Bitcoin: A Seemingly Rampant Elevator, or is Someone Pushing its Buttons?

- A Case Study on Bitcoin’s Fluctuations in Price and Concept.

Author: Oscar Wandery
Supervisor: Maria Smolander
Abstract

This study looks at the price mechanism of the digital quasi-currency bitcoin. Through statistical analysis of secondary data a probable significant results regarding correlation and regression between price and different independent variables have been established. The final analysis is pointing towards network effects being a part of the determinants for the crypto-currency’s price.

Complimentary to the quantitative study explained above, an implementation of hermeneutic analysis based on secondary theoretical sources, journalistic opinion and a professional qualified judgment has aided the author and study in conceptual understanding. This interpretation has semantic character, and takes a Socratic kickoff regarding the nature of bitcoin as a financial instrument. The analysis runs back and forth throughout the course of the study and finally intertwines with qualitative results in the discussion. It is the author’s impression that a significant dimorphism surrounds bitcoin, calling for a conceptual differentiation leading to practical rethinking.

The study takes the shape of a case-study conducted over four months. The author’s location during the process of writing was Stockholm Sweden, but the gathered data is of transnational character.

Keywords: Bitcoin, crypto-currency, money, digital money, price fluctuations, financial instruments, financial systems.
Sammanfattning


Studen tar formen av en fallstudie som genomförts om loppet av fyra månader. Författarens plats genom skrivandeprocessen var Stockholm Sverige, men den samlade datan har transnationell karaktär.

Nyckelord: Bitcoin, krypto-valuta, pengar, digitala pengar, pris fluktuationer, finansiella instrument, finansiella system.
Preface

As a student of not only business, but philosophy, and history, my interests span both the realms of finance and concept. The process in which we quantify terms into comparable mathematical evaluations, such as measuring risk in terms of beta, or mergers and acquisitions in terms of synergies, helps us to make qualified decisions. These practical tools enable us to express concepts in comparable values, and subsequently to make choices based on rational decision where we would otherwise have to rely on gut feeling. But it’s my opinion that these tools in their estimations also depend upon certain conceptual ideas, like an assumption of relatively homogenous relationships between the measured objects for example.

Therefore, as soon as I heard of bitcoin I was intrigued. How do we evaluate this, and based on what conceptual ideas? However, understanding bitcoin meant understanding the system in which it is situated; the conceptual context—or one might say its contingency. And in a way this thesis has been a project of not only explanation, but exploration. Of course, an understanding such as the one mentioned is not something one simply accumulates in the course of a few months. Not even years, decades or a lifetime would be enough for such a task. Through that perspective, this knowledge is barely grasped upon here. Still, the process of writing and exploring this phenomenon has been very rewarding, and I’m happy for setting foot on this path.

I would like to take the time to especially thank Tim Jones for his participation. His expertise on the subject has been very helpful and guiding through the course of this study. I would also like to thank my supervisor Maria Smolander for her help and support, as well as Robert Leonardi for extending valuable inspiration. Lastly special thanks are given to friends and colleagues donating encouragement and support.
# Table of Contents

1. Introduction ......................................................................................................................... 9
   1.1 Background .................................................................................................................... 9
       1.1.1 Digital Money and the Media .............................................................................. 9
       1.1.2 Digital Money and the Future ........................................................................... 10
       1.1.3 Digital Money, Fiat Money and the Government .................................................. 12
       1.1.4 Digital Money; The problem .............................................................................. 13
   1.2 Problematization ............................................................................................................. 16
   1.3 Study Inquiry ................................................................................................................. 17
   1.4 Purpose .......................................................................................................................... 17
   1.5 Delimitations ................................................................................................................... 17
   1.6 Terms ............................................................................................................................... 18
       1.6.1 Money ................................................................................................................... 18
       1.6.2 Currency ............................................................................................................... 20
       1.6.3 Exchange Rate ...................................................................................................... 20
       1.6.4 Different words for Digital Money ........................................................................ 21
       1.6.5 Digital Money ....................................................................................................... 21
       1.6.6 Digital Money ....................................................................................................... 22
       1.6.7 My Definition of Digital Money ........................................................................... 22

2. The Field of Study ................................................................................................................. 23
   2.1 Price Affecting Factors ................................................................................................. 23
       2.1.1 Market Effects .................................................................................................... 24
       2.1.2 Exchange Rate .................................................................................................... 26
       2.1.3 Law of One Price & Purchasing Power Parity ..................................................... 27
       2.1.4 Network Effects ................................................................................................. 27
       2.1.5 Bubbles ............................................................................................................... 30
   2.2 The Evolution of Money, & the Monetary System ........................................................ 32
       2.2.1 The Evolution of Money ...................................................................................... 32
       2.2.2 Money Supply & Currency Circulation ............................................................... 33
   2.3 Bitcoin ............................................................................................................................ 36
       2.3.1 The Workings of Bitcoin ..................................................................................... 36
       2.3.2 The Critique of Bitcoin ....................................................................................... 37

3. Method .................................................................................................................................. 39
   3.1 The Study’s Design ......................................................................................................... 39
   3.2 The Study’s Method of Data Gathering .......................................................................... 39
   3.3 Quantitative Data ............................................................................................................ 40
Table of Figures

Figure 1: Price development, bitcoin, 2013-04-16 to 2014-04-15 ......................................................... 47
Figure 2: Increase in supply, bitcoin, 2013-04-16 to 2014-04-15 ............................................................... 47
Figure 3: Number of BTC transactions, 2013-04-16 to 2014-04-15 ......................................................... 49

Table 1: Summary Price – Supply, 6 months ......................................................................................... 48
Table 2: Summary Price – Transaction, 6 Months .................................................................................. 49
Table 3: Summary Price – Trade, 12 & 6 months .................................................................................. 50
Table 4: Summary Price – Demand Indicator, 12 & 6 months .............................................................. 50
Table 5: Summary Price – Trade Transaction Balance, 12 & 6 months ............................................... 51
Table 6: Summary Price – My Wallet Users, 12 & 6 months ................................................................. 52
Table 7: Multiple-regression; Market variables, 12 months ................................................................. 53
Table 8: Multiple-regression; Market variables, 12 months (minus Trade) .......................................... 54
Table 9: Multiple-regression; Market variables, 12 months (minus Trade & Demand Indicator) ... 54
Table 10: Multiple-regression; Market variables, 6 months ................................................................. 54
Table 11: Multiple-regression; Market variables, 6 months (minus Supply) ........................................ 55
Table 12: Multiple-regression; Market variables, 6 months (minus Supply & Demand Indicator) ... 55
Table 13: Multiple-regression; Network variables, 12 months ............................................................ 56
Table 14: Multiple-regression; Network variables, 12 months (minus TT-Ratio) .................................. 56
Table 15: Multiple-regression; Network variables, 6 months ............................................................. 57
Table 16: Multiple-regression; Network variables, 6 months (minus TT-Ratio) ................................... 57

Chart 1: Exchange Volume Distribution, By Market & Currency ......................................................... 42
1. Introduction

This chapter introduces the reader to the background, problem and purpose of this study. The first sub-chapter aims to act as a gateway into the discourse of digital money—giving the reader a broad sense of what controversies and discussions are created around the subject. This background builds up to the actual problem that will be examined, which together with study-inquiry thematize the purpose with this thesis.

1.1 Background

1.1.1 Digital Money and the Media

Crypto-currencies have created much discussion in the media recently, with stories that are mainly about the successes and failures of bitcoin. The successes of bitcoin are usually related to the prosperity of bitcoin millionaires, or whenever there is a forecast of increase in usage. The failures on the other hand, are normally related to the millions of losses—both in value and “currencies”—due to institutional crisis, like for example when Mt. Gox fell—Mt. Gox being one of the former biggest bitcoin banks—or whenever different countries, institutions or organizations have declined or even abolished bitcoin (e.g. Thailand, Vietnam, China).

Most of these news articles, in essence, are discussing three main subjects that are key to the future of digital currencies. This being: Security, Legality and Usage. Is it secure? Is it legal? And is it used? The interesting thing is that this is not something new. The same discussions were prompted around the successes and failures of the mondex system in the 90s and early 2000s.

In 1994, a report to the European Monetary Institute stated that “Given the potential of electronic purse schemes to attain widespread acceptance, central banks need to formulate their views on the issues raised by this payment instrument.”¹ This, in part, was a response to the development of mondex.

The mondex system, in the same way as bitcoin, was an electronic money system that was peer-to-peer based and created to simplify and digitalize currency transactions in order to make par value exchanges possible.² This is one of the main factors in favor of digital money. The possibility to transfer money or trade without paying any transaction cost.

Felix Stalder, who has a PhD from the Department of Sociology at Queen’s University, Kingston, has written an article where he discusses the Failures and Successes of mondex. According to him mondex began to be developed when Tim Jones and Graham Higgins asked themselves how to make physical coins into an electronic system without disrupting the central banks role in the

² An important parenthesis to emphasize is that Mondex was developed in the early 90s, before the invention, or rather the wide public spread, of the internet.
circulation of money. The purpose of creating an electronic system being that such a system would be more cost-effective than the active physical cash system.

I have in this thesis had the opportunity to exchange some words via telephone discussion with Tim Jones himself, a great innovator of payment systems and now CEO at NEST, a corporation building the NEST pension scheme for the UK government.

He explained to me that mondex was their attempt of circumventing an unnecessarily long evolution of the monetary system, whereby all different sorts of innovations had to be made before electronic currencies were immanent. According to them, creating digital money did not have to be so complicated. It was simply a matter of extending the concept of money from just including currency and coins, to include currency, coins and digital money.

So as we see, digital money is not such a new phenomenon as we might think. However when mondex was being developed the discussions were mostly done on a professional arena, whereas with bitcoin it’s highly discussed in popular media.

1.1.2 Digital Money and the Future

Many people have a hard time to understand what “digital money” actually is. Simply expressed: it is physical money made digital. That is to say, if we take the coins and bills you have in your wallet and make them digital, so you instead can have them in your phone or computer, we’ve created digital money. However, digital money should not be confused with digital payment options such as PayPal, and the distinction between these two will be discussed later in this study.

You might ask “what is the purpose of creating digital money?” I previously mentioned par value exchanges, which essentially is the answer to that question. Meaning that transaction costs, such as for example the cost of purchases done with debit or credit card, are reduced to zero. Now you might think “but when I pay with my debit card in a store I don’t seem to pay any transaction costs…” True, but the store does. They pay either the bank or the card terminal provider for the service of debit/credit payment options.

Another argument in favor of digitalized money is the reduction of certain fraud possibilities that exist with debit and credit cards. For example, anyone who has ever worked in an electronic store, or other type of store where intermediary expensive goods are sold, might have been warned about taking card payments without PIN for high value purchases. Or even been told to refuse selling goods to tourists wanting to pay with card but claiming they lost their code. This is because the card might not be with its rightful owner. Or in the case with the tourist when the person returns to their country he/she simply reports their card stolen, and the bank stops the payment for the good bought in your store. Thus, he/she has gained a shining new product without paying anything, and there is basically nothing your company can do about it. A digital money transfer doesn’t work in the same

_____________________
3 Stalder, 2002, p.211
way. Instead it works as a cash payment; meaning no possibility to stop or reverse payments, and no credit, and therefore digital money prevents this type of fraud.

Now you might say “fair enough for debit and credit cards, but how about electronic transfers?” At the moment you might not pay anything to transfer within your country, but as soon as the transfer is international, fees are added. Also these transfers would be made at par with digital money, which of course is a strong argument—with regards to the globalization—for bitcoin and the likes of it.

Tim Jones seems to believe that digital money holds a place in future human society for some of the above reasons. However, in line with other thinkers and professionals, I get the feeling he agrees that a system such as bitcoin is not the way to go. Forbes posted an article on the 19th of December 2013 saying that bitcoin might be following a classic bubble pattern.⁴ Paul Krugman, in an article from the New York Times, questions bitcoins ability to work as a stable store of value, which is one of the fundamental aspects of any money, and therefore doubts its future.⁵ Nouriel Noubini who has a PhD in economy, has said that bitcoin is not a currency, but rather that it is ponzi game.⁶ And Tim Jones equals it to the Black tulips of 17th century.

The reason for this criticism, as I see it, is bitcoin’s inconsistency and incompatible nature with the contemporary monetary system. Bitcoin is not money in the same sense as fiat money (coins or currencies). Bitcoin is something crazy and new, and not an extension of the concept of money that was envisioned with mondex for example. Mondex was an incremental small innovation to the existing system, whereas bitcoin is a total revolutionary novelty.

In order to decrease the criticism and satisfy the expectations of professions, bitcoin has to prove itself as comparable to fiat currencies. One way for bitcoin to do that might be, as Joe Nocera claims⁷, to embrace the one thing that it was created to circumvent, namely the government and the finance sector. Another way could be by simply being a sufficient medium of exchange, store of value and a good unit of account (as Mishkin et al defines money⁸). On the first two points, bitcoin has so far failed due to the enormous fluctuations in price.

The price fluctuations—together with the bitcoins undefined nature and inconsistency with fiat money—makes it unmanageable as a financial instrument. Until we know what fundamentally is driving bitcoin price we won’t be able to create sufficient tools to evaluate and estimate value. Until then bitcoins potentially positive aspects—Cheap and quick long distance transfers—remains untouchable. Here is one source to the line of inquiry in this study. The other source has to do with the monetary system and the term security.

---

⁴ Colombo, Jesse. 2013. “Bitcoin May be following This Classic Bubble Stages”. In: Forbes.
⁸ Mishkin et al. 2013, s.47ff
1.1.3 Digital Money, Fiat Money and the Government

In order for any type of money to be successful, or acceptable, it has to be secure, trustworthy and accessible—security, trustworthiness and accessibility in money leads to acceptability—something that mainly the state has been able to guarantee, which is why we primarily use fiat money as means of transaction. It could be argued that historically this was first possible through systems based on backing, meaning that money was a “value check” that could be exchanged for precious metals in the countries reserves. A holder of fiat money therefore had the right to a part of the countries wealth, and this acted as a security; if you cannot use your money, or if the country is failing, you can always take your piece of the precious metal—such as gold—and leave. Hence security was ensured by the intrinsic value of gold. Trustworthiness on the other hand was given by the superiority to the previous system—the barter system—acting as incentive to use money, and accessibility became possible through the control of the printing of money.

The classical monetary theory called metallism formed the idea around these systems that money therefore derived its value from the scarcity of gold, and was developed because of the problems associated in doing business in a barter economy. However, in alternative monetary theory—such as chartalism, as for example found with Knapp and Keynes—gold has little to do with the value of money; and backing is simply one method of establishing general acceptability. Here the value of money has to do with the sovereignty of the state. A stable sovereign state can ensure security and trustworthiness by simply accepting money as legal tender for payment of tax and other obligations. Thus anyone who has obligations to the state—which is most people—will accept fiat money as payment since they know they can use it to settle their debt. And the ones who don’t have obligations will also accept it because they know they can use it to trade with most of the other people—the tax payers.

With the fall of most formal backings one could argue that state derived theories such as chartalism were correct, which shines light on one of the problems with bitcoin: there is no—and will never be—an official institution guaranteeing its value. This leads to enormous fluctuations in price, which in turn makes bitcoin a bad means of exchange. Why use bitcoin today, when I know the value might double in a couple of weeks? And why accept bitcoin as payment, when I know the value might drop 30% tomorrow? The big fluctuations in value also lead to bitcoin being a bad store of value—since next year the bubble might have burst, and the value the holder had in bitcoin has disappeared.

There are corporations, such as Bitpay, that secure the risks for retailers of doing customer transactions in bitcoin. This is done by being an intermediary to the transaction. When a customer buys something with bitcoin, Bitpay takes the payment and delivers an equivalent sum of fiat money to the company. Meaning the company never has to have a store of bitcoin, and avoids going through the hustle of exchanging it. This, however, takes away the advantage and purpose of digital money since the transaction is no longer made at par value. It’s also a perfect example of how risky bitcoin actually is. In order to avoid these problems, according to some, bitcoin would have to be

---

9 Söderberg, 2007, p.175ff
10 Lerner, 1947, p.312
11 Lerner, 1947, p.313
12 Lerner, 1947, p.313
under the control of central banks or governments; which would stabilize the price, as well as securing the future value of the “currency”. But this is totally against the libertarian ideals which many of the people in the bitcoin community abide by. And these are the people who have pushed the digital coin into existence. People such as Tom Ver, who has been a very big actor of the bitcoin expansion, have been quoted celebrating the fact that “Bitcoin totally strips away the state’s control over money”\textsuperscript{13}.

Not only this, it is even against the intention with which Satoshi Nakamoto created bitcoin. The money creation process, also called \textit{mining}, in bitcoin is made as an incentive for people who build up the system of nodes that then enables transactions throughout the world and makes the entire peer-to-peer system safe and possible. Bitcoins are continuously being created in a linear development until it reaches the limit of 21 million, and all these bitcoins are handed out to people running certain software on their computer—which is available for everyone to do—and this is called mining. These people are the actual transaction system for bitcoin. So the creation of money could not, through a technical perspective, be controlled by the finance sector. Furthermore it has been suggested that Satoshi Nakamoto was unsatisfied with the centralized monetary systems of today, and wanted to create a decentralized alternative. In the official article of bitcoin he/ she/ they\textsuperscript{14} write “A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution.”\textsuperscript{15} Here we see the intent of avoiding the financial sector.

But even if centralization was not against the bitcoin ideology or intention, giving the financial sector or the government the control of the creation of money was exactly what mondex did, and mondex failed in 2002. So taking this into account, maybe centralization is not the way to go? Well yes and no. Centralized digital money does indeed seem hard to achieve, but the reasons why mondex failed were not directly related to the centralization.

Both Tim Jones and Felix Stalder argue that it was not the institutionalization of mondex that led to its abolition in 2002, but rather other aspects, mainly dealing with usage. Stalder says that the mondex users found no incentive to own mondex value, and that it added nothing to the cash or debit cards that they were already using.\textsuperscript{16} \textit{In essence mondex problem was that it was not able to ensure trustworthiness, even if it had security and accessibility.}

\subsection*{1.1.4 Digital Money; The problem}

\textbf{With reference to the discussion in the previous chapter, the question might be put: how does bitcoin ensure security, trustworthiness and accessibility?} Accessibility is enabled through mining; the previously mentioned transaction system that also distributes all newly created bitcoin. Trustworthiness, or incentive, is ensured in different ways. In contrast to mondex, bitcoin has for

\begin{itemize}
  \item \textsuperscript{13} Raskin, Max. 2013. “Meet the Bitcoin Millionaires”. In: \textit{Bloomberg Businessweek}.
  \item \textsuperscript{14} Even though Newsweek has claimed to unveil the creator of bitcoin (see: McGrath Goodman, Leah. 2014. \textit{The Face Behind Bitcoin}. In: \textit{Newsweek}.), I will not assume or acknowledge this until more prof has been brought forward, or until a confession has been made.
  \item \textsuperscript{15} Nakamoto S, 2008, p.1
  \item \textsuperscript{16} Stalder, 2002, p.216
\end{itemize}
example created incentive for users by being a great way for people to gamble, and potentially make money, as well as it is a way to buy illegal goods and services. Charlie Shrem is a good example of both aspects. He made lot of money and said to Businessweek that he was not driven by ideology but rather had a specific profit driven plan.\textsuperscript{17} And also he was later arrested on the allegation of helping an illegal network called Silk Road with money laundering.\textsuperscript{18}

Bitcoin is also creating incentive and trustworthiness by ideology and social pressure. Despite all the critique that has been made, a lot of people like the idea of bitcoin, and see it as a future certainty. It enables quick long distance transfers at low costs and does it \textit{anonymously}. Even Tim Jones, who is very critical of the crypto-currencies like bitcoin, believes that the potential power that exists in the concept of \textit{real digital currency} (namely: working as physical money, i.e. being exchanged at par but without the frictional costs), would be a very significant “lubricant for electronic commerce”\textsuperscript{19}. These are powerful arguments, and it’s important to note that these did not arise out of thin air. There is a reason why systems such as bitcoin are being created, for example skepticism of banks and mistrust of the financial system to deal with economical crisis. These reasons are probably why bitcoin set of a chain reaction whereby many alternatives based on the bitcoin technology have emerged since 2008: Dogecoin, Litecoin and Peercoin being the most prominent. They all work in basically the same way as bitcoin but with alterations; like the lag time of transfer or the upper limit of total number of coins.

