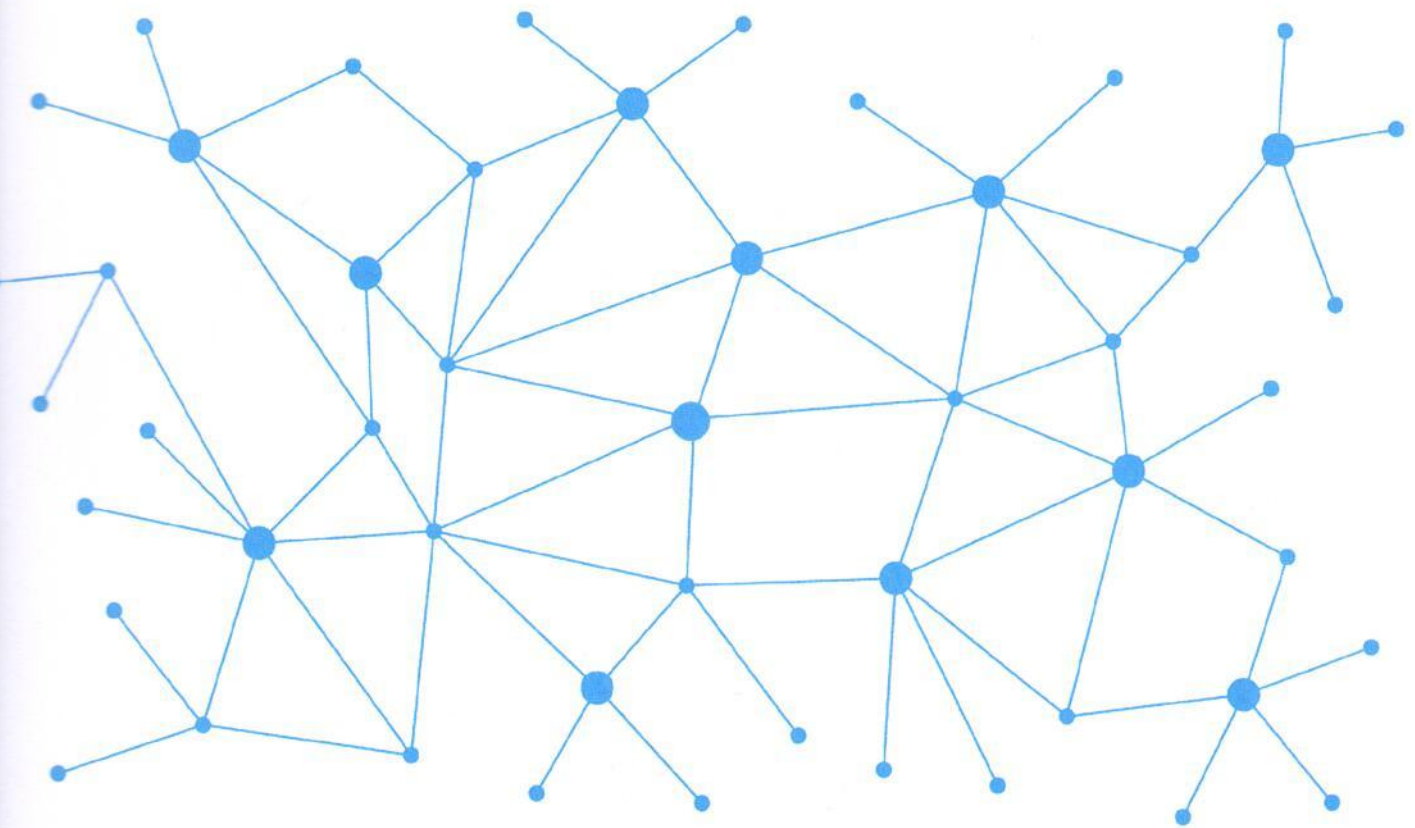# Analysis on the Perspectives
of Cryptocurrencies

Mariano García de la Concepción
Gabriela Kattan Bendaña
Silvia Ortiz Lana

COLEGIO UNIVERSITARIO DE ESTUDIOS FINANCIEROS

MÁSTER EN INSTITUCIONES Y MERCADOS FINANCIEROS

(ANALYSIS ON THE PERSPECTIVE OF CRYPTOCURRENCIES)

Realizado por:

D./Dª Mariano García de la Concepción

D./Dª Gabriela Kattan Bendaña

D./Dª Silvia Ortiz Lana

Dirigido por:
Professor Steven Zitzer

CUNEF (Colegio Universitario de Estudios Financieros)

MADRID, a 23 de Mayo de 2018

INDEX

1. OVERVIEW

In this section, our goal is to help readers understand the concept of cryptocurrencies, why they came to be and the workings of their underlying technology (Blockchain).

