



Facultat de Ciències Jurídiques
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CRYPTOCURRENCIES: A THEORETICAL AND FINANCIAL ANALYSIS

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ABSTRACT

Cryptocurrencies represent an alternative and modern pay mode, through new technologies. Although cryptocurrencies were used before the Great Recession of 2008, this fact achieved the development and international boom of cryptocurrencies, especially Bitcoin.

The objective of this paper is to analyze cryptocurrencies, on one hand from a theoretical view (explaining history, functioning, legislation and economic effects), and on the other hand from a practical view, showing the price index between the main cryptocurrencies and other currencies, with the objective of showing the effect of cryptocurrencies, trying to find out if they suppose an investment and an alternative payment, or cryptocurrencies, or they are just unstable and at risk of become an economic "bubble".

Finally, in the conclusion of this paper the potential that cryptocurrencies could have in the future will be explained.

1. INTRODUCTION

As a consequence of the 2008 financial crisis, the society lost the confidence with typical ways of payment and currencies, such as The United States dollar or European Euro. The 2008 financial crisis caused the development and fame of a new alternative in the entire world, the cryptocurrencies.

Bitcoin is an alternative to other currencies, because can be used as same payment in all the world, in addition, there is no institution that regulates Bitcoin, it is not subject to the rules of any Central Bank, and it is a cryptocurrency that can be used as investment, like other currencies (for example the Euro or the Dollar), or also the way of payment for exchange goods and services. Nowadays there are a lot of people and companies that offer Bitcoin as a form of payment

The technology that is used in Bitcoin is complex, because it is based on the Blockchain technology, with to the chain of blocks. Despite its complexity, this cryptocurrency offers a security that it is very complicated to hack and, consequently, to steal. The Bitcoin and other cryptocurrencies are saved in electronic purses called "wallets", which are considered virtual wallets, with an operation similar to PayPal.

However, the security of cryptocurrencies has been a problem too, because criminals use Bitcoin as a method of payment because it gives them privacy, for not being discovered using pages like the Deep Web, a site where they obtain illegal material, such as weapons, drugs, child pornography, etc... (Link Campus, 2017)





Bitcoin is a cryptocurrency used in P2P (peer to peer) protocol, this means that you do not need any fixed servers or financial intermediaries to make a transaction online, unlike other currencies, which, in exchange for indirect intermediation in the transaction, charge you a commission, sometimes too high. In Bitcoin this situation does not happen, which are costs that you can save in the transaction and, as a consequence, makes Bitcoin an attractive payment method. (Nakamoto, 2008).

This is a project for the Degree in Finance and Accounting of the Universitat Jaume I. Cryptocurrencies is a subject that may have a great potential for studies related to this Degree, because in the future they can be really important for the economy, in Bitcoin, other cryptocurrencies, or even cryptocurrencies that do not currently exist in financial

markets. On the other hand, this project will allow us to know the operation of the currencies, because although Bitcoin is exclusively digital, it works just like any other currency in the market, and can be used as an investment instrument too.

It is important to analyze the study and understand the cryptocurrencies, because in recent years, thanks to this asset, they have moved large amounts of money, as can be seen in Table 1, with the results obtained on 26 March. For example, only in the Bitcoin cryptocurrency, it has a market capitalization of more than 69.000.000.000 \$, this demonstrates the great role of cryptocurrencies in financial markets.

TABLE 1: "Top Cryptocurrencies"

Top Cryptocurrencies »						
Name :	Symbol :	Price (USD)	Market Cap :	Vol (24H) :	Chg (24H) :	
 Bitcoin	BTC	3,926.9	\$69.77B	\$10.32B	-1.85%	
 Ethereum	ETH	134.34	\$14.23B	\$4.61B	-1.35%	
 XRP	XRP	0.30019	\$12.61B	\$750.59M	-2.02%	
 Litecoin	LTC	58.718	\$3.60B	\$2.04B	-1.78%	

SOURCE: Investing.com (2019)

This paper is divided into several parts. The first part will show a general definition of cryptocurrencies, explaining their history, their characteristics, and their technology. On the other hand, at this point, cryptocurrencies that exist in financial markets that are not Bitcoin will also be mentioned, such as Litecoin, Dogecoin, IOTA, or Ripple. Finally, there will be a mention of the main Spanish cryptocurrency that currently exists, the PesetaCoin.

The second part will be dedicated exclusively to Bitcoin, the most used cryptocurrency of financial markets and the most used cryptocurrency to make transactions. It will be mentioned about its history, who created it, why it arose, how Bitcoin works (through the well-known Mining process), the advantages and disadvantages of using Bitcoin (especially the disadvantage that this cryptocurrency is way of payment for buy in illegal websites), its international legislation (trying to show countries that are against the use

of Bitcoin, and justifying their possible reasons), and also the effects produced in the world economy as consequence of using Bitcoin.

On the other hand, in the third point, a comparison will be made between cryptocurrencies, to see their evolution, with their historical prices, and it will be exposed if the cryptocurrencies, especially Bitcoin, follow a reasonable price evolution, or in an opposite situation, Bitcoin can be considered as a " bubble ", like for example The Spanish property bubble or the dotcom. At this point, the correlation between Bitcoin and other cryptocurrencies will also be shown. In addition, there will also be a comparison between Bitcoin and other currencies that already exist in the world.

Finally, in this project, there will be a conclusion about cryptocurrencies, arguing why they can be a payment method with a great future in the economy if their market prices are stabilized. In addition, it will be argued why cryptocurrencies should not be criminalized, due to the opinions that cryptocurrencies contribute to be used for criminal purposes, especially in Deep Web.

2. GENERAL CONCEPT ABOUT CRYPTOCURRENCIES

This section will be divided into two parts, in the first part, a general overview will be given about what any cryptocurrency can be, explaining its function as a means of payment and its main characteristics. The technology to which cryptocurrencies are used will also be explained, despite being a project more focused on the economic-financial part than on the Computing.

In the second part of this section, it will appear some of the main cryptocurrencies that exist in the financial markets, with the exception of Bitcoin, that due to their degree of development, we will talk more deeply in section 3 of this paper. The cryptocurrencies that are mentioned in this project are Litecoin, Dogecoin, IOTA, Ripple and also, in a special way, a Spanish cryptocurrency, the Pesetacoin.

2.1 CHARACTERISTICS AND FUNCTIONING OF CRYPTOCURRENCIES

A cryptocurrency can be defined in a simple way, as a virtual currency, whose means of payment is based on cryptography (Houben and Snyers, 2018).






Cryptography allows the virtual currency, with specific codes, such as mathematical algorithms for example, to be practically impossible to steal, especially by hackers, virtual criminals, etc...



The cryptocurrency is a virtual and modern currency, but its purpose is to serve as a means of payment to acquire or sell some good or service. Although the means of payment have evolved (for example, gold coins, silver coins, or barter), the goal of using money has always been the same. (European Central Bank, p.9, 2012).

In recent years, cryptocurrencies have been a payment method that has developed very quickly, many investors were interested in these assets, trying to obtain high profitability, however, cryptocurrencies also had a very high risk, lowering suddenly the price.

In Table 2 appears the evolution of the fall of the Bitcoin cryptocurrency. From January 1st to January 6th, in just one week, the Bitcoin value increased by 3807 \$, the price was 17,161 \$ to get 1 Bitcoin. As of this date, only 5 days later, Bitcoin loses value for \$ 3895, and between January 6th 2018, and February 6th, the fall is 9487.8 \$, going from trading 17,161 \$ = 1 BTC, to 7673.8 \$ = 1 BTC, that means that just in one month, Bitcoin lost more than double of its value.

TABLE 2: “BTC/USD Bitfinex Historical Data”

BTC/USD Bitfinex Historical Data






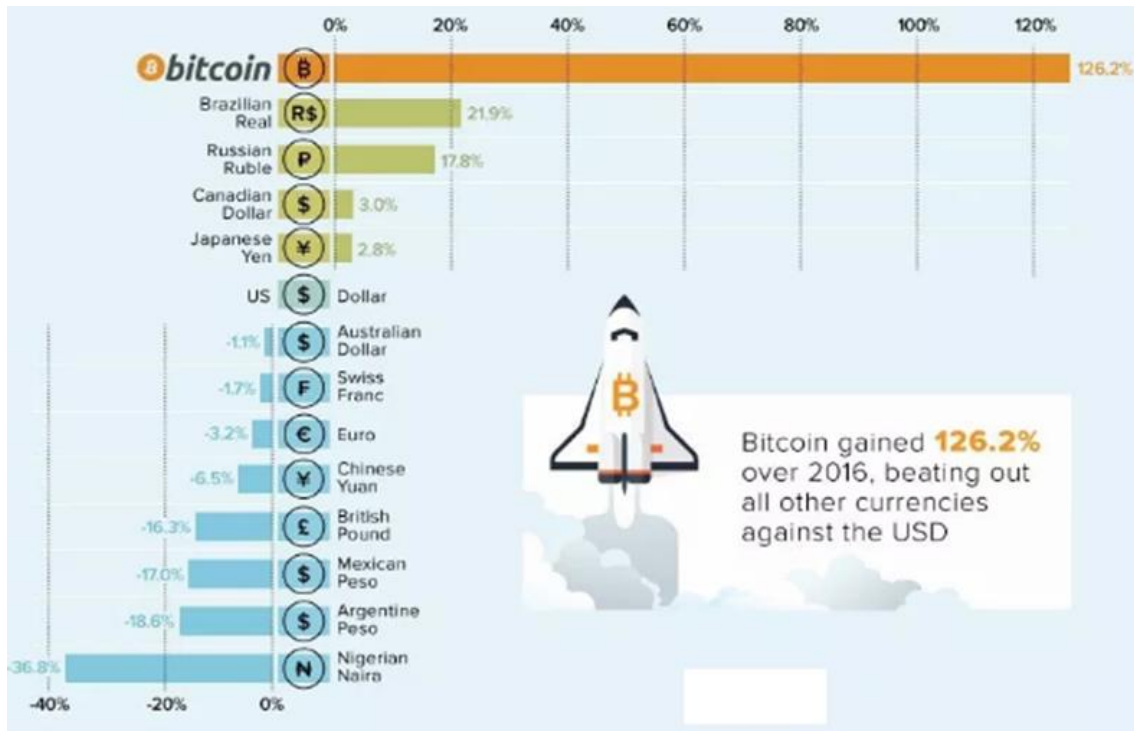
Time Frame: Daily ▾
 Download Data
 01/01/2018 - 06/02/2018 

Date ↕	Price ↕	Open ↕	High ↕	Low ↕	Vol. ↕	Change % ↕
Feb 06, 2018	7,673.8	6,946.6	7,860.0	6,000.0	192.76K	10.42%
Feb 05, 2018	6,949.9	8,185.2	8,378.0	6,658.8	131.29K	-15.25%
Feb 04, 2018	8,200.0	9,225.1	9,403.3	7,840.0	74.42K	-11.06%
Jan 16, 2018	11,072.0	13,594.0	13,604.0	9,949.4	131.86K	-18.44%
Jan 15, 2018	13,575.0	13,558.0	14,350.0	13,307.0	33.46K	0.13%
Jan 14, 2018	13,558.0	14,190.0	14,391.0	12,874.3	35.60K	-4.46%
Jan 13, 2018	14,191.0	13,794.0	14,580.0	13,760.0	29.01K	2.96%
Jan 12, 2018	13,783.0	13,248.0	14,095.0	12,778.0	37.42K	3.90%
Jan 11, 2018	13,266.0	14,895.0	14,949.8	12,639.0	71.70K	-10.94%
Jan 10, 2018	14,896.0	14,426.0	14,896.0	13,338.0	57.33K	3.28%
Jan 09, 2018	14,423.0	14,902.0	15,355.0	14,122.0	43.44K	-3.40%
Jan 08, 2018	14,930.0	16,216.0	16,279.0	13,760.0	64.95K	-7.82%
Jan 07, 2018	16,196.0	17,163.0	17,176.0	15,726.0	30.84K	-5.62%
Jan 06, 2018	17,161.0	16,911.0	17,252.0	16,251.0	29.61K	1.44%
Jan 05, 2018	16,917.0	15,159.0	17,101.0	14,769.0	54.63K	11.59%
Jan 04, 2018	15,160.0	15,150.0	15,390.0	14,064.0	46.47K	0.03%
Jan 03, 2018	15,155.0	14,713.0	15,428.0	14,522.0	38.35K	3.03%
Jan 02, 2018	14,709.8	13,448.0	15,300.0	12,810.0	56.18K	10.15%
Jan 01, 2018	13,354.0	13,794.0	13,893.0	12,787.0	29.54K	-3.23%

SOURCE: Investing.com (2019)

In addition to the features mentioned before, cryptocurrencies can also become an attractive financial asset to invest, for example, in FIGURE 1, it shows how Bitcoin became the most profitable currency to invest, according to 2016 results.

