews that were conducted over Skype, while all others were conducted face-to-face. Face-to-face interviews are valuable because it allows the interviewer to gather observation information thereby allowing the interviewer to question facial expression or other body language.

The face-to-face interviews however may introduce a fear of lack of anonymity of the participant. Fortunately, all participants indicated a trust towards the research institution and by extension the interviewer. A consent letter that ensured the participation was voluntary and interview content was confidential was signed by the participant. The consent letter is included in Appendix A. The structure of the interviews asked for the background of the participant first, thus enabling free flow conversation to reduce any tension and ensure the participant was more comfortable with the interviewer.

All interviews were conducted in English, in which the participants and interviewer were fluent. The interview schedule is included in Appendix B.

4.4.2. Transcription and Tool Input

Davidson (2009) argued that transcription has been overlooked in recent years, and is imperative in qualitative research. Therefore, all interviews were recorded in audio format and transcribed for analysis. The interviews were supplemented with notes that were taken by hand and used to add to Chapter 5. The transcripts were created in Microsoft Word.

All interviews were transcribed verbatim from the audio recordings to reduce selective systematic bias. The transcripts were all compared against the audio recordings in order to ensure correctness and to rectify any errors. When analysing transcripts, Denscombe (2014) highlights that emphasis and accent that are used in speech are difficult to identify in a transcript, and care should be taken in noting changes in voice tone. The transcriptions are included in Appendix C.

The transcriptions were named as per a numbering convention to maintain confidentiality. These were then uploaded onto Atlas.ti analysis tool for the coding and analysis. The interview sequence was maintained in order to ensure integrity of the data collection for the coding procedure.

4.4.3. Data Analysis

For the qualitative analysis, the Atlas.ti software was used together with Microsoft Excel. For qualitative research, the aim in terms of analysis was to develop themes that result from the interviews.

An inductive analysis was used to develop theory and new themes that emerge and potential levers for price fluctuations of cryptocurrencies were developed. Once the data was input to Atlas.ti, the categories and subcategories were created. Codes were developed when mention to a specific association with a theme was made. The associated code families, which was an aggregation of the codes was thereafter developed. Lastly, the themes were formed by collating the code families.

The expected output was that the results and literature review should be combined to form the themes/theory. This is documented in Chapter 6.

4.4.4. Coding

In qualitative data, the phrases and sentences were used to represent themes. The coding procedure took approximately 35 hours. Code books or code families were created and reviewed using the code manager function of Atlas.ti. The codes were derived from the data collected through the interviews and included themes developed from the literature. Initially 168 codes were developed and classified into 28 code families. The code book is included in Appendix D. The codes were then analysed to develop themes, in order to relate to possible reasons for price fluctuations. The thematic content analysis code sheet is contained in Appendix E.

The data was coded in the order that the interviews were conducted, and the new codes that resulted during each interview were recorded. The frequency of emergence of new codes were used to determine when saturation was reached. Figure 6 indicates the number of new codes as the interviews progressed, showing that saturation occurred after nine interviews.
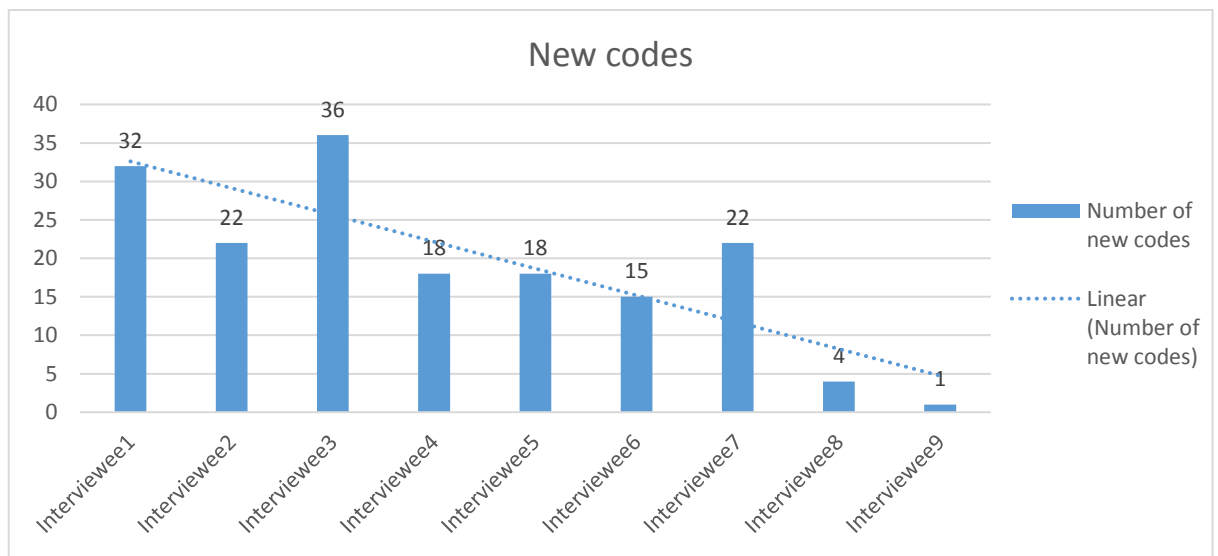
Figure 6 - Number of new codes illustrating saturation

4.5. Data Validity

The validation of the responses took place at the end of each interview when a summary of the factors that influence price fluctuations was provided by the interviewer, before asking if there were any additional factors that should be considered. This assisted in validating the themes and identifying the new themes in an efficient manner. The participant was able to validate responses by acknowledging the summary and further explain concepts that required a greater understanding.

26

The key themes were inferred by the interviewer using the verbatim transcripts of the interviews.

4.6. Research Limitations

The limitations of the research are listed below:

- Non-probability sampling does not allow for extrapolating the findings to the entire population as there is a non-statistical representation of the population in the sample (Saunders & Lewis, 2012)
- All participants were from South African institutions or owners of South African based companies, implying that the research may not be applicable to other geographic locations
- All participants were male, which could introduce gender bias although not significant in this research.

This methodology described the qualitative approach that was used for the research project and set forth the description of the sample that was interviewed. The reason for choosing a qualitative method has been indicated, followed by an indication of the tool and description of the method that was used for analysis. The coding technique was described and evidence of reaching saturation was provided. This chapter is concluded with the limitations for the chosen research methodology.

27

Chapter 5: Results

The purpose of the research was to determine the factors influencing price fluctuations of cryptocurrencies by conducting a qualitative study into the reasons for the fluctuations. There were nine participants that were interviewed, with a total of eight hours of recordings. The qualitative data was gathered from August 2017 until September 2017.

The description of the participants is described below, followed by the presentation of results that were captured. The research questions that were outlined in Chapter 3 above are used to guide the presentation of responses.

5.1 The Sample

The sample consisted of nine individuals that have experience in the cryptocurrency environment and are knowledgeable about the associated volatility in price. The sample was purposefully diverse in terms of experience, however there were only males interviewed due to the environment being male dominated.

The interviews were conducted in English, in which all participants were fluent. Participants educational background was not a requirement, but noted to be at least a secondary qualification.

Table 1 - Sample description (occupation and experience)

	Blockchain start-up owner	MBA student	Academic	Economist	Asset Manager
Less than 5 years of experience	2	1			
More than 5 years of experience	2	1	1	1	1

The first question was for the participant to explain their involvement in the cryptocurrency environment. A screening process was conducted before the interview to ensure that the participants had the necessary experience to part take in the interview. When potential participants were found to be too inexperienced, informal conversations were held to understand the field better. Seven participants stated that they were knowledgeable about the blockchain/cryptocurrency environment and two participants were more familiar with fiat currencies and the economics surrounding commodities than cryptocurrencies, and were included in the interviews to gain a holistic perspective.

28

There were four individuals interviewed that had founded blockchain start-ups, and it was noted that two of the remaining participants had invested in some form of cryptocurrency. The percentage of participants that invested in cryptocurrencies is indicated in Figure 7.
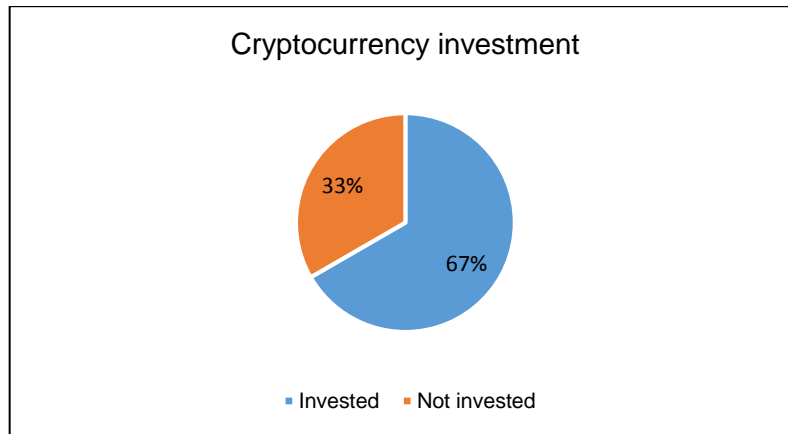
Figure 7 - Participant investment in cryptocurrencies

Upon completion of the interviews, it was found that two additional interviewees had purchased one or more cryptocurrency. The types of cryptocurrency were enquired about and the most popular was Bitcoin (five of the six participants that purchased cryptocurrencies) as indicated in Figure 8, which could introduce a certain skew into the data. There was one participant that had investment in Ethereum.
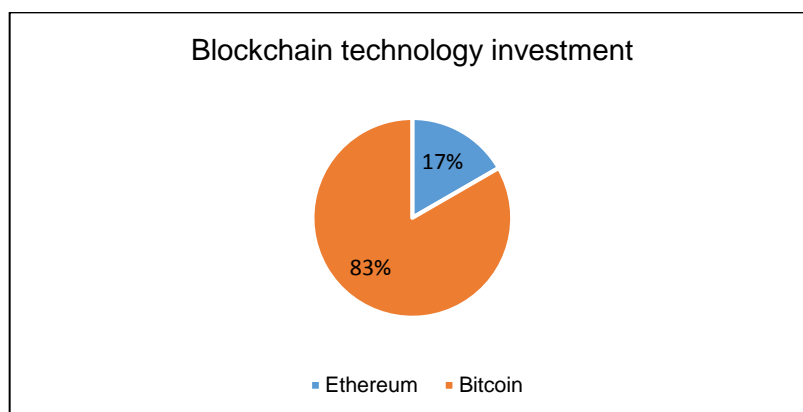
Figure 8 - Percentage of participants' investment in Bitcoin versus Ethereum

All participants are geographically located within South Africa, with a more specific breakdown indicated in Table 2.

Table 2 - Participant geographical location

	Johannesburg	Pretoria	Cape Town
Cryptocurrency start-up owner		1	3
Not a cryptocurrency start up owner	4	1	

Three of the cryptocurrency start up owners are based in Cape Town, with a fourth based in Pretoria. There is thus a split between Johannesburg, Pretoria and Cape Town, with Pretoria covering two of the interviewees. Upon further investigation, it was found that there are more blockchain start-ups and training institutions in Cape Town than in the rest of the country.

Two of the participants had left their full-time employment to pursue a start-up that develops a cryptocurrency. The participants that own start-ups were more vocal on their opinions surrounding cryptocurrencies (current and future state) than those who did not own start-ups. This could be a form of bias, in that there would be stronger opinions from start-up owners.

5.2.   Other Participant Observations

The participants were not required to disclose their age; however, it was noticed that they were all approximately 35 – 45 years old. This illustrates that there is a similarity in the sample in terms of the personal stage of their lives.

There were seven face to face interviews and two conducted over Skype. This was due to the availability of interviewee and interviewer and the geographical distance. There were two potential participants that were unable to part take due to unforeseen circumstances. In both cases, meetings were rescheduled and thereafter cancelled. In order to still gain opinions from these individuals, their twitter feeds were analysed for cryptocurrency related information.

5.3.   Presentation of the Findings

In order to understand the reasons for price fluctuations, the participants' opinion of certain factors and their effects on the fluctuations were determined. This part of the interview was to determine if the factors that resulted from the literature review were adequate and relevant.

The participants were then able to contribute their own views on what triggers the price fluctuations and associated reasons.