1.1. ORIGINS

It is important to state that cryptocurrencies came into existence as a response to the problems and lack of trust in the financial system and in the fiat currencies. Cryptocurrencies supporters believe most people are not satisfied with how the financial system works but have become accustomed to the status quo and they have learned to live with its flaws. The creators of the first cryptocurrencies support the notion that there are people whom are ready for new financial alternatives.

Several efforts to create digital currencies existed in the 1990's. For example, Flooz, Beenz and DigiCash were attempts that failed because they all kept utilizing a trusted third party to execute and verify transactions. According to an article in Cointelegraph, some were accused of fraud, others had financial problems while others experienced frictions between the company's employees and owners. Among the value propositions of the new emerging cryptocurrencies is their decentralized nature.

The first viable cryptocurrency, Bitcoin, was created in 2009 and emerged in the midst of the financial crisis, when the reputation of the financial and economic system was at a major low. The failings of the financial system became more apparent during and after the global financial crisis, when it became evident that banking executives engaged in irresponsible lending and excessive risk-taking. Instead of punishing the reckless actions of banks, governments provided them with massive bailouts in order to avoid the collapse of the entire financial system. These bailouts required for additional fiscal policies. The financial crisis affected consumer confidence and destroyed their faith in the system.

Bitcoin was designed as a response to the lack of confidence in both the fiat currencies and in the financial system in general. Before, during the times of the 'gold standard', fiat currencies were pegged to actual gold bullion. However, now the value of fiat currencies is dependent solely on supply, demand and trust in the system rather than on intrinsic value. Alan Greenspan, a former chairman of the Fed once stated *"In the absence of the gold standard, there is no way to protect savings from confiscation through inflation. There is no safe store of value."*[1] When taxes are not enough, governments fund their spending by printing additional money. Constantly printing money theoretically results in an increase in supply and in the depreciation of the currency. Demanding citizens and businesses to pay for their tax liabilities in the local currency prevents them from selling it off in exchange for another that would better store value. The people must trust that the central bank will do everything in their power to not debase the currency. In some sense, it's as if Bitcoin creators deliberately wanted to mimic gold. For example, Bitcoin cannot just be printed but instead must be "mined." Mining Bitcoin, like mining gold is not easy and is extremely costly. A massive amount of energy is needed to mine it and thus it mimics the scarcity of gold.

---

[1] <https://masterthecrypto.com/evolution-cryptocurrency-problem-money-today/> [5th April 2018]

Moreover, other responsibilities of banks are to keep record of the balances and transactions, avoid fraud and double-spending and store funds as fiat currency has limited portability. As if this is not enough, we must trust banks with all our personal information as well. However, history has taught us that there have been numerous breaches to that trust. For example, the SWIFT System has been hacked numerous times. Cyberattacks have been targeting fraudulent SWIFT transactions around the world resulting in disproportionate losses to banks. In 2018, 6 million USD were stolen in a bank hack via SWIFT System.

Satoshi Nakamoto, the pseudonym for the programmer or group of programmers which created Bitcoin, was evidently motivated by this lack of confidence as he/she/they once stated that *"Banks must be trusted to hold our money and transfer it electronically, but they lend it out in waves of credit bubbles with barely a fraction in reserve. We have to trust them with our privacy, trust them not to let identity thieves drain our accounts."[2]*

While creating Bitcoin, the goal of Satoshi Nakamoto was to create an *"electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact with each other without the need for a trusted third party."[3]* Satoshi described it as a 'peer-to-peer electronic payment system'. The key distinction of this new digital currency is that it is entirely decentralized, meaning there is no central controlling authority in which the people must place their trust. Although the problem of the third-party was removed, cryptocurrencies continue to have many issues and are not widely accepted yet. For example, to some, the question remains as to how this peer-to-peer, decentralized, electronic system can prevent double-spending and fraud. This issue was resolved with the underlying technology called Blockchain, a secure, digital ledger system, which is also used in all emerging cryptocurrencies known as Altcoins. It was created by Satoshi Nakamoto to ensure the anonymity and to protect the legitimacy of every Bitcoin transaction. Blockchain will be explained further in following sections.