FIGURE 1: "Bitcoin: Top currency in 2016".



SOURCE: *The Money Project - Visual Capitalist (2017)*

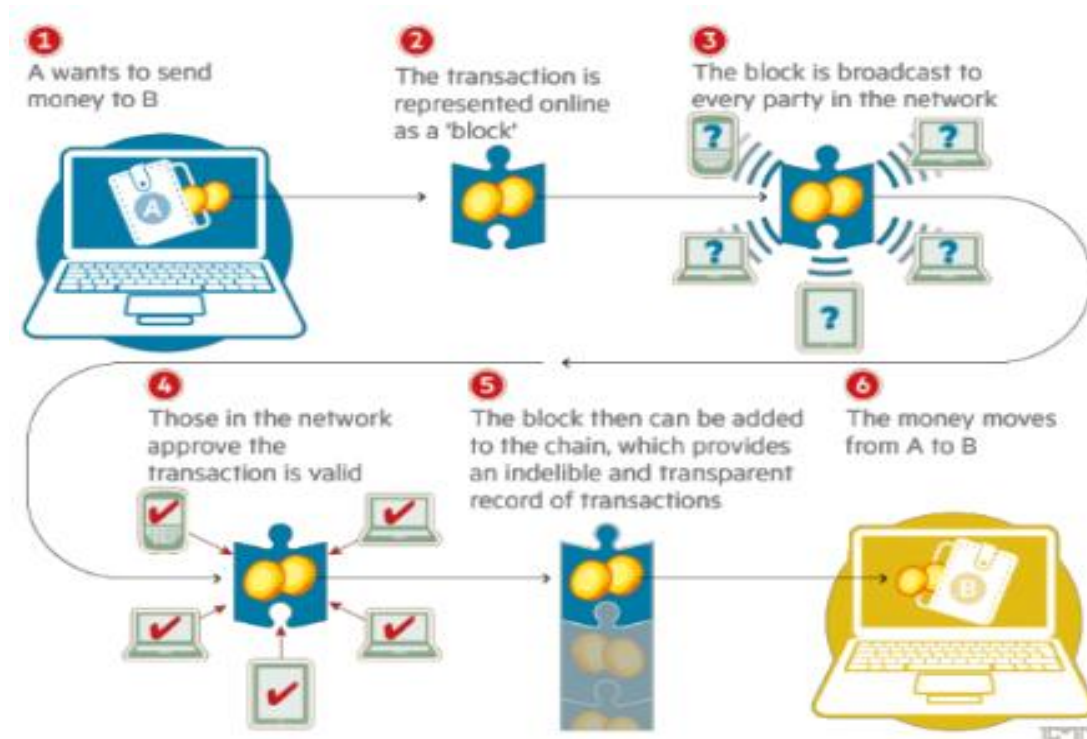
The security offered by cryptocurrencies is another of the characteristics most valued by investors. The cryptocurrencies are subject to cryptography, which is a technique used in computing that, thanks to mathematical algorithms, can protect all the information circulating on the network, and make it impossible to delete. The cryptography system is based mainly on security layer protocols, known in English as TLS (Transport Layer Security) (Boneh and Shoup, 2016).

The technology that is used in cryptography is known as Blockchain. According to Houben and Snyers (2018), Blockchain can be defined as the "accounting book" of the cryptocurrencies, that means that each transaction is registered in the chain of blocks, to know the own operation, we should look for the cryptographic code assigned to each cryptocurrency. The blockchain technology is maintained and controlled collectively by a network of computer servers called "nodes".

Another important feature of cryptocurrencies is that the costs and transaction fees are of little or even no value, unlike using other currencies such as dollars or euros, in which by making a transaction, the bank charges a commission for the management . In sectors such as advertising, this is a great advantage, since they can monetize their customers

all over the world in a uniform way, and in a relatively fast, comfortable and simple way. (GroupBTC, 2016).

FIGURE 2: "HOW A BLOCKCHAIN WORKS"



SOURCE: Arnold, M.; Stafford P, and Wild, J. *Financial Times* (2015).

2.2 EXAMPLES OF MOST PRINCIPAL CRYPTOCURRENCIES

Every time there are more cryptocurrencies in the financial markets, as a consequence the "boom" of the Bitcoin has taken place, then some of the main cryptocurrency will be explained (except Bitcoin, which will be explained in point 3 of this project), with its history and its characteristics.

In FIGURE 3, it is shown an image with the main cryptocurrencies that currently exist is shown; since it would be an almost impossible and ineffective task have to search

absolutely all the cryptocurrencies that exist in the world, because just with the Blockchain technology a cryptocurrency can be created. According to results of Coinmarketcap.com, in 2019 there are around 2100 cryptocurrencies.

FIGURE 3: Most famous cryptocurrencies



SOURCE: Own elaboration

The characteristics of some of the cryptocurrencies that appear in Figure 3 will be explained.

- **Litecoin (LTC)** : It is a cryptocurrency created in 2011 by Charlie Lee, this cryptocurrency is part of a project through the MIT (Massachusetts Institute of Technology). The limit of LTC in circulation in the markets, will be 84 million, and is programmed to work 4 times faster than Bitcoin, while the average transaction time of a Bitcoin (BTC) is 10 minutes, in Litecoin is between 2 and 3 minutes, as it is demonstrated in the web publication from Criptonoticias (2019).

This cryptocurrency is considered very similar to Bitcoin, most features and ways of working are virtually identical. However, Litecoin has several differences, such as those mentioned above of its speed, or its limit in the market, Litecoin was the first cryptocurrency in using the Script security function called "Proof of Work" (PoW).

This function makes it easier to mine Litecoin, since unlike other cryptocurrencies, you do not need specific machines to mine, since through any computer, Litecoin can be got. (Houben et Snyers, 2018).

-IOTA: It literally means "application of the Internet of things", was created in 2016 by the Norwegian David Sonstebo. This cryptocurrency differs from the rest because IOTA does not have an "accounting book", and the miners do not need to feed network. Houben and Snyers (2018), in their report to the European Parliament, define the electronic book of IOTA as "a sequence of individual Transactions entangled together"

This cryptocurrency is subject to the technological protocol "Tangle", to send a transaction to the IOTA ledger, it is necessary to contrast two previous transactions (Coincentral, 2018).

IOTA and its technology can achieve that the more transactions there are, the faster these transactions can be confirmed, the transaction time is inversely proportional to the number of operations in the Tangle.

According to official IOTA data: "The total money supply of 2.779.530.283.277.761 is optimized for ternary computing and for ease of notation using SI units.. $((3^{33}-1)/2) = 2.779 \times 10^{15}$ ". (IOTA Support, 2019).

-Ethereum (ETH) : This cryptocurrency was officially created in 2015 by the Russian Vitalik Buterin, and developed by Gavin Wood. This British programmer, already belonged to the Bitcoin network, and was an investor of this cryptocurrency, so he could observe the main deficiencies that Bitcoin had (such as, for example, its barriers in the programming language). As a result, Wood tried to develop a more advanced cryptocurrency, through Ethereum technology (Metssalu, 2019).

In order to sustain possible inflationary tendencies that may change the price, Ethereum establishes a maximum amount that can be released in the market, this amount is 18 million per year, with an initial market launch of 72 million (Bit2Me, 2018).

Another important feature highlighted by Wood in his work is that Ether lets write intelligent contracts just by writing a few lines of code, unlike Bitcoin. (Wood, 2014).

- **Dogecoin (DOGE)** : This cryptocurrency was created in 2013 by Billy Markus and Jackson Palmer. It is interesting to include this cryptocurrency, because at first, it was a parody of the Bitcoin, taking advantage of the fame that Bitcoin had. Dogecoin has as its main banner the dog Doge, a dog of the Shiba Inu breed that appears as a "meme" on the Internet.

Through the Reddit portal, this cryptocurrency became popular, and went from being a cryptocurrency based on parody, to one of the most used for transactions, reaching up to 40,000 daily. Initially, Dogecoin had a market limit of 100,000,000,000 DOGEs, but the creators and the Dogecoin network considered that it was too high, and ended up not putting any limit. The technology used in Dogecoin is Scrypt, P2P network and SHA-256 (Economía de ahorro, 2019.).

- **Ripple (XRP)** : Unlike other cryptocurrencies, Ripple is used by large financial institutions worldwide to make an operation, among other reasons, due to its speed, since in about 4 minutes, you can already make an operation, however with other cryptocurrencies, the process is slower

Ripple has the ability to fulfill up to 1500 transactions per second, this is one of its main features. Something important to note is that there is no mining process in Ripple to get new cryptocurrencies. The limit is in 100,000,000 XRPs. The chain of blocks does not serve to extract Ripple, it only has the function of verifying that the operations have gone correctly. Users see Ripple as a kind of decentralized bank that organizes itself (economiasimple.net, 2019.).

-**PesetaCoin (PTC)** : This cryptocurrency was created in 2014 by the computer scientists Ramón Martínez and CryptoMP (it is not known the real identity of CryptoMP, it has its identity under a pseudonym). Although it is not a famous cryptocurrency worldwide, it is important to mention it, because it is the main cryptocurrency of Spanish origin, and was created in honour to the old Spanish peseta. This cryptocurrency has as main references Bitcoin and Litecoin, and can be got by mining, exchanging for other cryptocurrencies, or also exchanging for more common currencies, such as euros (ABC, 2014).

The amount that there will be of PTC in the market will be 166,386,000 PTCs, this is because the exchange rate that was between euro-peseta, was 166,386 pesetas for the value of one euro (El Mundo, 2014).

3. BITCOIN

This section will be dedicated exclusively to Bitcoin cryptocurrency, because it is the most famous cryptocurrency that operates in the market. Firstly, its history and evolution will be explained, secondly how it works, third the advantages and disadvantages offered by Bitcoin will be explained, and finally the effects that Bitcoin has on legislative and economic levels will be mentioned.

TABLE 3: *Bitcoin Predefined Values*

BITCOIN UNITS	
1 BTC	100.000.000 Satoshi
	1.000 milibitcoin (mBTC)
	1.000.000 microbitcoin (μBTC)

SOURCE: *Own elaboration.*

3.1 HISTORY OF BITCOIN

Bitcoin was a cryptocurrency created in 2009 by Satoshi Nakamoto, as consequence of the financial crisis of 2008, which resulted in a loss of confidence of the people in political and economic institutions.

The name of Satoshi Nakamoto is a pseudonym (the word "Satoshi" in Japanese, means "ingenious"), the true identity has not discovered even nowadays, then we cannot know with certainty if there is only one founder, or are a group of people who founded Bitcoin. (Bitcoin.org, 2019)

The identity of the creator or creators of Bitcoin has been a constant object of research in all this time. For example, an article in Newsweek (2014), published that the creator of Bitcoin was a man with 68 years from California, called Dorian S. Nakamoto. However, this man has always denied being the creator of this cryptocurrency.