5.3.1. Proposition 1

This section begins with a description of the codes used in the analysis. Perception and security are addressed in separate sections. Security is considered as a subset of the technology aspect of cryptocurrencies. All phrases or keywords that were related to perception and technology were coded, resulting in associated themes. The data captured for each code used to form the adoption and technology themes thereafter follows:

- Adoption: perception, cryptocurrency use, future of cryptocurrencies, low confidence, perception of value, unethical use of cryptocurrencies
- Technology: Alternate currencies, authentication, bitcoin network, blockchain technology, exchanges, security

The first proposition was addressed in two separate questions during the interview, as two factors that could impact price fluctuations are considered. All respondents answered the questions that related to this proposition. The questions were conducted in an inductive manner, where codes were formed from the transcripts and the themes that were developed are indicated below.

The number of times adoption and security were mentioned is indicated in Figure 9; this represents a count of the codewords during the interview that relate to adoption and security. These were the most often mentioned codes with regard to the proposition in question. It is observed that there were 54 mentions to adoption and 63 mentions to security in total. In seven cases, those participants that mentioned adoption also spoke about security.
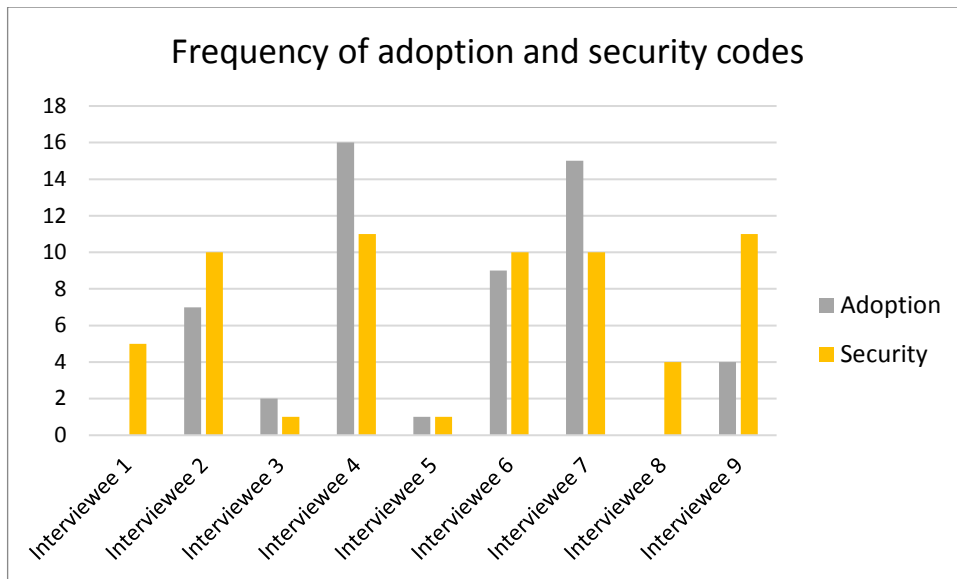
Figure 9 - Adoption and security code frequency

5.3.2. Proposition 1 – Part 1: Perception influences cryptocurrency competition

Adoption

The participants that mentioned adoption were of mixed opinions regarding the adoption rate. Participants range between gradual and exponential adoption. The rate of adoption was found to depend on the perception surrounding blockchains/cryptocurrencies.

Participant 6 and 7 concur by stating "there is no underlying asset attached to cryptocurrency" and cryptocurrencies are "valueless" respectively. Participant 7 has a varying opinion and emphasises that there is more adoption: "There's much more mainstream adoption". This participant predicts that it will be approximately five years before there is mainstream adoption in cryptocurrencies. Further, the adoption has been described as exponential.

Participant 7:

"I am very open to being surprised and for it to happen faster than five years"

The participant acknowledged that exponential curves are very difficult to predict. Participant 4 sheds light on the link of adoption to price fluctuations by explaining the relation of legitimacy: "Legitimacy equals adoption equals strengthening price".

Another aspect that involves the price fluctuation is the adoption by merchants, as mentioned by participant 6:

32

"with the number of merchants that take on or adopt this cryptocurrency, and where merchants decline or are opposed to adopting cryptocurrency as a medium of exchange then it will influence the price"

Legitimacy in this sense links to authentication, which is a security measure of the blockchain technology. Since blockchains are designed to be decentralised, there is no central authority providing authentication.

Perception

All nine participants indicated that perception plays a role in influencing price fluctuations. The price fluctuations were also said to impact adoption, as per a comment by participant 4:

"the recent fluctuations are on the positive side adoption, on the negative side technological or awkward threats"

Participant 3 referred to cryptocurrencies as a speculative currency and participant 5 linked the perception to confidence in the cryptocurrency. Participant 5 stated that adoption could be as a result of fear.

Participant 5:

"So I think it's almost like a hedge for fear that people think okay fine it's the regulated system is going to go down then the unregulated might go up. I think there's a fear of something, that's what drives the price'

Participant 6 shares similar views about fear as participant 5, and mentions the aspect of risk appetite for adoption of cryptocurrencies.

Participant 6:

"I think if you are risk averse at this point you would be reluctant to invest in cryptocurrency and therefore demand for cryptocurrency is less than what it could be if everyone was risk neutral"

Participant 9 links market conditions to perception and indicates that this influences the price fluctuations:

"We saw what's happened with the price ahead of the halving last year when the reward for Bitcoin mining was halved by the network Algorithm and there was – before an event the market tries to price it in, leading up to the event there's a lot of frenetic movement based on perception, and then following the event there's a reaction based on reality"

Participant 4 describes the adoption as gradual and links the lack of adoption to a constraint for the demand of cryptocurrencies. Participant 1 shares the same sentiments by stating that there has been no personal investment in cryptocurrencies. The reasons for the low confidence revolve around users being sceptical about new technology and there is no value (underlying asset).

Participant 5: "Yes, that's what Warren Buffet always says, if a good company goes down 30% then you buy, because you can measure the value behind that company. You can't measure anything around Bitcoin".

<u>Adopter characteristics</u>

The types of people classified as adopters have been described by participant 4 as good people. The participant goes on to mention that these adopters are also in the minority. Further, those participants that speak about adoption mention users as being "tech aware" and those who trust technology.

There is more of a description of adopters by Participant 2, where inference is made to early adoption. Participant 2:

> "most of the greater proportion of people using Bitcoin at the moment are tech-savvy people, people who understand or are earlier adopters of technology, and as a result they follow the technological development of this system"

Participant 1 supports the view, by stating that the users of cryptocurrencies are early adopters.

<u>Usage of cryptocurrencies</u>

According to participant 4, the use of cryptocurrencies is limited due to being unable to spend these currencies at many places. The same sentiments are shared by participant 5:

> "if you can't really cash out then how can you go and buy something"

Contrary to this participant 3 feels that it is a plus that Bitcoin can be used to pay for things, even though it is limited. There are investors and traders that use cryptocurrencies in order to make more money, according to participant 5.

Participant 1 mentions that telecommunication knowledge will be useful as there will be a need for the expertise with the further evolution of cryptocurrencies. An application that participant 1 has been involved with Bitcoins in solving an energy problem.

There were three participants that mentioned the unethical use of cryptocurrencies, of which one participant (Participant 4) felt that this will not be a large market:

> "I don't think you are going to get a huge sell-off from the criminal or underworld, I don't think they are a big element of this thing, by and large the users are good people and they want to use it more universally"

The other two participants that mentioned the unethical use (Participant 3 and 5) both acknowledged use in this space. The concern of a decrease in value with unethical use was raised by participant 3:

> "how do you solve the problem of fraud? Because by increasing supply you reduce the value".

<u>Future of cryptocurrencies</u>

Most of the participants that mentioned the future of cryptocurrencies referred to an uncertain future. Participant 2: "It's a ride, no-one quite knows where it ends up" and participant 9: "why we wouldn't know exactly what would happen, because that would require to predict the future, the dynamics at play are the same as in any other market". Participant 6 shared the same sentiments. Participant 7 believes that as the currency matures that there will be stability, and that it is just a matter of time.

The waves of technology were mentioned when Participant 9 explained that the second wave of innovation is usually the one that supersedes the others:

> "And so that's always in the back of my mind when I think about Bitcoin, is that Bitcoin is the first wave and that means it's where all the experimenting and making and breaking happens, but maybe something in the second wave like Ethereum is the one that stays the course and ultimately wins in the long term"

It was also mentioned in the same interview that it is unlikely for open source projects to stop, as there is usually an amendment to it in some way (referred to as a 'fork') and there is continuation. The open source nature is further elaborated on in the quote below, by participant 9:

> "when we are talking about something that's open source like Bitcoin, because of the rate of change of open source systems, and because of how contribution happens and the inherent agility that exists in an open source project, that technology itself could become the second wave"

Due to the open source nature of cryptocurrencies there could be development of many other cryptocurrencies, which has been stated by participant 9:

> "eventually we end up with several currencies that are globally available but not sovereign currencies in the future"

The same participant also predicts the future Bitcoin Cash, which resulted from the hard fork in August 2017. Participant 9: "I think Bitcoin cash will just become another old coin and phase into obscurity"

Perception of value

Overall, Bitcoins are well known and seen as more valuable than the other cryptocurrencies. Speculation is largely influenced by the perception surrounding the cryptocurrency. Participant 2 mentions that perception and regulation are related when it comes to the price fluctuations of cryptocurrencies.

The speculation leads to a store of value, as per a comment by participant 3: "then we have a store of value which is in some ways speculative. So it's a speculative currency and that's why it floats around".

Participant 4 mentions the three perceptions and that it is linked to cryptocurrencies and speculation surrounding prices. The perception is strongly linked to confidence. The currencies that have a high confidence are those that have a good perception.

The aspect of 'fear' also comes into perception. Participant 5 explains: "I can't really tell you why the supply and demand goes up except for people fearing they are missing out on something".

The perception also links to the value of the cryptocurrency. It was unanimous that cryptocurrencies have no value as there is no asset attached to it. The perceptions surrounding fiat currencies have prevented it from losing value over time, as per participant 6: "the dollar and the Euro has been around forever. I mean it has that stability, it's experienced fluctuations but the dollar hasn't gone to nothing".

The perception surrounding security was highlighted. The security hacks (hacks to the exchanges, not the blockchain network) are not to be ignored as highlighted by participant 7: "people are just kind of ignoring the risks, and with that comes the security hacks, they are like, well, as long as we are making money this is fine."

Participant 8 brings in the aspect of social norms: "I think beyond the political and regulatory conventions there is also social norms which would have an impact. And if

social norms can be fickle, we have seen currencies that have potentially become widely circulated and they just don't get the traction, and suddenly that cryptocurrency is worth nothing, no-one wants it".

The media is a strong influencer of people's perception. Participant 9 highlights that when there is a news break about something there is an immediate reaction by people to it.

5.3.3. Proposition 1 – Part 2: Security influences cryptocurrency competition

Technology

Technology has been described from the perspectives of the blockchain technology and alternate currencies, the network, exchanges and security. The chart in Figure 10 shows the frequency of the technology related codes.
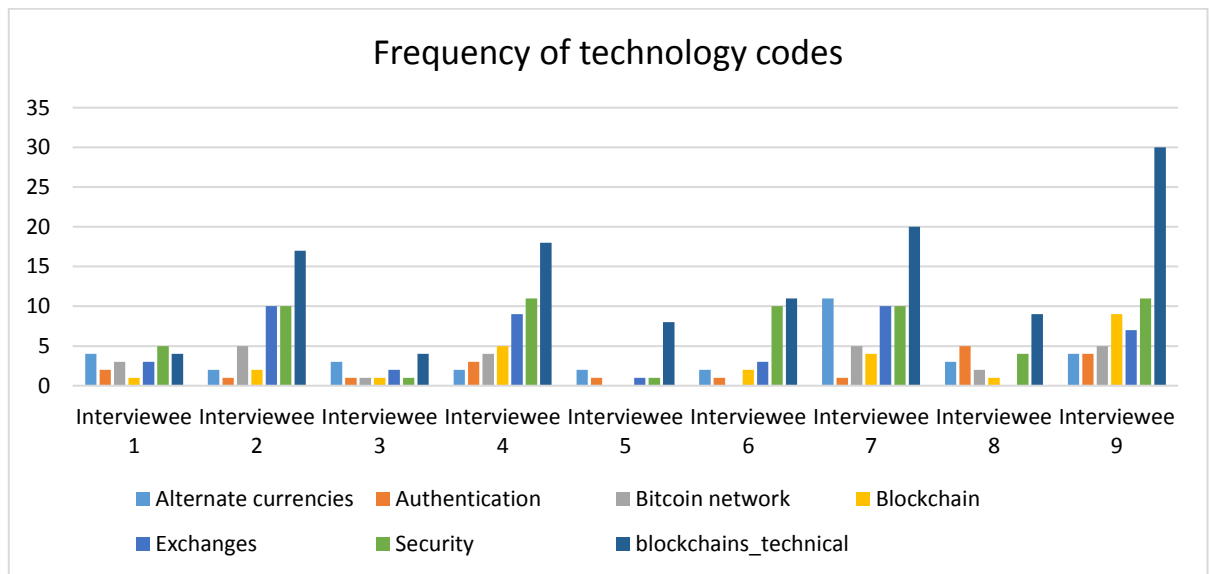
Figure 10 - Technology code frequency

In terms of technology, the most frequent mention was made to the technical aspects surrounding blockchains, which was done by all nine participants. This is not related to the proposition in question, however covers the security aspect that links to the proposition. The security aspect, authentication and alternate currencies was also mentioned by all participants, although more frequently by some as indicated in Figure 10.