However, the success of bitcoin, as well as the lubrication effect that Tim Jones talks about, cannot occur just by trustworthiness and accessibility; \textit{and this is where security comes into the picture}. Bitcoin does not ensure security through backing nor sovereignty of state. In fact, bitcoin has not ensured security at all, and neither metallism nor chartalism can explain, nor be the reason for bitcoin-value. If bitcoin fails, or someone is able to either shutdown or damage the system, no one or nothing exists to secure the wealth of all the holders of bitcoins. Everything would be lost and nobody would get back any of the value they owned.

Why then, if bitcoin lacks the security inherent in gold backed or sovereign state money, does it still work? Well the answer is simple. It is not money; at least not in the same sense as fiat money or the type of money referenced in the works of monetary theorists. Hence the problem is not “how does this thing ensure security?” but rather—in the same way as when stocks, bonds or any other type of financial instrument is first introduced—\textit{what is it, and how is it managed}?

Anyone interested in global trade or engaging in international business—which is the case for me—should be intrigued by the possibilities that bitcoin might hold. Cheap and quick long distance transfers—\textit{if manageable}—could be profitable business tools. However the nature of bitcoin remains unclear and the price mechanisms are uncharted—meaning it’s unmanageable since we have no way to evaluate or estimate price changes.

\textsuperscript{17} Raskin, Max. 2013. “Meet the Bitcoin Millionaires”. In: \textit{Bloomberg Businessweek}.
\textsuperscript{18} Russell, Kyle. 2014. “Meet the ‘Bitcoin Millionaire’ Arrested For Allegedly Helping Silk Road Launder $1 Million”. In: \textit{Business Insider}.
\textsuperscript{19} Quote: Tim Jones
Thusly the problem I here set out to research is the price determining factors and the nature of bitcoin. This in hope it will lead me to empirical results and conceptual understanding showing if and how bitcoin should or could be managed.
1.2 Problematization

This part aims to express and deliver the fundamental and central core of the study’s problem.

In the scope of this study there are two main problems. One is purely conceptual and theoretical: what is bitcoin? The second is practical and empirical: What determines the price? Both these add up and can be expressed through the general question: how can we manage something that we don’t even know what it is? Without knowing what something is—which attributes it owns, what patterns it exhibits as driving forces and what its social contingency is—we cannot make valid evaluations and estimations of the object.

By categorizing things under certain umbrella terms humans are able to look at groupings of things and give judgments about how to control and make these things efficient. However, if you make the umbrella too big it’s a problem with precision, and making it too small on the other hand might make any statements you do seem very un-universal. But not having an umbrella at all or putting something under the wrong umbrella might lead to even bigger problems. This, according to me, is a controversy with bitcoin. It has been said that no digital currencies exist, or have ever existed. Yet, a lot of different things, including bitcoin, are marketed or get confused as such. This is an issue that needs clarification and refers to the conceptual and theoretical problem mentioned above. However, important to note is that in order to research the nature of bitcoin I have to research not only the attributes of the object itself, but also its place in the existing system. Bitcoin, in line with money in the propositions of chartalism as given by Tcherneva, has to be understood not only by the attributes it holds, but by its creation and nature as “a social relation of a particular kind.”

The second problem, the practical and empirical matter of value determinants, is researched through identifying factors, i.e. different forces and patterns that are correlating with price. Notice that we are not talking about exchange rate—which might normally be what we refer to when dealing with different currencies—but rather price. The reason for this is because there is no purpose in viewing bitcoin in terms of exchange rate. “Exchange rates are important because they affect the relative price of domestic and foreign goods.” This would mean that there is no interest in talking about exchange rate of bitcoin, since it has no domestic or foreign market. Bitcoin is international, and it doesn’t affect any specific economy whether its price appreciates or depreciates. The only thing it affects is the wealth of the holders of the digital coins. Hence, we should not be interested in exchange rate, but rather in what is driving the price. Since the fluctuations in price are one of the biggest problems with bitcoin, it is of interest for us to know what the main factors are. This is what I will devote this study to.

Both of these problems are intertwined in the same way that price determination of stock or bonds are done based on the fact that they are of certain nature, and exhibit attributes and patterns based

---

20 Stadler, 2002, p.209
21 Tcherneva, 2008, p.70
22 Mishkin et al., 2013, p.384
on said nature. Researching and identifying the nature and factors driving price of bitcoin will therefore shine light on how it should or could be managed.

1.3 Study Inquiry

In order to guide the study this part aims to express different questions that will be touched upon. These questions are studied through both theory and data.

What variables, forces or patterns can be identified as factors affecting bitcoin-price? What factors (or groupings of factors) are correlating with the price of bitcoin? What attributes does bitcoin hold? Where is its place in the existing monetary system and how is it affecting the already existing institutions?

1.4 Purpose

This part displays the general intent with which this study is made.

The purpose of this study is (1) to identify what factor(s) are driving the price of bitcoin; and (2) through conceptual interpretation, based on said factors and related theories, express ideas on how to manage bitcoin.

1.5 Delimitations

Delimitations express the boundaries and limitations of the studies subject and inquiry set by the author. (For further discussion see 3.3.3)

In order to get as clear results in the research of the price mechanisms the study limits itself in space and time to empirical research of bitcoin, and not any other equivalent digital currency. It does so within the boundaries of a six and twelve month period. The reason for this is to decrease the potential disturbance another unstudied phenomenon might cause on the results. Bitcoin has as of yet not been studied to a great extent, and some of its alternatives has not been studied at all. Therefore there is a purpose in studying this by itself before attempting comparative studies.

Conceptual understanding however is not gained by limiting oneself to just one case when that case is influenced and dependent on phenomenon. Therefore the theoretical research has been extended to take into account multiple sources of theory. However, it is limited to the subjects of money, currency, digital money—including mondex and bitcoin—, financial systems, commodities, stock as well as price patterns of the mentioned phenomenon. This limits in time to the knowledge that can be gained through a four month period of fulltime studies.
1.6 Terms

This part aims to clarify the terms used in this study. Even if this discussion often takes the form of semantics, it is necessary in order to build a uniform vocabulary that terms which might seem obvious and rudimentary nevertheless are examined and explained. For the use and meaning of such terms differ to great extent between popular use and jargon.

1.6.1 Money

One way to define money is the following: “Economists define money (also referred to as money supply) as anything that is generally accepted in payment for goods or services or in the repayment of debts.”23 In this sense, money is dependent on acceptance of a recipient. It also has to be differentiated from currencies, wealth and income. Currency is a form of money; wealth can include money; and income is a flow of earnings that can be given in money, but is not money in itself. Money here is static. It is one amount, at one specific time, which grants it value. A promise of money for example (like income or receivables) is not money in itself, until it can be used as acceptable payment in a transaction. However the money must not hold any concrete value in itself. The value in cash for example is nothing more than the metal in the coins or the cotton in the bills. Hence money must not hold a tangible aspect, the money in our bank accounts is as much money as currency and coins; it’s all about usage.

Another dimension that can be given to money is socio-geographic circumstances. That is to say: under what social and geographical conditions is the transaction taking place, for this determines if it is generally, commonly or acceptable to all as payment.

If, for example, the transaction is taking place in China and I’m trying to pay with Euros there might be a problem. If it’s taking place in 15th century India, then rice or coconuts might be accepted in transaction as viable payment24 and therefore could be regarded as money, while my debit card holds little to no value (other than to maybe awe local natives).

We must however, in regard to the discussion above, confuse money with commodities, which is something we might be tempted to do if we look at the example with rice and coconuts. For in such historical economies—barter economies—it is neither coins nor currencies that are used for trade, instead it is goods. The difference between trading with money and goods is that money is characterized by having and improving three fundamental functions. These three being: Means of exchange, Store of value and Unit of account.2526 We can be certain that money works in transactions; when we store money it does not deteriorate in the same sense that goods or services (can) do; and money can be used to compare the value of different goods or services in a simple and understandable way.

23 Mishkin et al. 2013, p.46
24 Söderberg, 2007, p.30
25 Mishkin et al. 2013, p.47ff
26 Ingham, 1996, p.508
The aspect of being universally accepted is central to what is considered as money—as is the three previously mentioned fundamental functions. In Mishkin et al.’s definition the key word is *generally*, which falls in line with Lerner when she said that general acceptability is the basic condition for money’s effectiveness. Furthermore, Galbraith used *commonly* when he said that money has to be “commonly offered”\(^{27}\), and Bernstein claimed that "Money is whatever is readily transferable and acceptable to all in payment for goods and services bought and for debts issued and repaid."\(^{28}\) Even though the choice of words might differ, what can be said is that universality is fundamental. However, different schools of thought argue for different chronology and hierarchy of money, as shown by a statement by Ingham in the article *Money is a Social Relation*. He said “there is, in fact, wide and at times quite vigorous disagreement as to what money does and which are the most important of the functions.”\(^{29}\) The functions mentioned in Inghams quote refers to the three previously mentioned functions, i.e *unit of account*, *means of exchange* and *store of value*.

Through the metallists point of view, money is an answer to problems inherent in doing trade in a barter economy. They assume that humans have a certain predisposition to trade, but that trading with commodities—also called barter, which they assume pre-dates money—has some flaws, for example valuation and logistics. Therefore metallism believes that money evolved gradually to deal with these problems, and the theory hence focuses on money as a medium of exchange.\(^{30}\)

Chartalists on the other hand focus on money as a unit of account; taking a historic point of view that money first arose as an expression of debt. Some even speculate that—since the earliest forms of writing that has been found are records of monetary debt—that money predates writing.\(^{31}\) For this theory, money takes the expression of a unit of account, and gets its value from the state proclaiming an embodiment of this unit of account as acceptable for debt payments. Whereas in metallism money doesn’t need to be issued by the state and regarded as fiat money in order to attain value as long as it has a certain “metallic” properties; that is to say scarcity, longevity and utility, which gives rise to the three functions mentioned above. Meaning that in history, gold and other metals for example would be considered money because you were sure it would be *tradable*, *storable* and *accountable*. However it did not have to be recognized by the specific state you traded in. Instead it was the inherent value of the precious metal that worked as a guarantee.

Today, money has become highly institutionalized and to trade in unacknowledged gold- or silver coins would not be possible. It is hard for us to grasp a concept of money that is not recognized by the state or any official institution like a bank. This is because fiat money, or electronic signals represented in fiat money, is the only thing we generally use for trade (with certain exceptions).

This contributes to the phenomenon whereby the terms “money” and “currency” in many cases are viewed as synonymous. However this is a narrow view of money, that cripples and distorts the economists’ vocabulary according to Mishkin et al.\(^{32}\) Money is something abstract that enables trade, whereas currency is simply a piece of money.

---

\(^{27}\) Galbraith, 1995, p.3  
\(^{28}\) Bernstein, 2008, p.35  
\(^{29}\) Ingham, 1996, p.508  
\(^{30}\) Tcherneva, 2008, p.74-75  
\(^{31}\) Tymoigne & Randall, 2008, p.1  
\(^{32}\) Mishkin et al. 2013, p.46
1.6.2 Currency

When people think about currency, there is sometimes the misconception that currency is the same as exchange rate. This is because we think “exchange rate, of the specific currency”. But in Bersteins view, currency is the same as bills, i.e. paper money. That is to say; currency is a specific form of money.

... the money we use takes two forms - coin and currency that we can see and hold in our hands, and checking accounts, which have no tangible existence at all and are only bookkeeping entries at commercial banks.33

In his view, checks, coins and paper money are all forms of money, but only paper money is currency. Money is thereby the general form of value used in any given transaction. Cash is the common word for the tangible forms of money, and currency is bills. Notice that not even coins are considered as currency in Bernsteins view, and this of course means that neither are coins of bits.34 With this said, Bernstein’s book is first published in 1965, and a lot can happen with language in 49 years.

There are sources that argue that Bitcoin is a currency, and even prestigious magazines such as the economist use the word digital money and call it a currency (they go so far as to compare it to digital gold).35 But of course the opinions are divided. A Forbes article from last year argues the right opposite to the previously mentioned article in The Economist.36

And Paul Krugman calls it, in a way, the ultimate fiat money, since it derives its value from “thin air”. However, at one point he also chose to call it “Bitcoin Stock”, suggesting a different nature than that of real money. And as we have established earlier, money is not synonymous with currency, so even if Mr. Krugman is right in calling it the “ultimate fiat money”, it doesn’t mean he would say it’s a currency.37

1.6.3 Exchange Rate

Exchange rate is one currency’s price in terms of another currency. So when we express pound sterling in dollars, or Swedish kronas in terms of Euros, we are expressing the exchange rate.38 A discussion about this term and why we can’t or shouldn’t view bitcoin in terms of exchange rate will be further developed upon in the section “Field of Study”.

33 Bernstein, 2008, s.30
34 Bernstein, 2008, s.4
35 The Economist. 2013. “Mining digital gold”..
38 Mishkin et al., 2013, p.383f
1.6.4 Different words for Digital Money

Digital Money and Electronic Money: Firstly it is important to make the distinction between electronic payments and electronic money. Electronic payment is just a signal that changes the money in different checking accounts, i.e. the digitalized bookkeeping entries. Whereas when digital currencies are sent, it is a digital electronic signal that actually sends what represents an “entity” that looks like a coin or currency. This entity can for example be a cryptographic code, as is the case with bitcoin.

There is a small distinction between the different names for this phenomenon. But in this thesis, for all intents and purposes, electronic-money and digital-money is synonyms, and will hence forward be used as such.

Digital currency and crypto currency: Digital-currency and crypto-currency, in contrast to digital money, refer to the “tangible” aspect of money (as the previous discussion about currency suggests). As we have noted before, cash and currency refer to a specific form of money. You have money on your bank account, which represents value with which you have buying power. But you do not have cash on your bank account. You can however liquidate the money on your bank account into cash by withdrawing it.

Digital money is the value in your digital wallet, and digital currency therefore is the specific coins in said wallet. That is to say, digital currency is the electronic signature that represents an entity in your digital wallet (e.g. the unique digital signature of one specific bitcoin). An equivalent to digital currency would be to say digital coin or electronic coin, which in essence is what bitcoin aims to be. Crypto-currency on the other hand is a specific form of digital currency where the proof of transaction is done through a cryptographic process.

1.6.6 Digital Money

There is in fact not a clear unambiguous definition of digital money. Is bitcoin digital money for example? Some say it is and others, like Time Jones, say it’s not. Mishkin et al. never the less suggests that we should try to refine our definition of money, so that if a “financial innovation leads to a financial product that acts as money, we can immediately recognize this and include it in the measure of money.”

In our search for a definition of digital money we have two tools to help us on the way. (1) The three previous definitions of ordinary Money; and (2) the statements of Tim Jones about what he views as being the core concepts of digital money.

Definitions of money (the following are quotes):

Economists define money (also referred to as money supply) as anything that is generally

---

39 Mishkin et al. 2013, p.47
40 For the report of the interview with Tim Jones see chapter 4.2
accepted in payment for goods or services or in the repayment of debts.  

What is commonly offered or received for the purchase or sale of goods, services or other things.

Money is whatever is readily transferable and acceptable to all in payment for goods and services bought and for debts issued and repaid.

**Tim Jones statements:**

As of today there exists no digital money, but if digital money is created, it should have these following features according to Tim Jones:

1. It should be exchangeable at par.
   Meaning that other things that look like digital currencies, (debit-/ credit cards, charge cards, PayPal) are according to Jones not electronic money, since they charge for the actual transaction, they are instead “payment vehicles”.  

2. Electronic money is based on the core rules of physical money.
   No transaction fees what so ever. The business of digital money should be based on the adjacent fees (putting it back in the bank, interest on the float, and so on).

**1.6.7 My Definition of Digital Money**

It follows from the term “digital money” that it should be, and work, as money that exists within the digital world. Therefore I can deduce from this, and the statements above, that digital money is: A programmatic entity that works like physical cash (par value exchanges) and is generally accepted in payment and commonly offered in sales for goods and services.

---

41 Mishkin et al. 2013, p.46  
42 Galbraith, 1995, p.3  
43 Bernstein, 2008, p.35  
44 Quote: Tim Jones
2. The Field of Study

*This part aims to explain the theories and workings of the world within which our study subject is situated.*

2.1 Price Affecting Factors

Whilst researching bitcoin on the internet I once came across an author writing about what he viewed as misconceptions about the phenomenon, where he inadvertently makes four inconsistent and heterogeneous claims about the nature of bitcoin price. Since it wasn’t the author’s intent with the article to look at bitcoin pricing—but rather to clarify the workings of the bitcoin system—and because the article is not a recognized study or of peer-reviewed academic origin, I have chosen not to mention the author’s name. However, I have found some of the same claims regarding bitcoin price in other more relevant sources and those will later be mentioned. The reason I show these claims are partly because it is thematic of the conceptual problem with bitcoin, but foremost I show it because these claims are reoccurring, and will guide the empirical work of this study.45

(1) The forces behind the price of bitcoin are the same market forces as for stock.

(2) The price follows the laws of supply and demand, in the same way as any given commodity.

(3) Bitcoin is an un-backed currency; hence the value is derived from usefulness and confidence in the system, not unlike normal fiat currency.

(4) In line with the telephone, bitcoin is subject to the network effect, beginning its life as a novelty but increasing in value with growing user base.

As seen the above statements, bitcoin is a *stock, commodity, currency*, and a *network good*. True that all these products *can* have in common the fact of being traded—suggesting a supply and demand relation—however there is a big difference in how demand and supply occur for these different goods, which in turn affect the price. For example one factor for demand can be how we evaluate the price. Simply evaluating a stock can differ to great extents between methods based on income statements or market values. Not to mention the different assumptions regarding calculations and estimates that can be done within each method. From dividend based discount models with zero growth, constant growth or differential growth, to firm valuations based on cash flows. This in itself can be—as Hiller et al. states—a “very imprecise science”.46

In this study I will focus on the claims stated in the points two, three and four. That bitcoin’s value is created by *market forces* and *network effect*. With regards to the first claim, there is indeed interest in studying that as well. Some other authors have made the same connection between

45 The following statements are not quotes. They are the authors own summary of the mentioned claims.

46 Hiller et al., 2013, P.140
bitcoin and stock. Such as the previously mentioned Paul Krugman and Paula Rosenblum at Forbes who said that bitcoin is a “cross between a stock and a form of payment.” However, I have not found any such claims in the studies I’ve reviewed, and researching this claims relevance demands different methods than the ones I’ve chosen. Therefore I leave this claim for others to study, and will here focus on the Market forces and Network effect.

2.1.1 Market Effects

Borenstein and Saloner’s article “Economics and Electronic Commerce” from 2001, is polemic against the claim that standard economic theory is out of play due to the different nature of electronic commerce. They argue that normal economic forces are still relevant and can be used to understand value creation and behaviors’ on the electronic arena. In their view the digital internet dimension to a product simply increases the already existing fundamental or intrinsic value of the good by decreasing costs or stimulating demand.

General Laws for Supply and Demand

In basic economics there are certain laws that state how price can affect supply and demand, and vice versa. The Law of Demand states that if price of a product decreases the demand increases, and subsequently if the price increases the demand decreases. This is assuming all other related factors stay the same and is explained by the substitution effect and the income effect; stating that a decrease in price makes the good more attractive in comparison to substitutes and less costly on the consumers income.

Some other factors are usually associated with being able to shift the market based demand; meaning that the same price for the product has more or less demand than “usual”. These factors are: Income, Price of related goods, population and demographics, expected future prices. For example, if income increases, the demand for any specific product will increase, and vice versa for a decrease in income.

The law of demand is a negative relation, a downward slope in a curve diagram, whereas the Law of Supply is a positive relation, an upwards slope. The law of supply states that if prices increase, so does the quantity supplied—assuming everything else is constant and that demand is not affected. The variables shifting the market supply are: Price of inputs, Technological change, Price of substitutes in production, Number of firms in the market, expected future prices. Meaning more or less supplied quantity but at the same price.

Supply and Demand of Money

The previous paragraphs discuss supply and demand relationships when it deals with normal goods or commodities, but how about demand and supply of money? Well, the supply is determined by

48 Borenstein & Saloner, 2001, p.4
49 Borenstein & Saloner, 2001, p.5ff
50 Hubbard & O'Brian, 2011, p.66f
51 Hubbard & O'Brian, 2011, p.68
52 Hubbard & O'Brian, 2011, p.75
central banks, or the Federal Reserve System in America.\textsuperscript{53} In bitcoin it is controlled by software. In certain macroeconomic theories the supply of money is the same as the demand of money, this due to equilibrium of the money market where income and interest rates adjust demand and supply differences by influencing price. A detailed description of how theories around the demand of money have evolved, from the equation of exchange and velocity of money, to quantity theory\textsuperscript{54}, liquidity preference theory\textsuperscript{55} and Friedman’s modern quantity theory of money\textsuperscript{56}, can be found in Mishkin et al.’s book \textit{The Economics of Money, Banking \\& Financial Markets}. But for my intents and purposes I’ve chosen to explain one theory of the demand of money, which will show that conventional calculations are not possible with bitcoin.