Joshua Davis, in another article published by The New Yorker (2011), investigated more than 80,000 words from the writings of Satoshi Nakamoto, obtaining as conclusion that behind the pseudonym of Satoshi Nakamoto is Michael Clear, a cryptography student of Trinity College, in Dublin. However, this conclusion has not been confirmed.

The identity of the creator of Bitcoin has always been the subject of speculation, since it is one of the greatest mysteries of the entire economic world. In an article by Cointelegraph (2019), there is a list of possible creators of Bitcoin, apart from those previously mentioned; in that list appear even names like Nick Szabo, creator of the BitGold company, or Elon Musk, founder of the company Tesla.

However, Bitcoin is not the first cryptocurrency created in History. In the past, there were other previous projects, such as Beenz, Flooz, Linden Dollars, E-Gold, etc ... Even the social network Facebook had its own project to create its cryptocurrency. All these projects were developed in the last 15-20 years, and all have the same common factor, ended in failure, because they did not have the enough acceptance, and the same good luck that Bitcoin had for be famous. (Miller, 2015, pp. 18-22)

3.2 EVOLUTION OF BITCOIN

In this section is analyzed the evolution of Bitcoin, because Bitcoin is a financial asset of a relatively short life, therefore, in this self-prepared summary, the main related news is mentioned with Bitcoin, to understand the increase and fail that Bitcoin market prices had.

Year 2008: As a result of the economic crisis, there are people trying to find an alternative that allows investors and society in general to trust, this alternative is Bitcoin cryptocurrency, registered as Bitcoin.org in August of this year , and with the first documents related to this cryptographic currency created in October of that same year (Rankia, 2013)

Year 2009: Year in which the first Bitcoin network is officially born and the first transactions begin to emerge. This year, the first Bitcoin transfer from Satoshi Nakamoto to Hal Finney takes place. On the other hand, starting this year you can already exchange Bitcoin for US dollars, the first change was 1309.03 Bitcoin = 1 \$ (Rankia, 2013).

This same amount of Bitcoin, with the market prices of March 2019, would be equivalent to more than \$ 500,000, this shows the evolution of Bitcoin in these 10 years.

Year 2010: This is one of the most important years in the history of Bitcoin, the first real transfer with this cryptocurrency is officially made. A programmer called Laszlo Hanyecz, from Florida, proposed a challenge on the Internet, trying to see if anyone could buy two pizzas from him and send to his house. It is said that a programmer in London accepted this challenge, and sent those pizzas to Hanyecz, who in exchange, paid 10,000 Bitcoin, with an exchange in that year of about 0.008 American cents. Therefore, it can be said that the first transaction that was made with Bitcoin, was to buy 2 pizzas for the value of 10,000 BTC (Forbes, 2018).

The value of these two pizzas, following the quotations as of March 2019, would be equivalent to more than 35.000.000 € or about 40.000.000 \$ at the exchange rate.

On the other hand, in this year, the web slashdot.org (important web related to topics about open-source model) published an article about Bitcoin. This article spoke very well of this cryptocurrency, and its advantages were exposed very well, this caused that the value of Bitcoin passed less than 1 cent to 7 cents in days. In a very short margin of 5 days, multiply by 10 its price, from 0.008 to 0.08 dollars per Bitcoin. (Slashdot.org, 2010) (Rankia, 2013)

Year 2011: Webs like Wikileaks starts to accept donations in Bitcoin, in addition, the specialized magazine in business and finance Forbes, published an article entitled "Cripto Currency" (Rankia, 2013).

These two circumstances can be considered so important for Bitcoin, because in the example of Forbes, it is considered as a serious journalistic medium, and caused Bitcoin's fame to increase. The article talks about Bitcoin as an alternative means of payment, and points out that this cryptocurrency is different from other similar projects that failed, such as Beenz (Forbes, 2011)

Year 2012: The European Central Bank mentions Bitcoin, warning that it is getting more and more frequent, and Bitcoin was starting to be an alternative means of payment against other currencies, such as the Euro, and this could get a lot of troubles for Central Banks countries, because one of the main characteristics of Bitcoin, is that it is a

decentralized currency. At that time, when the ECB mentioned Bitcoin, it is considered another "victory" for Bitcoin, it is started to assume that Bitcoin was beginning to be consolidated in the financial world. (Rankia, 2013)

Year 2013: Bitcoin is more valuable than an ounce of silver, and even that an ounce of gold (Rankia, 2013). This situation definitely increases the popularity of Bitcoin, because it supposes a historical moment even in the economic history.

FIGURE 4: "GOLD VS BITCOIN"



SOURCE: Coindesk (2014)

However, in this year, there are also negative news for Bitcoin. The People's Bank of China (BPC) restricts the use of this Bitcoin, for two main reasons. The first reason is that Bitcoin can be a threat to China's economic stability, as there was increasing demand for Bitcoin, against the China's official currency, the Yuan. The second reason is to avoid promoting "money laundering", because the anonymity offered by Bitcoin can induce possible criminal activities, which could be against the interests of China. (The New York Times, 2013)

Year 2014: The popularity of Bitcoin is so high that large companies, such as Microsoft, Dell or XBOX, offer Bitcoin as a payment medium (CryptoNews, 2016).

Although we must bear in mind that, finally, Microsoft stopped accepting this cryptocurrency as a means of payment, because it has increasingly had greater volatility in Bitcoin price, too much instability in prices for Microsoft. (CCN, 2018)

Year 2015: In this year there are also important news for Bitcoin, for example, Bitcoin network programmers, specifically Bitcoin Core, join a project to develop Bitcoin with the Massachusetts Institute of Technology (MIT) considered a major institution prestige. This project is called "MIT Digital Currency" and aims to provide support and support to Bitcoin. (Coindesk, 2015)

On the other hand, in Australia, the purchase of Bitcoin (and other cryptocurrencies, such as Ethereum) is officially allowed. This can be done through the Coinbase platform, which acts as "brokers" and allows operating with cryptocurrencies. (CCN, 2016).

Year 2016: Although one of the main platforms that operate with Bitcoin (Bitfinex) is hacked and more than 120,000 Bitcoin are stolen (approximately 60 million \$), more and more companies accept Bitcoin as a means of payment, such as the Steam multiplayer service platform, the Swiss railway company (CFF) to acquire train tickets, or the Uber car rental company in Argentina. (Medium, 2018)

On the other hand, Bitcoin is a topic that more and more researchers are trying to study, since according to data from Google Scholar, in 2012 Bitcoin had less than 450 articles dedicated in 2012, in 2016, topics about Bitcoin was over 3500 (Medium, 2018). This example shows to us the importance that Bitcoin has had in the economy, being a research topic for many academics.

Year 2017: The popularity of Bitcoin was already at record levels, as shown in Figure 4, the Bitcoin price evolved in a year from \$ 900 = 1 BTC, up to the amount of 20,000 \$ = 1 BTC.

This radical change occurs for several fundamental reasons. The first reason is that more and more companies use Bitcoin as a means of payment between B2B (Medium, 2018). This situation causes an increase in your price, because one of the factors that influence the price of Bitcoin, is the acceptance that you have, therefore the more used it is, the more valuable Bitcoin will be.

Another main reason is that a lot of new funds, observing the upward trend and the popularity of Bitcoin, decided to invest in this cryptocurrency. Consequently, taking into account that there is a limit amount of Bitcoin, and that there is no institution that controls it, causes a "shock" in the market prices, because Bitcoin has a demand that was unprecedented. (Bit2Me Academy, 2018).

A third important reason that would justify the increase in Bitcoin's price, can be considered to have been politically motivated all over the world. Situations such as the exit of the United Kingdom from the European Union (Brexit), the victory of Donald Trump in the US, or the political situations of China and India, caused fluctuations in their local currencies, all these situations were in favor of Bitcoin, because many investors, in consequence of the uncertainty that there was in British Pound, the US Dollar, or the Chinese Yuan, decided to invest in Bitcoin. (Bit2me Academy, 2018)

Year 2018: This year is the one that definitely supposes a turning point in Bitcoin, as the price plummets, as shown in Figure 5, Bitcoin reached a "ceiling" limit of \$ 20,000, but this is year that price has been losing value continuously until 2019, which is returning again to increase its value, as will be reported more broadly in section 4 of this project " COMPARISON BETWEEN CRYPTOCURRENCIES ".

On the one hand, as mentioned before, the value of Bitcoin depends on its acceptance, but there comes a time that if there is not so much demand for Bitcoin, the value of Bitcoin falls. On the other hand, The announcement of the Securities and Exchange Commission of the USA, announcing the legal problems that it had with the ICO projects (Initial Offer of Currencies, with the objective to the financing of projects through Bitcoin), caused a loss of confidence of Bitcoin investors, in addition, the tension between Bitcoin and Bitcoin Cash, also influenced against market price, decreasing its value. (Fortune, 2018).

FIGURE 5: Historical evolution of Bitcoin market price



SOURCE: Coinmarketcap (2019)

3.3 FUNCTIONING OF BITCOIN

Bitcoin is subject to the Blockchain technology and the "Peer to Peer" (P2P) network. This network, considered one of the main characteristics of Bitcoin, is the point of connection that two or more computer registers have, these registers are known as "nodes".

The P2P network on which Bitcoin is based, however, is not new in computing, since at the beginning of the 21st century, the Internet portal Napster, already used the P2P network so that people could transfer songs directly, this fact provoked a great controversy with many artists, for copyright. (The Economist, 2015)

The process in which Bitcoin is issued is called the "mining" process, in which a group of people, known as "miners". The miners try to compete constantly to solve mathematical problems of great complexity, based on cryptography. The answers to these mathematical problems are known as "Proof of Work" (PoW), and this solution is registered in a block, known as "blockchain". Miners who solve these mathematical problems, are rewarded by receiving Bitcoin, as a reward for all the effort made. (Antonopoulos, 2010. pp. 177-178).

When the "miners" already have Bitcoin on their property, they transfer it to exchange platforms, such as Coinbase, Changelly or Bittrex, for example. The purpose of these platforms is to facilitate the purchase of Bitcoin from investors who are interested in acquiring this cryptocurrency, and they work practically the same as any other platform to invest in financial assets. (CoinList, 2019).

A fact also to take into account in Bitcoin, is that as mentioned before, the emission limit is 21,000,000 BTC, that emission follows a negative geometric progression, as shown in TABLE 4, every 4 years, the emission is reduced by half.

TABLE 4: Bitcoin emission

Date reached	Block	Reward Era	BTC/block	Year (estimate)	Start BTC	BTC Added	End BTC	BTC Increase	End BTC % of Limit
2009-01-03	0	1	50.00	2009	0	2625000	2625000	infinite	12.500%
2010-04-22	52500	1	50.00	2010	2625000	2625000	5250000	100.00%	25.000%
2011-01-28	105000	1	50.00	2011*	5250000	2625000	7875000	50.00%	37.500%
2011-12-14	157500	1	50.00	2012	7875000	2625000	10500000	33.33%	50.000%
2012-11-28	210000	2	25.00	2013	10500000	1312500	11812500	12.50%	56.250%
2013-10-09	262500	2	25.00	2014	11812500	1312500	13125000	11.11%	62.500%
2014-08-11	315000	2	25.00	2015	13125000	1312500	14437500	10.00%	68.750%
2015-07-29	367500	2	25.00	2016	14437500	1312500	15750000	9.09%	75.000%
2016-07-09	420000	3	12.50	2016	15750000	656250	16406250	4.17%	78.125%
2017-06-23	472500	3	12.50	2018	16406250	656250	17062500	4.00%	81.250%
2018-05-29	525000	3	12.50	2019	17062500	656250	17718750	3.85%	84.375%
	577500	3	12.50	2020	17718750	656250	18375000	3.70%	87.500%
	630000	4	6.25	2021	18375000	328125	18703125	1.79%	89.063%
	682500	4	6.25	2022	18703125	328125	19031250	1.75%	90.625%
	735000	4	6.25	2023	19031250	328125	19359375	1.72%	92.188%
	787500	4	6.25	2024	19359375	328125	19687500	1.69%	93.750%

SOURCE: BitcoinWiki.org (2019)

3.4 ADVANTAGES AND DISADVANTAGES OF BITCOIN

The Bitcoin, same that rest of financial assets, has advantages and disadvantages in its use, in this section, the most important ones will be mentioned, with the objective to understanding better the situation of Bitcoin.