37

<u>Alternate currencies</u>

When participants were questioned about competition, alternate currencies were often mentioned. The participant was asked to indicate what their thoughts were surrounding cryptocurrency competition. The competition aspect is discussed in the following section; however, the technology aspects are considered here.

The blockchain technology used as a base for these alternate currencies was mentioned by all participants. The two participants (participant 1 and 7) that have developed their own cryptocurrency explained the purpose and technical aspects around the currency. Participant 1 alluded to the fact that the alternate currencies build on the Bitcoin technology:

> "people have started making alternative cryptocurrency with improvements on Bitcoin, maybe it can handle more transactions per second, shorter block times too"

Participant 5 referred to the open source nature of these alternate currencies, by stating: "it's such an open environment, anyone can start a cryptocurrency"

The four main cryptocurrencies alternate to bitcoin have been listed by participant 4 as ripple, monero, litecoin, ethereum. Litecoin was elaborated on by participant 7:

> "Especially since Litecoin has also activated segregated witness and all of the tech that Bitcoin wants to activate Litecoin seems to have done already. So for a lot of people Litecoin is a bit of a backup at the moment and we have seen a major increase in the price of Litecoin as well"

The same participant mentions alternate cryptocurrencies of Ethereum, Dash and Litecoin. Participant 7 is of the opinion that Ethereum has challenges:

> "I think Ethereum has some challenges because solidity is really complex, the smart contract language is complex and the way Ethereum is structured is they are trying not to have any features. So they have very, very base layer basics and a lot of the real work is happening in the contracts"

The use of Ethereum is primarily smart contracts according to the two participants that were knowledgeable on the cryptocurrency. The Multisig wallet technology that can be used in the contract space by exchanges was mentioned by participant 7:

38

> "So even your wallets now are contracts, Multisig wallets, developed by really reputable developers like Parity for instance, there was a bug in their Multisig wallet"

The hard fork that took place on 1 August was highlighted by participant 7 and linked to the issue of scaling. Participant 8 focused on the split in the market that the fork will cause. Participant 9 linked this hard fork phenomena to price fluctuations:

> "When people think Bitcoin is going to fork or when there's a big news story saying that a central bank is thinking of making Bitcoin illegal we see an immediate impact on the price"

The alternate currencies are linked to both technology (blockchain technology) and market conditions due to the rise in competition that it provides.

<u>Authentication</u>

The use of cryptocurrency is evident when authentication in cryptocurrencies have been mentioned. The cryptographic nature is what makes these currencies authentic.

Participant 7 and 9 mentioned the cryptographic public and private keys that are used to ensure authentication. Cryptography is mentioned by participant 8 in the form of hashes and security keys.

The concern of no authentication from a regulatory perspective was raised by participant 5:

> "you buy cryptocurrency through your credit card, there's no FICA or anything. So, a person doing that I don't think they really care about personal information"

<u>Bitcoin network</u>

As mentioned by 7 participants, Bitcoin seems to be the leader in the cryptocurrency space. The purpose of Bitcoins has been explained by participant 2:

> "you can use it as a medium of exchange but that's not what its purpose was. Bitcoin is being designed to facilitate transactions of value between people with very small amounts of data encoded in it, in as fast a way possible with the lowest transaction fees"

The security aspect has been mentioned to support the confidence surrounding Bitcoins. Participant 9 refers to Bitcoins as 'un-hackable'. Participant 4, although sceptical about new technology, trusts Bitcoin based on the technology:

"I am a bit sceptical about new technology, I like Bitcoin specifically because it's good technology, it's robust technology"

Further mention to confidence in the technology is referred to below. Participant 4:

"And I think the latest move with Bitcoin with improving the protocol is a good move to stave off potential competition and what it also means is that it can demonstrate that it is upgradable and that the participants on the Bitcoin network are prepared to upgrade and defend against potentially better technology. So competition will come from better technology"

The possible concerned security perception is explained by participant 2, as being an issue with the management at exchange level rather than the security surrounding the technology:

"Bitcoins were stolen from users but that wasn't from the Bitcoin network, that was the exchange. Someone stole a laptop of one of the people running the exchange and it had the passwords on it. Yes, that's the shortfall. But the Bitcoin price has come up today, so that security issue didn't cause a correction in the Bitcoin price because it's not about new technology and it's sufficiently mature now for people to know that if a Bitcoin exchange gets hacked it's got nothing to do with the technology behind Bitcoin and Blockchain, it's to do with a badly run digital currency exchange"

The bitcoin network has the ability to fork into an alternate cryptocurrency, termed a 'hard fork' by participant 4. This has been echoed by participant 1 as a problem.

Participant 1:

"The problem with that is then Bitcoin can actually split into two. If it splits into two then it loses a lot of its network effects and if it actually happens that it splits into two I think Bitcoin is going to be in a lot of pain and I won't be surprised if one of the alternative currencies takes over the number one spot"

The split is also mentioned by participant 7:

"There was a time recently when Bitcoin was struggling quite a bit with a lot of the drama around the hard fork and so on"

Participant 7 addresses scaling in terms of forks (both hard and soft forks):

"if you think about Bitcoin it is just still chugging along, still does exactly what it's supposed to, nothing really has changed, and yet there's been tremendous

40

drama around scaling, hard forks, soft forks, these guys threatening to do this, segregated witness, yes. That drama and perceived instability based on people not making those decisions, and people in the community that have great visibility and are respected make a statement, that can cause price fluctuation as well"

The day that participant 9 was interviewed is the day that the segregated witness fork took place: "Bitcoin cash fork is happening as we speak". Participant 1 provided the following reason for a fork in Bitcoins not taking off:

"The big problem is if we start to advantage the big miners then the mining becomes more centralised and we start to form a weak spot where the network can be attacked. And so I can't see the logic of these miners doing that"

Participant 1 also elaborates on the reason for security of the Bitcoin network:

"I think the big positive is the market's first mover, it's well known and it's very secure because of the large amount of computing power securing it."

The security of Bitcoin is also mentioned by participant 4:

"thus far Bitcoin hasn't managed to be hacked, and it seems like something that is pretty secure. If you want to go and change a transaction all the way up the chain it's impossible, you are going to create a fork"

Participant 7 refers to the blockchain technology as self-regulating, as it does not require a central authority.

"Bitcoin is a self-regulating currency, there's no-one in the world that can change it because of the way it's built"

This brings in the regulatory aspects, which is echoed by participant 9:

"Bitcoin has already won technically but is halfway to failing politically"

The themes of technology, security and regulations are prominent in the discussions surrounding Bitcoins.

Blockchain

The underlying technology of the Bitcoin has been explained briefly by participant 2: "deviated from Bitcoin to Blockchain to Distributed Ledger". The nature of the technology is 'elegant' as per participant 9. The same participant does not fail to mention that blockchain technology is in an infancy stage.

Participant 9:

41

"as far as the internet has taken us, less than half of the world's population is currently connected, there are three and a half billion people who don't have access to the internet. So if that's how long it's taken the internet to transform the globe, blockchains are just completely nascent"

The fact that the technology is widely available (due to access of the internet) has been mentioned by participant 3. Bitcoin is one of the uses of blockchains:

Participant 7:

"last year we saw Blockchain, Blockchain, Blockchain, all the financial institutions were around Blockchain, not interested in Bitcoin, this year suddenly Bitcoin has made an entrance again"

Participant 9 also identified banking as an application for the blockchain technology. Rand Merchant Bank was mentioned in the following context: "innovative work being done in banking and blockchains at the moment"

The innovation of the blockchain technology is admired by those that understand it. Participant 9:

"we are talking about something that's open source like Bitcoin, because of the rate of change of open source systems, and because of how contribution happens and the inherent agility that exists in an open source project, that technology itself could become the second wave"

Participant 4 links the technology and politics:

"so technology risk of an underlying crypto is really analogous to political risk of an economy that issues fiat currency"

Exchanges

Most participants mentioned the security risks with exchanges. Participant 2 provides an example of Bitcoin exchange hacks. There was one participant that did not understand that the hacking of Bitcoins is the hacking of an exchange and not the Bitcoin network. Participant 1 stated that users of cryptocurrencies must self-ensure that Bitcoins are secured. To elaborate further:

"The exchanges have got security issues which enable people to access people's wallets because they have got their keys available, or through the exchanges. If a Bitcoin exchange gets hacked it's got nothing to do with the technology behind Bitcoin and Blockchain, it's to do with a badly run digital currency exchange"

42

Participant 3 mentioned that the untraceable nature of the blockchain technology frees it from regulatory issues:

> "So it can be a threat to exchange control regulations, to monetary policy, fiscal policy, avoiding tax"

Participants mentioned the hacking (e.g. Mt Gox hack in 2013) that has been taking place in the cryptocurrency space, and related them to the exchange security. Participant 7 mentioned how regulators can play a role in a decentralised network, through exchanges:

> "I feel that that's where regulators can assist, in terms of making sure that the security is good enough, or by making sure that there's some kind of recourse for citizens if these exchanges or hacked or so on and so forth"

The exchange Bankymoon is the first exchange to be piloted with regulations. This announcement took place during the process of these interviews. Two participants referred to the pilot and are familiar with the Bankymoon CEO.

Regulations surrounding cryptocurrencies have the tendency to make those using them feel more confident about the security. Participant 6:

> "thinking about the ease of transacting and my concerns with the wallet services, I think regulated wallet or exchange services would actually encourage me to participate"

The exchanges were linked to price fluctuations based on their limited supply by participant 1:

> "driven by the prices on the exchanges and because the technology behind Bitcoin and a lot of people store their Bitcoin in cold storage, so they don't leave their Bitcoin on the exchanges or anything, and there is only so much supply on the exchanges"

The consensus regarding the reason for using exchanges is the convenience factor. It has been compared to a bank, as a storage of cryptocurrencies. There is still room in the cryptocurrency space to develop a holistic value proposition that is able to promote the efficient and secure technology, while winning over the confidence of the masses.

Participant 4:

> "And we don't know who the Apple or the Google of the Blockchain will be yet because quite frankly no such company exists. Nobody has come up with a consumer proposition that is anywhere near winning hearts and minds"

Security

The vast majority of participants that mentioned security aspects related it to the security concern of exchanges. All participants linked security to a possible reason for price fluctuations. Participant 7 has described the blockchain technology as very secure:

> "In terms of the Bitcoin Blockchain itself I would say that it's probably the most secure database in the world, so a lot of it is around perceived security"

Participant 8 is of the opinion that there needs to be more education surrounding the technology for people to be more confident about it:

> "I think that the security feature of crypto is an element that makes it far more compelling than conventional currencies. And if people get that then - it wouldn't so much translate into volatility but into an appreciation in a cryptocurrency, it would make the currency more desirable"

The security aspect is linked to cryptography and the same sentiments about understanding the technology to understand that cryptography is secure has been echoed by participant 9.