The theory of money demand states that the demand of money is dependent on three factors, being: (1) \textit{interest rate}, (2) \textit{income}, and (3) \textit{price}.

\textbf{Factor (1)}: As interest rates increase people are less likely to demand money since letting it stay in a savings deposit renders a higher profit—money in the pocket tends to decrease in value due to inflation. In contrast, when interest rates are low this incentive for profit decreases, thus making people more likely to carry more money.

\textbf{Factor (2)}: When income increases people usually spend a larger amount than they previously did, meaning demand for money increases, whereas a decrease in income results in a decrease in demand for money.

\textbf{Factor (3)}: Higher prices result in higher expenditures for households while lower prices equal lower expenditures, which in turn increase/decrease the demand for money.\textsuperscript{57}

This theory gives us a basis for calculating the demand of money. Mathematically expressed as: $M = (kY - hR)P$. This formula says that the effect of a income change minus the effect of a interest rate change times the price equals the demand of money.\textsuperscript{58}

\textbf{Conclusion on Supply and Demand: the Relevance for Bitcoin}

As shown in the example above the demand of money is dependent on the income and interest rate of a certain monetary system. Take away this—which we are forced to do since bitcoin interest rates and income do not exist—and only the price remains. This leaves us with the classical supply and demand functions given by trade of normal goods, i.e. the law of supply and demand mentioned before.

Regarding supply it is worth mentioning that in the bitcoin system supply is created through the process called mining. Simply put mining is the incentive for being a part of the peer-to-peer based node system enabling transfer of bitcoins. By running bitcoin software on your computer and letting

\textsuperscript{53} Hall \& Papell, 2005, p.195
\textsuperscript{54} Mishkin et al. 2013, p.445ff
\textsuperscript{55} Mishkin et al. 2013, p.449ff
\textsuperscript{56} Mishkin et al. 2013, p.455ff
\textsuperscript{57} Hall \& Papell, 2005, p.193ff
\textsuperscript{58} Hall \& Papell, 2005, p.194
your processing unit contribute calculation power to the system you can be rewarded with bitcoins each time a so called “hash” is solved.

2.1.2 Exchange Rate

The reason why I have not yet talked about exchange rate, or why I don’t say “the exchange rate of bitcoin”, is because it’s not really relevant. Exchange rate is one currency’s price in terms of another currency; like expressing pound sterling in terms of dollars.\(^59\)\(^60\) Only considering this we could say that expressing bitcoin in terms of dollar is exchange rate. But we gain nothing in saying exchange rate instead of price, and in fact exchange rate can be rather misguiding.

Why the term exchange rate is interesting and widely discussed is because it’s a good way for economists to express relative advantages of import and export. One might say it’s an indicator for a specific country’s or region’s market position. A good way to explain it might be Mishkin et al.’s explanation: as one country’s currency appreciates/ depreciates the country’s goods abroad become more expensive/ cheap and foreign goods in that country become cheaper/ more expensive. For example when the Pound depreciates the British export becomes attractive for foreigners and the import of foreign goods becomes less attractive for British people.\(^61\)\(^62\)

In our everyday life we don’t pay so much attention to the exchange rate, except when we go abroad and have to either pay with our card in a foreign country or exchange our money for foreign currency. And actually exchanging my Swedish krona for Pound Sterling is not (in a way) so different from exchanging my krona for bitcoin. Other than that in one case I receive a physical currency and the other a digital coin. The difference appears in the large transactions taking place in the private and official sector. When banks, companies or governments want to buy or sell foreign currencies they are not doing it in the same way as me, the consumer going for holidays. Instead they are trading bank deposits denominated in different currencies.\(^63\) This is mostly done on a foreign exchange market with a flexible exchange-rate system.\(^64\)

Since there are no (and cannot exist any) deposits denominated in bitcoin, there is subsequently no such “exchange” taking place. Instead it is bitcoin reserves that are traded. When you buy and sell a bitcoin, you are buying or selling that specific digital coin, not just transferring a deposit.

Even though we might not pay attention to exchange rate in our everyday life, we are still subject to it. And every time we go into the supermarket and notice that the milk price has increased or decreased we might be observing aggregate macroeconomic workings taking place; workings that are related to the determining factors of exchange rate. However, the same cannot be said for bitcoin, as the exchange rate laws in the coming paragraphs will illustrate.

\(^59\) Mishkin et al., 2013, p.383f
\(^60\) Hall & Papell, 2005, p.47
\(^61\) Mishkin et al. 2013, p.384
\(^62\) Hall & Papell, 2005, p.47, 331
\(^63\) Mishkin et al. 2013, p.385
\(^64\) Hall & Papell, 2005, p.329
2.1.3 Law of One Price & Purchasing Power Parity

In economic theory there are different things said to affect the exchange rate, and perhaps the most basic and fundamental is the Law of one price. It states that if two countries produce an identical product the price of the product should be the same everywhere in the world; independent of where it is produced (assuming transportation costs and trade barriers are very low).\(^{65}\)

If we again relate this back to bitcoin; no production is made denominated in bitcoin. If bitcoin was backed by a specific economy, and production of goods and services was made in Bitcoin, then a valuation of bitcoin price could be made through the Law of one price. Today this is not the case, meaning there must be other factors that determine the bitcoin price. This also means that Purchasing Power Parity (PPP) cannot occur in bitcoin pricing, as PPP is a derivative of the law of one price. PPP is an adaptation of the law of one price to national price levels rather than to individual prices.\(^{66}\)

2.1.4 Network Effects

In 1985 an article from Michael Katz and Carl Shapiro was published in The American Economic Review.\(^{67}\) An article that would later be called “Among the most influential statements on network externality…”\(^{68}\) In Katz and Shapiro’s work they examine markets that exhibit what they called “network externality”—which is when a product derives utility, and subsequently value, from the number of other agents using that good.\(^{69}\) This is due to what will later also be called “network effect”, a term that is not used by Katz and Shapiro in this article but by others since then.

The network effect is most commonly illustrated with the example of a telephone. As the number of agents in a telephone network increases more possible phone calls can be made, thus increasing the perceived value of anyone buying a telephone. Katz and Shapiro in their article are discussing this phenomenon through a view of customer expectations of the network size and market equilibriums. They envision a rational customer behavior where the value of a product is compared to the cost, and they argue that perceived network pre-purchase adds to the total value of a product.\(^{70}\) Here we see an important remark to make, namely that Katz and Shapiro are writing this a few years before Tim Berners-Lee invention of the World Wide Web, and the goods that they envision are thusly mostly physical products with a certain intrinsic value and costs to the consumer. Like telephones, cars, stereos and other products with certain costs.\(^{71}\) Not the social network phenomenon’s of the 21th century, which has no such direct costs.

When Liebowitz and Margolis write their paper called “Network Externalities: An Uncommon Tragedy” in 1994, it is in part as a critique of the problems mentioned in the above paragraph.

\(^{65}\) Mishkin et al. 2013, p.385
\(^{66}\) Mishkin et al. 2013, p.386
\(^{67}\) Katz & Shapiro, 1985, Vol. 75, No. 3. 424-440
\(^{68}\) Liebowitz & Margolis, 1994, p.133
\(^{69}\) Katz & Shapiro, 1985, p.424
\(^{70}\) Katz & Shapiro, 1985, p.426
\(^{71}\) Katz & Shapiro, 1985, p.424
Liebowitz and Margolis argue that the scope of the term “network externality” is too broad. They claim that in Katz and Shapiro’s definition it spans numerous categories of products, and adds value in so many different ways that the magnitude of phenomenon makes the term fruitless as an analysis tool and it runs into a problem related to market failures.\textsuperscript{72} One might say that network externality in Katz and Shapiro’s sense becomes just a part of the value added chain, like for example the one described by Porter in his Book “Competitive Advantage: Creating and Sustaining Superior Performance.”\textsuperscript{73}

Liebowitz and Margolis instead call the broader term “Network Effect” and reserve network externality for a part of the network effect that is more limited.\textsuperscript{74} They also acknowledge a negative network effect, in contrast to the positive network effect that previously has been focused on. Their study shows no empirical evidence for network externality, even though network effect is assumed to be persistent and reoccurring. However, they also point to the fact that network effect often can be other phenomenon disguised as network. Like for example technological progress.\textsuperscript{75}

**Network Valuation: Globally**

In an article published on arXiv on November 2013 called “The Unreasonable Fundamental Incertitudes Behind Bitcoin Mining”, the authors argue that bitcoin value is derived from the network effect.\textsuperscript{76} Based on their claims, four main factors building up the value can be identified: *Security, Functionality, Usage and Belief*. These factors are highly different from those mentioned by Liebowitz and Margolis, which are “… compatibility, brand familiarity, product information, status, service availability or the prices of network related goods.”\textsuperscript{77} But this is a difference that can be attributed to the different nature of the good.

In general it could be said that network effect is mainly due to the number of participants in the network. Katz and Shapiro identify three different types of network effect: *direct, indirect* and *indirect post-purchase service effects*.\textsuperscript{78} *Direct* refers to effects due to the size of the network; if many people use bitcoin the chance is greater that I have use for it myself, which increases utility and value. *Indirect* effects relate to the adjacent functions, products and services associated with the network good: for example if more people use bitcoin than other types of crypto-currencies the chance is bigger that I find good online-wallet services for bitcoin than its competitor, thus increasing utility and value. Lastly *indirect post-purchase service effects* have to do with the quality of the services mentioned in the indirect effect: The probability that the online wallet service provider for bitcoin is good, is higher than for competitors due to competition and that service providers develop more in markets with bigger possible revenues.

As previously mentioned all these derive their value from the number of users in the network. However, there are some points Katz and Shapiro failed to mention, mainly dealing with the negative aspects of network effects such as congestion. This, however, is something that Liebowitz

\textsuperscript{72} Liebowitz & Margolis, 1994, p.134
\textsuperscript{73} Porter, 1985.
\textsuperscript{74} Liebowitz & Margolis, 1994, p.135
\textsuperscript{75} Liebowitz & Margolis, 1994, p.149
\textsuperscript{76} Courtois et al. 2013, p.5
\textsuperscript{77} Liebowitz & Margolis, 1995, p.134
\textsuperscript{78} Katz & Shapiro, 1985, p.424
and Margolis mention in their article.\textsuperscript{79} Congestion has to do with the fact that too many users can decrease the utility and value of a network. An example being that an increased number of email users also increase the number of spam possibilities, and when the number of spam you get exceeds a certain point it becomes value-decreasing.

**Network Valuation: Locally**

The above mentioned authors have focused mostly on the aggregate network, viewing an entire network and determining its value and functions. Arun Sundararajan in contrast to this has developed a model where he argued for a view of local networks where each individual valuates a product based on what he calls a “heterogeneous subset of other agents”\textsuperscript{80}. Meaning that when someone is thinking about adopting a network product or service, that individual will look at the users in his/her social circle, like friends, family, colleges, etc., and evaluates the network.\textsuperscript{81} In effect, if a random person joins the network, this will not necessarily affect the value perceived by other individuals. Not directly at least. But since each user of all the local networks has his/hers own social circle, there can be snowball effects of someone joining the network. A new user affects one local network by joining, which in turn can affect other local networks and individuals in their perceived value of the product of service.

\textit{Beckstrom’s Law} is another individually focused model of network valuation. It uses transactions through a network as the basis for any valuation. Beckstrom argues for a calculation of what net value the presence of network contributes to a user by making transactions possible through that medium.\textsuperscript{82} Mathematically Beckstrom uses a normal net present value discounting model to express the valuation, and his formula is the following:\textsuperscript{83}

\begin{equation}
V_{i,j} = \sum_{k=1}^{n} \frac{B_{i,k}}{(1 + r)^k} - \sum_{l=1}^{n} \frac{C_{i,l}}{(1 + r)^l}
\end{equation}

\textit{Equation 1: Beckstrom’s Law}


\textsuperscript{79} Liebowitz & Margolis, 1994, p.145
\textsuperscript{80} Sundararajan, 2007, abstract
\textsuperscript{81} Sundararajan, 2007, p.1
\textsuperscript{82} Beckstrom, 2009, p.2
\textsuperscript{83} Beckstrom, 2009, p.3
Where B is the benefits and C is the cost of using the network over any given period. The Benefits are calculated by alternative costs if the network was not in place. He uses the example of amazon.com. If buying a book at amazon.com costs $16 all costs included and the alternative cost of going to a physical store are $26, then the benefits of the network is $10.\textsuperscript{84}

**Conclusion on Network Effect: the Relation to Bitcoin**

In conclusion network effect mainly has to do with users. An increase in users corresponds to a change in utility and value for members of the network. It also affects the expectations of people thinking about entering the network. More recent ideas like Beckstrom’s Law has also claimed a network affect based on relative advantages of transactions within the system.

With bitcoin we have certain member data and indicators suggesting usage. Therefore testing the correlation between these variables is highly executable. But regarding Beckstrom’s Law measuring relative advantages of bitcoin transactions against fiat currency or other crypto-currencies is much more difficult. It would involve estimating benefit from reduced transaction costs which is highly subjective and varying, as well as costs of using bitcoin that in the end will be abstract estimates probably based on uncertainty. Furthermore it goes outside of the case-study design I’ve chosen, and is more suitable for a cross-sectional design.

### 2.1.5 Bubbles

**Bitcoin is often accused of being a bubble. However saying that something is a bubble doesn’t necessarily mean that said thing lacks intrinsic value.** It simply refers to a state of significant deviation from fundamental value, as Hommes et al. for example define it. “Bubbles, defined as significant persistent deviations from fundamental value, express one of the most paradoxical behaviors of real financial markets.”\textsuperscript{85} With this definition (in a semantic sense) it might be argued that we should not say that bitcoin is a bubble, and rather we should say that bitcoin is going through a bubble, or going through a bubble regime (which is Hommes et al’s vocabulary and refers to a strong deviation from fundamental value). For if we look at the price development of bitcoin since its creation (see attachment 10.1.3) we see that for the majority of its existence it has not been “deviating from its fundamental value”. Rather we can identify what could be considered as three bubble regimes. One in summer 2011, one in spring 2013 and yet another in winter 2013-2014. Hommes et al. in their study from May 2013 use the bitcoin price growth and drop earlier that year as an example of a recent bubble.\textsuperscript{86}

Never the less, it should be noted that there is some legitimacy to the claim that bitcoin is in fact a bubble; and that claim is rooted in an argument that the fundamental value of bitcoin is zero. Hommes et al. themselves say that “Bitcoins have no intrinsic fundamental value”. However this claim can be criticized, since we cannot simply use intrinsic value as synonymous to fundamental value, something I’m sure Hommes et al. would agree with and is probably why they said specifically “have no intrinsic fundamental value” and not “have no fundamental value”. If we said

\textsuperscript{84} Beckstrom, 2009, p.3  
\textsuperscript{85} Hommes et al.,2013, p.304  
\textsuperscript{86} Hommes et al. 2013, p.305
that intrinsic and fundamental value were the same, then fiat money for example would have little
to no fundamental value and could be regarded as perpetually being a bubble. One bill of 100
Swedish krona, approximately $15,87 has a cost of 0.47 SEK for the central bank,88 which is
probably production-, transport- and raw material cost, while the purchasing power of the same bill
is far greater than said intrinsic value. It is other factors that determine fundamental value of fiat
currency, and the same can be said for bitcoin.

In Hommes et al.’s study they examine the dynamics of bubbles (super-exponential bubbles) in
previously done lab experiments. In the lab experiment a number of participants were asked to
forecast the price of a single asset for 50 periods. All of them were given the same data and
estimates, and with this information it was possible to arrive to the same conclusion regarding
fundamental price. In this experiment fundamental price was found using the Gordon method of
price determination of a financial asset, assuming the same dividend for an infinite number of years.
Despite the same data a bubble occurs in the experiment and Hommes et al. are able to find
evidence showing that laboratory bubbles have a tendency to grow faster than exponentially due to
a phenomenon called positive feedback.

Positive feedback could subsequently be applied to understand the bubbles of bitcoin. Positive
feedback meaning that traders use previous price or return levels rather than fundamental value
when they calculate future price, which leads to faster than exponential growth of the asset.

Hommes et al.’s study from 2013 is not a conceptual one about what actually constitutes a bubble.
Therefore it is not surprising that they leave out a discussion about what a bubble actually is. And in
their rather limited definition, one could draw the conclusion that a bubble can be forever. But
surely there must be a certain temporality to bubbles? After all; don’t all bubbles burst? According
to Charles P. Kindleberger, who has been credited a master of financial crisis by The Economist89, a
future burst is inherent in the word bubble. When explaining bubbles he writes:

As firms or households see others making profits from speculative purchases and
resales, they tend to follow. When the number of firms and households indulging in
these practices grows large, bringing in segments of the population that are normally
aloof from such ventures, speculation for profit leads away from normal, rational
behavior to what have been described as “manias” or “bubbles.” The word “mania”
emphasizes the irrationality; “bubble” foreshadows the bursting.90

The bursting that Kindleberger suggests is presenting us with a problem. When is a bubble over? In
the case of bitcoin the problem shows itself when we want to research stable periods. Is bitcoin still
in a bubble regime, or has it ended? And if it has ended, does this mean that the fundamental value
has doubled since last October?

87 www.xe.com 2014-05-05, 15.34
90 Kindleberger, 1978, p.17
2.2 The Evolution of Money, & the Monetary System

2.2.1 The Evolution of Money

One might say, as Bernstein does in his book *A primer on money, banking, and gold*, that the creation of money is a solution to the problems associated with doing business in a barter economy. Mishkin et al. also discuss the problems associated with Barter systems but does not make the connection between these difficulties and the creation of a modern monetary system (even if this might be regarded as implied). However, assuming that money is created, for whatever reason that is, Mishkin et al offer an evolutionary model of the monetary systems. This evolution builds on the assumption that each system is created as a response to the problems inherent in the previous system. This leads to a hierarchy which gives birth to the electronic payment system of today. Below is an account of Mishkin et al.’s evolution of money. Later, in the analysis, we will see how this evolution, this mapping of the system, does not give room for the phenomenon bitcoin, and where bitcoin is situated in relation to this evolution.

Commodity money

Commodity money is monetary system based on precious commodities. For example metals such as gold and silver. They are generally accepted as payments, without having to be recognized by the state. There is a certain intrinsic immanent value in the metal (e.g. because of its scarcity or difficulty in refining).

Fiat money

The next innovation to change economic transactions was paper currencies, which later developed into what we now call Fiat money. The original paper currencies were value-checks that could be used to exchange for coins or precious metals. The Chinese were early with paper currencies, which they had as early as the 11th century. This was predicated on the ability to print money, which did not appear in Europe until the 15th century. When paper money did appear in Europe, it evolved from that original “value-checks” use into Fiat money. That is to say; money “decreed by governments as legal tender”.

The base of most transaction today is Fiat money. Even if you write a check or make an electronic payment via your bank, the value you are transferring is a value measured in Fiat money.

Checks

The check was an innovation predicated on the ability to transfer value from one place to another without actually transferring the objects the value represents, that is to say; transferring money from one bank account to another, without actually having to move the cash. This means that there had to exist a banking system which worked via bookkeeping entries. The check solved the security

---

91 Bernstein, 2008, p.4
92 For an illustrative picture of said model see attachment 10.1.1 for Mishkin et al. & 10.1.2 a model showing Bitcoins exclusion.
93 Söderberg, 2007, p.175ff
94 Mishkin et al. 2013, p.50
problems related to having to transfer big amounts of cash, which was a major problem in the previous system.95

**Electronic payment**

The electronic payment is an innovation that came with cheap computers and the invention of the internet. The internet made it possible for people to do the same job that checks had done, but instead via the use of a computer and without the hustle of having to send, give, move or otherwise cash-in the check.96

**E-money**

E-money in Mishkin et al.’s sense should not be confused with digital-money. E-money, in most cases, is a way to transfer money (normally measured in fiat money) as an electronic digital signal. The most common and first version of e-money was the debit card.

There is also the smart card version, which stores a specific value on a computer chip, which later can be used under certain circumstances. Here again, it is normally the currency of fiat money with which you load the card, and then the payment is measured in fiat money currency. E-cash is a similar system, but instead of the value being stored on a chip on a card, it is stored on your computer, and transferred from there (normally through web payments).