3.4.1 ADVANTAGES OF BITCOIN

TABLE 5: MOST PRINCIPAL ADVANTAGES OF BITCOIN

ADVANTAGES OF BITCOIN	
<ul style="list-style-type: none"> • Personal data protection <p>(Unlike traditional bank transactions, where you have to be identified with your data, in Bitcoin transactions it is not necessary to know your data; only one address of your wallet is needed.)</p>	<ul style="list-style-type: none"> • Faster payment confirmation <p>(It only takes about 10 minutes for a transaction through Bitcoin to be confirmed. This does not happen in banking entities, because it takes several days to confirm a transaction.)</p>
<ul style="list-style-type: none"> • Reduced transaction costs <p>(In banking transactions, in a transaction of \$ 100, the commission would be almost \$ 3.4 while in Bitcoin, it would be \$ 0.61.</p> <p>This amount is usually symbolic, goes to the miners of the Bitcoin network, as "donation".)</p>	<ul style="list-style-type: none"> • Bitcoin is immune to inflation <p>(The Bitcoin limit is limited to 21,000,000. When this amount is achieved, it will stop issuing.</p> <p>The objective of limiting the amount of Bitcoin in circulation, is that it does not happen like with other currencies, such as the German Mark or Zimbabwe Dollar, currencies that suffered the effects of inflation.)</p>

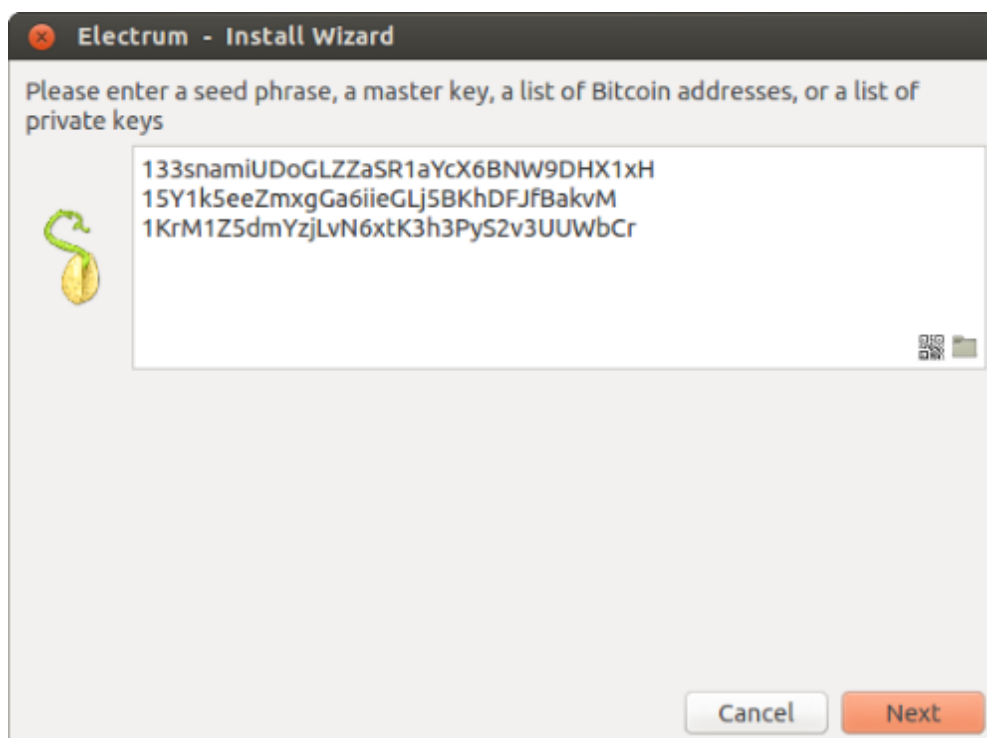
SOURCE: Dumitrescu (2017)

An important advantage is the security and privacy offered by Bitcoin if it is used as a means of payment. According to Franco (2015), only Bitcoin owners have control of their private keys, through virtual wallets.

Each transaction is registered with an "own identity", therefore, it is impossible to plagiarise, falsify or duplicate the payment with Bitcoin. (Bunjaku et al., 2017)

In FIGURE 6, there is an example of the code that must be written when you install an electronic wallet. In this case, an address appears formed by letters and numbers, combined in such a way that it is practically impossible to steal that code, since not even used powerful computer tools that constantly generate codes, the letters and numbers are so mixed that it is not possible to copy codes.

FIGURE 6: *Installation of wallet Electrum*



SOURCE: *GitHub (2019)*

This is one of the main reasons why Bitcoin stands out, the privacy it offers, since it is not necessary to know the real identity of a Bitcoin owner, because the address of the virtual wallet where Bitcoin is deposited, can be formed by letters and numbers. Bitcoin uses a security system based on cryptography, and each transaction is saved in an "accounting book" called Blockchain. (Franco (2015), p. 30)

Another advantage that Bitcoin has is decentralization. Not being ruled by any political institution or any Central Bank, you can not expropriate Bitcoin to any owner (Franco, 2015, p.30). It is also related to decentralization the fact that the limit of Bitcoin that will be issued in the market, will have a limit of 21 million BTC, therefore, Bitcoin is a deflationary currency and no political or economic institution can regulate it. (Bunjaku et al., 2017)

A third important advantage is that transactions with Bitcoin are P2P, that is peer to peer. This means that any person, anywhere in the world, can do an operation directly, without having to be in contact with bank or similar intermediaries, nor is any type of tax paid.. (Bunjaku et al., 2017)

In many financial operations, commissions are not paid for making transactions with Bitcoin, and in other cases, a very small commission is charged, whose amount would be as much as 0.1%, a much lower amount than what the fees usually charge. financial entities. This amount goes to the "miners" of Bitcoin, in a symbolic way. It only takes two people registered in a digital wallet (in about 5 minutes you can create a wallet), and through your digital device, you can transfer any amount of Bitcoin anywhere in the world.

3.4.2 DISADVANTAGES OF BITCOIN

TABLE 6: MOST PRINCIPAL DISADVANTAGES OF BITCOIN

DISADVANTAGES OF BITCOIN	
<ul style="list-style-type: none"> • There is not enough solidity in anonymity <p>(Although Bitcoin is characterized by its anonymity, it is not 100% effective, because sometimes, wallets have been hacked and the identities of their owners discovered)</p>	<ul style="list-style-type: none"> • The lack of knowledge of investors with Bitcoin <p>(Bitcoin is a relatively modern currency, this causes many people with the intention of investing in Bitcoin, end up suffering scams, as a result of their lack of ignorance in Bitcoin legislation, how to exchange, etc)</p>
<ul style="list-style-type: none"> • The relationship between Bitcoin and Deep Web <p>(There are opinions that say that Bitcoin promotes Deep Web, a portal where you can buy all kinds of illegal material, such as drugs, weapons, etc.)</p>	<ul style="list-style-type: none"> • The decentralization of Bitcoin <p>(This can be a disadvantage, because the value of Bitcoin, depends on the acceptance that it has, that is, the more used Bitcoin is, the more valuable it will be. There is no political or economic authority that can regulate in case of big changes in the market price.)</p>

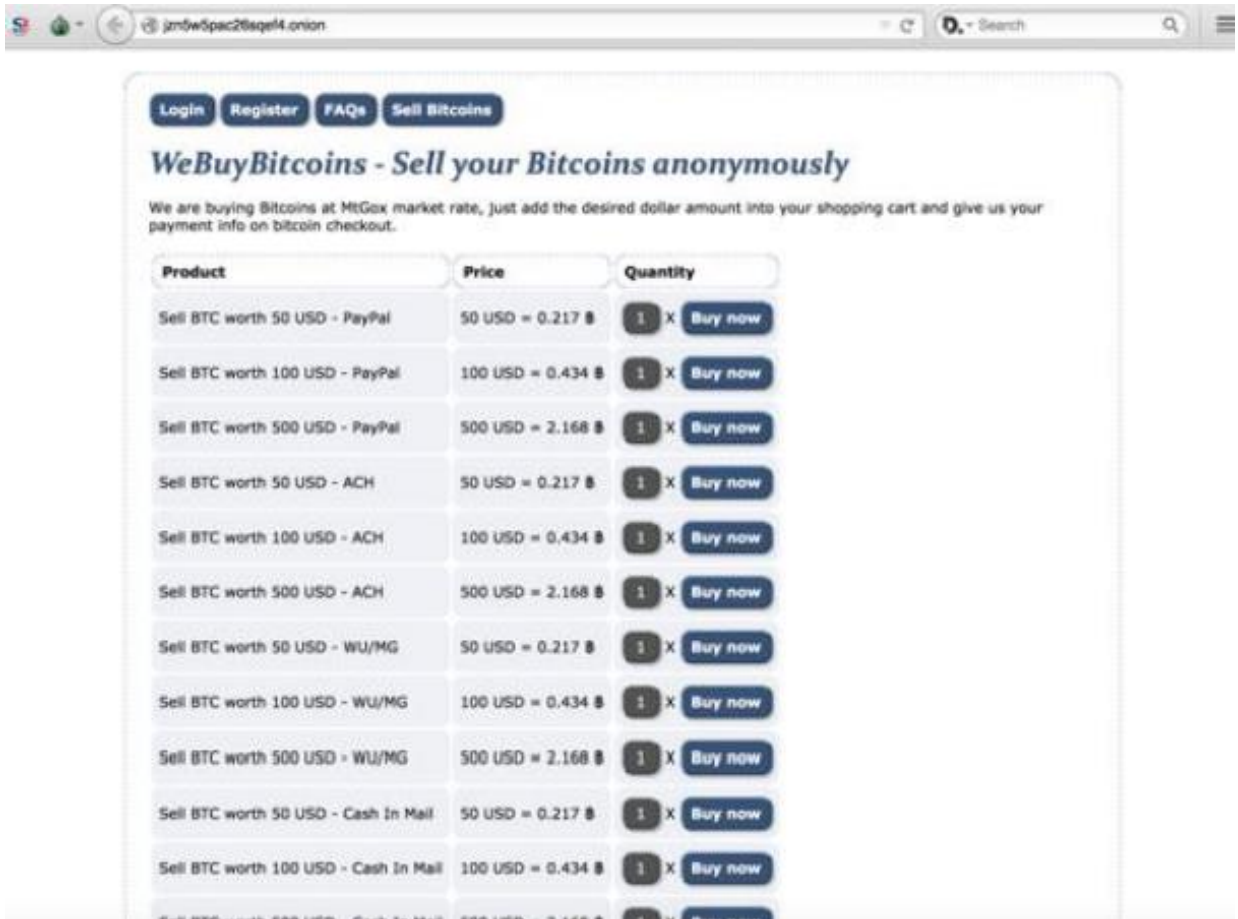
SOURCE: Dumitrescu (2017), Nedvedova and Stroukal (2016), Ivashchenko (2016)

One of the main disadvantages of using Bitcoin is that, like any other cryptocurrency, it has a too high volatility, which causes a great price risk. As mentioned in section 3.4.1, Bitcoin is a decentralized currency, this means that no political or economic authority has the power to control the price of Bitcoin. This can be a disadvantage, because Bitcoin's price depends of offer and demand that has. This depends of a lot of reasons, for example, if it is declared legal or illegal, can influence the market price. (Ivashchenko, 2016)

Another important disadvantage is that Bitcoin, has always had a bad reputation within most of the people, because it is used in the Deep Web. Deep Web is a portal that through the installation of the Tor program, allows you to navigate the depth of the Internet. In this portal, all types of material for sale appear, such as content of child pornography, drugs, assassins, weapons, etc ... But also other objects such as passports, credit cards, mobile phones, and virtually any object. However, the majority of content sold on the Deep Web, is illegal, therefore, to leave no trace and can be discovered the crime, It is used Bitcoin cryptocurrency as a method of payment. (Nedvedova and Stroukal, 2016)

In FIGURE 7, appears a screenshot of a Deep Web portal, in that screenshot, you can observe how can be bought VISA credit cards. As you can see in the image, they can be acquired through dollars, or also through Bitcoin (BTC). Of course, cyber criminals themselves are also interested in receiving payment in Bitcoin, since they, like their buyers, would also be committing the same crime.