Technology

The main aspect that has been highlighted in terms of the technology is that it is decentralised. Participant 2 explains the decentralisation as follows: "It exists to be a decentralised financial network, a democratic financial network". The purpose of Bitcoin has also been elaborated on by participant 2:

> "Bitcoin is being designed to facilitate transactions of value between people with very small amounts of data encoded in it, in as fast a way possible with the lowest transaction fees"

Participant 2 also mentions that the biggest driver of technology is user adoption. This is due to users being sceptical about the technology, as mentioned by participant 4. The cryptographic and decentralised nature of the technology is also evident when investing this theme.

5.3.4. Proposition 2: Competition of cryptocurrencies influence price fluctuations

Market conditions

There were three codes that constitute market conditions, and the frequency for each code is illustrated in Figure 11. The code that was used most frequently overall was market dominance, followed by the Bitcoin market. Most participants identified with Bitcoin being the market leader in the cryptocurrency space and that the technology makes the system robust against a certain player dominating the market.

<u>Bitcoin market</u>

The confidence in Bitcoin has been echoed while exploring this theme as well. Participant 8: "Bitcoin is going to take over the world, buy Bitcoin". Participant 9 concurs by saying: "Bitcoin still rules the roost". This confidence is part of the reason that there is higher stability in Bitcoins compared to the other cryptocurrencies.

Participant 7:

> "Bitcoins and for sure these get hacked, they are honey pots. And that has caused massive price fluctuations in the past, Mt Gox is your classic. What I have noticed though is that Bitcoin seems to be a lot more resilient in terms of price".

The market is such that the alternate currencies build on Bitcoin, which has an offering that differs from the others:

Participant 7:

> "you can't say that there is natural competition between Bitcoin and the alternative coin providers because Bitcoin has a unique offering, but people build on the Bitcoin platform".

45
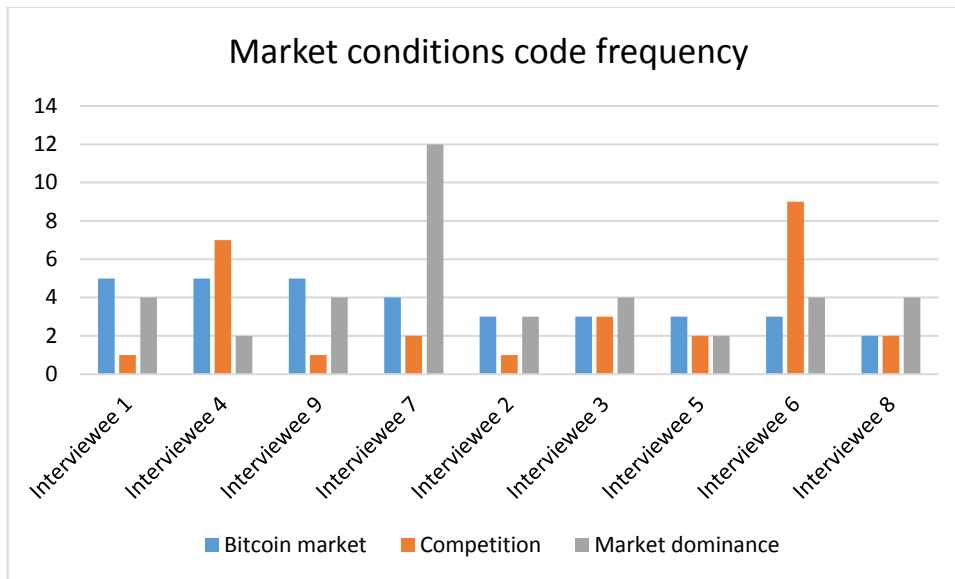
Figure 11 - Frequency of market condition codes

There are a fixed number of Bitcoins in circulation and this brings in the concept of fractional reserve. Participant 7 highlights the prediction that within the next 100 years all 21 million Bitcoins will be in circulation, of which there are currently 16.5 million in circulation.

The current market does not allow for the extensive usage of cryptocurrencies. Participant 5 highlights this in the following: "if you can't really cash out then how can you go and buy something? It's difficult".

There is constant revision of protocols and improvement of the existing technology. This results in a dynamic environment. Participant 5:

> "I think the latest move with Bitcoin with improving the protocol is a good move to stave off potential competition and what it also means is that it can demonstrate that it is upgradable and that the participants on the Bitcoin network are prepared to upgrade and defend against potentially better technology"

Competition

Competition has been agreed by all participants to influence price fluctuations of cryptocurrencies. Most participants feel that Bitcoin is the leader and there are a few main players in the cryptocurrency space.

The market needs to be competitive as highlighted by participant 2. Participant 1 provides some insight into a keen competitor of Bitcoin:

46

> "Look, there is actually a lot of competition on the old coins and maybe a month ago there was Ethereum came close to passing Bitcoins market cap. So if you want to use market indicator of success or whatever, Ethereum actually came quite close to surpassing Bitcoin"

Competition is a delicate matter, and difficult to understand in a market that is new. Participant 6:

> "and I think it's because it's so new that competition cannot be understood in its entirety because it's an ever growing industry, people are concerned about security or intrinsic value, or governments getting involved and the legality of Bitcoin"

It is possible that competition between cryptocurrencies and fiat currencies exists, as per the view by participant 10:

> "we are in the midst of an experiment and some cryptocurrencies, of course Bitcoin chief amongst them, has been imagined as a challenge to the central banking system and to fractional reserve banking. Now we are nowhere in this competition yet and it remains to be seen how much of the fiat markets something like Bitcoin manages to displace and we are in for a few messy decades before we figure it out"

Market dominance

The same sentiments as those echoed in the 'Bitcoin market' section are expressed. Bitcoin is the leader in the market. The cryptocurrencies generally fluctuate together, as explained by participant 7, however Bitcoin usually signals the change.

Bitcoin is a self-regulating currency, thus there is no need for a central authority. This leaves room for the market to be dominated by the cryptocurrency, without interference from a central authority or regulator.

5.3.5. Proposition 3: Supply and demand of cryptocurrencies influence price fluctuations

Economics

The economics aspect considered the code families mentioned below:

- Commodities
- Fiat currency
- Liquidity
- Price fluctuation correlation
- Substitution
- Supply and demand
- Theory of money
- Volatility

Supply and demand, fiat currencies and commodities were mentioned most frequently with respect to economics, with total frequencies of 64, 64 and 60 respectively. The frequency of these code families as mentioned by each interviewee is depicted in Figure 12.
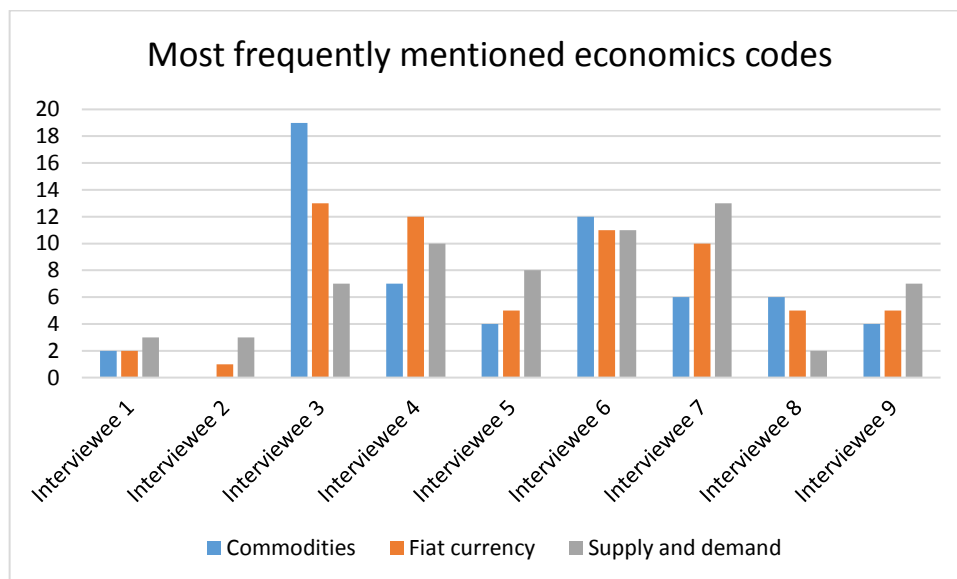
Figure 12 - Frequency of most referred to economics codes

Commodities

There was comparison of cryptocurrencies to fiat currencies and commodities in the interviews. There exists a value for fiat currencies and commodities, whereas for

cryptocurrencies there is no underpinned value, highlighted by participant 6: "there is no underlying asset attached to cryptocurrency". The value is thus speculative, according to participant 7:

"It's not worth equity, it's not worth anything other than it's pure speculative value"

Participant 7 is optimistic that cryptocurrencies are a store of value:

"I think it's just people are seeing Bitcoin almost as a decent store of value in troubling times as if they would around gold. So Bitcoin has been related to gold quite a lot and I think it's a valid comparison"

The value of cryptocurrencies is still to be discovered and exposed. Participant 8:

"when stamp collectors discover a first day cover they give it a unique value, a scarcity value, it has the attributes of an unknown entity, this uniqueness. And I think there is an element of that that is still resident in cryptocurrencies because although there might be some understanding about how currencies behave generally, that understanding is modest"

The demand for cryptocurrencies could have an influence on the demand for other commodities e.g. gold, just as the fiat currencies could influence cryptocurrencies. Participant 4:

"So a dollar crisis or maybe sterling, but certainly a euro crisis, dollar euro are the two most obvious that could cause a surge in appetite for a cryptocurrency, as it would surge the demand for gold"

Regulations could have an influence in the value of cryptocurrencies, thus impacting the price fluctuations.

Participant 8:

"So if a cryptocurrency becomes accepted as a means of exchange in a country it would be equivalent to dollarisation in Zimbabwe, which makes dollars valuable and attractive"

There are individuals that convert Ethereum to Bitcoin before converting to fiat currencies to be used. This is because there are more exchanges converting Bitcoin to fiat than there are that convert Ethereum to fiat currencies. The other commodity that cryptocurrencies are related to is gold, according to participant 7.

The consensus was that there is no value attached to cryptocurrencies due to the fact that there is nothing to back it on. Participant 4 believes it will never replace fiat

currencies. Further, the data indicates that until cryptocurrencies have their own value it appears they are operating based on the fiat currencies.

Participant 4:

> "I think that the exchange rates of crypto's are – they are basically sub-sets of dollars – there was something I was thinking of, is if the dollar strengthens against the Euro for instance, I think currently what we would see is that all the crypto's would float up the dollar and all the crypto's would become stronger than – relatively stronger to say the Euro"

<u>Fiat currency</u>

The confidence in fiat currencies has been highlighted during the interviews. There is a value attached to these currencies that enable trust and confidence. There is therefore a want to transact with it. Transaction demand determines the need for fiat currencies and is mentioned by participant 3. The same participant believes cryptocurrencies are becoming more of a transaction demand as a substitute for fiat currencies.

It is possible that government can see cryptocurrencies as a threat to fiat currencies, thereby resulting in possible methods to regulate the market. This has been echoed by participant 3 and 4.

Participant 4:

> "Firstly the security in the underlying itself is akin to the risk associated with fiat currency, so technology risk of an underlying crypto is really analogous to political risk of an economy that issues fiat currency"

Participant 6 explains that many people do not understand how to invest cryptocurrencies and invest based on knowledge of investing in fiat currencies/commodities. These require different approaches as the markets are very different. Another difference comes in with regulation. It is not possible to regulate cryptocurrencies in the same way that fiat currencies are regulated, due to the technology, as explained by participant 7.

Fiat currencies are stable, due to various reasons. Cryptocurrencies on the other hand play in a volatile space. Participant 7:

> "In order for the US dollar to fluctuate it takes quite a lot, even with major influences saying all sorts of things. Whereas with Bitcoin, because the volume

is not that big, you end up having someone who decides to sell off his Bitcoin, suddenly the price drops"

The competition between fiat currencies and cryptocurrencies is not significant at this point. The evolution of cryptocurrencies is necessary to see the results, as mentioned in a comment by Participant 9. Participant 9.

Liquidity

Liquidity has been identified by participants 3 and 5 as a possible reason for the volatility of cryptocurrencies.

Price fluctuation correlation

The following were listed by participant 5 as possible correlators to the price fluctuations of cryptocurrencies:

- Nasdaq stocks
- VIX (volatility index)
- Dollar value

Participant 6 listed the possible correlation of the Nasdaq to price fluctuations and this was supported by participant 8.