### 2.2.2 Money Supply & Currency Circulation

**As Burstein points out our monetary system is hardly only built on currencies creation.97 As the name suggests it is not a currency system but rather a money system. Currency is simply a tangible aspect of the monetary system.** In history, or in societies where the invention of digitalization and checking accounts have not yet occurred, the tangible aspect coincides with the total supply of money.98 That is to say; the amount of cash (currency and coins) is the same as the amount of money in the system. Today however, this is not the case. As we know, most expenditure, both in governments and private sectors, such as salaries or invoice payments are done electronically or by check, not by actual cash payments. This means that currency in circulation in today’s monetary system is not as dependent on the actual printing of currency, but rather on the total money supply. Instead it is the consumer’s demand for cash, such as an increase in public preferences of the use of currency that determines the amount of cash in circulation. This is why currency and coins in circulation go up during Christmas shopping, and down after. The banks extend more of their money reserves to the public during Christmas, and gets more back after.

Currency in circulation is however still a liability post at the central banks. Currency in circulation together with reserves is what is called the monetary base. And an increase in the monetary base will lead to an increase in money supply.99 Still, printing more bills doesn’t necessarily mean an

---

95 Mishkin et al. 2013, p.50
96 Mishkin et al. 2013, p.51
97 Bernstein, 2008, p.30ff
98 Bernstein, 2008, p.30ff
99 Mishkin et al. 2013, p.302
increase in demand for currency in circulation. Rather it is an increase in loans or securities of the central banks that affect the monetary base the most.¹⁰⁰ So in conclusion the greatest component of the money supply is actually the asset side of the balance sheet, loans and securities, rather than increase in currency.¹⁰¹

**Inflation & Price**

In today’s system, the government or central bank prints the money, but does not control how much is circulating the system. Burstein even says that”…an increase in the supply of money must originally come about through a rise in checking accounts.”¹⁰² Meaning that the increase in money is not dependent on the printing of currency, and therefore neither the inflation. Inflation can occur when the government prints a lot of money, it is not impossible to increase money supply this way. Like for example if the government prints money and uses it to cover its expenditures. This has been done in the past (for example Germany’s hyper inflation), but now government and central banks are prohibited by law from doing so.

This can be contrasted to the bitcoin system, where these two aspects coincide, where the printing and actual the amount circulating in the system are the same. Therefore in bitcoin, price and quantity should have a clear connection.

**Banking**

As we talked about in the segment before, the amount of money supply is not totally dependent on the currency creation process. Rather it is due to the commercial banks that money is “created” in the economy, in the same way as buying-power and wealth is dependent on the commercial banks. Bernstein explains the banking industry as following:

> While the banker wants to make a profit just as much as the next man, and while the profits in his business comes from lending out and investing the funds his customers deposit with him, he can remain in business only so long as his depositors are confident that he will really give them back their money when they ask for it.¹⁰³

In other words the banks interests are driven by the invested funds in securities, as well as interests from the loans they extend. But in order to be sustainable the banker must manage its inflow and outflow of money through the bank, making sure the bank’s customers can liquidate the money they have into their bank account if they so desire.

If I open a bank account and deposit money, the banker has many different alternatives of what to do with my money. If he/she thinks there is a possibility that I, or someone else, might withdraw this amount tomorrow, the banker can leave the money and let it act as a reserve for future withdraws. If the banker instead thinks that the money will not be needed within a certain amount of time, say 2 months, he/she might buy a security with the money. A security that is frequently traded and therefore easy to liquidate when the day comes that the banker needs to give this money to its

¹⁰⁰ Mishkin et al. 2013, p.303
¹⁰¹ Mishkin et al. 2013, p.301
¹⁰² Bernstein, 2008, p.36
¹⁰³ Bernstein, 2008, p.40
depositors. Or lastly if the banker believes that the money won’t be need for quite some time, he/she can give it out as a loan to someone else, giving the bank a big interstate and profitable investment. But also locks the amount, which means that the banker has to consider the risks of customer not paying back to loan.\footnote{Bernstein, 2008, chapter 5}

Another way for the bank to receive money that it can later use to buy securities or extending loans, is via the central bank. The central bank can offer a loan or buy securities in the commercial banks, thus increasing the banks deposits that it can later extend to consumers as loans. And this is actually creating money in the economy.\footnote{Mishkin et al. 2013, p.308}

**The Creation of Money; Increase in Total Money Supply**

There is a fundamental difference between getting a loan from a bank, and receiving it from say family or friends. Might seem obvious, but the distinction through an economic point of view is important to make. When a friend or family member loans you money, it simply means a transfer of money from one account to another. The value in their bank account decreases, and the value in yours increases. In other words the money supply is unchanged, the value stays at par. And when you transfer electronically or by check, it’s a matter of simple book-keeping. No actual currency changes place from one bank account to the other. In the view of the economy, it’s simply one person’s credit increases and another’s decreases.\footnote{Bernstein, 2008, chapter 6}

However it is totally different when a bank extends a loan. If you instead had gone to your bank, and the banker grants you a loan, then the money is not taken from somewhere to increase the “credit” your account. The banker simply adds figures to your bank account, thereby increasing the money-supply, the buying-power and subsequently the GDP of the economy. You get more money that you can use to spend, without someone else’s bank account going down. The money supply of the economy has suddenly increased.\footnote{Burnstein, 2008, chapter 6}

The only time when the money of one specific bank is reduced is when you choose to withdraw, transfer or pay with the money you’ve taken as a loan. But it as soon as you pay something, say you buy a car, the car dealer usually has a bank where they deposit the money. So even if it’s not the same bank as yours, the money is still in the bank system. Same with transfers, you might transfer the money to someone else in the same bank or some other bank, the money still stays in the system. When you withdraw however, the money is temporarily put into another system, the currencies in circulation i.e. the monetary base, until the point where it again is deposited in a bank.

**Multiple Deposit Creation**

The extended chain whereby one bank’s loans go to another bank as a deposit, and that other bank then lends this money to a third and so on, is called the *Multiple deposit creation*. There are other ways of explaining the process of deposit creation, and increase in money supply. In an article we will come to in the section about bitcoin, Brian P. Hanley explains it by what is called the “toy model”. Mishkin et al. has the same thematic approach. But it works on the same principal. A bank
gets a deposit, and then the bank makes a loan on said deposit with a certain reserve ratio (retaining a certain percentage of the original deposit in the bank). The actual original deposit or value in the bank is untouched when a loan is made. The reserves then go down if the one borrowing the money cashes the check at another bank. And the other bank view this as a deposit and gets an increase in reserves that it then extends as loan to a new borrower, and so on. The banks original deposit is not decreased, but can still be lent.\(^\text{108}\text{109}\)

When you withdraw money it’s temporally not in the bank system. Instead it is in your pocket, security safe or madras. But as soon as you deposit the money again, or buy something whereby the person you buy from deposits it, it’s right back in the banking system. The only way you can be sure that you are reducing the money supply in the economy (if for some reason that is what you like to do on your spare time) is therefore by withdrawing your money and never depositing it or using it again, i.e. you can burn it.

But what happens when you decide to buy bitcoin with your money? And how are the banks and the economic system influenced? Is that like burning money? We will come to these questions later in this thesis.

### 2.3 Bitcoin

#### 2.3.1 The Workings of Bitcoin

**Bitcoin starts out with the assumption that transaction costs are high due to fraudulent behavior rooted in the double spending problem.** This problem gave rise to a trust based system of transaction that relies on financial institutions for the control and guarantee of safe transactions, checking that transactions are not spent twice.\(^\text{110}\)

If we look at the official document of bitcoin from 2008 it defines an electronic coin as a strain of digital signatures. These digital signatures are created through transactions. Every time someone transfers a bitcoin the sender signs the “hash” of the previous owner that is left from all previous transfers as well as the public key of the receiver. And then this is added at the end of the digital chain.\(^\text{111}\) This proves the chain of ownership as well as makes the coins “unique”. And actually this is the first part of solving the problem of double spending.

The second part consists of creating a public log of all transfers. The log shows all transfers taking place and the bitcoins involved. This is done through what is called a timestamp server that takes a hash of different items that wants to be sent and publicly announces these so that they can be checked against previous transfers.\(^\text{112}\)

\(^{108}\) Hanley, 2013, p.10f  
\(^{109}\) Mishkin et al, 2013, p.308f  
\(^{110}\) Nakamoto, 2008, p.1  
\(^{111}\) Nakamoto, 2008, p.2  
\(^{112}\) Nakamoto, 2008, p.3
This controlling organ in turn needs to be safe and uncompromised. This is done by making the controlling organ into a big system of nodes, that has the incentive to be honest (if a majority of nodes in the controlling organ where dishonest, double spending could occur). These nodes consist of calculating power such as the CPU in personal computers. In principal one CPU (or one calculating power) is one node, or one vote.\(^{113}\) So the entire idea of the proofing system is that it would be built up by a community of ordinary people running bitcoin software on their PC’s.

The workings of the node-based system are explained as the following (the bullet-points below are taken directly from the official bitcoin article by Satoshi Nakamoto):

1. New transactions are broadcast to all nodes.
2. Each node collects new transactions into a block.
3. Each node works on finding a difficult proof-of-work for its block.
4. When a node finds a proof-of-work, it broadcasts the block to all nodes.
5. Nodes accept the block only if all transactions in it are valid and not already spent.
6. Nodes express their acceptance of the block by working on creating the next block in the chain, using the hash of the accepted block as the previous hash.\(^{114}\)

The incentive of each node to do stage 3 (working on finding proof-of-work) is the potential reward of a bitcoin. The effect of this incentive scheme is two-folded. It is both a way to keep people motivated to participate in making the system safe. But it is also a way of distributing bitcoins.

### 2.3.2 The Critique of Bitcoin

Brian P. Hanley has written a critique of bitcoin based on fundamental economic concepts of currency and banking, where he claims that the premises of bitcoin is built on an “intellectual house of cards”.\(^{115}\) He aims to expose bitcoin through four main critiques.

Firstly he claims the upper limit of total supply of bitcoin is not credible. Bitcoin is supposed to reach a limit of total 21 million BTC, which in turn is divisible by 100 million of which the smallest component is called a satoshis (i.e. 0,00000001 BTC is one satoshis) making 2,1 quadrillion satoshis in total. To illustrate that this is not reasonable he takes the 2012 GDP of the U.K. as an example. If we assume that all bitcoins are available and is supposed to amount to a commerce equal to the U.K. alone, then each bitcoin would have to be worth $116 100. Today one is worth around $438.\(^{116}\) That means an appreciation of around 270 times, something that no other commodity has ever been able to achieve.\(^ {117}\) And since this is for the U.K. alone, an even higher price can be imagined for a world wide currency. With this in mind Hanley suggests that no rational human being would ever use their bitcoi for purchase.\(^ {118}\) And without people using it for trade there is no way bitcoin can ever reach such high price through commerce, therein lies a paradox.

---

\(^{113}\) Nakamoto, 2008, p.4

\(^{114}\) Nakamoto, 2008, p.3

\(^{115}\) Hanley, 2013, p.3

\(^{116}\) www.preev.com

\(^{117}\) Hanley, 2013, p.6

\(^{118}\) Hanley, 2013, p.8
The second problem is based on the fact that bitcoin cannot be the base of loans. Subsequently no creation of money, or increase in money supply, can be created out of thin air in the same sense money can through commercial banking and loans—i.e. essentially, no increase in welfare.\textsuperscript{119}

Then we have the problem of hoarding. Hanley argues that saving bitcoin is like putting money in the madras. And putting money in the mattress gives no interest and no value creation for the economy as a whole, whereas with normal money interest rate can be received and deposited money into a bank can be used in reserve banking. But a bitcoin can only be hoarded, spent or lost according to Hanley.\textsuperscript{120} And since there is no difference between a lost bitcoin and a hoarded bitcoin through the systems point of view, there are basically only two options of what to do with the digital coin: spend in transaction, or hoard.\textsuperscript{121}

And lastly it is a zero-sum game for investors. When bitcoin reaches its upper limit, no further value can be created. This means that when one person receives a bitcoin, someone else has to lose one. There is thus no incentive for investors to make money on interest rates, or value creation through loans.\textsuperscript{122}

\textsuperscript{119} Hanley, 2013, p.10ff
\textsuperscript{120} Hanley, 2013, p.13f
\textsuperscript{121} Hanely, 2013, p.6
\textsuperscript{122} Hanley, 2013, p.17
3. Method

This part aims to show the design of this study by thematizing the creation of the thesis and explaining the process of data-gathering, boundaries and demarcations, analysis as well as the underlying factors for the authors’ choice of approach.

3.1 The Study’s Design

In essence, this study is mostly characterized, and conducted, in terms of a case study. Like many case studies it implements both quantitative and qualitative methods, and because of this it attains some of the aspects of a cross-sectional design. This is due to the two-folded problem regarding bitcoin that is stated in the problematization of the thesis (i.e. the conceptual problem of definition, and the empirical problem of price fluctuations).

The actual study gathers empirical data and performs an analysis on different factors that might affect the price. This is the main objective of the case and will henceforth be referred to as the quantitative part of this study. In order to make sense of this data the study uses conceptual theories from other cases and phenomenon as guidelines. This is necessary, according to the author, mainly due to the deductive nature of a quantitative approach, whereby existing theories are used as premises to the drawn conclusions.

But there is also a need for generating theories around the subject of Bitcoin (what is it? How does it work?), therefore—because of the inductive nature of a qualitative approach—an unstructured interview as well as a limited theory review has also been preformed. This is what will be referred to as the qualitative part of this study, which has a hermeneutic approach and interprets many different sources in order to arrive at a greater understanding of the studied phenomenon.

3.2 The Study’s Method of Data Gathering

Case studies are usually associated with a qualitative approach. However one problem with using only a qualitative approach is that aspects such as validity, reliability and replication become mute as quality indicators (according to some). By using a quantitative approach I hope to introduce these aspects to the study, making it easier to retest. Furthermore, given the nature of bitcoin and the abundance of quantitative data—in contrast to the scarcity of qualitative data—the choice of a quantitative method is logical and practical.

This being said, there will always be a lack of what is called external validity when judging the quality of a case study. The qualitative approach delivers some other desirable contributions, which is the reason for the author’s choice of dual method.

---

123 Bryman & Bell, 2010, p.72
124 Bryman & Bell, 2010, p.73
Even if case studies are known not to amount to any results that can be generalized—as noted by Bryman & Bell for example\textsuperscript{125}—a researcher can still hope to generate theories that later can be tried and tested on a broader scale. This is largely due to the inductive nature of the qualitative approach. As Kanter writes in her preface to *Men and Women of the Corporation* “My observations at Indsco made the theory come alive.”\textsuperscript{126}

### 3.3 Quantitative Data

In this study I’ve used secondary data. By using secondary data I’m saving time and money without compromising the quality of the data. This very valuable aspect of secondary data offers great advantages to a student at my level.

The data that will be used in the quantitative analysis is gathered from different sources. For all data considering bitcoin—such as price levels, trade quantity, transactions and so on—is gathered from the websites www.blockchain.info and www.bitcoincharts.com. The remarkable thing about bitcoin and modern technology is the transparency and abundance of data. From Blockchain data concerning everything from trade, transactions and price levels (both in aggregates and per unit) to miner revenue and costs can be found. This data spans all time that bitcoin has existed, or for certain data the time said data has existed, and is freely available, and easily accessible.

On Bitcoincharts we find more elaborate data concerning trade; mainly the traded value and volumes throughout time at specific Banks around the world. Furthermore Bitcoincharts offers technical analyzing tool such as the Bollinger Band, and indicators such as Donchian Channel.

#### 3.3.1 The Data

Firstly I compare different variables one by one, looking at the correlation and significant regression between my dependent variable (price) and the independent variables, initially looking at a number of observations that spans one year. However, this period might be characterized by what some\textsuperscript{127} have called a bubble-sign, and this questions the results legitimacy, and is corrected by also trying a period that is not characterized by a bubble-sign.

There is still an interest of looking at the results of this period. Bubbles are generally characterized by overestimated valuations that have no “concrete” basis, meaning that the asset or product experiences increase in price—sometimes exponential or even faster than exponential—for a certain period before either bursting or plummeting to a normal value. The increase in value of bitcoin since last November is most definitely characterized by an exponential growth. However it has not yet, as of today (2014-04-28), burst or reached the previously held value. Therefore we cannot yet be sure whether bitcoin is still characterized by signs of bubble activity, or if it has actually reached a new stable price. The spike of November – December 2013 might either way be viewed as an untypical activity. Despite this I have chosen to keep the values, in order to see whether the spikes correspond to any antypical activity of the independent variables, and will compare the different periods to each other.

\textsuperscript{125} Bryman & Bell,2010, p.73  
\textsuperscript{126} Kanter, 1993, p.XVI  
\textsuperscript{127} Colombo, Jesse. 2013. “Bitcoin May be following This Classic Bubble Stages”. In: *Forbes*. 
3.3.2 Analysis method

Two statistical tools have been used in this study: simple- and multiple- regression analysis. T-tests have been conducted to determine the significance of the regressions results. The simple-regression tool is used to see how different independent variables correlate and form a regression with the independent variable. The multiple-regression tool is used for the same purpose but instead of looking at just one variable it takes multiple into consideration.

The two groupings of variables used in the multiple regression analysis are: Market Variables (MV) and Network Variables (NV). One set of variables is a grouping that is assumed to represent normal market forces, or economic forces, such as Supply/ Demand. The other set of variables, Network Variables, represents another set of forces including indicators of Usage. Usage is a variable that has been said to build up most of the Bitcoin value.\(^\text{128}\) For a more detailed discussion about these groupings theoretical Background see section 4.4 Bitcoin, about the “theories” of bitcoin.

3.3.3 Sample: Size, Time, Boundaries & Limitations

Due to the vast supply of secondary data available the boundaries made in this study regarding sample size are not made on the basis of problems related to gathering of data. Instead limitations are made with regards to the relevance and legitimacy of different samples.

The main limitations are made regarding time periods. In this study two different time periods are used and the results compared in order to be able to say something about internal validity. As an effect of the relatively short and volatile life of bitcoin it is complicated to say anything about the periodicity of bitcoin, and subsequently what constitutes a “normal period”. Therefore I have used two time periods and done a comparison between these two.

The two periods are: Six months between the middle of April 2013 to the middle of October 2013, and twelve months from the middle of April 2013 to the middle of April 2014. The samples constitute 185 observations for the first period and 365 observations for the second, i.e. one observation per day.

3.3.4 Variables & Indicators

All variables are gathered with daily intervals. One observation per day renders 365 observations per year. Below is an account of the variables and indicators used.

Variables

*BTC Price* – Mean price per day for an aggregate of bitcoin banks throughout the world.

*Supply* – The total supply of bitcoins in the system.

*Transactions* – The total number of transactions made in the world on a daily basis.

*Trade* – An aggregate of Buying and Selling of bitcoins at Banks throughout the world. The raw material for this variable is given in trade volume (i.e. the total value of trade given in USD per

\(^{128}\) Courtois et al. 2013, p.5
day). This becomes a problem when correlating against bitcoin value since BTC price is included in the trade volume calculation. Therefore I have modified the variable by dividing it with BTC price, mathematically giving us Trade Quantity instead of Volume. However, since BTC price is considered to be highly volatile, the legitimacy of this modification is questionable. It might not be reasonable to assume that all transactions during one day are made at the same price, which puts our new measurement at question. A simple calculation on the previous year’s BTC price renders a standard deviation of approximately $300 per day. Mathematically this means that—assuming a normal distribution—there is a 68% probability that the price fluctuates with an interval of $600 from day to day. Of course we can see on the price development of attachment 10.1.3 that this doesn’t seem to be the case, and that the high standard deviation rather is due to a sizeable change in price over time. Still, we cannot deny that price fluctuations in BTC price exist, and using this method might not be recommended.

Therefore I have also conducted another correlation test, where I gathered data from one specific Bank where it was possible to get actual trade quantity data. I then correlated this against their recorded daily price, and compared the results against my other measure of trade quantity. For this I had to find a sample with as high external validity as possible.

As shown in chart 1 the trade of bitcoin is mainly taking place in America. And the biggest actor on the American market is Bitstamp. Therefore I chose American Bitstamp data as my source for the sample. I use the same time periods, but Bitstamps own data regarding BTC price—that is to say, I here use the closing price of BTC at Bitstamp rather than a mean of aggregate BTC price.

**Chart 1: Exchange Volume Distribution, By Market & Currency**

![Exchange Volume Distribution Chart](www.bitcoincharts.com)

Source: www.bitcoincharts.com

**Indicators:**

*Demand Indicator* – A ratio between total trade quantity and total supply of Bitcoin. The indicator is made to indicate the trade demand in percentage of the total supply available.