1.2. DEFINITION OF CRYPTOCURRENCIES AND THE EMERGENCE OF ALTCOINS

Before going any further, some current definitions of cryptocurrency must be mentioned. Most sources define 'cryptocurrency' as its name suggests, a digital currency. For example, Oxford Dictionary defines it as *"A digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank."[4]* Investopedia describes cryptocurrency as, *"a digital or virtual currency that uses cryptography for security. A cryptocurrency is difficult to counterfeit because of this security feature. A defining feature of a cryptocurrency, and arguably its most endearing allure, is its organic nature; it is not issued by any central authority, rendering it theoretically immune to government interference or manipulation."[5]* Even though most sources

---

[2] <https://masterthecrypto.com/evolution-cryptocurrency-problem-money-today/> [5th April 2018]
[3] Virdi, D., Seoyoung , K. and Sarin, A. (January 2018) *Crypto-Assets Unencrypted*. Santa Clara University.
[4] < https://en.oxforddictionaries.com/definition/cryptocurrency> [5th April 2018]
[5] <https://www.investopedia.com/terms/c/cryptocurrency.asp#ixzz5CSiAnCU4 > [6th April 2018]

define it as a currency, there are many skeptics that argue that as it is not widely accepted as a medium of exchange, cannot store value due to its volatility, and cannot be used as a unit of account, 'currency' is a misnomer. Debates are currently still taking place as to how cryptocurrencies should be defined; some say currency, others say asset class, whereas others say commodity. All of these options will be discussed in upcoming sections. Nonetheless, the following are characteristics of most cryptocurrencies:

- **No need for trust** – as previously mentioned, Cryptocurrency removes this need to trust a third party by incentivizing every actor in the network to not commit fraud since it is very difficult to do, and the user would be banned from executing other transactions.

- **Decentralization** – with cryptocurrencies no individual or group can affect the supply or influence the currency in any way without the prior approval of the majority.

- **Immutability** – with fiat currencies, people must refer to the transaction history available from their online banking accounts to verify that their money is still there or has been debited in the correct amount. This implies that we are confident our bank is being honest and not manipulating the transactions. The encrypted nature of cryptocurrencies makes it extremely difficult to change or manipulate the transaction ledger as it would require that the majority of network users approve the change.

- **Volatility** – the volatile prices of cryptocurrencies have been in the headlines for a while now. Bitcoin and Altcoins are relatively new and misunderstood compared to fiat currencies. Since cryptocurrencies are still not widely accepted as a medium of exchange, its value is not defined by the value of the goods or services it can be exchanged for but by the value of the fiat or other cryptocurrencies it is exchanged for, in order to obtain liquidity. In other words, volatility is increased because instead of pegging its value against a hard asset, it is pegged to other volatile currencies. Reasons for this volatility will be discussed further in another section.

- **Security** – Establishing trust in a digital financial system is of vital importance to the success of cryptocurrencies. Many people fear technology and feel vulnerable to cyberattacks. Moreover, cryptocurrencies use wallets which require users to store addresses for receiving new units and stores the secret passwords for approving any transaction. Technically, the users' funds are safe as long as they have access to their wallet. This might not always be the case as there is a possibility that a third-party off-site might steal your coins. There are some people who feel uncomfortable with this aspect. Moreover, some wallets can be left online in cryptocurrency exchanges, but this is not recommended as they are more easily targeted by cyber attackers. Those who do not understand how Blockchain works, fear that data can easily be deleted. Since cryptocurrencies are distributed across a chain of blocks, to destroy one block you must destroy all of

them. Once the transactions are added to the public ledger, they have to be confirmed by other nodes. As more blocks are added to the chain, for all to see, tampering with them, or deleting them is nearly impossible. Blockchain ensures the legitimacy of all transactions.

- **Mining** – new units are created through the process of mining. Most cryptocurrencies use the system of proof-of-work for mining new units. Miners compete in solving a difficult computational problem and the winner obtains the right to mine new units or new coins. [6]

- **Anonymity (more like Pseudonymity)** – identities of users are protected. Transactions do not include names but public addresses which cannot easily identify the user. Anonymity is not 100% guaranteed as there are ways to attempt identifying a person with the public address.