Price fluctuation reasons

The reasons for price fluctuations have been identified as depicted in Table 3, where the participant that mentioned a specific reason has been identified. These were reasons mentioned apart from the questions.

Table 3 - Reasons for price fluctuations

Reason	Participant
Supply and demand	1,3,6,7,9
Technology	1,2,4,6,7
Speculation/perception	2,3,6,9
Exchange supply	1,7
Market manipulation/dominance	1,3
User adoption	2,4
Media	2,9
Regulations	2,6
technology shares	4,5
Ease of use	6,7
Exchange prices	1
Price of substitute	3
Access to market	3
Legitimacy	4
competition	5
Security	8
Financial crisis on fiat	8

The frequency of the most common price fluctuation codes is depicted in Figure 13. The codes that were mentioned most often are user adoption, regulation, supply and demand, perception and technology.
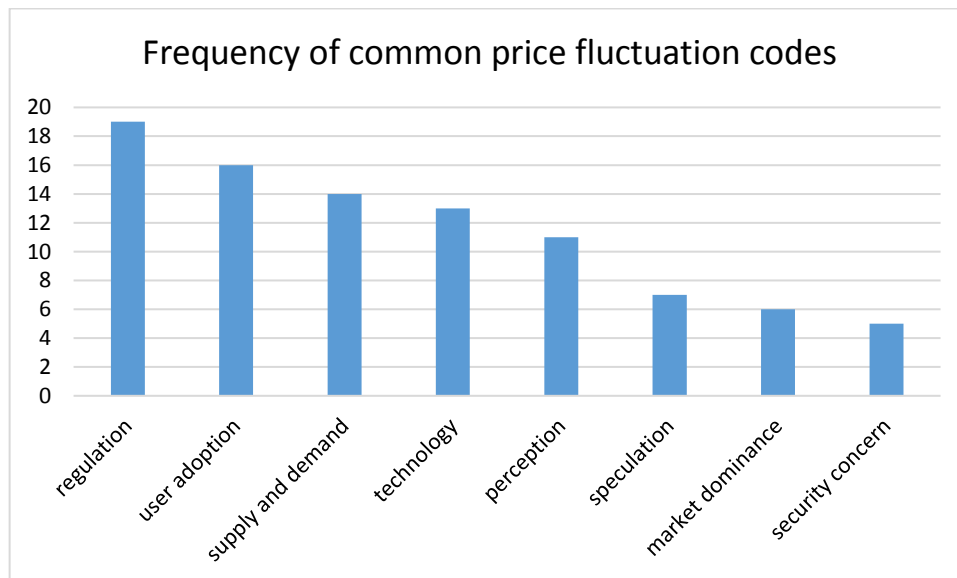
Figure 13 - Most frequent reasons for price fluctuations

Substitution

Substitution largely revolves around the alternate currencies. The ease of developing a cryptocurrency has also been mentioned, as the underlying technology remains the same and the technology is open source.

The technology aspects of Litecoin and segregated witness has been mentioned by participant 7, as changes in technology to Bitcoin. There are currently approximately 800 cryptocurrencies as mentioned by participant 4, which demonstrates the ease of using the technology. Bitcoin cash is the version of Bitcoin that resulted after a hard fork in the technology that took place during the course of the interviews.

Supply and demand

The supply and demand was found to also be a key driver of price fluctuations related to cryptocurrencies. There is a fixed supply, and a consensus that there will be more stability in the environment the closer the supply approaches the maximum amount. Participant 4 points out that the nature of the protocol constrains the supply.

The drivers of supply and demand were highlighted by participant 6 as possible influences on the price fluctuations. The participant suggested understanding the drivers of supply and demand, e.g. technological certainty or uncertainty.

The supply is fixed on 22 million coins, as explained by participant 4. The exchange supply is said to influence the price fluctuations. The demand is largely responsible for driving the price fluctuations, as per participant 4:

> "the more people buying it so therefore you have got more support, you have got more upward pressure. So when there is a scare in the market there is more people still coming in that's driving the price upwards"

The supply and demand has been described as fixed and limitless respectively by participant 1. Participant 3 draws on this, and mentions that when the supply is able to quickly adapt to demand there could be some stabilisation in the price fluctuations.

Participant 7 explains the current supply: "at the moment we have 16.6 million Bitcoin available, 12.5 Bitcoin get created on average every 10 minutes". The same participant believes that the demand is exceeding the rate of supply. Participant 9 highlights that there is an infinite indefinite supply of Ethereum, as opposed to the finite supply of Bitcoin.

<u>Theory of money</u>

There were certain theories mentioned during the interviews that could assist with understanding the price fluctuations of cryptocurrencies. The following are theories/concepts to consider, as per recommendation by participant 3:

- Concept of value rather than a transaction amount
- Hayek's theory of decentralisation
- Fundamental nature of money/theory of money

Participant 4 makes mention to the monetary system and understanding the concepts surrounding it.

<u>Volatility</u>

All participants agreed that the cryptocurrency environment is volatile. The belief is that this volatility will continue until there is a fixed supply of a cryptocurrency in circulation. Participant 7 predicts that this could take place within the next 5 years.

There are predictions of more volatility in the future surrounding cryptocurrencies. The volatility is a desirable or undesirable characteristic depending on your use of cryptocurrencies. Participant 3 explains that if you are a speculator then volatility is desirable and if the currency is to be used for trading, buying and selling products then the volatility is undesirable. Overall, cryptocurrency prices fluctuate together, for example a decrease in price of Bitcoins will happen at approximately the same time as a decrease in the price of Ethereum.

The volatility index was mentioned as a possible avenue to investigate the price fluctuations. The volatility could also be due to the rapid change in technology, as mentioned by participant 6.

5.3.6. Proposition 4: Political factors related to cryptocurrencies influence price fluctuations

Politics/Regulations

The politics/regulations theme focused on two main areas: cryptocurrencies used as an avenue to avoid economic fluctuations and on the regulations.

The frequencies of the codes used for politics/regulations is indicated in Figure 14.
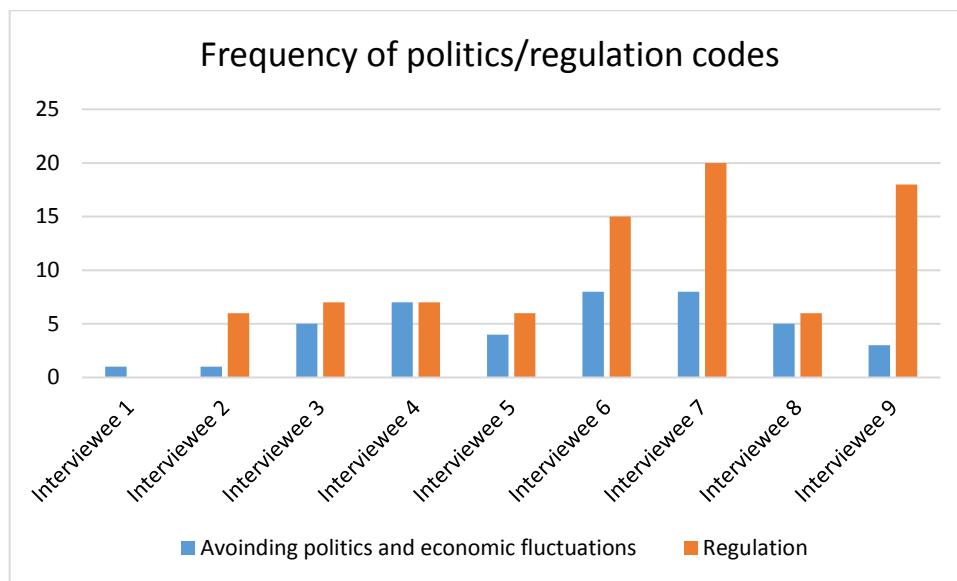
Figure 14 - Frequency of code words used for politics/regulations

Avoiding politics and economic fluctuations

The fact that cryptocurrencies do not require a central authority means that regulators do not serve any purpose in the network, as highlighted by participant 1 and 4. This can therefore be a threat, according to participant 4: "regulators are scared of it", and Participant 2: "no bad political actors can come in and try and interfere with it".

Participant 3 describes cryptocurrencies as being free from government interference and debasement. In an elaboration, it is explained that cryptocurrencies are seen as a threat (Participant 3): "So it can be a threat to exchange control regulations, to monetary policy, fiscal policy, avoiding tax".

The non-requirement for regulations can cause for the cryptocurrencies to be seen as an escape route. Participant 4: "a safe haven against global melt-down"

The regulatory bodies/government does however have influence on the price of cryptocurrencies, as explained by participant 6:

55

> "so if government bans cryptocurrency, for example, it will influence the price. If government comes on board, like you saw with South Korea, they come on board and the price spikes"

The government controlling fiat currencies provides a security surrounding it, which cryptocurrencies do not have. Participant 6 describes what needs to take place as a balancing act between government and cryptocurrency companies. The same participant also spoke about hedging on Bitcoin, as it also results in price fluctuations.

The South African Reserve Bank (SARB) was mentioned by participant 8 as a remarkable institution, and this is backed by the fact that SARB at the time of interviews had piloted implementing regulations with a South African Bitcoin exchange.

Regulations

The consensus is that regulators are apprehensive and have influence over the market. Participants 7 and 9 highlight that regulators are essential to provide security at exchanges, since there is no means to influence the network. The exchanges are easily hackable and need the security.

Participant 6 mentioned South Korea that has successfully implemented regulations surrounding cryptocurrencies in the country. Participant 9 mentioned another possible example:

> "A lot of people expected Venezuela to be a good candidate for this as well, where we would see governments or central banks rather establishing a blockchain platform for their fiat currency"

The regulators have an influence on price fluctuations. Participant 9: "Any time there is news of a regulator considering overplaying their hand or in some cases outright banning the currency we see an immediate effect on the price".

Participant 6 used an example of a South African treaty that dictates prices: "So the African Growth and Opportunities Act (AGOA) regulates how much chicken can come in, as an example, into the country and that determines the price". This was linked to regulations playing a role in the fluctuations of prices for commodities.

This chapter has presented the responses from the nine interviews that relate to each proposition. The responses are documented in relation to the research propositions. The

participant responses were indicated as quotes in most cases and where necessary the frequency of use of codes have been indicated. The main themes are identifiable from the responses and have been documented in relation to each proposition: adoption, technology, market conditions, economics, politics/regulations.

Chapter 6: Discussion of Results

6.1. Introduction

Chapter 5 presented the findings from the semi-structured in-depth interviews with participants that were knowledgeable about cryptocurrencies. The developing of codes and themes assisted with the understanding and development of factors that influence the price fluctuations of cryptocurrencies. This chapter leads on from chapter 5, by detailing the discussion of the responses and comparing it to the views of academics and professionals in the field.

To ensure consistency, the same structure that was used in Chapter 5 follows for the discussion of the responses. The reader is thus able to follow the thread of arguments and the discussion clearly while covering all the research propositions.

6.2. Addressing the Research Propositions

Due to the limited research in the field it was paramount to investigate further. This refers to a major take away from the literature review that there is a latent gap regarding research into the price fluctuations of cryptocurrencies. The possible reasons for price fluctuations unfolded when addressing each of the research propositions. The themes that were uncovered in Chapter 5 are considered as a base for developing the theory and necessary associated factors required for the inductive research. The themes follow the main aspects of cryptocurrencies as mentioned by Polasik *et al.* (2016). These are covered below in relation to each proposition.

6.2.1. Proposition 1: Perception and security influence cryptocurrency competition

The purpose of the study was to determine the price fluctuations of cryptocurrencies, hence the reasons for attractiveness of Bitcoin fluctuating from below 0.01 USD to over 250 USD (Ahamad, Nair, & Varghese, 2013) that has been previously mentioned was studied further. The major factor is the perception of the cryptocurrency that leads to a greater sense of confidence. An uptake in adoption provides an increase in the demand, thereby driving price fluctuations or stability.