*Transaction Trade Ratio* – This is a ratio between the total amount of transactions and total amount of trade volume per day. The idea behind this ratio was given by a coder named David Perry in 2012. He argued that the ratio between transaction and trade is an index that might be able to
measure speculation and correlate with the actual price of bitcoin. In 2012 David Perry wrote a post named *Measuring Bitcoin Speculation* on his website www.codinginmysleep.com, where he discusses the ability to use this index as an indicator of speculation.\(^{129}\) His argument is that since bitcoin strives to be a currency, it should follow equal trading and transaction patterns as normal currency. This means that the biggest amount of money moving around in the economy should come from everyday transactions, and not currency trade. Therefore the ratio of transaction to trade should be a high one. And any actual price change in bitcoin should be accompanied by an increase in the trade transaction ratio. If it’s not, that suggests price change due to speculation according to the author. I wanted to test this variable, not only to see whether Perry’s idea actually had anything to it. But also because I thought this index might actually be a measurement of *stocking*. Something that certainly is worth trying since, as we will see in the next chapter, stocking has been argued to be one of bitcoins biggest problems.

*Transaction-Supply Ratio* – This is a ratio between transaction and supply that is intended to express the percent of transaction of the total supply, indicating the percentage use has of total supply.

*My Wallet Users* – The total number of members who are connected to the bitcoin wallet service called My Wallet. My Wallet is a cloud based wallet service where holders of bitcoin can store, manage and review their stock of bitcoin as well as their transfer and trade statistics. An increase or decrease in My Wallet Users could be viewed as an increase or decrease in the usage and subsequently the network of Bitcoin.

**Groupings:**

*Market Variables (MV)* – The MV grouping consists of the previously explained variables and indicator: *Quantity, Transaction, Trade, and Demand Indicator.*

*Network Variables (NV)* – This grouping consists of only the indicators: *Transaction Trade Ratio, Transaction Quantity Ratio* and *My Wallet Users*. Since the entire grouping consists of indicators we must admit the problems associated with this. Namely that if our analysis fails, it can either be because there is no correlation between the price and the network effect. Or it can mean that our indicators lack validity, and thus are not measuring what they are intended to measure.

The Network effect has been said to include *Security, Functionality, Usage* and *Belief*.\(^{130}\) Security and Functionality are two variables that are hard to quantify. Firstly we have the problem with different types of security and functionality—e.g. perceived security, relative security towards other alternatives, actual security protocols and actual security breaches. Furthermore, how do we measure this and which one should we choose? Secondly we don’t have any data to go by, and developing reliable data for this would take too much time. Therefore I will have to leave these variables to future studies.

Belief in the product runs into basically the same problems as Security and Functionality. But with the even bigger problem that general belief might very well include the variables functionality and


\(^{130}\) Courtois et al., 2013, p.5
security. That is to say: belief in bitcoin maybe dependable as much on the security and functionality of the tool as the ideology behind it.

Therefore the only option we have in this study is to try and find indicators for Usage. Here I have used three different data sources for independent parameters: The number of My Wallet Users, Transaction Quantity Ratio (TQ-Ratio) and Transaction Trade Ratio (TT-Ratio).

### 3.4 Qualitative Data

The qualitative data in this study consists of both secondary and primary data. Bryman & Bell have noted that students who decide to use secondary data often are (unnecessarily) tempted to gather primary data as well. The reason for this is a misconception about the quality of secondary data. However in my case the choice to add primary data to this study is not rooted in the “flaws” of my secondary data, but rather in the conceptual problem of bitcoin—what is it? In order to answer this we cannot simply rely on secondary data, we need qualified statements.

To research the question on what digital money actually is, and what definition we should give it, I have relied on the secondary statements of experts and economists in news articles and literature, and a primary professional opinion from the innovator and co-creator of the mondex system, Tim Jones. Using these statements as premises, I have then deduced a definition of digital money and analyzed the implications.

The reason for conducting an interview with Tim Jones is the following: since economists have largely been occupied by thinking about the nature and aspects of the current monetary system I wanted to get some statements from someone who could be regarded as a professional expert on the specific phenomenon of digital money. This profile fits well to Tim Jones, being the co-creator of one of the first types of digital money.

The statements from Tim Jones were gathered through a telephone discussion with an unstructured interview format.

However, the author perceives and recognizes the limitations to his ability of making standing contributions to conceptual understanding of economic phenomenon. Therefore the problem regarding the definition of digital money must only be viewed as sub-important in this thesis, and should instead be discussed further by academic professionals with longer experience and knowledge.

The interview is reviewed in the data section of this study. And both qualitative and quantitative data will be discussed in the analysis and conclusion of this study.

---

131 Byrman & Bell, 2010, p.231
3.5 Method Discussion

Any study is subject to critique, and here I try to submit some of the concerns that have emerged regarding my study.

3.5.1 Validity, Reliability & Replication

The biggest problem regarding validity in this study has to do with the indicators meant to measure network effect. Are the indicators actually measuring network effect, and what factors are left out? In my study the main focus has been usage. But it’s not hard to imagine that other factors building up the trust in a network could influence a market value. These I have not been able to measure, something that shows in the results by giving the multiple-regression a low coefficient of determination. Furthermore, the question arises whether the indicators are good representations. I’ve tried to make corrections to the variables in order to reduce any misleading effects: like using the percental transaction quantity of supply instead of just transaction quantity, which corrects for any effects of supply increase. But still some reasonable doubt is recommended. And retesting is suggested in order to confirm or falsify what I’ve concluded in this study.

Furthermore, the method of statistical probability through correlation can be critiqued. Correlation is known not to measure cause and effect; it measures how well two variables conform to a regression and if there is a significant connection between the variables. Therefore, the cause and effect could be the reverse of the assumed. It might be that it’s not network effect that is affecting price, but instead that price is creating use in the network. However, this seems rather unlikely considering theory, but is still a point that should be kept in mind.

The case that is examined in this study is highly changeable; both regarding concept and function. Therefore the stability in this study might be questioned, and thus subsequently the reliability.

Considering replication this study has both hard and soft aspects. The hard aspects of the quantitative research are easy to replicate. Since the study relies on secondary data, the same data gathered from the websites can easily be reexamined. The soft aspects on the other hand, conserving hermeneutic interpretation and examination of the phenomenon, would most likely render a very different subjective result. Same can be said for the qualitative interview, due to its unstructured format.

3.5.2 Critique of Method

My approach in this study is to test certain claims about the nature of bitcoin price against statistical criteria of “probable truth”. For example: I’m testing variables and indicators for market forces with established statistical methods rendering me results of probable significance. There are assumptions and limitations associated with this. One assumption is that the criteria—the method of hypotheses testing based on a normal probability curve and critical deviating values from said curve—is

132 Lind et al. 2012, p.333-397
relevant for this case. This can be criticized both with the argument of non conformity to the normal probability curve, or with other methods relative advantage.

Another assumption that can be criticized is the validity of the variables and indicators used. Whether these are in fact good representations of forces I aim to test, which is something that absolutely can and should be questioned. Since theory is not established on this relatively new phenomenon the choice of variables to test in this study is made without a clear answer of what is relevant. Therefore assumptions were based on related theories and the supply of data, instead of established theories with empirical anchoring.

The limitations of this study relate both to examined forces and used methods. Are the forces examined the major alternatives, or does other major factors exist that are disregarded? And also could other alternative methods be used to examine said forces with better results.

Further more, the choice of data has to be viewed through a light of uncertainty. I’ve previously talked about the advantages of using secondary data, there are however some disadvantages to using this source as well. For example the data gathering process is not transparent in the sources of choice. Therefore the virtue of the data used is relying on the transparency and good intent of the service-provider.

### 3.5.3 Critique of Sources

Many of the theoretical sources used in this study was not created with bitcoin in mind. Studies and papers written in network effects for example were written long before this contemporary phenomenon. While other studies and sources that have been released in the past few years, like Mishkin et al.’s book on money and banking, shows little to no interest in the phenomenon.

Some of the sources that actually have been written with bitcoin in mind could be argued not to be reliable. Some are not of peer-reviewed character for example, and the statements gained from the interview performed are only compared to theoretical and journalistic sources, not against any other qualified interviews. This is important to remember throughout this study.
4. Data

This part explicates the process of testing the gathered data. It also displays the results of the testing process; results that will later be analyzed.

4.1 Bitcoin Price

This part explains how the collected data of bitcoin (BTC) price is compared to different independent variables.

4.1.1 Price & Supply

In figure 1 we see how BTC price has developed in the past six months. Supply is displayed in figure 2 and has had a much more predictable development. This is because the BTC creation process is controlled by computer software to have a stable growth, making the BTC supply increase more or less linear.

Figure 1: Price development, bitcoin, 2013-04-16 to 2014-04-15

Source: www.bitcoincharts.com

Figure 2: Increase in supply, bitcoin, 2013-04-16 to 2014-04-15

Source: www.blockchain.info
These two diagrams might seem highly incompatible. However, measured with the data collected for one year, there is a significant correlation of \(0.770\) between the variables price and supply. The coefficient of determination suggest that \(59.4\%\) of the changes in price is explained by changes in supply, and at a 95% significance ratio a t-test shows significant results.

Casewise diagnostics shows that four observations exhibit significant deviation from the regression. By removing these observations, and two subsequent observations from one more casewise diagnostics on the adjusted sample, we arrive at a slightly stronger correlation of \(0.791\) and determination coefficient of \(62.6\%\).

However, the same procedure on the more stable six months between april and oktober 2013 renders very different results. As can be seen in figure 1 the price fluctuations of the first six months are not as volatile as the six later. Measured on the entire twelve months we get an astounding standard deviation from the regression of $191.96 (i.e. 70% more than the mean price of the initial 6 months). The standard deviation of the first six months on the other hand is $15.78, which is far less volatile.

Doing a regression analysis of said six months give us a weak correlation of \(0.114\), and subsequently an insignificant coefficient of determination at \(1.3\%\). It might go without saying that a t-test on these observations suggests an insignificant correlation and regression between price and supply. Never the less, the results are summarized in the table below.

Table 1: Summary Price – Supply, 6 months

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>Beta</th>
<th>t</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.114</td>
<td>0.013</td>
<td>$15,779022</td>
<td>0.114</td>
<td>1.545</td>
<td>0.124</td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.2

4.1.2 Price & Transactions

All transactions through the bitcoin system is registered and recorded, and can be viewed as an indicator of usage. Usage has been said to be one of the factors that creates value in bitcoin, therefore a change in usage should result in a change in price.
Figure 3: Number of BTC transactions, 2013-04-16 to 2014-04-15

Source: www.blockchain.info

As shown in figure 3 the transaction quantity of bitcoin fluctuates highly from time to time. This results in an even higher standard deviation from the regression than that shown in the previous segment, here it’s $241.77.

The correlation between the variables is 0.596 and the coefficient of determination 0.355, which suggests that 35.5% of the changes in price are given by changes in transaction. This might not seem like a big percentage in comparison to our previous 62.6%. However, a t-test of these variables shows that there is a significant correlation and regression between the two variables, which again strengthens the idea that transaction and price variations might be related.

Looking instead at the initial six month period, as shown in table 2, we see a lowering of all results but still a significant t-test.

Table 2: Summary Price – Transaction, 6 Months

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>Beta</th>
<th>t</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.474</td>
<td>0.225</td>
<td>$13,985851</td>
<td>0.474</td>
<td>7.260</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.4

4.1.3 Price & Trade

As discussed in the method, analyzing trade is a bit complicated. The data we have from www.blockchain.info is given in trade volume and not trade quantity. Looking at trade volume—that is to say the trade of bitcoin given in aggregate dollar values—instead of trade quantity is of course misleading. This since such a variable has the BTC price in its own calculation and will subsequently be highly dependable on price variable. For a discussion on what corrections I have chosen and why, see method part 2.3.
As table 3 shows, the different methods differ a bit, however the result is the same, with more or less significance. In the twelve month period we have a significant t-test, meaning there’s a connection between the variables. But it’s a very week connection, with only 7.3% and 3.4% coefficient of determination for the different methods.

On the six month period however there is no significant connection between the variables and the determination coefficient is even lower, suggesting that trade has little or nothing to do with price.

Table 3: Summary Price – Trade, 12 & 6 months

<table>
<thead>
<tr>
<th>Place/Time</th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>Beta</th>
<th>t</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitstamp (12 months)</td>
<td>0.271</td>
<td>0.073</td>
<td>$291.17</td>
<td>0.271</td>
<td>5.355</td>
<td>0.000</td>
</tr>
<tr>
<td>Aggregate (12 months)</td>
<td>0.183</td>
<td>0.034</td>
<td>$295.99</td>
<td>-0.183</td>
<td>-3.547</td>
<td>0.000</td>
</tr>
<tr>
<td>Bitstamp (6 months)</td>
<td>0.126</td>
<td>0.016</td>
<td>$17.01</td>
<td>-0.126</td>
<td>-1.719</td>
<td>0.087</td>
</tr>
<tr>
<td>Aggregate (6 months)</td>
<td>0.083</td>
<td>0.007</td>
<td>$15.83</td>
<td>-0.083</td>
<td>-1.120</td>
<td>0.264</td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.5-8

4.1.4 Price & Demand Indicator (Trade/ Supply)

Our next variable, or rather Indicator, is of a softer nature than the previous variables. This indicator is here called the Demand Indictor. This indicator is a ratio between the total trade and supply of bitcoin, showing the percent of supply that is used in trade.

As table 4 shows, there’s a weak correlation between this indicator and BTC price. Suggesting that either our indicator unreliable or demand plays little role in the price of bitcoin. If the later option is true it would be totally contrary to normal economic theory.

Despite this, for the one year period there is still a significant regression between the two variables. However if we adjust to the shorter time period we arrive at a highly insignificant result. Meaning that during a stable period there is neither a correlation nor regression between the variables.

Table 4: Summary Price – Demand Indicator, 12 & 6 months

<table>
<thead>
<tr>
<th>Time</th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>Beta</th>
<th>t</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 months</td>
<td>0.195</td>
<td>0.038</td>
<td>$295.33</td>
<td>-0.195</td>
<td>-3.781</td>
<td>0.000</td>
</tr>
<tr>
<td>6 months</td>
<td>0.073</td>
<td>0.005</td>
<td>$15.84</td>
<td>-0.073</td>
<td>-0.986</td>
<td>0.325</td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.9-10

4.1.5 Price & Transaction Trade Ratio (Transaction Trade Balance)

Transaction trade ratio is an index that has been claimed to measure speculation and correlate with the actual price of bitcoin. In 2012 David Perry wrote a post named Measuring Bitcoin Speculation
on his website *Coding In My Sleep*, where he discusses the ability to use this index as an indicator of speculation. His argument is that since bitcoin strives to be a currency, it should follow equal trading and transaction patterns as normal currency; suggesting that the biggest amount of money moving around in the economy should come from everyday transactions, and not currency trade. Therefore the ratio of Transaction to Trade should be a high one. And any actual price change in bitcoin should be accompanied by an increase in the transaction trade ratio. If it’s not, that suggests price change due to speculation according to Perry.

According to a simple correlation analysis of the previous **twelve months**, as well as the **six months** between April and September 2013, there seems to be **no merit to this claim**. The result gives us a very low correlation and a t-test with no significant. Suggesting there is no correlation or regression between price and this Transaction Trade Ratio. Either this means that the index as an indicator is flawed, or that all price changes in bitcoin for the past year is the result of speculation. Both alternatives are of course possible.

### Table 5: Summary Price – Trade Transaction Balance, 12 & 6 months

<table>
<thead>
<tr>
<th>Time</th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>Beta</th>
<th>t</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 months</td>
<td>0,011</td>
<td>0,000</td>
<td>$301,07</td>
<td>-0,011</td>
<td>-0,207</td>
<td>0,836</td>
</tr>
<tr>
<td>6 months</td>
<td>0,060</td>
<td>0,004</td>
<td>$15,85</td>
<td>0,060</td>
<td>0,811</td>
<td>0,418</td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.11-12

Yet I have chosen to keep this index in the groupings I will later analyze. Not as an indicator of speculation, but as an indicator of usage. My argument is that the index might still show some trends regarding the *stocking of bitcoin*, and subsequently the usage.

Since all transactions of bitcoins are recorded, we know that if a trade of bitcoin is not followed by a transaction it means that the one buying the bitcoin is stocking it in his/hers own personal collection. Therefore if the ratio increases it suggests that either the trade is decreasing or the number of transaction is increasing, or both. If trade decreases but the number of transactions stays the same it would mean that less people are trading with bitcoin but still using them as means of transaction. That is to say, people are not buying more bitcoin into their personal collection and instead use it in transactions, meaning less stocking. If trade stays the same but transaction increases it would mean that people are trading the same amount of bitcoin but also use them more in transactions; transactions that must come from somewhere other than increase in trade, i.e. bitcoin stockings go down. When stockings go down, usage goes up.

If on the other hand the ratio decreases it would suggest that people buy and sell bitcoin more than they use it in transactions. If a bitcoin bank buys a bitcoin they have four options: put it to reserves, sell it to a customer, trade it to another bank or use it in payments. This means that, unless the increase in trade is accompanied by an increase in transactions in the private sector, the stockings go up. Same if a consumer buys bitcoin without later using it in a transaction. It would mean that the consumer is putting the bitcoin to its own personal storage.

---

So even if this indicator shows no significance here I also tried it in a multiple regression analysis that is reviewed in a later chapter, to see whether it still can hold some significance amongst a grouping of variables.

### 4.1.6 Price & My Wallet Users

My Wallet is an online web service that allegedly makes it easier and safer to manage your bitcoins.\(^{134}\) The service makes it possible for people to see their saldo, make payments and review history, online. This is done through uploading the data to a server, presumably owned by the corporation. However they don’t regard themselves as a bank, since the data is not available for the corporation. Instead the data is encrypted on the local user’s computer before being uploaded to the server.\(^ {135}\)

This data is interesting as it shows a part of the community’s expansion. However it should be noted that this is by no means the entire bitcoin community.

As the results presented in table 6 shows, a correlation and regression analysis of these variables renders **big difference between the twelve months and six month period**. One shows significant results and relatively strong (or at least significant) correlation, whereas the other shows the opposite. For the **twelve month** period we have **significant correlation of 0.754**, whereas for the **six month** it’s an **insignificant correlation of 0.094**.

**Table 6: Summary Price – My Wallet Users, 12 & 6 months**

<table>
<thead>
<tr>
<th>Time</th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>Beta</th>
<th>t</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 months</td>
<td>0.754</td>
<td>0.568</td>
<td>$197.85</td>
<td>0.754</td>
<td>21.855</td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>0.094</td>
<td>0.009</td>
<td>$15.81</td>
<td>0.094</td>
<td>1.268</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.13-14

### 4.1.7 Multiple-Regression: Market Variables

After looking at simple-regressions I conducted a multiple regression analysis. The interest here is to see how different groupings of variables affect the price. In our discussion earlier we identified two different forces that are said to affect the price of bitcoin; these are the two groupings we will examine.

One is ordinary market forces: Supply/ Demand. We call this grouping **MV (market variables)**. Same as before we use the price per BTC in USD as dependent variable. As independent variables we use the aggregates of Supply of BTC, Transaction Quantity of BTC, Trade Quantity of BTC and our Demand Indicator. These variables could also be called **hard variables**, since their measurement is easier to achieve in quantities. Firstly we will focus on these variables.

---

\(^{134}\) [https://blockchain.info/wallet/ 2014-05-06, 14:28](https://blockchain.info/wallet/ 2014-05-06, 14:28)

Same as in the previous simple regression analysis’ we use a 95% confidence interval and casewise diagnostics, and will subsequently correct for any anomalies that might affect the result.

Our first result renders a high correlation between the variables, and a coefficient of determination of 64.9%. We also found a significant result on the variables Supply and Transaction, but a greatly insignificant result on the other two variables. For the entire sample there was only one observation in casewise diagnostics. By removing this observation the result is slightly modified, but hardly with any significant change. The data is reviewed in the table below.