FIGURE 8: “WeBuyBitcoins -Exchanging Bitcoin for cash or electronic payment“



SOURCE: Balduzzi, M. et al. (2015)

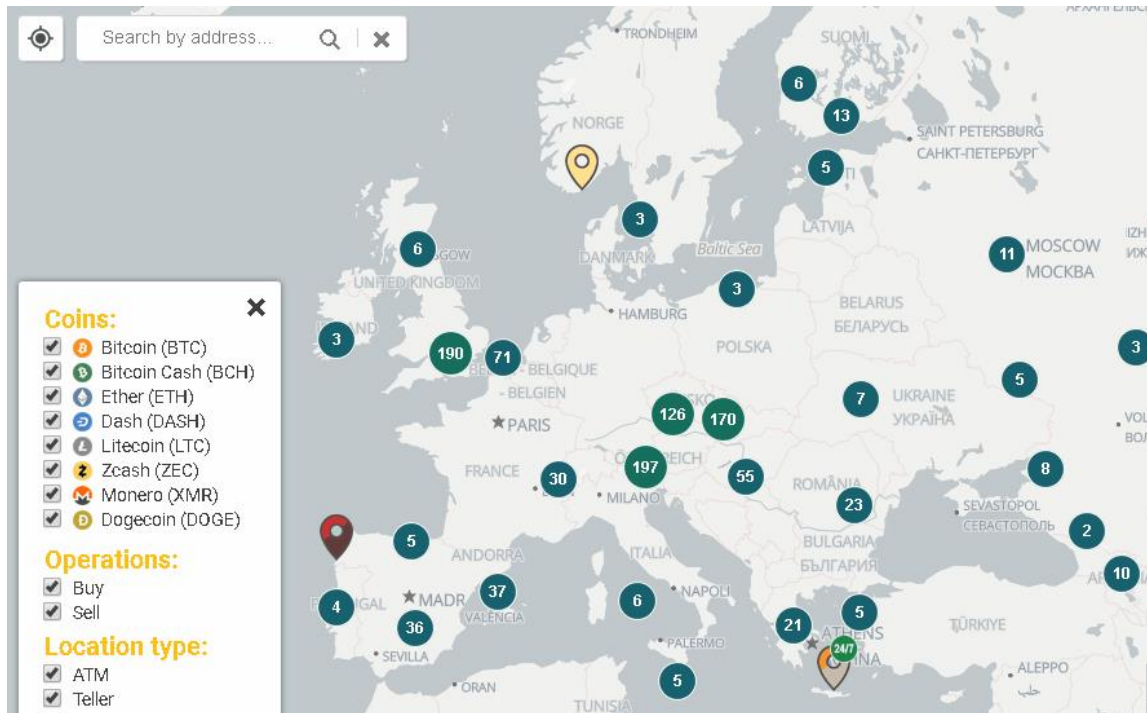
3.5 INTERNATIONAL LEGISLATION ON BITCOIN

The legal regulation of Bitcoin depends on each country, since it is not regulated the same in all the countries of the World. On the one hand, the most developed countries are those that have most accepted the use of Bitcoin, such as Australia, the United States, South Korea, and practically all the countries of the European Union, through institutions such as Danish Financial Supervisory, in Denmark, or The Swedish Financial Supervisory Authority (Finansinspektionen) in Sweden. (Dumitrescu, 2017)

However, in the case of the European Union, the Bitcoin legislation has been controversial, since the European Police Office (Europol) has been investigating the relationship that Bitcoin has to finance terrorism, in relation to the attacks of Paris in

November 2015. Finally, Bitcoin was declared innocent of financing terrorism, which was good news for Bitcoin and its presence in Europe. (DiarioBitcoin, 2016)

FIGURE 9: ATMs in Europe to Exchange Bitcoin and other cryptocurrencies



SOURCE: Coin ATM Radar (2019)

On the other hand, the countries that have least accepted Bitcoin are Nigeria, Bolivia, China, Iceland, Ecuador, India, Russia, Thailand and Vietnam. In some of the countries mentioned before, Bitcoin is declared illegal. (Dumitrescu, 2017)

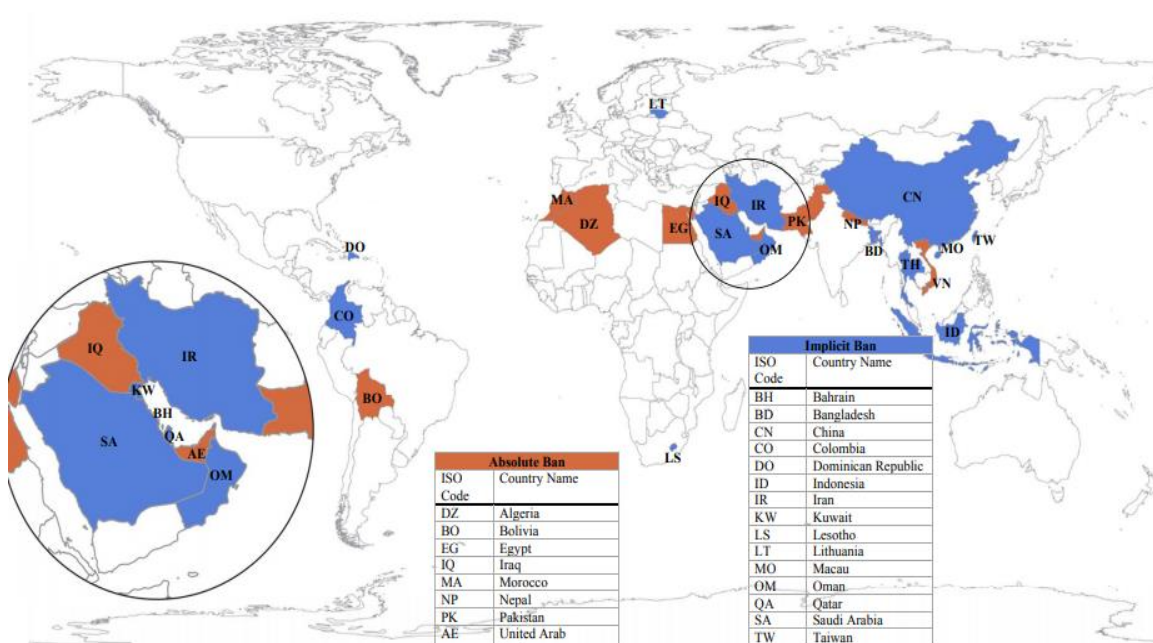
The reasons why some countries are reluctant to use Bitcoin, are divided in two main reasons. The first reason is that some of the aforementioned countries could lose control of their local currency, therefore, the Central Banks would see their power threatened with the economy of their respective countries. (ABC, 2017). If you do not control the monetary policy, you cannot control the amount of currency that has to be issued to control inflation, the rise / fall of interest rates, etc ... In conclusion, you do not have the economic control of the country.

The second reason could be considered the fact that countries like China, consider Bitcoin instead of a form of payment, as a "tool" for money laundering (The New York Times, 2013), criminal activity that China tries to eliminate. In addition to money

laundering, it is also about combating other illegal uses of Bitcoin, mentioned earlier in this project, such as the purchase of illegal material on the Deep Web, or the financing of terrorism.

In FIGURE 10 is available a map worldwide, which shows the legal situation of Bitcoin in the world, the countries that are not white, are those that the Bitcoin, directly (orange color) or indirect (blue color), is considered illegal.

FIGURE 10: “Legal Status of Cryptocurrencies”



SOURCE: The Law Library of Congress (2018)

As it can be observed, a lot of countries where Bitcoin is totally or partially illegalized are countries located in Asia and North Africa. The reasons why China has not accepted Bitcoin, have been mentioned before, but Bitcoin is not accepted in many countries of Islamic religion, such as Iran, Saudi Arabia, Indonesia, Morocco, Algeria, etc ... But it is important to add that the reason why Bitcoin is illegal in these countries, is not for religious reasons. In Islamic countries, Bitcoin is compared to gold, because gold has been accepted as a means of payment in those countries, and gold can also be the object of speculation. On the other hand, there are companies such as OneGram, based in Dubai, that develop their own cryptocurrencies, respecting the Islamic laws. Currently,

there is an open debate in Islamic countries, discussing whether or not Bitcoin meets the precepts of Islam. (Al-Jazeera, 2018)

In Spain, it is not illegal to get Bitcoin, however, the National Securities Market Commission (CNMV), in a statement with the support of the Bank of Spain (BdE), warned that Bitcoin does not have the guarantee or the backing of no higher organism. This statement was issued in order to avoid fraud and scams. In addition, the report mentions that Bitcoin is not subject to value added tax (IVA), but that it is subject to Personal Income Tax. (IRPF). (The Law Library of Congress, 2018)

3.6 BITCOIN AND ITS EFFECTS ON ECONOMY

Although Bitcoin is a relatively modern concept (Bitcoin was born in 2009, as mentioned in section 3.1 of this project), thanks to this cryptocurrency, large volumes of money have been moved, in legally and illegal operations.

An evidence of the large amount of money that has been moved, we can find it in the report that Christin and Soska (2015) made, of Carnegie Mellon University (Pittsburgh, Pennsylvania, USA), sponsored by USENIX (Association of Computing Systems) Advanced). In this report, it is mentioned that in the online black market, it manages to move an average of 500.000 \$ daily in 2014. Obviously, when dealing with illegal merchandise, such as drugs, weapons, etc ... the payment is not made in a common transfer, but is done through Bitcoin and other cryptocurrencies, but especially through Bitcoin.

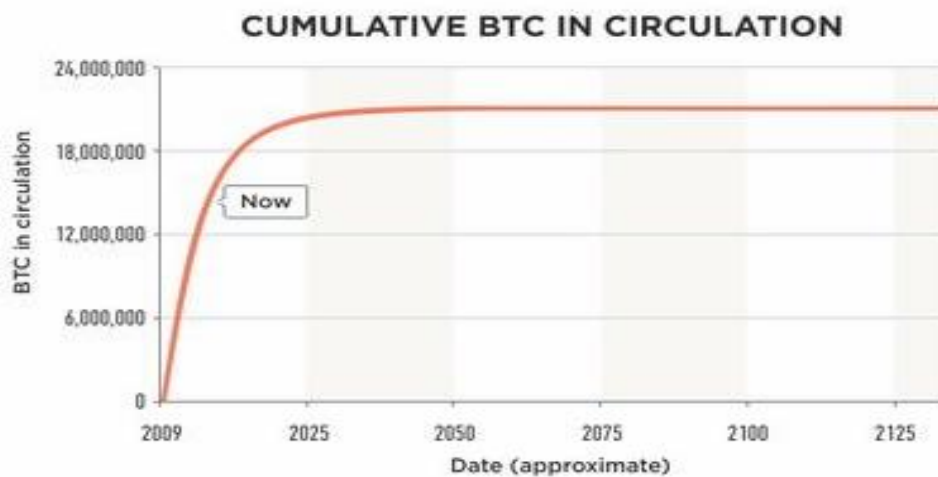
This amount means that annually, 182.500.000 \$ in Bitcoin was moved as a means of payment, only in 2014. From a conservative point of view, because the prohibited websites are continually being reinvented, if the same average had been maintained until 2018, the online black market would have moved in just 4 years, the high figure of 730.000.000 \$ in illegal purchases.