  Since the ledger is public, all addresses involved in transactions can be seen but it is extremely difficult to establish connections between a specific person and a given address by just looking at the information in the ledger.

- **Divisibility** – cryptocurrencies are extremely divisible. It can be divisible up to 18 decimal places. The more you divide fiat currency, the less portable it becomes as it decreases in value but takes up more space (pennies for example).[7] Satoshi's, which are the smallest unit of Bitcoin, is still portable.

- **Portability** – unlike fiat currencies, cryptocurrencies are extremely portable due since they are stores in the cloud. However, to access them, WIFI or mobile data connection and an application are required.

- **Uniformity** – all units of cryptocurrencies are identical to each other. No one can tell a Bitcoin apart from another Bitcoin. Some cryptocurrencies can have serial numbers to indicate authenticity, but they are all interchangeable.[8]

- **Instant transferability** – Although different cryptocurrencies have different transaction speeds, all of them are considerably fast. Blockchain transactions are being validated 24/7 which implies that most of them process in seconds, while some can be processed in a few hours at the most. This wait is nothing compared to the 3-5 business days cross-border transactions usually take in traditional banking systems. However, BTC transaction speed has not always been so fast due to capacity issues. Also, average credit card transaction per second is much higher (Visa for example). There are several factors affecting transaction speeds such as the current average fee, current volume of transactions, and the type of transaction included in the block. The transaction speed varies among the different cryptocurrencies. See the following chart which compares the average transaction times[9]:

---

[6] <http://www.blockfortune.com/2017/07/characteristics-of-cryptocurrencies/> [8th April 2018]
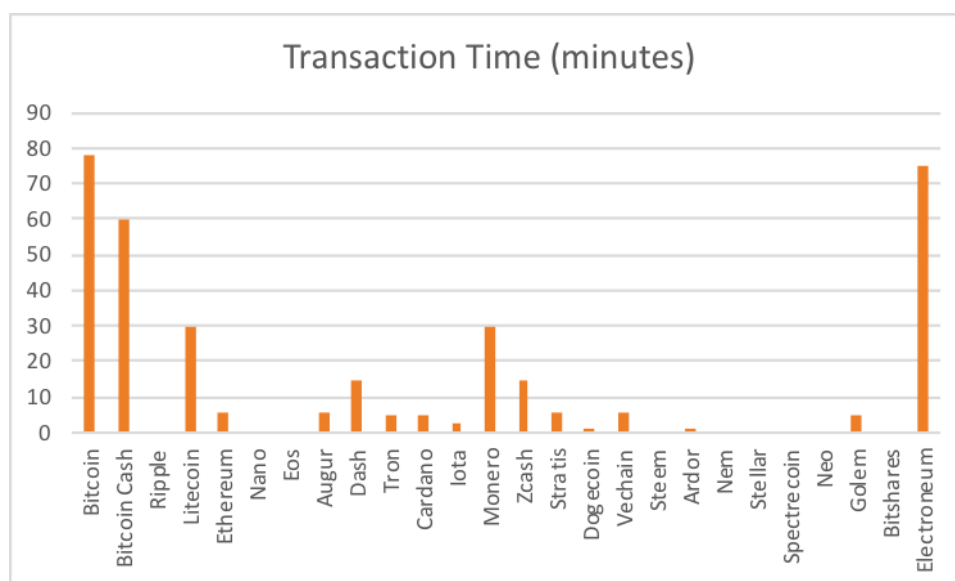[7] <https://masterthecrypto.com/evolution-cryptocurrency-replacing-modern-cash/> [5th April 2018]
[8] <https://masterthecrypto.com/evolution-cryptocurrency-replacing-modern-cash/> [5th April 2018]
[9] <https://www.abitgreedy.com/transaction-speed/> [14th May 2018]

Transaction Time (minutes)

Source: A Bit Greedy

With the proven viability and open source of Bitcoin, more cryptocurrencies are emerging as an alternative to the traditional financial system. These new cryptocurrencies are known collectively as Altcoins. Initial coin offerings have surged to a point of surpassing venture capital funding and other types of early-stage funding.[10]

1.3. HOW DOES BLOCKCHAIN WORK?

Blockchain is a decentralized, permanent and public ledger of records. These records are individual segments called blocks, which are linked and secured using cryptography through a process called mining. Although there are two different methods for mining (Proof of work and proof of stake), this paper centers on the proof of work method.