Table 7: Multiple-regression; Market variables, 12 months

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0.806</td>
<td>0.649</td>
<td>$179,09</td>
<td>166,486</td>
<td>0,000</td>
</tr>
<tr>
<td>General (2)*</td>
<td>0.807</td>
<td>0.652</td>
<td>$177,01</td>
<td>167,878</td>
<td>0,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Beta</th>
<th>t</th>
<th>Sig. (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>0,000</td>
<td>0,663</td>
<td>15,843</td>
<td>0,000</td>
</tr>
<tr>
<td>Transaction</td>
<td>0,007</td>
<td>0,256</td>
<td>6,592</td>
<td>0,000</td>
</tr>
<tr>
<td>Trade</td>
<td>-0,003</td>
<td>-0,393</td>
<td>-1,072</td>
<td>0,284</td>
</tr>
<tr>
<td>Demand Indicator</td>
<td>34076,679</td>
<td>0,444</td>
<td>1,207</td>
<td>0,228</td>
</tr>
<tr>
<td>Supply (2)*</td>
<td>0,000</td>
<td>0,676</td>
<td>16,171</td>
<td>0,000</td>
</tr>
<tr>
<td>Transaction (2)*</td>
<td>0,006</td>
<td>0,243</td>
<td>6,254</td>
<td>0,000</td>
</tr>
<tr>
<td>Trade (2)*</td>
<td>-0,003</td>
<td>-0,373</td>
<td>-1,020</td>
<td>0,308</td>
</tr>
<tr>
<td>Demand Indicator (2)*</td>
<td>32714,311</td>
<td>0,430</td>
<td>1,172</td>
<td>0,242</td>
</tr>
</tbody>
</table>

(* = After correction of casewise diagnostics deviating observation)
Source: Own presentation based on data shown in attachment 10.1.15

Since two variables seem to have little or no significance we try to remove them one by one, beginning with the most insignificant one, in this case the Trade variable. By doing so, the t-value is increased for the remaining insignificant variable, the Demand Indicator. From being at a level of 24.2% significant deviation, it’s now at 10.7%. So this increase in t-value leads to a big decrease in insignificance. But still, 10.7% is significantly bigger than 5%.

The correlation and coefficient of determination is insignificantly changed, meaning the variable Trade seems irrelevant in this grouping of variables.
Table 8: Multiple-regression; Market variables, 12 months (minus Trade)

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0.807</td>
<td>0.651</td>
<td>$177,02</td>
<td>223,466</td>
<td>0.000</td>
</tr>
<tr>
<td>Supply</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transaction</td>
<td>0.006</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand Indicator</td>
<td>4391,381</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.15

In the same way as with the Trade variable, removing the Demand Indicator does not result in much change to the multiple regression analysis either. The correlation is changed by 0.1% and the coefficient of determination by 0.3%.

Table 9: Multiple-regression; Market variables, 12 months (minus Trade & Demand Indicator)

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0.805</td>
<td>0.648</td>
<td>$177,41</td>
<td>332,401</td>
<td>0.000</td>
</tr>
<tr>
<td>Supply</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transaction</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.15

From the above, it seems like only BTC supply and transactions are correlating with the BTC price over the previous twelve months.

In the six month period, supply is the most insignificant variable, followed by demand. Trade is close to the 5% limit, but not above.

Table 10: Multiple-regression; Market variables, 6 months

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0.516</td>
<td>0.267</td>
<td>$13,715</td>
<td>16,264</td>
<td>0.000</td>
</tr>
<tr>
<td>Supply</td>
<td>1.699E-006</td>
<td>0.025</td>
<td>0.320</td>
<td>0.750</td>
<td></td>
</tr>
<tr>
<td>Transaction</td>
<td>0.001</td>
<td>0.488</td>
<td>7.428</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Trade</td>
<td>-0.001</td>
<td>-2.200</td>
<td>-2.028</td>
<td>0.044</td>
<td></td>
</tr>
<tr>
<td>Demand Indicator</td>
<td>6278,807</td>
<td>2.053</td>
<td>1.891</td>
<td>0.060</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.16
By removing supply from the regression we see basically no change to the correlation, and the trade variable now seems 0.1% better. **Suggesting quantity was not important to regression.**

Table 11: Multiple-regression; Market variables, 6 months (minus Supply)

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0.516</td>
<td>0.266</td>
<td>$13,681</td>
<td>21,761</td>
<td>0.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Beta</th>
<th>t</th>
<th>Sig. (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transaction</td>
<td>0.001</td>
<td>0.491</td>
<td>0.000</td>
</tr>
<tr>
<td>Trade</td>
<td>-0.001</td>
<td>-2.210</td>
<td>0.043</td>
</tr>
<tr>
<td>Demand Indicator</td>
<td>6264,839</td>
<td>2.049</td>
<td>0.060</td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.16

Removing the demand indicator however, renders the multiple-regression totally mute. The Demand indicator previously showed insignificance with 6% to the 5% limit. But removing the indicator changes the correlation with 0.014 points and lowers the coefficient of determination with 14%. Even more importantly it raises the insignificance of the trade variable to 11%, and if that is insignificant the only thing remaining is transaction.

Table 12: Multiple-regression; Market variables, 6 months (minus Supply & Demand Indicator)

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0.502</td>
<td>0.252</td>
<td>$13,78</td>
<td>30,418</td>
<td>0.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Beta</th>
<th>t</th>
<th>Sig. (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transaction</td>
<td>0.001</td>
<td>0.502</td>
<td>0.000</td>
</tr>
<tr>
<td>Trade</td>
<td>-4.601E-005</td>
<td>-0.167</td>
<td>0.011</td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.16

The result of this analysis is self-contradicting and the MV’s legitimacy and relevance will further be discussed in the Analysis chapter.

4.1.8 Multiple-Regression: Network Variables

The other grouping is derived by what we call *Network forces*, and is called NV (network variables). These variables are less obvious as concrete quantitative values, and are therefore considered soft. The variables used in the NV grouping must therefore be viewed as “indicators” rather than actual measurements, which makes it subject to critique (is taken up in the Method section). The indicators in this multiple-regression are intended to measure *Usage*.

*My Wallet Users* is thought as an indicator of usage since it shows the number of people subscribing to the community and thereby contributing to the network effect. *Transaction Supply Ratio* is an
indicator meant to show how much of the “total money supply” (remember that in bitcoin the “Total Money Supply” equals the total number of bitcoin in the system) is used for transaction; suggesting the use of Money in circulation. The last parameter, Transaction Trade Ratio, is most dubious of these, and a discussion about why we still are interested in testing this parameter can be found in chapter 5.1.5 Price & Transaction Trade Ratio.

Same as in the previous simple regression analysis’ we use a 95% confidence interval and casewise diagnostics, and will subsequently correct for any anomalies that might affect the result.

The multiple-regression of the NV variables for twelve months shows a pretty high correlation. Two of the variables seems highly significant and one—the Trade Transaction Ratio—not significant. However after correcting three casewise diagnostic observations the significant deviation of the TT-Ratio decreases almost to 5%.

Table 13: Multiple-regression; Network variables, 12 months

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0,791</td>
<td>0,626</td>
<td>$184,73</td>
<td>201,085</td>
<td>0,000</td>
</tr>
<tr>
<td>General (2)*</td>
<td>0,799</td>
<td>0,639</td>
<td>$177,52</td>
<td>210,939</td>
<td>0,000</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My Wallet Users</td>
<td>0,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TT- Ratio</td>
<td>-1,960</td>
<td>-0,052</td>
<td>-1,621</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS - Ratio</td>
<td>78737,170</td>
<td>0,246</td>
<td>7,145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My Wallet Users</td>
<td>0,000</td>
<td>0,701</td>
<td>20,524</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TT - Ratio (2)*</td>
<td>-2,256</td>
<td>-0,062</td>
<td>-1,940</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS - Ratio (2)*</td>
<td>66877,908</td>
<td>0,211</td>
<td>6,191</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(* = After correction of casewise diagnostics deviating observation)
Source: Own presentation based on data shown in attachment 10.1.17

If we try to remove the variable we get a small change to the overall correlation. But not enough to be considered as a significant change to the regression. This suggests that the TT-Ratio has a weak impact on the multiple-regression. But still my wallet users and transaction supply ratio shows a high correlation with price.

Table 14: Multiple-regression; Network variables, 12 months (minus TT-Ratio)

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0,797</td>
<td>0,635</td>
<td>$178,20</td>
<td>312,126</td>
<td>0,000</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My Wallet Users</td>
<td>0,000</td>
<td>0,694</td>
<td>20,354</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS-Ratio</td>
<td>68381,294</td>
<td>0,216</td>
<td>6,323</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.17
If we instead turn to the six month period the correlation decreases with 0.312 points, and the coefficient of determination is less than half of our other period. Initially we here see two variables that seemingly are insignificant; TT-Ratio and My Wallet Users.

Table 15: Multiple-regression; Network variables, 6 months

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0.485</td>
<td>0.235</td>
<td>$13.97</td>
<td>18.426</td>
<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>Beta</td>
<td>T</td>
<td>Sig. (5% level)</td>
<td></td>
</tr>
<tr>
<td>My Wallet Users</td>
<td>3,471E-005</td>
<td>0.156</td>
<td>1.807</td>
<td>0.072</td>
<td></td>
</tr>
<tr>
<td>TT-Ratio</td>
<td>-0.021</td>
<td>-0.010</td>
<td>-0.115</td>
<td>0.909</td>
<td></td>
</tr>
<tr>
<td>TQ-Ratio</td>
<td>9402.743</td>
<td>0.479</td>
<td>7.295</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.18

The TT-Ratio’s insignificance is vast, and removing it does not affect the correlation. Therefore we can conclude that this variable seems not to affect the dependent variable.

When we removed the TT-Ratio the insignificance of the remaining variable My Wallet Users decreased and is now at an acceptable level. Suggesting there is a significant regression between TS-Ratio, My Wallet users and the BTC price also for the six month period.

Table 16: Multiple-regression; Network variables, 6 months (minus TT-Ratio)

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>Coefficient of determination</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Significance (5% level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>0.485</td>
<td>0.235</td>
<td>$13.93</td>
<td>27.785</td>
<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>Beta</td>
<td>T</td>
<td>Sig. (5% level)</td>
<td></td>
</tr>
<tr>
<td>My Wallet Users</td>
<td>3,328E-005</td>
<td>0.149</td>
<td>2.280</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>TQ-Ratio</td>
<td>9400.759</td>
<td>0.479</td>
<td>7.314</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own presentation based on data shown in attachment 10.1.18

4.2 Discussion with Tim Jones

The following text is based on the information received through a telephone conversation with Tim Jones, co-creator of the mondex system. The formulations and disposition of the text is not an exact representation of said telephone call, but a recreation of the central points as viewed by the author.

Telephone discussion, format: unstructured interview.

Date: April 30th, 2014. 6:00 pm (Swedish Time)

4.2.1 About Digital Money & Mondex

“The evolution is a very incremental one. From notes and coins, to electronic money.”

[Quote: Tim Jones]
Mondex was invented on March 1990, and developed through 1991 and 1992. Meaning it was being developed pre-the modern version of the internet.

The starting point of the development was to create something that would add another subdivision to the existing forms of money; namely add electronic money to coins and notes. Tim Jones explains the progress as the following. Expressed in monetary aggregates, notes and coins is M0, and to go from M0 to M1 you add sight deposits, meaning that M0 fits inside M1, to go from M1 to M2 you add time deposits and so on. In order to make economic sense of electronic money you don’t have to make it so complicated, you simply add a subdivision to M0.

“It’s still money, it’s just in a different technological form” [quote: Tim Jones].

This means that when value is created in the mondex system, the banks would buy this with sight deposit money from bank accounts. Much in the same way as when the central banks print money and the different banks buys the money from the print.

4.2.2 The Functions and Intentions of Mondex

Their concern: With physical money come frictional costs. But the notion of trading at par, which the physical money holds, is incredible powerful. And in some sense was the object of creating digital currency—at least they wondered if it was possible.

It will not however work exactly as physical money. Even if it adapts some of the core values, it has different functions of usage. For example, Tim Jones argues that mondex, and digital currencies like it, works best in highly digitalized environments. This because there is no hygiene, you can send it remotely, etc.

4.2.3 About Bitcoin (crypto-currencies)

The point of bitcoin according to Tim Jones is to do something crazy and new. This is what’s driving the community. And because the creation of bitcoin started out from the position of just creating some bitcoins, then value is created from transfer. But for Tim Jones a currency must have the backing of a real economy. Something that bitcoin is lacking. For him there are no real economic workings behind bitcoin, instead he makes a comparison of bitcoin to the black tulips.

4.2.4 Bitcoin’s “success” & Mondex “Failures”

Bitcoin success according to Tim Jones mainly has to do with the fact that there is an allowed lobby of people who want bitcoin to exist for ideological reasons.

Mondex was criticized as a technology looking for a market, which was not true according to Tim Jones. The research they did showed that the targeted people were positive to mondex. People liked the idea of using their mobile phone as a cash dispenser. However, the thing they used now (physical money) works everywhere, so mondex had to have the same condition, which they were unable to supply.

The biggest mistake they did, according to Mr. Jones, was restricting mondex to a geographical area, i.e. different cities around the world. They thought that they would be able to offer the “works everywhere” condition by doing this. But since there was nothing forcing the shops to use mondex, they simply didn’t, and therefore it was quickly rejected, and the usable everywhere objective was
never achieved. Still, according to Jones, it had been successful amongst some groups of people, in particular students. Instead he suggests that they should have gone through the way he calls “Branded ubiquity”. Meaning it works everywhere, but in a bounded part of its existence.

4.2.5 The Main Difference Between Mondex and Bitcoin
There is nothing real that backs the value of the bitcoin, whereas mondex would be backed by the relevant economies, and would trade at par with the physical alternative, thereby making mondex stable, when bitcoin is unstable. And this is according to Tim Jones is a more real expression of digital money.

4.2.6 Features of Digital Money
There are no digital money so far according to Tim Jones, but if it’s created it should have these following features, which none of the existing alternatives have:

- It should be exchangeable at par.
  Meaning that other things that look like digital currencies, (debit/credit cards, charge card, PayPal) are according to Jones not electronic money, they are payment vehicles.

- Electronic money is based on the core rules of physical money.
  No transaction fees whatsoever. The business of it should be based on the adjacent fees (putting it back in the bank, interest rate on the float and so on).
5. Results

This part aims to concisely present the results given by the data in chapter 4.1.

Summary: Simple-regression

Out of the six different variables tested in the simple-regression test four have shown inconclusive results, one is falsified and only one not falsified.

The four inconclusive results are: Supply, Trade, Demand Indicator, and My Wallet Users. All these show different results depending on if we look at a twelve month period or a six month, where the twelve month period show significant results and the six month insignificant results. Furthermore, when considering the histograms given in attachments 10.2.5, 6, 9 and 13 which is showing that the variables Trade, Demand Indicator, and My Wallet Users conforms badly to a normal distribution curve for the twelve month period, we have to further question the results.

That supply would show a correlation with the price for the past twelve months is not surprising. Since supply develops in a more or less positive linear, ending the period at a higher price than the entering price suggests a correlation. However, looking at the six months shows that the supply is not significantly correlated to price.

The falsified result is Transaction trade ratio that shows highly insignificant results on both periods.

The not falsified result is Transaction. This variable shows significant results on both periods, and conforms well to the normal probability. However, the correlation of the variable is not high. For the longer period the variable has a coefficient of determination of 35.5%, and 22.5% for the shorter period. This suggests that even though transaction seems to have a significant relationship with price, it can only be said to explain a certain amount of the price development.

Summary: Multiple-regression

The multiple-regression of the market variables for twelve months shows a significant regression and high correlation for the variables supply and transaction with price. The observations conform pretty well to a normal probability. Though for the six month period the results show only transaction as being relevant for the price since the other variables gives insignificant results.

For the network variables the results are conclusive and consistent for both periods. Transaction-trade ratio shows insignificance to the correlation for both periods, while the other two variables render a positive result. With more or less significance trade supply ratio and my wallet users seems to correlate with the variable price, independent of what time period. However, as with transaction in the simple-regression the network variables have low correlation for the six month period, but also a rather high correlation for the twelve month period.
6. Analysis

This part ties together theory with data into a final synthesis on what statements and general claims can be made by this study.

6.1 Price Driving Factors & the Importance of Transaction

In line with Courtois et al.’s statement that bitcoins value is mainly derived from network effect, I show in this study that there is a correlation between values that can be viewed as network variables and the price of bitcoin. But while this might merit the claim of Courtois et al., it should also be noted that the correlation found is one with low determination.

Furthermore I have found that transaction proves to be an important variable for bitcoin, for two main reasons: transaction is the only variable that conclusively correlated with Price; and it is from transfers that Tim Jones claims that bitcoin derived its value.

In the extended view, transaction can be seen as an indicator of usage. This because there is only two things you can do with a bitcoin—in line with what we learned from Hanley—spend or hoard\textsuperscript{136}, use or save, transfer or don’t transfer, which means that when a bitcoin is transferred in a transaction, it is being used. Here we see the connection to the wider view of the network effect where usage is fundamental to creating value, as can be found in the theories of Katz and Shapiros.

However the question could be put forward whether it’s actually transaction that correlates with price and not supply. Since increase in supply would probably result in an increase in transaction, it could be argued that it is supply that is affecting price. But this has been shown not to be true.

Firstly supply only correlates with price for the period between March 2013 and March 2014, and not March to October 2013, whereas transaction correlates for both periods. Furthermore, in the multiple-regression test preformed in this study I used the variable transaction-quantity instead of just transaction. This ratio, showing the percental of transactions in relation to supply, which corrects for the increases in supply, also proved to have a significant correlation with price. 

Hence transaction can be proven to correlate with price.

There is one more variable that correlates with price, My Wallet user—another assumed indicator of usage—gives significant results in the multiple-regression test preformed.

6.1.1 Implications to Bitcoin from the Performed Study

From quantitative study some knowledge about the fundaments of bitcoin can be extracted.

(1) Bitcoin has no intrinsic value, but has fundamental value.

\textsuperscript{136} Hanley, 2013, p.6, 14
(2) From 23.5% to 63.5% of the fundamental value can be said to be derived from network effect, the rest is unaccounted for.

(3) Fundamental value of bitcoin should be estimated based on discounting models of network based transaction gains.

(4) No connection to market variables and demand and supply factors can be established.

Statement (1): Courtois et al. claims that bitcoin has intrinsic value, and that this is derived from network effect, whereas Hommes et al. claims that bitcoin has no intrinsic fundamental value. It can be said about the two groups of scientists that Hommes et al. seem to have long experience in the fields of financial crisis, movements and instruments, but less experience with the workings of bitcoin, whereas Courtois et al. on the contrary seems to have much experience with the workings of bitcoin but less regarding financial phenomenon. Never the less I tend to agree with Hommes et al. that bitcoin has no intrinsic fundamental value, but that it has abstract fundamental value, in the same way as any other non-physical marketable object. And in fact I believe that when Coutois et al. says that bitcoin has intrinsic value, this is what they actually mean, and that their choice of words is simply a case of semantic mistake.

Statement (2): This statement stems from the multiple-regression of network variables. The longer period rendered a 63.5% coefficient of determination, and the shorter 23.5%. The remaining unexplained variations in price can only be speculated about. Either it is network values that were not able to be measured in this study, such as the value of increased security in comparison to alternatives, increase in functionality to alternatives, or ideological belief and hype. It could also be explained by general speculation. Since the unexplained factors in price can amount to such high percentage as 76.5% it would be of great importance to establish.

Statement (3): Beckstrom’s Law shows that transactions can be viewed as the backbone of the creation of value in a network system. He suggests a method of discounting alternative gains against inherent costs in order to valuate networks. Since bitcoin’s price seem dependable on transaction it might be possible, and reasonable, to conduct the same calculation on bitcoin in order to valuate bitcoins fundamental value. However, Beckstrom’s Law relies on subjective estimations, both with regards to who is comparing and what systems are compared. Therefore further studies should be done on how to best estimate transactions into quantitative values that then can be discounted. This might render a model for crypto-currency valuation, making the market less prone to speculation.

Statement (4): In this study no conclusive results relating price to market variables was found. Neither supply nor traded quantity—or the percental traded quantity of supply— could be proven to affect price, both with regards to stable and fluctuating periods. Some results showed significance on one period but insignificance on the other. With consideration to that—and the fact that market variables show unconformity to the normal distribution—this grouping can be said to be inconclusive, and is regarded as insignificant for bitcoin. But with regards to supply some general claims can still be made. Supply is increasing linearly and the price of bitcoin has since its creation increased significantly. Considering this it can be said that bitcoin is deflating, or follows the Law of Supply.
6.2 Conceptual Interpretation & Management Implications

Is bitcoin money? Is it even digital money? The answer to that question is not—at the moment—unambiguously neither yes nor no. Of course you will get different answers depending on whom you ask, but also depending on where you ask. If digital money is a programmatic entity that works like physical cash (par value exchanges) and is generally accepted in payment and commonly offered in sales for goods and services, as I have defined it in this study, then bitcoin can be viewed as money, if it is generally accepted.