On the other hand, practically all economic powers have admitted the economic potential that Bitcoin has, for example, in the case of China, as mentioned in section 3.2 of this project, Bitcoin was banned from losing value against the Chinese currency.

In the map that appears in FIGURE 10, the countries in which Bitcoin is partially or totally restricted appear, therefore, it can be evidenced that the impact that Bitcoin has had, has been worldwide.

Another important detail is that Bitcoin is a deflationary currency, when it reaches the limit of 21.000.000 BTC, it will stop issuing. FIGURE 11 shows how the number of Bitcoin in emission grows exponentially less.

FIGURE 11: "CUMULATIVE BTC IN CIRCULATION"

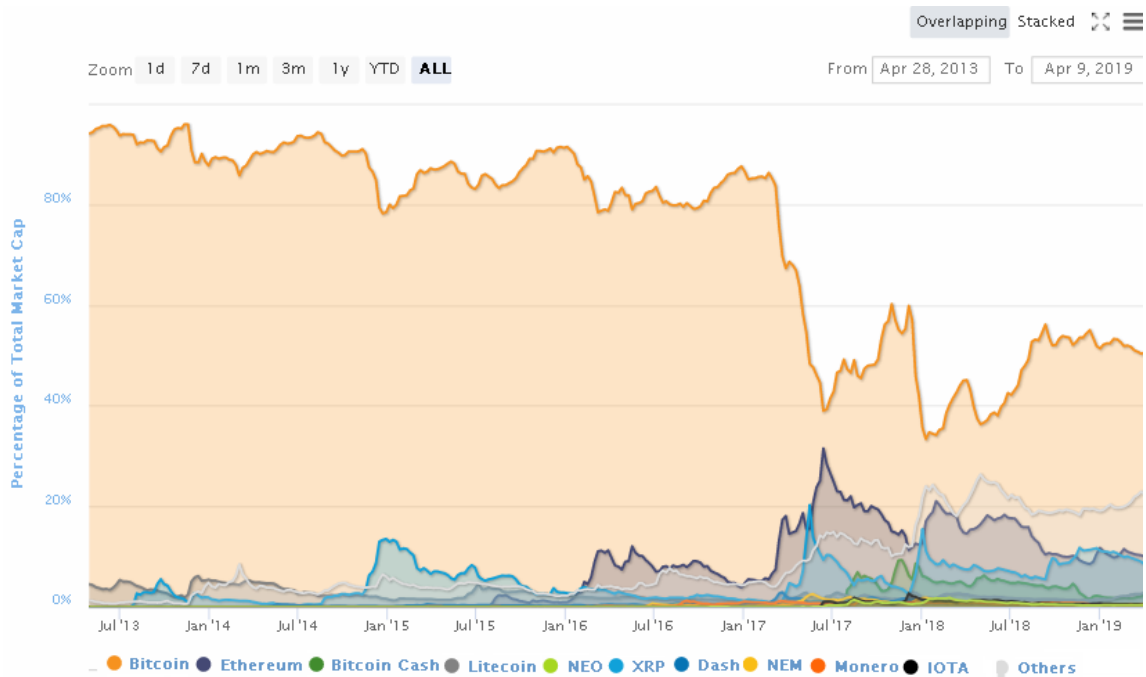


SOURCE: BitcoinWiki.org (2018)

4. COMPARISON BETWEEN CRYPTOCURRENCIES

Actually, there are more than 2.100 cryptocurrencies in circulation, operating in over 17.000 markets, with a market capitalization of 179.087.784.734 \$ in 9th of April 2019 (Coinmarketcap.com). However, not all cryptocurrencies have developed in the same way, as it is shown in FIGURE 12.

FIGURE 12: Percentage of Total Market Capitalization (Dominance)



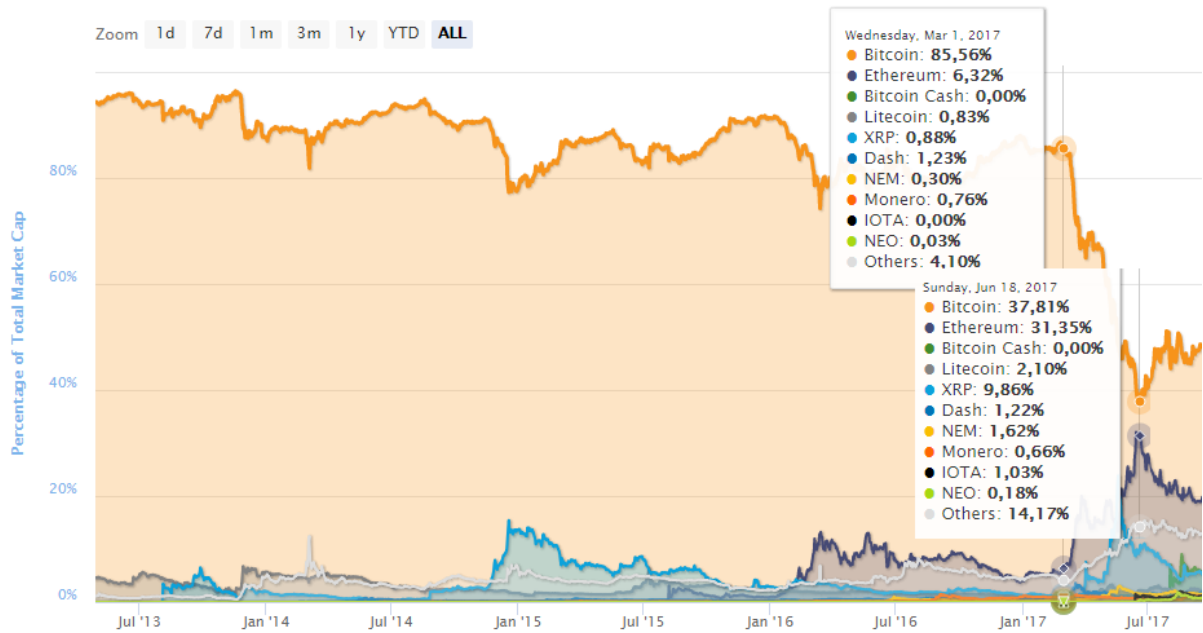
SOURCE: Coinmarketcap (2019)

The main conclusion is that there is a cryptocurrency that stands out above the rest, and that cryptocurrency is Bitcoin. This is evidence about why it is important to go deep in Bitcoin when the cryptocurrency topic is mentioned, because only Bitcoin represents more than half of the total of cryptocurrencies that are currently on the market.

Although Bitcoin's market share is not as high as in previous years, when Bitcoin came to have up to 80% market share from 2013 to 2017, currently, in April 2019, according to official results from the website Coinmarketcap.com, Bitcoin's market share represents 51.2% of the total market cryptocurrencies.

An interesting fact is that as can be observed, in the first half of 2017, Bitcoin lost more than half of its market share, going from 85.56% on March 1 2017, to a share of market value of 37.81%, on June 18 of the same year, as shown in FIGURE 13.

FIGURE 13: Drop of in Bitcoin's market share



SOURCE: Coinmarketcap (2019)

However, the reason why Bitcoin lost so much market share in such a short time, is not because it had lost value, in fact as it appears in TABLE 7, taking Bitcoin's weekly prices as reference, starting on March 1st. 2017 until June 18 of the same year, it is observed as Bitcoin even increased its value, going from a price of 1232.8 \$ for 1 BTC, to almost 2500 \$, this represents a growth of 102% in less than 4 months .

TABLE 7: Bitcoin market prices from 01/03/2017 to 18/07/2017

Date	Price
01/03/2017	1,232.8
08/03/2017	1,149.3
15/03/2017	1,256.1
22/03/2017	1,039.1
29/03/2017	1,041.8
05/04/2017	1,140.6
12/04/2017	1,227.4
19/04/2017	1,260.5
26/04/2017	1,399.3
03/05/2017	1,617.8
10/05/2017	1,796.8
17/05/2017	1,870.0
24/05/2017	2,394.8
31/05/2017	2,191.8
07/06/2017	2,642.6
14/06/2017	2,395.0
18/06/2017	2,491.5

SOURCE: Own elaboration. Prices obtained from Investing.com (2019)

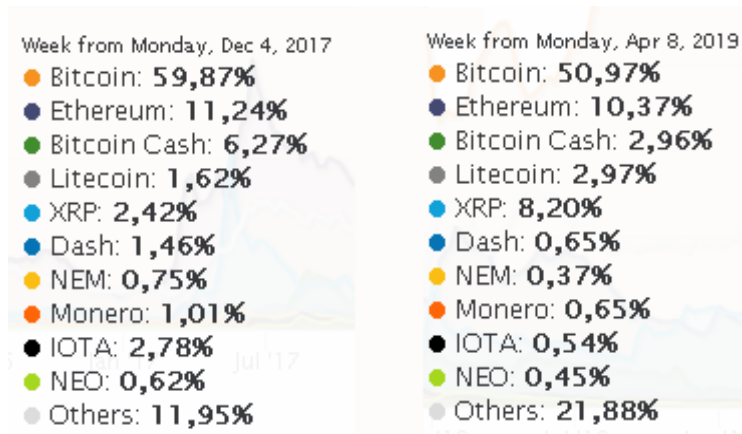
There is no official reason to justify such a large loss of market share, although one possible reason could be the "boom" that was the cryptocurrencies, 2017 was the year in which all records were broken, as mentioned in the section 3.2 "Evolution of Bitcoin", and became so popular that many investors wanted to try their luck, diversifying their investments in new cryptocurrencies other than Bitcoin.

Another conclusion that can be observed from FIGURE 13 is that the second cryptocurrency with the most market share varies according to the years. For example, in January 2015, the second cryptocurrency with the most market share was Ripple, with a share of 13%. In the year 2017, the second most used cryptocurrency was Ethereum, this change may be due to the improvements of its network, for example, the development in the confidentiality of its transactions (CoinJournal, 2017).

Since 2018 to nowadays, according to data from coinmarketcap.com, Ethereum is still the second cryptocurrency with the most market share, although it is following a downward trend since June 2017, having a market share of 31.53% to date June 12, where Ethereum reached its "peak", until April 9, 2019, the current date that this project was written, where Ethereum has a market share of 10.37%.

However, if the cryptocurrencies that do not appear in this graph were together in a common cryptocurrency, this cryptocurrency would be the second most used in the market, as shown in Figure 14, from December 2017 to the present, with a market share of 21.88%.

FIGURE 14: Market share of the main cryptocurrencies



SOURCE: Coinmarketcap (2019)

With these results, we can conclude that investors buy different cryptocurrencies that are different to Bitcoin. There is no special reason to justify this, although one possible reason could be that the big fall that Bitcoin had in 2018 (as mentioned in point 3.2 of this project). As a result of this fact, many investors preferred to invest in other cryptocurrencies not so famous, especially those cryptocurrencies in which there are not many speculators that come to alter the price, as it happened in Bitcoin.