The Blockchain is a decentralized, permanent and public ledger of records. It records all transactions, network actors and every single piece of data that has been input into the network. [11]These records are individual segments called blocks, which are linked and secured using cryptography through a process called mining. Mining can be done using two consensus methods: the proof-of-work (*"where the algorithm rewards miners who solve mathematical problems with the goal of validating transactions and creating new blocks"*)[12] or the proof-of-stake (*"the creator of a new block is chosen in a deterministic way, depending on its wealth, also defined as stake"*)[13]. However, the most common, so far, is proof-of-work (Bitcoin uses SHA-256 for the proof of work. SHA stands for Secure Hash Algorithm). The aim of the miners is to provide all the network actors with cryptographic proof for the block in order to verify its validity and ensure the legitimacy of the transactions. The Blockchain is growing continuously as new blocks, composed of the most recent transactions, are being added in chronological order. Each transaction and each block contain cryptographic hashes

---

[10] <https://masterthecrypto.com/evolution-cryptocurrency-problem-money-today/> [5th April 2018]
[11] <https://www.investopedia.com/terms/b/Blockchain.asp#ixzz5CWbL3zQ1> [6th April 2018]
[12] < https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/> [17th April 2018]
[13] <https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/> [17th April 2018]

which are meant to help identify each block and provide a clue to the identity of the following block. A hash is produced by a hash function, which refers to a math equation that reduces any amount of text or data to 64-character string. Every time you input the same exact data through the mathematical hash function, the output will be the same 64-character string. But if you change even the smallest detail, the 64-character string changes entirely. This hash function makes it extremely difficult to tamper with a transaction or a block. Each block included a hash of the previous block and therefore, if a previous block is tampered with, the hash for the following block would have to change. Therefore, this means that all blocks are connected and there is no way of tampering with the ledger or with data in a block without rendering all the other blocks in the chain invalid as well.

To better explain how Blockchain works, all actors in the Blockchain network must be listed and described. There are three types of non-exclusive actors in the Blockchain network:

- **Users**: are those that transact in and own cryptocurrencies, but users can also be a node and/or a miner.

- **Nodes:** are the machines that are connected to the network and verify the transactions.

- **Miners**: are those that create and add new blocks to the Blockchain. Miners are those that decide to include the transactions into a block. Once this is done, and other blocks are added on top of it, it is said to be confirmed.

Every transaction begins with the user inputting the wallet addresses for both the sender and the receiver of the funds as well as the amounts transferred. The wallet addresses are each user's public key. Additionally, in order to send funds, the sender must also approve the transaction using a private key. Together, the public and private keys make up a digital signature. With the transaction details as well as the private key, the transaction is sent to the network for validation before being added to the Blockchain. Nodes validate transactions by running the inputs form the transactions into the mathematical hash function to confirm the output is exactly the same. If the output does not match, this means inputs do not match and there has been either an error or an attempt of fraud. In this case, the transaction is ignored. However, the cryptocurrency network functions properly because network nodes must reach a consensus with regards to the balances and transactions. If the output matches, the transaction is validated and is included in a block of transactions by a miner. Miners are those that decide to include the transactions into a block. Once this is done, and other blocks are added on top of it, it is said to be confirmed.

Blockchain network actors perform checks and balances on each other, which makes attempts of fraud very difficult. Also, there are incentives put in place to avoid fraud on behalf of the actors.
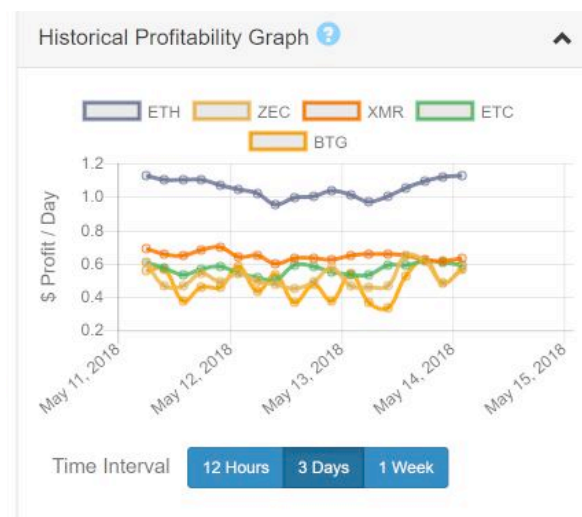
As previously mentioned, miners confirm each transaction. Miners are profit-maximizing. Miners must buy expensive computers and absorb larger electricity costs in order to create new blocks. Because of the additional risks they undertake, they are