The literature covered the fundamental aspects of perception that were related to trust, as per the layered trust model *(Lucassen, 2013)*. Trusting the information is at the core, followed by the source, medium and likelihood to trust. It is difficult to measure trust; hence it is primarily determined by confidence in a specific cryptocurrency. The participants indicated the highest confidence in the Bitcoin cryptocurrency, where 67% of participants that have invested in cryptocurrency have made Bitcoin investments. The guidelines of diversifying options and investing in multiple coins as stipulated by Horder (2016) seem to not be followed by the participants from these interviews as investments are made in either Bitcoin or Ethereum. The confidence in Bitcoin, which results from the positive perception could be the reason that the cryptocurrency is experiencing resiliency in price when fluctuating.

The perception of the cryptocurrency environment is largely influenced by the underlying technology, namely the blockchain. This is again linked to Lucassen's (2013) layered model in terms of the bias that exists at each layer. Those that understand the technology are biased towards cryptocurrencies and more likely to invest in or promote them to their networks. This is with reference to the Yelowitz and Wilson (2015) study that was the first to analyse the characteristics of those interested in Bitcoins, among which were programming enthusiasts. Adoption is currently high among those that are familiar with the technology. These individuals understand that the blockchain has a multitude of applications with the most prominent being in the financial environment. The technical aspects are understood and trusted, hence there is a higher level of confidence.

During the course of the interviews, the segregated witness hard fork took place, where a significant amendment to Bitcoin was made. The segregated witness concept introduced a more efficient Bitcoin in terms of computing power, however the digital signature was removed which compromises security (Alternate technology base, 2017). Those that understand the technology understood that there would be instability in the environment and kept their investments in Bitcoins, emphasising their confidence in the technology. There was a 49 million US dollar reduction in the cryptocurrency market cap overall due to the reduced confidence by the rest of the market.

Adoption influences the economic aspects of supply and demand and is a major factor in determining if the cryptocurrency will fluctuate in price. The adoption influences the demand and as per Sams (2015), the unpredictable nature of adoption could be attributed to volatility in the cryptocurrency. The participant responses indicated that the rate of adoption is largely linked to perception surrounding the technological implications of cryptocurrencies.

One of the largest technological influences on adoption is the security of cryptocurrencies. The influence of security on competition and price fluctuations that has been described by Zhao (2015) is drawn on as a fundamental in understanding the impact that security has on the perception of cryptocurrencies. Participants indicated that security was a major factor influencing adoption, and during the interviews the understanding of blockchain technology that is 'un-hackable' surfaced. However, the exchanges and wallets where these cryptocurrencies are housed are susceptible to hacking and other forms of cybercrime. The security concern of the cryptocurrency network (those that reply on the blockchain technology) is thus a misconception. Bitcoin itself cannot be hacked, as this would require every ledger across thousands to be hacked simultaneously. The data provides an example of the hack of the Mt Gox exchange; it is worth noting that it impacted Bitcoin pricing severely. The contradiction is that the data says Bitcoin is more resilient in terms of price, however was severely affected in 2013 by the attack.

Apart from technology, perception is influenced by social norms and the media, which impact the price fluctuations. The work done by Craggs and Rashid (2016) indicate that for Bitcoin (and by extension other cryptocurrencies) to be adopted, there must be the creation of media awareness. It has happened previously in the cryptocurrency space that when a significant personality in the market makes a statement the cryptocurrency price fluctuates, based on the confidence associated with what they have been reported to say. A recent example is JP Morgan CEO that stated that anyone who invests in Bitcoins in his company will be fired (Van Zyl, 2017). A few days thereafter the price of Bitcoins decreased and the company purchased a large chunk of Bitcoins at the reduced price in order to improve shareholder returns as per conspiracy, which later evolved into the third-party clients purchasing Bitcoins via JP Morgan (Chaparro, 2017). These influential individuals are able to fluctuate the prices based on their reputation and associated confidence. Market makers, therefore could influence fluctuation of prices for commercial gains.

Less significant to the media is the social norms aspect that can be related to fundamental theory of Maslow's hierarchy of needs, which describes how our backgrounds and beliefs constitute current perceptions. There are people that believe that money should be seen and do not believe in digital currencies, based on their childhood perception. These individuals are less likely to adopt cryptocurrencies.

Those that make use of cryptocurrencies tend to be early adopters. The wave of cryptocurrency adoption has been described as exponential, and something that will

60

increase in the future. This is related to the S-curve for technologies. There is evidence to suggest that the second phase of innovation is the one that supersedes the first, and data from one participant during the interviews suggest that Bitcoin is the first wave of innovation and Ethereum is the second, where the latter will survive. There are predictions by a few participants that adoption will occur exponentially, which results in an increase in usage and improved perception.

Another factor that affects adoption is the ease of use of the cryptocurrencies. This involves being able to easily pay for products/services using cryptocurrency technology. Late adopters and those that are laggards are generally reluctant to embrace new technologies unless there is tangible evidence that there is confidence in the technology. The second wave of technology is a theme that was highlighted.

The future of cryptocurrencies is generally uncertain. There is room for more research on how the technological changes (e.g. hard forks) affect the volatility of cryptocurrencies. The next fork for Bitcoin is due to take place in November 2017, and it is certain that due to the low overhead in creating a fork there will be many more in the future. A few participants believe that there will be stability in the price fluctuations when all coins are in circulation. As per the data, the predicted year for this to occur is 2100, however since adoption is increasing exponentially it is possible that it will happen sooner.

Another aspect that influences adoption is politics and regulations in the future making provision for cryptocurrencies. Governments are able to influence masses of people, which is considered an avenue that could influence the user adoption.

Adoption further has the element of fear associated with it. People are generally sceptical about the use of cryptocurrencies however there has been a large amount of people that have invested in cryptocurrencies based on the fact that others are doing it; mainly because of the fear of missing out. The hype and perception surrounding cryptocurrencies is responsible for the fear that is created.

Based on the above discussion, the finding is that adoption is the result of the following factors:

- Understanding the technology – technical aspects and security
- Media influence
- Social influence (backgrounds)
- Ease of use
- Fear of missing out

61

- Regulations

Perception, that results from the adoption factors therefore contribute to the price fluctuation of cryptocurrencies. This is related to the layered trust model where trust in the information is paramount, and the adoption factors provide either trust or distrust in cryptocurrencies. The findings in this study contributed to bridging the gap presented by the literature with regard to a better understanding of the perception and factors that are required for adoption of cryptocurrencies. The insights generated regarding the user adoption and perception can assist to support those that are looking to construct a value proposition around increasing the adoption of cryptocurrencies.

6.2.2. Proposition 2: Competition of cryptocurrencies influence price fluctuations

Having understood the perception of cryptocurrencies and the conditions required for user adoption, proposition 2 focuses on the competitive market conditions of cryptocurrencies. These conditions are fundamental in influencing the competition in the cryptocurrency space. Bitcoin is the market dominator, therefore sets the pace that the rest of the market follows and is responsible for dictating the market conditions. It has been mentioned that Bitcoin was able to become a dominant currency as it was the first broad cryptocurrency, which had not emerged out of cryptocurrency competition (Iwamura, Kitamura, & Matsumoto, 2014).

The general interest in cryptocurrencies is caused by the substitution effects as per Gandal and Halaburda (2016), thereby implying that the adoption is affected by the versatility of cryptocurrencies. Participants have indicated that if cryptocurrencies can be used to make payments easily there will be a higher rate of adoption. The substitution effect influences the adoption, and therefore the price fluctuation of cryptocurrencies.

Participants indicate that there is minimal competition between cryptocurrencies as they perform varying functions – e.g. Bitcoin provides a secure distributed currency while Ethereum is a currency used for smart contracts. The differentiating factor (unique attribute) is the what ensures the currency can compete. Therefore, if there are two cryptocurrencies that provide a similar function there will be competition amongst them.

Due to the alternate currencies, there is inherent competition that surfaces. There are many alternate currencies, where South Africa has recently started competing. The first South African cryptocurrency was launched in July 2017, called Ubu (Universal Basic Unit). A participant indicated that at present there are over 800 alternate currencies, and this results from the ease of creation.

62

In this environment, competition could result from cryptocurrencies competing with each other or the competition between cryptocurrencies and fiat currencies. The intra cryptocurrency competition (competition between cryptocurrencies) is characterised by unique abilities of each as mentioned above, while the inter cryptocurrency competition (competition with fiat currencies) is as a result of the substitution effect, since cryptocurrencies can be used as an alternative to fiat currencies. Ngai (2014) reported that digital currencies are in competition with fiat currencies due to the same factors. The future could see cryptocurrencies as competition to fiat currencies as it could replace the latter. Should this be the case, the digital nature will be of significance as there will be a paradigm shift around money and how it has been traditionally viewed. During the interviews, it was mentioned that the South Korean government has regulated cryptocurrencies, which indicates that it is closer to becoming a substitute for fiat currencies.

The ability of a cryptocurrency to stabilise after an internal or external change is an indication of the volatility in price, and related to the unique offering of the cryptocurrency. Internal changes could be the hard or soft forks, which impact the underlying software. External changes could be the press release of an influential person in the cryptocurrency space. The example of JP Morgan CEO, Jamie Dimon mentioned above is also related to this argument. The price of these cryptocurrencies is however gaining momentum and able to withstand the external influences. As an extension from the above example, after Jamie Dimon's announcement, the price of Bitcoin fell 8% to 3,792.43 USD (Kharpal, 2017). Five days later, the Bitcoin price rose to 4,084.1 USD (ZA Investing, 2017). The increase in confidence of the cryptocurrency has been thought to influence the resiliency.

The number of coins in circulation, due to it currently being a fraction of the maximum number of total coins is a factor that contributes to the supply and demand, and by extension to the price fluctuations. Until the maximum number is achieved, the production of coins is a subset of the total at any point in time. The market dominator element is introduced here, as the market is influenced because those with a larger fraction can influence the market at a greater rate. The market is influenced by dominant cryptocurrencies, which in this case is Bitcoin. Most participants have indicated the dominant characteristic of Bitcoin. The dominator is able to set the trend and can be used as a forecast to the fluctuations in the alternate cryptocurrencies.

63

The competition of cryptocurrencies has therefore proven to influence the price fluctuation of cryptocurrencies. The factors that contribute to the competition mainly stem from the market conditions, which is influenced by:

- Unique offering
- Market dominance/key players
- Volatility in economic conditions
- Adoption

The data shows that the competition between cryptocurrencies depends on the differentiating factor and it is likely that cryptocurrencies will become a preferred substitution for fiat currencies should adoption increase. The unique offerings, volatility in economic conditions and market dominance of key players contributes to the market conditions that influence price fluctuations.

6.2.3. Proposition 3: Supply and demand of cryptocurrencies influence price fluctuations

As deduced in the literature review, the economic issues are linked to the supply and demand and relate to the price fluctuations of cryptocurrencies. The underlying theory that provides a model for the money market by Sauer (2016) has been considered. The supply is a function of the demand for the transaction in relation to the national income and the demand for speculation purposes. In the case of fractional currencies, e.g. Bitcoin, the supply is related to the technological limits as per design. This remains true for the alternate cryptocurrencies that do not have a hard coded limit. The argument put forth by Sams (2015) for the next generation of cryptocurrencies to include an elastic supply rule to amend the quantity of supplied coins has been implemented, for example in Ethereum.

The supply and demand is an economic condition and the fluctuations are underpinned by the value associated with a specific commodity or currency. The stability of the supply and demand is of concern for price fluctuations. Ametrano's (2014) argument that it is a misconception that bitcoins become more stable with an increase in adoption is generally not supported by the participants. According to those interviewed, perception (and therefore adoption) has a significant influence on the price fluctuations. The fluctuations are however significant and there is no reliable prediction of when stability will be achieved. This is concerning, as per Hayek's (1990) view that currencies that suffer from price instability will lose customers to the currencies that are able to maintain price stability. In the present situation, these stable currencies are fiat currencies. The theory

64

of decentralisation put forward by Hayek is imperative in that the hypothesis that the use of competitive currencies are an alternative to government monopoly can be associated with cryptocurrencies. The decentralised nature of cryptocurrencies eliminates the need for government involvement thereby improving the influence of private issuers on the system.

It can be argued that fiat currencies have a value, which is not the case for cryptocurrencies. The same holds true for commodities. Cryptocurrencies do not have a value because there is no underlying asset attached to it. It may however have social value in that a user is aware that if Bitcoin is accepted as payment it can be exchanged for something of similar intrinsic value. With increased uptake, cryptocurrencies can be used to influence the demand for commodities. Cryptocurrencies have been described by the data as speculative currencies, because the value changes by speculation. The speculation is based on the uniqueness that cryptocurrencies has to offer and the technological aspects related to ease of use and security.