Following an evolution of the market prices of the 5 cryptocurrencies with more market share (as shown in FIGURE 14, they are Bitcoin, Ethereum, Bitcoin Cash, Litecoin and Ripple), both in the "boom" of the year 2017, and in his "crash" of the year 2018, several observations can be made.

(NOTE: All market prices that appear in TABLES 8, 9 and 10, are referenced to the exchange rate in US dollars, price = Cryptocurrency / USD)

In 2017, as shown in Table 8, is the year the price of cryptocurrencies grows the most, there are situations in which there are cryptocurrencies that grow more than 100% in just one month, as is the Ethereum case in March, Bitcoin Cash in November and Litecoin in December, and Ripple in March, April, May and December. The example of Ripple is the one that stands out the most, because there are anomalies such as, for example, an increase in its contribution up to 740% in the month of December.

As mentioned in section 3.2 of this project, the year 2017 was when cryptocurrencies were considered famous, and since their contributions depend (among other factors) on the demand they have, if their purchase increases, their market prices too, as can be shown in TABLE 8

TABLE 8: Monthly market prices of the main cryptocurrencies in the year 2017

****Change % means monthly return**

Date	BITCOIN Price	Change %	ETHERUM Price	Change %	Bitcoin Cash Price	Change %	Litecoin Price	Change %	RIPPLE Price	Change %
Dec 17	13,800.0	39.30%	736.77	70.47%	2,356.48	77.36%	227.170	164.71%	1,98000	740.41%
nov-17	9,907.0	53.40%	432.21	42.32%	1,328.66	204.39%	85.820	54.88%	0.23560	19.29%
oct-17	6,458.3	47.89%	303.69	0.08%	436.50	0.00%	55.410	0.27%	0.19750	-1.20%
sep-17	4,367.0	-7.44%	303.44	-21.65%	436.50	-26.02%	55.260	-24.54%	0.19990	-22.91%
Aug 17	4,718.2	65.20%	387.30	92.87%	-	-	73.230	73.24%	0.25930	57.34%
jul-17	2,856.0	17.98%	200.81	-27.14%	-	-	42.270	7.04%	0.16480	-33.17%
jun-17	2,420.7	10.44%	275.62	26.23%	-	-	39.490	52.59%	0.24660	-0.36%
may-17	2,191.8	52.72%	218.34	161.45%	-	-	25.880	59.75%	0.24750	374.32%
Apr 17	1,435.2	32.68%	83.51	67.96%	-	-	16.200	123.45%	0.05218	143.83%
mar-17	1,081.7	-9.03%	49.72	213.49%	-	-	7.250	88.31%	0.02140	284.20%
feb-17	1,189.1	23.07%	15.86	48.09%	-	-	3.850	-5.41%	0.00557	-13.10%
Jan 17	966.2	-0.04%	10.71	33.88%	-	-	4.070	-6.65%	0.00641	-1.55%

SOURCE: Own elaboration. Prices obtained from Investing.com (2019)

Another conclusion that can be observed is that in general, if Bitcoin increases in value, the rest of the cryptocurrencies increase also, as in the months of April, May, August, November and December. On the other way, when Bitcoin decreases in value, the rest of the cryptocurrencies follow it, this happened in the month of September, and except for the Ethereum exception, it also happens in the months of January and February.

The reason that could explain this behaviour is because, as can be seen in FIGURE 12, Bitcoin is the hegemonic cryptocurrency, which has the most market power, so any circumstance that may influence its price will probably also influence the rest of cryptocurrencies.

In 2018, as it can be seen in TABLE 9, it is the year where the "crash" of cryptocurrencies happens. All the cryptocurrencies decrease their value in large quantity. For example, Bitcoin goes from having a value about \$ 10,284 / BTC to \$ 3830.5 at the end of the year.

TABLE 9: Monthly market prices of the main cryptocurrencies in the year 2018

****Change % means monthly return**

Date	BITCOIN Price	Change %	ETHERUM Price	Change %	Bitcoin Cash Price	Change %	Litecoin Price	Change %	RIPPLE Price	Change %
Dec 18	3,830.5	-5.15%	136.00	19.63%	148.68	-16.31%	29.893	-7.25%	0.35100	-3.70%
nov-18	4,038.3	-36.59%	113.68	-42.79%	177.66	-58.41%	32.228	-35.47%	0.36448	-19.65%
oct-18	6,368.4	-3.77%	198.70	-14.63%	427.13	-19.60%	49.943	-18.43%	0.45361	-22.16%
sep-18	6,618.1	-5.80%	232.75	-17.43%	531.26	-2.05%	61.224	-1.30%	0.58274	73.94%
Aug 18	7,025.9	-9.12%	281.87	-34.70%	542.40	-30.06%	62.033	-21.44%	0.33503	-22.98%
jul-18	7,730.6	20.95%	431.65	-4.89%	775.48	3.54%	78.961	-2.84%	0.43498	-6.43%
jun-18	6,391.5	-14.62%	453.85	-21.40%	748.95	-24.88%	81.272	-31.39%	0.46486	-23.92%
may-18	7,485.8	-18.98%	577.41	-13.82%	996.98	-26.00%	118.462	-20.13%	0.61103	-10.53%
Apr 18	9,240.0	33.42%	670.00	70.50%	1,347.29	96.62%	148.327	27.49%	0.68296	36.34%
mar-18	6,925.3	-32.86%	392.97	-53.84%	685.23	-42.91%	116.340	-42.41%	0.50089	-43.53%
feb-18	10,315.0	0.30%	851.26	-24.08%	1,200.36	-19.55%	202.010	23.27%	0.88692	-22.15%
Jan 18	10,284.0	-25.48%	1,121.30	52.19%	1,492.09	-36.76%	163.879	-27.86%	1,13931	-42.46%

SOURCE: Own elaboration. Prices obtained from Investing.com (2019)

Another conclusion that can be observed is that in the few months in which the prices of the main cryptocurrencies increased, at specific moments, these specific increases can be explained by two main reasons, on the one hand, by the entry of speculators they invest in these cryptocurrencies, and on the other hand, specific news that affect their value, such as some improvement they have, in their security or in any other feature. Both factors have not been long-lasting, and the following month, as can be seen in table 8, they have again lost value in their quotations, following a downward trend.

In 2019, as can be seen in the results from TABLE 10, there is a certain parallelism between 2019 and 2017. In January 2019, both Bitcoin and the rest of the main cryptocurrencies lost value, although as of February, until April (current moment in which this project is being written), all the cryptocurrencies have increased their quotations, and except for Ripple, the rest of the main cryptocurrencies have increased in value 3 months in a row, following the same evolution as in 2017.

TABLE 10: Monthly market prices of the main cryptocurrencies in the year 2019

****Change % means monthly return**

Date	BITCOIN Price	Change %	ETHERUM Price	Change %	Bitcoin Cash Price	Change %	Litecoin Price	Change %	RIPPLE Price	Change %
Apr 19	5,282.2	26.74%	181.79	26.44%	299.61	77.45%	87.685	44.26%	0.35405	14.62%
mar-19	4,167.6	7.03%	143.78	4.06%	168.84	29.57%	60.785	32.66%	0.30890	-1.66%
feb-19	3,894.0	11.22%	138.17	27.40%	130.31	14.72%	45.820	45.80%	0.31412	1.56%
Jan 19	3,501.1	-8.60%	108.45	-20.26%	113.59	-23.60%	31.428	5.14%	0.30930	-11.88%

SOURCE: Own elaboration. Prices obtained from Investing.com (2019)

Following the market prices for 2017, 2018 and the first 4 months of 2019, it is likely that in the following months of 2019, the main cryptocurrencies may continue to increase their price for a few more months.

It is important to remember the fact that cryptocurrencies had a "crash" in 2018, as a result of the speculation and increase in prices so big that had in the year 2017. However, in 2019 the growth is being a bit more "sustainable" (there are no anomalies such as Ripple to increase its value by 700%, for example), although this growth is still quite high, therefore, we must be careful with the volatility in its quotations if we want to invest in cryptocurrencies, that there are periods that increase their value too much, and periods that also decrease too much, there is no "midpoint".

As mentioned before, Bitcoin is the "leader" cryptocurrency, so if the Bitcoin value increases or decreases, in the quotations of the rest of the cryptocurrencies, in most cases, they have the same behaviour and fail in price.

This theory can be confirmed in TABLE 11, where is calculated the Pearson correlation coefficient, to observe the relationship between Bitcoin monthly return and other cryptocurrencies.

TABLE 11: Correlation between cryptocurrencies from 2017 to 2019.

Date	Bitcoin monthly return %	Etherum monthly return %	Litecoin monthly return %	Ripple monthly return %
Apr 19	26,74%	26,44%	44,26%	14,62%
mar-19	7,03%	4,06%	32,66%	-1,66%
feb-19	11,22%	27,40%	45,80%	1,56%
Jan 19	-8,60%	-20,26%	5,14%	-11,88%
Dec 18	-5,15%	19,63%	-7,25%	-3,70%
nov-18	-36,59%	-42,79%	-35,47%	-19,65%
oct-18	-3,77%	-14,63%	-18,43%	-22,16%
sep-18	-5,80%	-17,43%	-1,30%	73,94%
Aug 18	-9,12%	-34,70%	-21,44%	-22,98%
jul-18	20,95%	-4,89%	-2,84%	-6,43%
jun-18	-14,62%	-21,40%	-31,39%	-23,92%
may-18	-18,98%	-13,82%	-20,13%	-10,53%
Apr 18	33,42%	70,50%	27,49%	36,34%
mar-18	-32,86%	-53,84%	-42,41%	-43,53%
feb-18	0,30%	-24,08%	23,27%	-22,15%
Jan 18	-25,48%	52,19%	-27,86%	-42,46%
Dec 17	39,30%	70,47%	164,71%	740,41%
nov-17	53,40%	42,32%	54,88%	19,29%
oct-17	47,89%	0,08%	0,27%	-1,20%
sep-17	-7,44%	-21,65%	-24,54%	-22,91%
Aug 17	65,20%	92,87%	73,24%	57,34%
jul-17	17,98%	-27,14%	7,04%	-33,17%
jun-17	10,44%	26,23%	52,59%	-0,36%
may-17	52,72%	161,45%	59,75%	374,32%
Apr 17	32,68%	67,96%	123,45%	143,83%
mar-17	-9,03%	213,49%	88,31%	284,20%
feb-17	23,07%	48,09%	-5,41%	-13,10%
Jan 17	-0,04%	33,88%	-6,65%	-1,55%
Correlation coefficient BITCOIN-ETHERUM			0,477916907	
Correlation coefficient BITCOIN-LITECOIN			0,642189268	
Correlation coefficient BITCOIN-RIPPLE			0,386862827	

SOURCE: Own elaboration. Monthly returns obtained from Investing.com (2019)

The results that we can obtain in conclusion, is that it is so close the correlation, especially between Bitcoin and Ethereum, and Bitcoin with Litecoin. With Ethereum, it is achieved a result of 0.47 out of 1. In the case of Ethereum, the degree of correlation exceeds even 0.64 out of 1. These results show that in the rest of most principal cryptocurrencies are highly dependent on Bitcoin movements.

Finally, in this section, the volatility that exists between cryptocurrencies will be shown. To measure volatility, the monthly returns that also appear in table 11 have been used, and the standard deviation has been calculated, a common way in the economy to measure the risk of a financial asset.