rewarded with both a block reward and transaction fees charged when a transaction is confirmed. When miners discover a new block, they are given a pre-determined fixed amount (depending on the rules of the underlying cryptocurrency). Some cryptocurrencies, such as Bitcoin are non-inflationary and have a limited supply, so the block reward decreases in time. Miners add 'liquidity' to the cryptocurrency Blockchain. Moreover, transaction fees are paid by the users in order to get their transactions confirmed and added to the Blockchain. This fee is a similar concept to typical payment processing fees.[14]

Mining cryptocurrencies can be very lucrative. However, profitability depends on the costs which in the case of mining can be significant as well. There are different ways of mining cryptocurrencies such as using CPUs ,GPUs or using ASICs. As stated in Investopedia, *"GPU (Graphic processing unit) is a processing device within computers and is in charge of graphics-intensive tasks such as video editing, gaming display, and decoding and rendering of 3D videos and animations."[15]* Initially, crypto mining was done with central processing units in computers. However, CPU's had limited processing speed and higher consumption of power which made them more inefficient than mining with GPUs. GPUs can perform repetitive computations in a much faster way.

New devices have emerged such as Field Programmable Gate Arrays (FPGA's) and Application Specific Integrated Circuits (ASICs) which perform better than GPUs in mining calculations and are more cost efficient. ASIC processors have been engineered with the sole purpose of computing hash SHA-256 and do so in a much more efficient way. As you can see, SHA-256 profitability is much higher than GPU profitability. ASICS are used to mine Bitcoin and Bitcoin Cash.

The following chart graphs the GPU profitability of some cryptocurrencies [16]:

Source: My Crypto Buddy

---

[14] <https://cointelegraph.com/bitcoin-for-beginners/what-are-cryptocurrencies#how-to-buy> [17th April 2018]
[15] < https://www.investopedia.com/tech/gpu-cryptocurrency-mining/#ixzz5FQ4Gsm53> [17th April 2018]
[16] <http://www.mycryptobuddy.com/GPUProfitability> [15th May 2018]

The following chart graphs the SHA-256 profitability[17]:

Source: My Crypto Buddy

Although the incentive for miners is monetary, the incentive set in place for nodes is not. Security is what incentivizes nodes. If a user does not run a node, it relies on the information granted by other nodes to verify the legitimacy of a transaction. Also, if a node confirms a fraudulent transaction it will be banned from the network of honest and trusted nodes therefore it would lose its value in a network whose functionality depends on the validation of others. When it comes to users, they are not immune to cyberattacks and scams. What cryptocurrency provides users is more control and transparency over their funds and the decreasing probability of not being defrauded by third parties. If fraudulent transactions are submitted into the network, the users can perform a hard fork as well and remove their value from the Blockchain. However, since the remuneration of miners depends on the blocks they confirm and add to the system, they would never allow someone to invalidate a portion as it would invalidate the entire chain. Invalidating the entire chain would mean that the transactions carried out no longer exits.

According to Satoshi Nakamoto, the creator of Blockchain, *"The incentive may help encourage nodes to stay honest. If a greedy attacker is able to assemble more CPU proof-of-worker than all the honest nodes, he would have to choose between using it to defraud people by stealing back his payments or using it to generate new coins. He ought to find it more profitable to play by the rules, such rules that favor him with more new coins than everyone else combined, than to undermine the system and the validity of his own wealth."[18]*

---

[17] <http://www.mycryptobuddy.com/SHA256Profitability> [15th May 2018]
[18] <https://masterthecrypto.com/what-is-cryptocurrency/> [5th April 2018]

2. ANALYSIS OF THE MAIN EXISTING CRYPTOCURRENCIES

Since the launch of Bitcoin in 2009, many cryptocurrencies have been released and currently there are more than 1,500 trading coins and many others unlisted. The number of existing cryptocurrencies is still growing, but the most important according to their market capitalization as of April 12th 2018 are Bitcoin (BTC), Ethereum (ETH), Ripple (XRP), Bitcoin Cash (BCC/BCH), Litecoin (LTC or Ł), and EOSIO.