The data shows many instances of comparison of cryptocurrencies to fiat currencies where the confidence in fiat currencies is mentioned. Cryptocurrencies are in the process of becoming a transaction demand. There is an element of hoarding that has been mentioned in the literature and is significant in terms of supply and demand. Hoarding of cryptocurrencies places pressure on the supply and demand, contributing to high short term gain. This influences the speculation, again impacting the price fluctuations.

Regulations are critical in impacting the price fluctuations of cryptocurrencies. In South Korea, cryptocurrencies have been embraced by government thus improving the perception and affecting the price. Regulations that influence the supply and demand are certain to impact the price fluctuations of cryptocurrencies. There has been no literature to the author's knowledge to support this view.

In light of Gandal and Halaburda's (2015) work on the correlations between exchange rates and the value of Bitcoin, an investigation was done into the economic factors that could affect cryptocurrency price fluctuations. The Nasdaq stocks, VIX (volatility index) and dollar value have been indicated in the data as factors that correlate to the fluctuation of cryptocurrency prices. Cryptocurrencies and these indexes/stocks follow similar upward and downward trends. The data further indicates the most common reasons for cryptocurrency price fluctuations:

- Regulation
- User adoption

65

- Supply and demand

Using the data, it can be inferred that user adoption stems from the perception of users, primarily their perception of the technology. The data indicates that the high volatility in cryptocurrencies is desirable for speculators and undesirable for trading. The supply and demand can thus be exploited depending on the use of cryptocurrencies, with an inevitable influence on the price fluctuations.

6.2.4. Proposition 4: Political factors related to cryptocurrencies influence price fluctuations

The last of the main aspects of cryptocurrencies as mentioned by Polasik *et al.* (2016) is political and ethical implications. This section aims to introduce the regulatory and political aspects associated with cryptocurrencies and price fluctuations. Since there are no taxes or interest, there is therefore no monetary policy in existence for the blockchain technology. It is an unconventional technology that requires an approach different to the norm. There has been mention of possible taxation laws by Chapman and Gordon (2014), however the data does not indicate any mention to taxation and monetary policies associated with cryptocurrencies.

The decentralised nature of cryptocurrencies makes it a preferable method to avoid regulatory influence and economic conditions. The literature review draws as a conclusion that should there be pressure surrounding fiat currency regulations it will be possible to use cryptocurrencies as an alternative. This provides an alternate method of transaction and assigns more value to the cryptocurrency. An example of citizens in favour of cryptocurrencies and the government not following suit is Venezuela. This is a country where Bitcoin mining is popular due to hyperinflation.

The blockchain technology functions on the decentralised technology that is able to withstand any external influences. This characteristic, as mentioned in the data allows for cryptocurrencies to be considered as a threat to government. This is supported by Yelowitz and Wilson (2015), where it is indicated that the political motives are limited. The ethical issues that could surface as a result have been indicated in the data.

Regulators do not have influence within the network, however there is room for significant involvement at the exchange level. By regulating the exchanges, it is possible to alleviate the security risk, thereby improving confidence in the cryptocurrency and by extension the perception. The data mentions the security attacks that have occurred in recent years at the exchange level and provides an opportunity for regulators to improve security and regulation.

Regulators have an influence on price fluctuations since regulations influence confidence in a specific entity, thereby influencing the perception. This is in line with the study conducted by Stratfor Analysis (2016) that states that if cryptocurrencies are to be widely trusted and accepted the regulations surrounding them need to be clear. The perception surrounding regulations influences the price fluctuations, as seen in South Korea. South Africa has recently adopted trial regulations for an exchange, Bankymoon. The cryptocurrency consortium is also keen on implementing regulations surrounding blockchain technology.

Regulation can thus be inferred (from the literature and data) to be influenced by the following factors:

- Government decisions
- Adoption
- Economic conditions, e.g. supply and demand

The factors that influence regulation are government decisions, adoption and economic conditions. This largely resides with the financial aspects of the government. The regulations, due to increasing the confidence in the cryptocurrency environment have a significant influence on price fluctuations.

6.2.5. Price Fluctuation Model

The themes that relate to the fluctuations in cryptocurrencies are illustrated in Figure 15. The data indicated the following influences:

- technology on adoption,
- regulations on adoption,
- adoption on competition,
- adoption on supply and demand,
- competition on supply and demand, and
- regulations on supply and demand.

These resulting themes together contribute to the price fluctuations of cryptocurrencies.
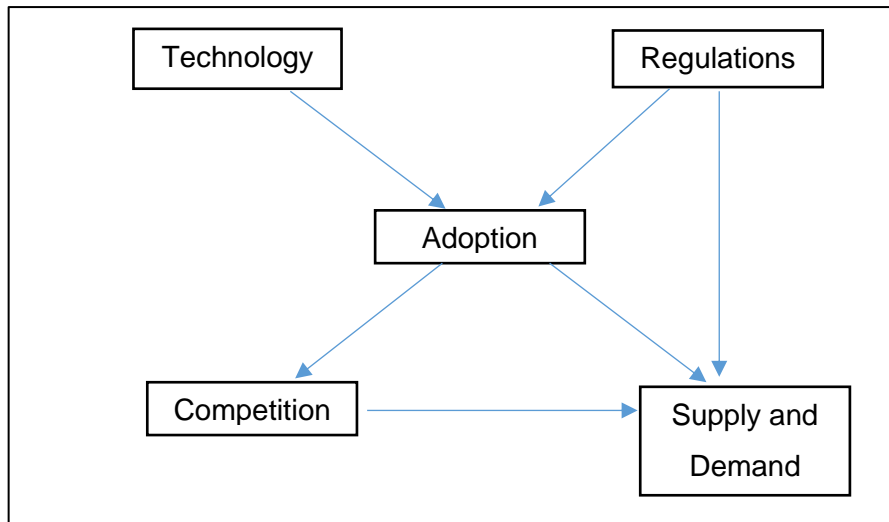
Figure 15 – Price fluctuation model

Adoption has been identified as centre to the price fluctuation model, mainly because the adoption determines the demand, which is key to enabling fluctuations in price. Adoption influences competition, in that for a higher adoption rate the value proposition is compelling and ensures there is a demand; this provides a competitive advantage. Competition, in terms of unique offerings could enable ease of use, which when combined with regulations contribute to an increase in the social value attached to the cryptocurrency, thereby stimulating the demand. In a similar way, technology influences adoption. The regulations and policies impact demand, as regulators perform a third-party role between the service and users, thus impacting the perception. The associations between these factors are identified and depicted as per the arrows indicated in Figure 15. By understanding these underlying factors, it is possible to create a more effective value proposition for cryptocurrencies.

This chapter has followed a similar structure to that of Chapter 5. The propositions were discussed in terms of the responses (data gathered) and the literature reviewed. The themes that have resulted were discussed based on each proposition and presented in Figure 15 in terms of their associations with one another. It is clear that price fluctuations revolve around user adoption, and supply and demand, with technology, regulations, and competition taking the role of secondary drivers. The study has provided insights into those factors that are considered important from a user and technology perspective to provide reasons for the fluctuations in prices of cryptocurrencies.

Chapter 7: Conclusion

The previous chapter presented a detailed discussion of the results that emerged from the research project. Chapter 7 concludes the study, with a recap of the research objectives, a description of the principal findings, the implications for management/businesses and limitations of the research. Due to the fact that there are limitations and the field is constantly being updated, recommendations for future research have been presented.

7.1. Review of the Research Problem and Objectives

The purpose of the study was to generate insight into the reasons for price fluctuations of cryptocurrencies, while expanding the existing literature on the factors that influence price fluctuations. The following research propositions have been addressed:

- 1.1. Perception influences cryptocurrency competition
- 1.2. Security influences cryptocurrency competition
- 2. Competition of cryptocurrencies influence price fluctuations
- 3. Supply and demand of cryptocurrencies influence price fluctuations
- 4. Political factors related to cryptocurrencies influence price fluctuations

The propositions were explored via the use of exploratory research, where in depth qualitative interviews were conducted. The sample included nine participants that were knowledgeable about cryptocurrencies, where there were four that are cryptocurrency start up owners.

7.2. Principal Findings

The results that have been presented in Chapter 5 and discussed and analysed in Chapter 6 suggest the following:

- The findings of this study contradicted the premise held by Zhao (2015) that perception and security contribute to the competition of cryptocurrencies. It was found that competition does not rely on perception and security as much as it depends on the value proposition of cryptocurrencies. The unique offerings and time to market of cryptocurrencies are the distinction for competition.

   Participant 7: "you can't say that there is natural competition between Bitcoin and the alternative coin providers because Bitcoin has a unique offering, but people build on the Bitcoin platform".

- The proposition that competition contributes to price fluctuations was confirmed to be true. The competition that exists between cryptocurrencies and between cryptocurrencies and fiat currencies (as cryptocurrencies may be a substitute) is not significant.

- The proposition that supply and demand influences price fluctuations holds true. The supply is fixed and the demand has room to fluctuate which was a lever to explore. The primary driver of demand is perception, and the fluctuating demand contributes to changes in price fluctuations.

Participant 7: "In order for the US dollar to fluctuate it takes quite a lot, even with major influences saying all sorts of things. Whereas with Bitcoin, because the volume is not that big, you end up having someone who decides to sell off his Bitcoin, suddenly the price drops"

- The theme of adoption and perception is significant as a driver for price fluctuations of cryptocurrencies. An uptake in adoption provides an increase in the demand, thereby driving price fluctuations or stability. The perception surrounding security came across as being a misconception, hence the limited literature for this aspect in the field. The security is not a major concern with the blockchain network, however it is when storing information at exchanges.

Participant 6: ""with the number of merchants that take on or adopt this cryptocurrency, and where merchants decline or are opposed to adopting cryptocurrency as a medium of exchange then it will influence the price"

Participant 1: "The exchanges have got security issues which enable people to access people's wallets because they have got their keys available, or through the exchanges. If a Bitcoin exchange gets hacked it's got nothing to do with the technology behind Bitcoin and Blockchain, it's to do with a badly run digital currency exchange"

- Politics and regulations were significant in terms of the perception it generates however not as important for the technology, due to the decentralised nature. There is no room for regulations within the blockchain network, however there is a need for security and regulations at the exchange level. This is where the

private keys are housed and have been hacked. Regulations were found to be a cause of price fluctuations due to the influence that regulators have on perception.

Participant 4: "I feel that that's where regulators can assist, in terms of making sure that the security is good enough, or by making sure that there's some kind of recourse for citizens if these exchanges or hacked or so on and so forth"

- The model that is depicted in Figure 15 illustrates the themes that contribute to price fluctuations and the association between each factor. The primary drivers for price fluctuations are user adoption and supply and demand, and secondary drivers are technology, regulations, and competition.

7.3.   Implications for Business and Management

The findings for this research contribute to attempting to fill the gap that exists in the literature, by exploring aspects of security and politics further. The insights brought more clarity to the role these factors play in the cryptocurrency environment.

The insights generated shed light on the technology that cryptocurrencies are built on; the blockchain. The various use cases have been highlighted in Chapter 2, which imply that the technology is useful beyond the cryptocurrency use case. Business wanting to make headway in the financial space should study the blockchain technology and consider implementation. This secured, distributed ledger is able to automate much of the mundane work involved in accounting as an example. This frees up employees to perform other more human intensive tasks.

The data suggested that regulators viewed cryptocurrencies as a threat, however this should not be the case. There is an avenue for regulators and government to provide policy and regulations and that is at the exchange or wallet level. There is opportunity for security breaches and hacks, and regulators/government can assist with changing the perception surrounding cryptocurrencies once more security and regulations are provided. Management and business are able to influence decisions in this regard.

The reasons for price fluctuations, the most significant being adoption and perception, can be used to develop a value propositions surrounding cryptocurrencies. The influence of the media can be exploited to increase/decrease investment in the cryptocurrency market, thus allowing for businesses to be aware and make use of the opportunities.

This is also important for start up owners, as the value proposition should be clear in developing new cryptocurrencies or by providing a unique service for the environment.