Tim Jones said that in their market research consumers wanted mondex to work everywhere, which in essence is to be generally accepted. And for him branded ubiquity was the way to do this, the way to make digital money work was to introduce the money into a certain business circumstance where it is generally accepted.

With the data given in this study I cannot really answer if bitcoin is generally accepted, however my own perception is that it is not. Bitcoin has not achieved branded ubiquity and is not generally accepted as a form of payment on the internet nor in physical stores and therefore it can’t be viewed as money. Furthermore, if we look through the Chartalists point of view where money derives its value from the state’s ability to decide what is valid as a legal tender, the argument can be made that general acceptability also steams from this sovereign action. At least this falls naturally from Lerners argument when she says that everyone will accept it in payment since they know they will be able to use it in order to repay their debts to the state.\(^{137}\) What then can be said about bitcoin, which has been abolished and frowned upon by various different countries and banks?

To me it’s pretty clear that bitcoin is not money in any conventional sense; both with reference to the theories and definitions existing around money—something that a lot of the economists reviewed in this study seems to testify to—but also with regards to bitcoins nature.

6.2.1 The Evolution of Money & Bitcoin

In the field of study I discussed Mishkin et al.’s model of “The Evolution of Money” (an illustration of that model can be found in attachment 10.1.1). But from looking at this model the question arises: where does bitcoin fit in? The answer is that it does not fit in. Instead it evolved through this system, it is a synthesis from the electronic payment and the commodity money system.

Bitcoin evolved with these systems in mind, and grows out of the common soil of Mishkin et al.’s evolution tree. This soil and common ground is economic interests of trade, and pre-exists even the commodity money system—but doesn’t show in the model. Economic interests of trade are the denominator that has given birth to the commodity money system—as well as Barter Markets and centralized redistribution systems which also are not mentioned by Mishkin et al.

In the metalist point of view as well as with Mishkin et al. we can observe that the evolution of money has been heading in the direction of lowering transaction costs; first in the sense of making it

\(^{137}\) Lerner, 1947, p.313
easier to transfer money, and also handling the problems associated with trading in barter economy. The commodity money demanded enormous security and logistical efforts to move big amounts of money. It was heavy and of great “intrinsic” value. Fiat money, i.e. paper money, was easier to move but still had a security problem—and of course, big enough amounts of paper money demanded for big transfers of paper as well. The check took care of the problem of transferring a big amount, and a certain part of the security was solved since the check can only be cashed by one specific person. However, a check still has to be moved. Eventually we got the electronic payment, which seemingly solved all these problems. With electronic payments there’s no logistical effort in moving the money, and no security problem as an effect of the moving—of course there are other security problems, but not of the same nature. However, with electronic payments a new perceived problem arose, one that has to do with the banks “monopoly” status in the financial system; transaction costs. It is from and in response to this that bitcoin is created, and therefore it is with regards to this that we understand bitcoins place in the evolution of money.

Before continuing to talk about the creation, problems and place of bitcoin in society, it is worth to mention that chartalists do not agree with the argument that money was created as a solution to the problems with trading in a barter economy. Instead they use the broader definition of money claiming it’s an abstract unit of account, a definition meaning that money might very well predate writing since the first forms of writing found are accounts of debt. I tend to agree with the chartalist tale of the creation of money as well as its definition and ideas of state derived value, which to me offers a more real picture of money and its origin. This however does not exclude the hierarchy given by the evolution of money, neither is it dichotomous to chartalism to say that *economic interests of trade* is denominator to money and that trade might still very well predate sovereignty and the state derived forms of money. Because a question one can make to the chartalists money as unit of account is: what predates debt? Sure, sovereignty with tax/tribute claims on its subjects might be one thing, but commodity trade is even more probable. Such as “my friend the farmer needs meat today, and I know I will need wheat tomorrow”, a trade with the promise of repayment to an equal value, relying on reciprocal actions and trust, seems more fundamental and deeper rooted in humanities self than the need for tributes or tax.

Returning to the subject of bitcoin, it is in part a response to the transaction costs given by the electronic payment systems. With electronic payments we have transaction costs in form of bank fees, and with the electronically globalised market and transaction flowing between banks and the borders of countries at great aggregated value, these transaction costs has become highly visible to the private consumer. Of course this is only part of the explanation of the creation of bitcoin. Because in a way transaction costs are not strange when you consider that it is a service provided by banks. It’s not strange to have fees when transporting goods, then why should it be strange for money? Well this has to do with liberal ideals. When you transport goods you have a lot of different ways to go about doing so. But not with money, you basically have to go through a bank. Therefore it can be said that the increase in liberal ideals that is stimulated in our modern capitalistic society by consumerism and free trade values opts for a general decentralization. It is no coincidence that many of the followers of bitcoin are libertarians neither is it a coincidence that the eruption of numerous crypto-currencies comes right after the crisis of the financial system from 2008. The skepticism that arises from a crisis of such magnitude fuels the already suspicious public into

---

138 Tymoigne & Randall, 2008, p.1
further mistrust of the financial system, and eventually we end up with a private invention created on the backs of similarly minded ideology driven individuals, that sets out to overthrow the ruling systems “totalitarianism”. After all, some claim that bitcoin is in itself a revolution—a term which I do not agree with as you will see, but that suggests a revolv/ turning against the existing system with the intention of shifting the center of power from the privileged few to the public many.

As can be viewed in the Satoshi Nakamotos official article of bitcoin from 2008, we can see that bitcoin is created partly as a response to the financial systems influence in people’s transaction. The centralized system of the financial sector, which handles with fiat money, makes it impossible for people to transfer money without being depended on a bank. Nakamotos argument is that due to the inability of the financial system to handle fraud, the transaction costs are raised and small value transfers are impossible.

But with regards to the evolution of money, banks are not a problem inherent in human society; they’re a solution. In fact, banks are our own, and so far only solution to an uncertainty problem of human economic transaction. But never the less, some people now view it as having evolved into an obstacle rather than a well lit path.

I therefore argue that in a way, bitcoin can be viewed as a monetary atavism—that paradoxically was possible only through technological advancement—rather than a revolution as mentioned above. Bitcoin asked itself: “How would it be possible to do trade throughout the world without transaction costs? Well, we need to take away the possibility of fraud. And the first steep of that is making the objects we transfer unique and distinguishable. The second step is creating some proof of transaction. These two steps should take away the fraud problem of double spending.” In using a unique object as the subject of transfer bitcoin created something that looks more like a commodity or a good than money—remember that Tim Jones equaled bitcoin to the black tulips mania, a mania based on commodities, not money. Bitcoin is more like a commodity in the way that commodities can be comparable in value, but different as objects. The gold value of two different 10 gram gold necklaces might be the same, but the shape and design of them can vary. In the same way the value of two different bitcoins might be the same but they hold unique digital signals. In fiat money coins and bills are thought to be comparable both in value and object.

In regard to the previous paragraph bitcoin could be thought of as an electronic commodity money system, that transfers “objects”—in commodity a metal and in bitcoin a unique digital signature—from one person to another, all over the world.

It should be emphasized that it’s not strange to consider more systems coexisting at the same time, or that societies shift back and forth between using different systems. There have throughout history existed more systems along side the commodity money system than is mentioned in Mishkin et al.’s evolution of money. For example in the ancient Inca Empire, a central redistribution system was used on a governmental level, whereas a barter economy was used by the different clans within the empire. In China, a country that might be viewed as one of the first market economies, thinkers opted for market systems as early as approximately 300 B.C., and as previously mentioned is the earliest know example of an economy using paper money, but they also later regressed into more

---

139 Söderberg, 2007, s.209
barter based systems.\textsuperscript{140} The different systems have come and gone and they have even coexisted within the same empire—as illustrated by the example of the Inca Empire.

In the light of the civilizations that has failed and the ones that have passed, we might be tempted to say that market economies who come up with the solution of fiat money are in the end the most successful systems available—there are even indications that the Inca Empire was striving for a market economy in the long run.\textsuperscript{141} However we cannot disregard the fact that there are alternative systems, that has had a role in human society, and might very well come to evolve and try again—even though it might be in very different form.

Chronologically we place digital money and crypto-currencies after E-money. Mondex for example would be put under electronic transactions. Regarding bitcoin, some claim it is a revolution, but placing it in a hierarchy of system evolution it would rather be viewed as an atavism. As I have illustrated in attachment 10.1.2.

\textbf{6.2.2 The Relationship to the Monetary System}

Mondex was digital money compatible with the existing monetary system. This was the intention with it, to create digital money without disrupting the role of the central bank.\textsuperscript{142} Bitcoin on the other hand is incompatible in the sense that it is uncontrolled and unbacked by any economy. Its value is derived from network effect rather than factors such as production, contracts, laws or governmental guarantees. And bitcoin price in contrast to fiat currencies cannot be measured as exchange rate based on economic laws such as the Law of One Price.

Neither can bitcoin create its own monetary system similar to contemporary banking. This due to the inability to create a deposit bases system where loans in bitcoin can be extended or interest gained. This means for example that no welfare effects due to multiple deposit creation can be made in a bitcoin monetary system.

However, this does not mean that bitcoin is doomed. It simply means it can never be comparable to fiat currency. \textit{Importantly it also means that the two different systems are not competing, and can coexist without disruption.} There will still be demand for loans, credit cards and saving accounts, and since these are things the bitcoin system can never provide, fiat money and banking will have to be the basis for these services. Further more, buying bitcoin does no direct affect against the banks of our monetary system. It is not like taking money from one system and putting it into another. Because when you buy bitcoin, the person you’re paying will still keep the money you’re losing, and probably it goes straight into that persons or company’s bank account. Exactly like when you buy any other \textit{good or service}. One checking account is reduced, another increased. Thus the money still stays in the financial system.

The only way bitcoin could affect banking is by being a \textit{payment vehicle}, as Tim Jones expressed it. When people want to transfer money from one place to another, say to a relative in a distant country, instead of using bank-transfer options they \textit{could} buy bitcoin and send this to their relative, free of charge and in 10 minutes. Then the relative can liquidate the bitcoin into fiat currency that

\textsuperscript{140} Söderberg, 2007, s.159ff
\textsuperscript{141} Söderberg, 2007, s.221
\textsuperscript{142} Stadler, 2002, p.211
he/she can then use in purchases. Thus people can circumvent the bank, and subsequently the bank looses some fees of transfer. The same could be done for online purchases where bitcoin is accepted.

However this is not a major threat to banking as a whole, considering that the biggest income of banking resides in commercial loans. Further more, there are risks associated with bitcoin transactions that can be avoided with banks. For example the risk of sending bitcoins instead of using bank transfers lies in the possibility of price change between the time at which you buy bitcoin and the time and bank at which to recipient sells it. This suggests that banks will still stand strong in their position.
7. Discussion

This part delivers some concluding discussion and statements about the preformed study.

I would say that bitcoin is a non-physical commodity or good with value transfer function and certain constrained trade abilities. This non-physical good derives some of its value from network effects that mainly has to do with transactions, and subsequently usage. But since transaction only can be said to explain a certain amount of the total fundamental value it is imperative to establish what other factors explains the price, and further studies are recommended to be made on this subject.

The nature of bitcoin is indecisive. Is it stock, commodity, currency or network good/service? This indecisiveness can be said to stem from the functions that bitcoin holds: transaction tool, tradable good, an instrument of gamble. It is a transaction tool due to the design of the system which enables cheap and quick transactions; it’s a tradable good since it cannot really be said to be money, but still is tradable at some places; and it’s a gamble because of the price fluctuations and the imagined increase in price. These functions are as incompatible as the claims about the nature of the thing itself.

But one thing can be said, bitcoin aims to become money. But in this intention a dimorphism has taken place, differentiating it from what we view as normal money—i.e. fiat money. Furthermore, bitcoin can also be said to differentiate itself against previous attempts at creating digital money. Therefore we have to judge it on those terms instead of critiquing it for being something it’s not.

One might say that you can criticize an orange all you want for not being an apple, but that doesn’t mean that the orange tastes bad. It’s not necessarily a dichotomous relationship. So as far as we know now, the tale of bitcoin might in the end spell out “the tale of the ugly duckling”.

If instead of viewing bitcoin as money and comparing it to fiat currency we focus on the strengths of tariff free transactions, we find incentive and function beside effects such as multiple deposit creation. Then we can see that bitcoin could be used as a tool of cost reduction, and be regarded as lowering trade barriers, which is fundamental for ideas such as free trade. Decisions and goals based on free trade ideology permeates all different sorts of institutions throughout the world, from the WTO to the European Union, and can be traced back as far as Adam Smith, and mainly his chapter on restraints of import in The Wealth of Nations.\(^{143}\)

However, in order for bitcoin to fill this function and actually work as a tariff reducing alternative it has to be stable; a criterion that it seems unable to fulfill, due to incompatible functionalities. Mondex on the other hand could have filled the free trade criterion, but lacked the proper public incentives to survive.

Finding stability by being controlled by a centralized government has shown not to be possible for bitcoin. But maybe by establishing a way by which we simply and coherently can calculate

---

\(^{143}\) Smith, 1991, p.397-415
fundamental price, bitcoin could stabilize. One way might be by adopting models such as Beckstrom’s Law, but for now the problems associated with this is far too great to be useable.

In conclusion: do I believe that bitcoin will succeed in becoming money, or has it played its final cards? I’m prone to think it will not succeed, but I also leave room for the possibility that the effects of bitcoin might be greater than we believe. Since the fall of mondex, digital money has seemed to be an unachievable ideal that is still today in flux. But if it was possible to create a system looking like mondex but with public incentives, there might still be a chance for it. And maybe bitcoin and the likes of it can be part of creating that incentive; maybe that is the final hand of bitcoin.

7.1 Suggestions for Further Studies

In order to develop a tool to estimate the fundamental value of bitcoin, further studies showing what factors affect bitcoin price has to be preformed.

(1) There are many other variables that could affect price: international incidents, scandals, business cycles. None of these are studied or considered in my study. Therefore a study further exploring other variables that does comparisons to other alternatives, could strengthen or falsify the claim of network effect on the price of bitcoin, as well as give a more complete view of the phenomenon.

(2) It is this author’s opinion that it would be relevant to perform a study based on cross-sectional design where bitcoin is compared to crypto-currency competitors in order to see how an increase in supply of alternative digital payment options affect the relative price levels.

Studies examining bitcoin through another assumption about it’s nature might shine more light over the phenomenon.

(3) There are research done on payment instruments efficiency and the competition between different payment instruments, such as that of Joseph Farrell from Review of Network Economics called Efficiency and Competition between Payment Instruments”. Studies regarding bitcoin as a payment instrument rather than money might come to different conclusions than I’ve made in this study.

(4) Studies assuming that bitcoin is a stock could examine whether bitcoin market patterns conform to general theories of stock exchange.
8.0 Conclusion

This part summarizes the preformed study and its results.

This study has looked at bitcoin, focusing on its price mechanism and social contingency, and renders two results of importance. Firstly it has shown that the price of bitcoin relies on usage, where network effect and transaction plays a bit part. A bigger network and more transactions indicate higher utility, which in turn affects price. This can be explained by bitcoins incomparability to fiat money, which also means it does not rely on price determining factors such as production costs. In fact I have showed in this study that using vocabulary such as exchange rate, commonly used for fiat money, is unnecessary and principally incorrect for bitcoin.

Secondly, I have argued in this study that bitcoin, in terms of monetary evolution, is an atavism. It was created because of an increased skepticism of financial systems which was stimulated by the crisis of 2008 as well as the liberal free trade ideals centered on decentralization—ideals that flourish amongst certain groups in our modern society. Bitcoin is a response to, as some see it, the problems in—and totalitarianism of—financial systems. However, I argue that bitcoin should not be seen as an improvement to the existing system, but rather as a compliment. The bitcoin system does not build upon the existing system in the same way as checks or electronic transfers to the system of banking and fiat money. Instead it goes back to basic principals of trade and adds the aspect of technology and globalization, and in this sense I here view it as an atavism.

Both these result show that we should rethink our approach to bitcoin; that instead of viewing it as a form of money, and therefore criticizing it for something it never was, we should regard it as a totally new phenomenon. We must try and evaluate its strengths and weaknesses for what they really are, and build instruments to measure performance. Like discounting value based on transaction advantages. Such a discount model—if successful—would add inventive to buy and sell bitcoin that goes beyond speculation, and in the end might show bitcoin to be manageable as a financial instrument or tool of transaction cost reduction.
9.0 References

Sources sorted by Author:


**Sources without author or with unknown author:**


10.0 Attachments

10.1 Theoretical Attachments

10.1.1 The Evolution of Money (illustration Mishkin et al)

The problems in the commodity money system gave rise to metal, gold and fiat minting.

The creation of Banks and banking.

Even though gold and metals of course still exists, and holds value, it is not considered as money.

The forms of money that still exist, to different extents and some altered from the original usage or form.

Source: An illustration based on the information given in Mishkin et al.
10.1.2 The Evolution of Money (adjusted illustration Mishkin et al)

I use the same model from the point of the commodity money system as Mishkin et al. But add the preexisting factors that are the denominator of all subsequent systems.

Bitcoin evolves out of pure economic interests. But builds upon ideas of the commodity money and the electronic payment system (including all subsequent systems).

The forms of money that still exist, to different extents and some altered from the original usage or form.

Source: An illustration based on the information given in Mishkin et al. and the authors analysis
10.1.3 Bubbles
10.2 Quantitative Data

10.2.1 Price – Supply (12 months)

Regression

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.770(^a)</td>
<td>.594</td>
<td>.592</td>
<td>$191.961984</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Quantity

b. Dependent Variable: 12m_Price (USD per BTC)

<table>
<thead>
<tr>
<th>Case Number</th>
<th>Std. Residual</th>
<th>12m_Price (USD per BTC)</th>
<th>Predicted Value</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>228</td>
<td>3.209</td>
<td>$1,083.900</td>
<td>$467.80874</td>
<td>$616.091261</td>
</tr>
<tr>
<td>229</td>
<td>3.387</td>
<td>$1,119.960</td>
<td>$469.75548</td>
<td>$650.204524</td>
</tr>
<tr>
<td>232</td>
<td>3.040</td>
<td>$1,060.000</td>
<td>$476.42305</td>
<td>$583.576948</td>
</tr>
<tr>
<td>233</td>
<td>3.503</td>
<td>$1,151.000</td>
<td>$478.57663</td>
<td>$672.423370</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>-5398.867</td>
<td>250,586</td>
<td></td>
<td>-21.545</td>
<td>.000</td>
<td>-5891.650</td>
</tr>
<tr>
<td>1</td>
<td>12m_Quantity</td>
<td>.000</td>
<td>.770</td>
<td>23.022</td>
<td>.000</td>
<td>.000</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)
**Charts**

- **Histogram**
  - Dependent Variable: 12m_Price (USD per BTC)
- **Normal P-P Plot of Regression Standardized Residual**
  - Dependent Variable: 12m_Price (USD per BTC)
- **12m_Price (USD per BTC)**
  - Observed vs. Predicted

### Adjustment one

**Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.785</td>
<td>.617</td>
<td>.616</td>
<td>$180.989098</td>
</tr>
</tbody>
</table>

- a. Predictors: (Constant), 12m_Quantity
- b. Dependent Variable: 12m_Price (USD per BTC)

### Casewise Diagnostics

<table>
<thead>
<tr>
<th>Case Number</th>
<th>Std. Residual</th>
<th>12m_Price (USD per BTC)</th>
<th>Predicted Value</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>227</td>
<td>3,049</td>
<td>$1,009.000</td>
<td>$457.14072</td>
<td>$551.859281</td>
</tr>
<tr>
<td>230</td>
<td>3,074</td>
<td>$1,028.340</td>
<td>$472.02707</td>
<td>$556.312934</td>
</tr>
</tbody>
</table>

- a. Dependent Variable: 12m_Price (USD per BTC)

### Adjustment two

**Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.791</td>
<td>.626</td>
<td>.625</td>
<td>$176.660362</td>
</tr>
</tbody>
</table>

- a. Predictors: (Constant), 12m_Quantity
- b. Dependent Variable: 12m_Price (USD per BTC)
10.2.2 Price – Supply (6 months)

Regression

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.114a</td>
<td>.013</td>
<td>.008</td>
<td>$15,779,022</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_Quantity

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>25.409</td>
<td>56.555</td>
<td>.449</td>
<td>136,998</td>
</tr>
<tr>
<td>1</td>
<td>6m_Quantity</td>
<td>7.643E-006</td>
<td>.000</td>
<td>.114</td>
<td>-86.179</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)

Charts
10.2.3 Price – Transaction (12 months)

Regression

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.596</td>
<td>.355</td>
<td>.353</td>
<td>$241.772112</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Transaction Quantity
b. Dependent Variable: 12m_Price (USD per BTC)