TABLE 12: Volatility between cryptocurrencies

	Desvest Return Bitcoin	Desvest Return Ethereum	Desvest Return Litecoin	Desvest Return Ripple
2019 ^{***} (From Jan. to Apr.)	0,1452857959	0,2252844424	0,1882053754	0,1092894627
YEAR 2018	0,2035998921	0,3714588329	0,2196751541	0,3325003827
YEAR 2017	0,2526899914	0,7085222014	0,5786208619	2,32726908
From Jan. 2017 to Apr. 2019	0,2701404983	0,6057790442	0,4982456987	1,649246463

SOURCE: Own elaboration

As we can observe, taking the monthly returns from January 2017 to nowadays (April 2019), Ripple is cryptocurrency with the highest volatility index, with a high difference against the rest of cryptocurrencies. The most popular cryptocurrency (Bitcoin) has a result around 0,27, so we can conclude that Bitcoin is the least risky.

5. COMPARISON BETWEEN BITCOIN AND OTHER CURRENCIES

Bitcoin is a cryptocurrency, and although it is not a means of physical payment, Bitcoin has the same characteristics as any other currency. However, if we analyze the prices of currencies in the world, we can observe how Bitcoin has more devaluated than the rest, as shown in TABLE 12.

In this table, revaluation will be measured through the standard deviation of yields, a generalized measure that is usually used to measure profitability. To do this, currency prices from El País will be used, this result, in addition to TABLE 12, will be used for TABLE 13

It should be noted that in TABLES 12 and 13, both in Bitcoin and the rest of currencies, the revaluation % is taken as reference the Euro.

TABLE 13: Standard deviation of most principal currencies and Bitcoin, with % of revaluating to (€) in 2018

CURRENCY	% Reval. (xi)	(xi) - (X)	((xi) - (X))^2
Japanese yen	7,56%	0,13040	0,01700416
Mexican peso	4,74%	0,10220	0,01044484
United States dollar	4,69%	0,10170	0,01034289
Hong Kong dollar	4,45%	0,09930	0,00986049
Swiss franc	3,74%	0,09220	0,00850084
Singapore dollar	2,63%	0,08110	0,00657721
Malaysian ringgit	2,49%	0,07970	0,00635209
Taiwan dollar	1,59%	0,07070	0,00499849
Peruvian sol	0,62%	0,06100	0,003721
South Korean won	0,45%	0,05930	0,00351649
Danish krone	-0,20%	0,05280	0,00278784
Norwegian krone	-0,60%	0,04880	0,00238144
Czech koruna	-0,64%	0,04840	0,00234256
New Zealand dollar	-0,90%	0,04580	0,00209764
Chinese renminbi	-0,97%	0,04510	0,00203401
British pound sterling	-1,19%	0,04290	0,00184041
Indonesian rupiah	-1,29%	0,04190	0,00175561
Polish zloty	-2,40%	0,03080	0,00094864
Israeli new shekel	-2,75%	0,02730	0,00074529
Hungarian forint	-3,17%	0,02310	0,00053361
Swedish krona	-3,23%	0,02250	0,00050625
Canadian dollar	-3,49%	0,01990	0,00039601
Colombian peso	-3,78%	0,01700	0,000289
Indian rupee	-4,16%	0,01320	0,00017424
Australian dollar	-5,50%	-0,00020	4E-08
Chilean peso	-7,11%	-0,01630	0,00026569
South African rand	-9,64%	-0,04160	0,00173056
Brazilian real	-10,60%	-0,05120	0,00262144
Russian ruble	-13,46%	-0,07980	0,00636804
Turkish lira	-24,82%	-0,19340	0,03740356
Argentine peso	-48,24%	-0,42760	0,18284176
Bitcoin	-60,18%	-0,54703	0,299241821

Total amount ((Xi) - (X)) ^ 2	0,63062
Number of currency (n)	32
Average (X)	-0,05480
Standard deviation ((0,63062/(32-1)) ^ 0,5	0,04068516

SOURCE: Own elaboration. Currency prices obtained from *El País* (2019)

In the standard deviation, is obtained a result of 0.04068516, a result very different from the one we obtain in the Bitcoin cell, with a result of 0.22924. The value of Bitcoin is the closest to value = 1 , so that here is the mathematical evidence that Bitcoin in 2018 had a greater devaluation than the rest of currencies.

As mentioned in the previous section, Bitcoin market price do not have a stable value, Bitcoin has periods in which the price rises a lot or goes too low. As shown in FIGURE 1 of this project, you can see how Bitcoin was the currency that grew the most in the year in 2016, taking the US dollar as a reference, Bitcoin revalued 126.2% in one year. This growth is much higher compared to the second currency that was most appreciated in 2016, which was the Brazilian real, with 21.9%

The following table shows the revaluation of the main currencies of the world in 2018, taking as reference the Euro. In this table, it can be seen that the currencies that

depreciated the most that year are the Turkish lira, the Russian ruble, and the Argentine peso (the latter lost the most value against the euro, with 48.24%)

TABLE 14: Revaluation against the Euro (€) in 2018

CURRENCY	% Revaluating
Japanese yen	7,56%
Mexican peso	4,74%
United States dollar	4,69%
Hong Kong dollar	4,45%
Swiss franc	3,74%
Singapore dollar	2,63%
Malaysian ringgit	2,49%
Taiwan dollar	1,59%
Peruvian sol	0,62%
South Korean won	0,45%
Danish krone	-0,20%
Norwegian krone	-0,60%
Czech koruna	-0,64%
New Zealand dollar	-0,90%
Chinese renminbi	-0,97%
British pound sterling	-1,19%
Indonesian rupiah	-1,29%
Polish złoty	-2,40%
Israeli new shekel	-2,75%
Hungarian forint	-3,17%
Swedish krona	-3,23%
Canadian dollar	-3,49%
Colombian peso	-3,78%
Indian rupee	-4,16%
Australian dollar	-5,50%
Chilean peso	-7,11%
South African rand	-9,64%
Brazilian real	-10,60%
Russian ruble	-13,46%
Turkish lira	-24,82%
Argentine peso	-48,24%

SOURCE: Own elaboration. Currency prices obtained from *El País* (2019)

Once we have already observed these results, if we compare the Bitcoin market prices of the same year, in TABLE 14, we observe how the drop is much higher than the rest of the TABLE 13 currencies.

In 2018, Bitcoin went from having a quotation of 1BTC = 8177.7 € in January, to a quotation of 1BTC = 3256.5 €, as can be seen in TABLE 14. This difference represents a loss of value to 60.183%.

TABLE 15: Monthly market prices of the main cryptocurrencies in 2018 compared to Euro (€)

****Change % means monthly return**

	BITCOIN		ETHERUM		BITCOIN CASH		LITECOIN		RIPPLE	
	BTC / EUR	Change %	ETH / EUR	Change %	BCH / EUR	Change %	LTC / EUR	Change %	XRP / EUR	Change %
Dec 18	3,256.5	-7.86%	115.05	15.97%	130.35	-13.72%	26.19	-6.50%	0.30490	-4.09%
nov-18	3,534.3	-36.88%	99.21	-42.98%	151.08	-59.70%	28.01	-35.82%	0.31790	-20.09%
oct-18	5,599.5	-1.78%	173.98	-13.00%	374.93	-18.01%	43.64	-16.97%	0.39780	-20.51%
sep-18	5,701.1	-5.66%	199.98	-17.57%	457.30	-2.14%	52.56	-1.57%	0.50043	73.83%
Aug 18	6,043.3	-8.69%	242.61	-34.32%	467.29	-29.62%	53.40	-20.71%	0.28789	-22.57%
jul-18	6,618.2	21.07%	369.39	-4.94%	663.98	3.62%	67.35	-2.72%	0.37179	-7.10%
jun-18	5,466.3	-14.77%	388.58	-21.22%	640.76	-24.65%	69.23	-31.47%	0.40019	-23.21%
may-18	6,413.5	-16.33%	493.26	-10.88%	850.34	-23.88%	101.02	-17.53%	0.52118	-24.45%
Apr 18	7,664.9	36.21%	553.48	73.01%	1,117.14	101.23%	122.49	29.89%	0.68983	70.04%
mar-18	5,627.3	-33.48%	319.92	-54.13%	555.15	-43.46%	94.30	-42.91%	0.40569	-43.94%
feb-18	8,459.8	3.45%	697.49	-21.54%	981.89	-17.03%	165.17	26.65%	0.72366	-19.90%
Jan 18	8,177.7	-30.99%	888.95	39.12%	1,183.50	-42.59%	130.41	-33.75%	0.90344	-45.58%

SOURCE: Own elaboration. Prices obtained from Investing.com (2019)

In the rest of cryptocurrencies happens the same situation that in Bitcoin. The cryptocurrencies from TABLE 14, if they were in the same ranking as the rest of currencies from TABLE 13, would be in the last positions, because they would be currencies that lost most value in 2018. In 2018 Ethereum loses 87.05% of its value, Bitcoin Cash loses 88.98%, Litecoin loses 79.91% and Ripple loses 66.25%.

With all these results, as a conclusion of this analysis, it can be shown that cryptocurrencies have more devaluation than rest of currencies, which is an important detail to take into account if you want to invest in cryptocurrencies, or use them as a payment method. Cryptocurrencies are a new concept, so cryptocurrencies have to be confirmed as a stable currency. However, the future can benefit cryptocurrencies, in consequence from the digital era and the technological revolution that we are currently living.

6. CONCLUSION

With this paper, it has been tried to show the situation of cryptocurrencies, from a theoretical and practical point of view. Taking into account the information and results shown, it is a fact that cryptocurrencies have the acceptance of being used as a payment method, as the result mentioned at the beginning of section 4 of this project, the cryptocurrencies move almost 180.000.000.000 \$. Therefore, is not far from being a project for the future, cryptocurrencies are the present.

On the other hand, it is also important to mention that cryptocurrencies still have time to stabilize their market prices, as explained in the data of point 4 of this project. Cryptocurrencies are very sensitive to the variation of data, if they do not stabilize, there may be a great risk that they become a "bubble" to speculate, but if they stabilize, they may have so much potential that they could be an alternative to the common currencies, even replace them in the long term.

In addition to the market price, cryptocurrencies still have to develop, for example at the technological level, since the networks of programmers working in the maintenance of cryptocurrencies have to face the potential demand of both investors and simply people. or even companies that want to use a cryptocurrency as a means of payment.

On the other hand, this work can be a useful guide for anyone who is interested in learning about cryptocurrencies, in a simple and direct way, but without losing the scientific part, showing mathematical data, and with the support of graphs and tables.

There are supporters who say that the cryptocurrency is a bubble that has exploded, and that in the future will lower its price value more, due to the great pressure that Bitcoin gives to the Central Banks. There is the theory that the Central Banks have not acted directly against the cryptocurrencies (especially Bitcoin), because they are letting, the same speculators to lower the price. That means that cryptocurrencies produce their own crash.

There is no official evidence to prove this theory, although the possibility may always remain. However, if this theory had been true, during the years 2016 and especially 2017, when the Bitcoin price was at record levels, it became a real threat to local currencies,

as shown in FIGURE 1 of this project, Bitcoin grew more than all the currencies combined, and most Central Banks, especially the West, did not act against Bitcoin. Therefore, the cryptocurrency to invest can be as valid as any currency or stock of a company to invest in. It is clear that there will be large increases and decreases in their contributions, but in the short term, as can be seen in the market prices of section 4 , it is practically impossible for prices to sink to a value of 0, in fact the trend in 2019 is going back to the upside.

On the other hand, there are people who claim that cryptocurrencies should be illegal, because their existence can increase the number of cyber crimes. However, computer criminals will always find a way to do their misdeeds and obtain profitability, if the cryptocurrencies were made illegal, in the medium / long term, a new alternative would arise. Deep Web was created in 2001, 8 years before the creation of Bitcoin, if cryptocurrencies really contributed to cybercrime, then other cryptocurrencies that existed in the past would have been used, such as Beenz, Flooz or any other cryptocurrency previous to Bitcoin, but they were not used and disappeared due to the lack of success, because nobody considered them useful.

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