7.4. Research Limitations

The limitations of the research are listed below:

- Non-probability sampling does not allow for extrapolating the findings to the entire population as there is a non-statistical representation of the population in the sample (Saunders & Lewis, 2012)
- All participants were from South African institutions or owners of South African based companies, implying that the research may not be applicable to other geographic locations
- All participants were male, which could introduce gender bias although not significant in this research.

In summary, there are research limitations for certain contexts. However, the research has challenged literature, by extending the propositions and introduced new findings. In order to test the additional contexts and use cases, future research is required.

7.5. Suggestions for Future Research

During the development of the research project, multiple opportunities for future research were identified. This stemmed from the opportunity to expand the blockchain technology and the distributed nature of cryptocurrencies.

The suggestions for future research are indicated below:

- Analysing the future of cryptocurrency adoption, and monetising the value that will result from developing more users.
- Research the unique offerings of alternate cryptocurrencies and determine what are desirable or unused uniqueness that can be implemented as a 'super' cryptocurrency.
- The expansion of blockchains (with cryptocurrencies as an application) can be considered for use in business/management
- Further research on regulations and influence of political situations on cryptocurrencies should be investigated.
- Further research into the factors that drive supply and demand and other economic related factors, e.g. inflation should be conducted.

72

7.6.   Concluding Remarks

The findings of this study are significant for those that are interested in cryptocurrencies, in management making decisions regarding cryptocurrencies and those that wish to pursue business opportunities in the cryptocurrency space. The significance of user perception, misconceptions that surround cryptocurrency security and the role of regulators in the cryptocurrency space were the major emergences from the study. The use of the underlying technology, namely the blockchain must be maximised as there is significant opportunity for growth and development in multiple industries. The findings are intended to provoke business and management to reshape the way that cryptocurrencies are received and positioned in the marketplace.

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Appendices

Appendix A: Ethical Committee Approval Letter

06 July 2017

Reevana Balmahoon

Dear Reevana,

Please be advised that your application for Ethical Clearance has been approved.

You are therefore allowed to continue collecting your data.

We wish you everything of the best for the rest of the project.

Kind Regards

GIBS MBA Research Ethical Clearance Committee

Appendix B: Interview Schedule

Interview Schedule (Qualitative)

In attempting to understand the aspects that cause price fluctuations in digital currencies, it is my intension to interview recognised experts from banking institutions, reserve banks, banking regulators, digital currency exchanges, international currency switching agencies, digital currency legal experts and academics. I hope to conduct interviews with approximately 10 individuals across these disciplines or until such a time as saturation is achieved.

Initial experts have been identified in each of the above areas and access to these individuals has been arranged. It is my hope that these initial contacts will result in additional referrals.

Consent will be sought prior to the commencement of interviews and confidentiality will be assured.

Semi-Structured Interview Plan

This is a draft of the questions that will be asked in the semi-structured interviews:

1. Introductory:
   Please advise your experience or involvement in the cryptocurrency field

2. How does the supply and demand of cryptocurrencies influence price fluctuations?
3. What do you understand by cryptocurrency competition?
4. Why would either competition between cryptocurrencies or competition with fiat currencies play a role in price fluctuations?
5. Explain the effect that security has on the perception of cryptocurrencies.
6. Why does security influence competition of cryptocurrencies to fiat currencies?
7. Why does perception influence competition of cryptocurrencies to fiat currencies?
8. What do you understand by political and regulatory issues related to cryptocurrencies? Why do these issues have an influence on price fluctuations?
9. Are there any factors other than competition, supply and demand and political issues that influence price fluctuations? If so, what are they and why are they linked to price fluctuations?

Appendix C: Informed Consent Letter

Letter of Consent

I am conducting research on the price fluctuations of digital currencies, and am attempting to establish the main causes of price fluctuations, as well as the possible implications for sectors related to digital currencies. Our interview is expected to last about an hour, and will help us understand the scenarios in which price fluctuations could be applied to the benefit of consumers and institutions alike. **Your participation is voluntary and you can withdraw at any time without penalty**. Of course, all data will be kept confidential.

If you have any concerns, please contact my supervisor or myself. Our details are provided below.

Researcher Supervisor	Craig Penfold
Email	cpenfold@tsebo.com
Phone	082 828 7091

Researcher	Reevana Balmahoon
Email	reevana.balmahoon@gmail.com
Phone	081 222 6666

Signature of participant: _____

Date: _____

Signature of researcher: _____

Date: _____

Appendix D: Code Book

Each code family is indicated in bold text, followed by the associated code words.

Adoption
acceptance of cryptocurrencies - for transactions
adopters - tech savvy
adoption - exponential
adoption - gradual
adoption - lack
trust is necessary
user adoption - influences price
Alternate currencies
alternate currencies - build on Bitcoin platform
alternate currencies - computation processing
alternate currencies - increase
alternate currencies - no investment
alternate currencies - no support
alternate currencies - own
Bitcoin hard fork - scaling debate
indices related to cryptocurrencies
top five cryptocurrencies
Authentication
decentralised network - promotes security
legitimacy - influences price
technology - cryptography
technology - identifiable identity
technology - no authentication
Avoiding politics and economic fluctuations
Bitcoin - protected from politics
Bitcoin - stable compared to alternate currencies
cryptocurrency role in hedging
financial crisis in a big currency - influences price
global financial collapse safe haven
government capital control avoided
hedging on Bitcoin - influences price
macro-economic state - influences price
political risk
regulation - government influence
tax haven
threat to control regulations
threat to government
Bitcoin market
access to the market - influences price
Bitcoin - dictates price fluctuations
Bitcoin - market dominance

83

Bitcoin - market dominance disadvantage
Bitcoin - segregated witness increase price
Bitcoin - used for payments
market cap
Bitcoin network
Bitcoin hard fork - scaling debate
Bitcoin - very secure
bitcoin - well known
Bitcoin network - high quality
Bitcoin technology - efficient
Blockchain
blockchain - advantages for bigger blocks
blockchain technology
Commodities
copper - transaction demand instead of value
cryptocurrencies - recently become transaction demand
currency - asset
fractional credit - fiat currencies
gold - value as opposed to transaction amount
market cap - gold
price of substitutes - influences price
store of value can be speculative
substitute - store of value of gold
substitution for fiat currency
Competition
competition
competition - aggressive between cryptos
competition - cryptocurrencies and fiat currencies
competition - gold
competition - limited understanding
competition - mild
competitive environment required
Cryptocurrency use
Bitcoin - used for payments
Bitcoin project - solar power
Bitcoin whales
cryptocurrency trading
telecommunications
users - early adopters
Exchanges
exchange - complying to regulations
exchange - contracts
exchange price
exchange prices
Exchange prices - influences price

exchange security - influences price
exchange technology - security concern
exchanges - convenient
exchanges - security concern
exchanges - similar to banks
Fiat currency
dividend and interest
equity
fiat contrast - printing money
fiat currencies - store of value
fiat currency - stability
fiat currency risk
fiat currency similarity
fractional credit - fiat currencies
inflation
investing money - limited understanding
stock market similarity
substitution for fiat currency
transaction demand
Future of cryptocurrencies
adoption - exponential
adoption - gradual
Increase in number of users
possible causes of future stability
second wave of innovation
uncertain future
Interviewee background
alternate currencies - own
background - engineering
Bitcoin hard fork - scaling debate
Bitcoin - learned and purchased
Bitcoin - user
BitData - raising funds
second wave of innovation
Liquidity
liquidity
Low confidence/perception
adoption - lack
alternate currencies - no investment
alternate currencies - no support
no link to value
no value
Market dominance
alternate currencies - build on Bitcoin platform
Bitcoin - market dominance
Bitcoin - market dominance disadvantage

cryptocurrencies - similarity in fluctuations
evolvement into one main cryptocurrency
high confidence
influenceable market
manipulation
market dominance - influences price
market manipulation - influences price
uniqueness phenomenon
Perception of value
bitcoin - well known
cryptocurrencies - recently become transaction demand
fear
fear - losing investment
fear of missing out
fiat currencies - store of value
influenceable market
mechanism for functional inclusion
perception - influences price
perception of value
perceptions
risk appetite - based on perception
social norms
speculation - hope for legitimacy
speculation - influences price
speculative demand
statements by SMEs - influences price
store of value can be speculative
Price fluctuation correlation
correlation - Nasdaq and cryptocurrency
correlation - value of dollar and Bitcoin
correlation - VIX and Bitcoin
Price fluctuation reasons
access to the market - influences price
Bitcoin - dictates price fluctuations
cryptocurrencies - similarity in fluctuations
Exchange prices - influences price
exchange security - influences price
financial crisis in a big currency - influences price
hedging on Bitcoin - influences price
legitimacy - influences price
macro economic state - influences price
market dominance - influences price
market manipulation - influences price
media - influences price
perception - influences price

price of substitutes - influences price
regulation - influences price
security concern - influences price
speculation - influences price
statements by SMEs - influences price
supply and demand - influences price
technology - influences price
technology shares - influences price
technology understanding - influences price
technology volatility - influences demand
user adoption - influences price
Regulation
exchange - complying to regulations
exchanges - similar to banks
lack of regulations - protection against government
regulation - follows innovation
regulation - follows innovation (car example)
regulation - government influence
regulation - influences price
regulation - regulators are apprehensive
regulation - stifles innovation
regulations
regulations - increasing openness
regulations - influences price (AGOA example)
regulations - know your customer
regulations - lack
regulations - no institutional framework
regulations - reserve bank
regulations - SARB
regulations - successful implementation (SK example)
regulations required
Security
Bitcoin - very secure
decentralised network - promotes security
exchange technology - security concern
exchanges - security concern
security concern
security concern - influences price
technology - very secure
very secure
Substitution
alternate currencies - build on Bitcoin platform
alternate currencies - increase
BitData - raising funds
cryptocurrencies - substitution effect in the future
price of substitutes - influences price

substitute - store of value of gold
substitution for fiat currency
Supply and demand
current volume is limited
fixed supply
supply and demand
supply and demand - drivers
supply and demand - influences price
Technology
alternate currencies - build on Bitcoin platform
alternate currencies - computation processing
Bitcoin network - high quality
Bitcoin technology - efficient
blockchain technology
decentralised network
drivers of supply - availability of infrastructure
exchange technology - security concern
speed matters
technology - accelerate acceptance and innovation
technology - advancing
technology - cryptography
technology - global audience
technology - identifiable identity
technology - influences price
technology - limited understanding
technology - no authentication
technology - public database
technology - very secure
technology shares - influences price
technology stocks
technology understanding - influences price
technology volatility - influences demand
Theory of money
commodities - transaction usage
form of money
fundamental theory of money
gold - value as opposed to transaction amount
Hayek - Denationalisation of money theory
Unethical use of cryptocurrencies
fraud
use of cryptocurrencies - unethical
Volatility
adoption - exponential
cryptocurrencies - similarity in fluctuations
uncertain future
volatile

Appendix E: Thematic Content Analysis Code Sheet

Code families	Themes	Number of codes
Adoption	Adoption (Perception, speculation, etc.)	7
Cryptocurrency use	Adoption (Perception, speculation, etc.)	6
Future of cryptocurrencies	Adoption (Perception, speculation, etc.)	6
Low confidence/perception	Adoption (Perception, speculation, etc.)	5
Perception of value	Adoption (Perception, speculation, etc.)	18
Unethical use of cryptocurrencies	Adoption (Perception, speculation, etc.)	2
Alternate currencies	Technology (infrastructure, algorithms, etc.)	9
Authentication	Technology (infrastructure, algorithms, etc.)	5
Bitcoin network	Technology (infrastructure, algorithms, etc.)	5
Blockchain	Technology (infrastructure, algorithms, etc.)	2
Exchanges	Technology (infrastructure, algorithms, etc.)	10
Security	Technology (infrastructure, algorithms, etc.)	8
Technology	Technology (infrastructure, algorithms, etc.)	23
Bitcoin market	Market conditions	7
Competition	Market conditions	7
Market dominance	Market conditions	11
Commodities	Economics	10
Fiat currency	Economics	13
Liquidity	Economics	1
Price fluctuation correlation	Economics	3
Price fluctuation reasons	Economics	24
Substitution	Economics	7
Supply and demand	Economics	5
Theory of money	Economics	5
Volatility	Economics	8
Avoiding politics and economic fluctuations	Politics/regulations	13
Regulation	Politics/regulations	19
Interviewee background	General	7