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td></td>
<td>(Constant)</td>
<td>-516,459</td>
<td>63,635</td>
<td>-8,116</td>
<td>.000</td>
</tr>
<tr>
<td>1</td>
<td>12m_Transaction Quantity</td>
<td>.016</td>
<td>.001</td>
<td>.596</td>
<td>14,140</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Charts

[Histogram] Dependent Variable: 12m_Price (USD per BTC)

[Normal P-P Plot of Regression Standardized Residual]

[12m_Price (USD per BTC)]
10.2.4 Price – Transaction (6 months)

Regression

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.474</td>
<td>.225</td>
<td>.220</td>
<td>$13.985851</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_Transaction Quantity
b. Dependent Variable: 6m_Price (USD per BTC)

c. Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95,0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>69,746</td>
<td>6,017</td>
<td>11,591</td>
<td>.000</td>
<td>57,873</td>
</tr>
<tr>
<td>6m_Transaction Quantity</td>
<td>.001</td>
<td>.000</td>
<td>.474</td>
<td>7,260</td>
<td>.000</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)

Charts

Histogram
Dependent Variable: 6m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: 6m_Price (USD per BTC)

6m_Price (USD per BTC)

Observed
Line

6m_Transaction Quantity
10.2.5 Price – Trade (12 months, Bitstamp)

Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>275,083</td>
<td>22,551</td>
<td>12,198</td>
<td>.000</td>
</tr>
<tr>
<td>Volume (BTC)</td>
<td>.005</td>
<td>.001</td>
<td>.271</td>
<td>5,355</td>
</tr>
</tbody>
</table>

Charts

- Histogram
  - Dependent Variable: Price (BitstampUSD)

- Normal P-P Plot of Regression Standardized Residual
  - Dependent Variable: Price (BitstampUSD)

- Price (BitstampUSD)
  - Observed
  - Linear

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.271a</td>
<td>.073</td>
<td>.071</td>
<td>$291,172,451</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Volume (BTC)
b. Dependent Variable: Price (BitstampUSD)
## 10.2.6 Price – Trade (12 months, Aggregates)

### Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>405,963</td>
<td>19,258</td>
<td></td>
<td>21,080</td>
</tr>
<tr>
<td></td>
<td>12m_Trade Quantity</td>
<td>-.001</td>
<td>.000</td>
<td>-.183</td>
<td>-3,547</td>
</tr>
</tbody>
</table>

*a. Dependent Variable: 12m_Price (USD per BTC)*

### Charts

**Histogram**

Dependent Variable: 12m_Price (USD per BTC)

**Normal P-P Plot of Regression Standardized Residual**

Dependent Variable: 12m_Price (USD per BTC)

**Boxplot**

Dependent Variable: 12m_Price (USD per BTC)
10.2.7 Price – Trade (6 months, Bitstamp)

Regression

<table>
<thead>
<tr>
<th>Model Summary b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m Volume (BTC)

<table>
<thead>
<tr>
<th>Coefficients a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (BitstampUSD)

Charts
10.2.8 Price – Trade (6 months, Aggregates)

Regression

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.083</td>
<td>.007</td>
<td>.001</td>
<td>$15.827715</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_Trade Quantity
b. Dependent Variable: 6m_Price (USD per BTC)

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>113,709</td>
<td>1,430</td>
<td>.000</td>
<td>110,888</td>
</tr>
<tr>
<td>6m_Trade Quantity</td>
<td>-2.284E-005</td>
<td>.000</td>
<td>-.083</td>
<td>-1.120</td>
<td>.264</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)

Charts

Histogram

Dependent Variable: 6m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: 6m_Price (USD per BTC)
10.2.9 Price - Demand Indicator (Trade/Supply) (12 months)

Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95,0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>406,857</td>
<td>18,953</td>
<td>21,467</td>
<td>.000</td>
<td>369,585</td>
</tr>
<tr>
<td>12m_Trade% of Supply</td>
<td>-14941.994</td>
<td>3951,509</td>
<td>-195</td>
<td>-3,781</td>
<td>-22712,717</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Charts

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.195</td>
<td>.038</td>
<td>.035</td>
<td>$295.322822</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Trade% of Supply
b. Dependent Variable: 12m_Price (USD per BTC)
10.2.10 Price - Demand Indicator (Trade/Supply) (6 months)

Regression

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.073(^a)</td>
<td>.005</td>
<td>.000</td>
<td>$15,839,944</td>
</tr>
</tbody>
</table>

\(^a\) Predictors: (Constant), 6m_Trade% of Supply

b. Dependent Variable: 6m_Price (USD per BTC)

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>113,582</td>
<td>1,421</td>
<td>-.073</td>
<td>79,931</td>
</tr>
<tr>
<td></td>
<td>6m_Trade% of Supply</td>
<td>-222,919</td>
<td>226,083</td>
<td>-.986</td>
<td>325</td>
</tr>
</tbody>
</table>

\(^a\) Dependent Variable: 6m_Price (USD per BTC)

Charts

Histogram

Dependent Variable: 6m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: 6m_Price (USD per BTC)

6m_Price (USD per BTC)

Observed

Linear

6m_Trade% of Supply
10.2.11 Price - Trade/Transaction Balance (12 months)

Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>369,511</td>
<td>25,399</td>
<td>14,548</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>12m_Trade/Transaction</td>
<td>-3.406</td>
<td>1.961</td>
<td>-.207</td>
<td>.836</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Charts

Histogram

Dependent Variable: 12m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: 12m_Price (USD per BTC)

12m_Price (USD per BTC)

Observed vs. Expected Cum Prob

12m_Trade/Transaction

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.11</td>
<td>.000</td>
<td>-.003</td>
<td>$301.065238</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Trade/Transaction

b. Dependent Variable: 12m_Price (USD per BTC)
10.2.12 Price - Trade/Transaction Balance (6 months)

Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>111,445</td>
<td>2,023</td>
<td></td>
<td>55,091</td>
</tr>
<tr>
<td></td>
<td>6m_Trade/Transaction</td>
<td>.130</td>
<td>.161</td>
<td>.060</td>
<td>.811</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)

Charts
10.2.13 Price - My Wallet Users (12 months)

Regression

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.754</td>
<td>.568</td>
<td>.567</td>
<td>$197,847,726</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_My Wallet Users
b. Dependent Variable: 12m_Price (USD per BTC)

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>-11,571</td>
<td>20,118</td>
<td>-.575</td>
<td>.566</td>
<td>-51,134</td>
</tr>
<tr>
<td>12m_My Wallet Users</td>
<td>.001</td>
<td>.000</td>
<td>.754</td>
<td>21.855</td>
<td>.001</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Casewise Diagnostics

<table>
<thead>
<tr>
<th>Case Number</th>
<th>Std. Residual</th>
<th>12m_Price (USD per BTC)</th>
<th>Predicted Value</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>226</td>
<td>3,069</td>
<td>$961.000</td>
<td>$353.77138</td>
<td>$607.228623</td>
</tr>
<tr>
<td>227</td>
<td>3,269</td>
<td>$1,009.000</td>
<td>$362.32903</td>
<td>$646.670972</td>
</tr>
<tr>
<td>228</td>
<td>3,603</td>
<td>$1,083.900</td>
<td>$371.13342</td>
<td>$712.766582</td>
</tr>
<tr>
<td>229</td>
<td>3,747</td>
<td>$1,119.960</td>
<td>$378.57744</td>
<td>$741.382560</td>
</tr>
<tr>
<td>231</td>
<td>3,009</td>
<td>$992.270</td>
<td>$396.90496</td>
<td>$595.365044</td>
</tr>
<tr>
<td>232</td>
<td>3,313</td>
<td>$1,060.000</td>
<td>$404.62766</td>
<td>$655.372339</td>
</tr>
<tr>
<td>233</td>
<td>3,740</td>
<td>$1,151.000</td>
<td>$411.06876</td>
<td>$739.931245</td>
</tr>
<tr>
<td>234</td>
<td>3,091</td>
<td>$1,028.340</td>
<td>$416.70079</td>
<td>$611.639211</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)
Charts

Histogram
Dependent Variable: 12m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: 12m_Price (USD per BTC)

12m_Price (USD per BTC)

Observed
Linear
10.2.14 Price - My Wallet Users (6 months)

Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>105,419</td>
<td>5,922</td>
<td>17,801</td>
<td>.000</td>
</tr>
<tr>
<td>2</td>
<td>6m_My Wallet Users</td>
<td>2,087E-005</td>
<td>.000</td>
<td>.094</td>
<td>.1268</td>
</tr>
</tbody>
</table>

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.094</td>
<td>.009</td>
<td>.003</td>
<td>$15.812457</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_My Wallet Users
b. Dependent Variable: 6m_Price (USD per BTC)

Charts

Histogram
Dependent Variable: 6m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: 6m_Price (USD per BTC)

6m_Price (USD per BTC)
Observation vs. Linear
10.2.15 Multiple Regression; Market Variables (12 months)

Regression

**Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.806</td>
<td>.649</td>
<td>.645</td>
<td>$179.092666</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Trade% of Supply, 12m_Transaction Quantity, 12m_Quantity, 12m_Trade quantity

b. Dependent Variable: 12m_Price (USD per BTC)

**Casewise Diagnostics**

<table>
<thead>
<tr>
<th>Case Number</th>
<th>Std. Residual</th>
<th>12m_Price (USD per BTC)</th>
<th>Predicted Value</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>233</td>
<td>.3025</td>
<td>$1,151.000</td>
<td>$609.31834</td>
<td>$541.681663</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

**Coefficients**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>-4983.351</td>
<td>287.957</td>
<td></td>
<td></td>
<td>-17,306</td>
</tr>
<tr>
<td>12m_Quantity</td>
<td>.000</td>
<td>.000</td>
<td>.663</td>
<td>15.843</td>
<td>.000</td>
</tr>
<tr>
<td>1</td>
<td>12m_Transaction Quantity</td>
<td>.07</td>
<td>.001</td>
<td>6.592</td>
<td>.005</td>
</tr>
<tr>
<td>12m_Trade quantity</td>
<td>-.003</td>
<td>.003</td>
<td>-.393</td>
<td>-1.072</td>
<td>.284</td>
</tr>
<tr>
<td>12m_Trade% of Supply</td>
<td>34076.679</td>
<td>28229.280</td>
<td>.444</td>
<td>1.207</td>
<td>.228</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

**Charts**

Histogram

Dependent Variable: 12m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: 12m_Price (USD per BTC)
Correction Casewise Diagnostics: Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>-5015.967</td>
<td>284.799</td>
<td>-17.612</td>
<td>0.000</td>
<td>-5576.050</td>
</tr>
<tr>
<td>12m_Quantity</td>
<td>0.000</td>
<td>0.000</td>
<td>0.676</td>
<td>16.171</td>
<td>0.000</td>
</tr>
<tr>
<td>1</td>
<td>12m_Transaction Quantity</td>
<td>0.006</td>
<td>0.001</td>
<td>0.243</td>
<td>6.254</td>
</tr>
<tr>
<td>12m_Trade quantity</td>
<td>-0.003</td>
<td>0.002</td>
<td>-0.373</td>
<td>-1.020</td>
<td>-0.007</td>
</tr>
<tr>
<td>12m_Trade% of Supply</td>
<td>32714.311</td>
<td>27903.981</td>
<td>0.430</td>
<td>1.172</td>
<td>0.242</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Model Summary:

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.807</td>
<td>.652</td>
<td>.648</td>
<td>$177.006768</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Trade% of Supply, 12m_Transaction Quantity, 12m_Quantity, 12m_Trade quantity
b. Dependent Variable: 12m_Price (USD per BTC)

Correction Casewise Diagnostics:

Histogram
Dependent Variable: 12m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: 12m_Price (USD per BTC)

Casewise Charts
Correction 1: Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>-4991.439</td>
<td>283.797</td>
<td></td>
<td>-17.588</td>
<td>0.000</td>
</tr>
<tr>
<td>12m_Quantity</td>
<td>0.000</td>
<td>0.000</td>
<td>0.673</td>
<td>16.138</td>
<td>0.000</td>
</tr>
<tr>
<td>12m_Transaction Quantity</td>
<td>0.006</td>
<td>0.001</td>
<td>0.237</td>
<td>6.172</td>
<td>0.000</td>
</tr>
<tr>
<td>12m_Trade% of Supply</td>
<td>4391.381</td>
<td>2714.196</td>
<td>0.058</td>
<td>1.618</td>
<td>0.107</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.807</td>
<td>.651</td>
<td>.648</td>
<td>$177.016625</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Trade% of Supply, 12m_Transaction Quantity, 12m_Quantity
b. Dependent Variable: 12m_Price (USD per BTC)

Charts

Histogram
Dependent Variable: 12m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: 12m_Price (USD per BTC)
Correction 2: Regression

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.805a</td>
<td>.648</td>
<td>.646</td>
<td>$177,412801</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Transaction Quantity, 12m_Quantity
b. Dependent Variable: 12m_Price (USD per BTC)

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95,0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>-4765,125</td>
<td>247,483</td>
<td>-19,254</td>
<td>.000</td>
<td>-5251,815</td>
</tr>
<tr>
<td>1</td>
<td>0.000</td>
<td>0.000</td>
<td>0.641</td>
<td>17.528</td>
<td>0.000</td>
</tr>
<tr>
<td>12m_Transaction Quantity</td>
<td>0.007</td>
<td>0.001</td>
<td>0.257</td>
<td>7.040</td>
<td>0.000</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Correction 2: Charts

![Histogram](image)

Dependent Variable: 12m_Price (USD per BTC)

![Normal P-P Plot](image)

Dependent Variable: 12m_Price (USD per BTC)
10.2.16 Multiple Regression; Market Variables (6 months)

Regression

<table>
<thead>
<tr>
<th>Model Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_Trade% of Supply, 6m_Transaction Quantity, 6m_Quantity, 6m_Trade quantity

<table>
<thead>
<tr>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
</tr>
<tr>
<td>6m_Quantity</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>6m_Trade quantity</td>
</tr>
<tr>
<td>6m_Trade% of Supply</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)

Charts
Correction 1: Regression

Correction 1: Charts

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.516a</td>
<td>.266</td>
<td>.254</td>
<td>$13.680854</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_Trade% of Supply, 6m_Transaction Quantity, 6m_Trade quantity

b. Dependent Variable: 6m_Price (USD per BTC)

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>70,479</td>
<td>5,938</td>
<td></td>
<td></td>
<td>58,762</td>
</tr>
<tr>
<td>6m_Transaction Quantity</td>
<td>0,001</td>
<td>0,000</td>
<td>.491</td>
<td>.000</td>
<td>7,549</td>
</tr>
<tr>
<td>6m_Trade quantity</td>
<td>-0,001</td>
<td>0,000</td>
<td>-2,210</td>
<td>.001</td>
<td>-2,043</td>
</tr>
<tr>
<td>6m_Trade% of Supply</td>
<td>6264,839</td>
<td>3311,417</td>
<td>2,049</td>
<td>.060</td>
<td>-269,351</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)
Correction 2: Regression

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.502</td>
<td>.252</td>
<td>.243</td>
<td>$13.777985</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_Trade quantity, 6m_Transaction Quantity
b. Dependent Variable: 6m_Price (USD per BTC)

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>69.077</td>
<td>5.934</td>
<td></td>
<td>11.641</td>
<td>.000</td>
</tr>
<tr>
<td>1</td>
<td>.001</td>
<td>.000</td>
<td>.502</td>
<td>7.693</td>
<td>.000</td>
</tr>
<tr>
<td>6m_Trade quantity</td>
<td>-4.601E-005</td>
<td>.000</td>
<td>-.167</td>
<td>-2.556</td>
<td>.011</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)

Correction 2: Charts

Histogram
Dependent Variable: 6m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: 6m_Price (USD per BTC)
10.2.17 Multiple Regression; Network Variables (12 months)

Regression

Casewise Diagnostics

<table>
<thead>
<tr>
<th>Case Number</th>
<th>Std. Residual</th>
<th>12m_Price (USD per BTC)</th>
<th>Predicted Value</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>229</td>
<td>3,132</td>
<td>1119,960</td>
<td>541,40334</td>
<td>578,556663</td>
</tr>
<tr>
<td>232</td>
<td>3,064</td>
<td>1060,000</td>
<td>493,92432</td>
<td>566,075679</td>
</tr>
<tr>
<td>233</td>
<td>3,135</td>
<td>1151,000</td>
<td>571,85601</td>
<td>579,143985</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95,0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>-328,549</td>
<td>52,336</td>
<td>-6,278</td>
<td>,000</td>
<td>-431,470 to -225,627</td>
</tr>
<tr>
<td>12m_My Wallet Users</td>
<td>,000</td>
<td>,000</td>
<td>,671</td>
<td>,000</td>
<td>,000 to ,001</td>
</tr>
<tr>
<td>12m_Trade/Transaction</td>
<td>-1,960</td>
<td>1,209</td>
<td>-.052</td>
<td>,106</td>
<td>-4,337 to ,418</td>
</tr>
<tr>
<td>12m_Usage (Trasaction/Quantity)</td>
<td>78737,170</td>
<td>11019,822</td>
<td>,246</td>
<td>,000</td>
<td>57066,060 to 100408,279</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.791a</td>
<td>.626</td>
<td>.623</td>
<td>184,732592</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Usage (Trasaction/Quantity), 12m_Trade/Transaction, 12m_My Wallet Users
b. Dependent Variable: 12m_Price (USD per BTC)

Charts

Histogram

Dependent Variable: 12m_Price (USD per BTC)

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: 12m_Price (USD per BTC)
Correction Casewise Diagnostics: Regression

### Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>(Constant)</td>
<td>-279.142</td>
<td>51.081</td>
<td>-</td>
<td>-5.465</td>
<td>.000</td>
</tr>
<tr>
<td>12m_My Wallet Users</td>
<td>0.000</td>
<td>0.000</td>
<td>.701</td>
<td>20.524</td>
<td>.000</td>
</tr>
<tr>
<td>12m_Trade/Transaction</td>
<td>-2.256</td>
<td>1.163</td>
<td>-0.062</td>
<td>-1.940</td>
<td>.053</td>
</tr>
<tr>
<td>12m_Usage</td>
<td>66877.908</td>
<td>10801.596</td>
<td>.211</td>
<td>6.191</td>
<td>.000</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

### Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.799*</td>
<td>.639</td>
<td>.636</td>
<td>177,518626</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Usage (Trasaction/Quantity), 12m_Trade/Transaction, 12m_My Wallet Users

b. Dependent Variable: 12m_Price (USD per BTC)

Correction Casewise Diagnostics: Charts
Correction 1: Regression

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>-306.159</td>
<td>49.334</td>
<td></td>
<td>-6.206</td>
<td>.000</td>
</tr>
<tr>
<td>12m_My Wallet Users</td>
<td>0.000</td>
<td>0.000</td>
<td>0.694</td>
<td>20.354</td>
<td>.000</td>
</tr>
<tr>
<td>12m_Usage (Transaction/Quantity)</td>
<td>68381.294</td>
<td>10815.111</td>
<td>0.216</td>
<td>6.323</td>
<td>.000</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 12m_Price (USD per BTC)

Correction 1: Charts

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.797</td>
<td>0.635</td>
<td>0.633</td>
<td>178,200.53</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 12m_Usage (Transaction/Quantity), 12m_My Wallet Users
b. Dependent Variable: 12m_Price (USD per BTC)
10.2.18 Multiple Regression; Network Variables (6 months)

Regression

**Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.485*</td>
<td>.235</td>
<td>.222</td>
<td>13.968644</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_Usage (Transaction/Quantity), 6m_Trade/Transaction, 6m_My Wallet Users

**Coefficients**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Constant)</td>
<td>59,107</td>
<td>8,585</td>
<td>6,885</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6m_My Wallet Users</td>
<td>3,471E-005</td>
<td>.000</td>
<td>.156</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>6m_Trade/Transaction</td>
<td>-.021</td>
<td>1,186</td>
<td>-.010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6m_Usage</td>
<td>9402,743</td>
<td>1288,924</td>
<td>.479</td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)

**Charts**

- Histogram: Dependent Variable: 6m_Price (USD per BTC)
- Normal P-P Plot of Regression Standardized Residual: Dependent Variable: 6m_Price (USD per BTC)
Correction 1: Regression

<table>
<thead>
<tr>
<th>Model Summary&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), 6m_Usage (Transaction/Quantity), 6m_My Wallet Users
b. Dependent Variable: 6m_Price (USD per BTC)

<table>
<thead>
<tr>
<th>Coefficients&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>(Constant)</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: 6m_Price (USD per BTC)

Correction 1: Charts