In this chapter, we are going to analyze some of the main characteristics of the major existing cryptocurrencies and how they have evolved, as well as the viability and potential impact of sovereign cryptocurrencies.

- **Bitcoin ("BTC")**

  Bitcoin is, as described in its website, "*a consensus network that enables a new payment system*" that works as a "*decentralized peer-to-peer payment network that is powered by its users with no central authority or middlemen[19]*". Not only does Bitcoin refers to the technology that allows users do these secure payments but also to the currency used in those payments.

  Bitcoin (BTC) is currently the dominant cryptocurrency with almost 17 million BTC units in circulation - with a maximum cap of 21 million BTC units- and a market capitalization of approximately $141 USD billion (as of May 19th 2018).

  Bitcoin has attracted the attention of investors during the last months, as its trading increased a lot during the year 2017. This cryptocurrency reached its peak back in December 2017, when one Bitcoin was equivalent to $19,511 USD[20]. Since then, Bitcoin has decreased its price by 58%, being its current price around $8,240.73 (as of May 18th 2018) as shown in the following chart:
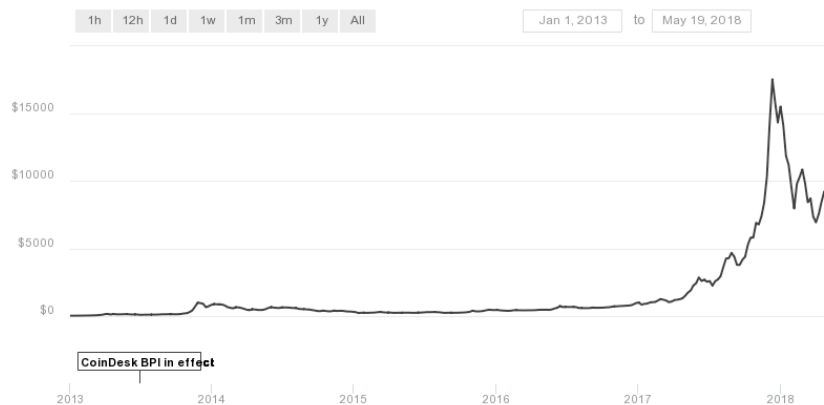
  Source: CoinDesk

  Bitcoin, as a first-mover, may easily become the dollar equivalent in the cryptocurrency world when it comes to convert one currency to another. Actually, it is currently playing a major role by being a readily converted to other cryptoassets. But, is Bitcoin the strongest player in this game? As we will below,

---

[19] <https://bitcoin.org/en/faq#what-is-bitcoin> [17th April 2018]
[20] <https://www.bloomberg.com/news/articles/2018-04-09/bitcoin-seen-popping-like-the-greatest-bubbles-by-bofa> [17th April 2018]

Bitcoin is technically weaker than its competitors when it comes to scalability, the speed of transaction processing, or transaction costs among other factors.

- **Ether ("ETH")**

Ether is the currency used within Ethereum and it is described as the necessary "fuel" to operate in its platform. Ethereum is an open-source Blockchain platform that allows developers to build their own decentralized applications with this Blockchain technology. It is more flexible and can be used for many more things than Bitcoin as it is quite easy to create new (and safe) applications using this technology.

The way Ethereum works is similar to the Bitcoin system as it keeps record of the whole transaction history. The point is that not only do they store the ether transaction but also information of the most recent status of smart contracts. But, what is a smart contract?

Smart contracts can be defined as self-executing contracts in which the parties involved establish the terms of the agreement using lines of code. Once certain circumstances or actions reflected in the contract take place, the smart contract produces all its effects automatically without the intervention of any other third party. In order to clarify this concept, here are some examples of what smart contracts are.

Case A. Imagine there is one individual that wants to settle an agreement with a company that offers him its digital products. Then, both parties agree that there will be a weekly payment for those products and they will be delivered when the company receives all the funds. How would we instrument this transaction using a smart contract? The payment schedule would be introduced in the smart contract and the payments will be produced automatically and once the company has received all the agreed funds, its digital products will be automatically transferred to the buyer. Nonetheless, Smart Contracts would be complemented with an oracle, an external agent that searches and verifies that certain facts have occurred in real life -payments, weather conditions, the price of oil in a certain date- and put that information in the block so that the smart contract protocol takes it into account. By using an Oracle, both parties can acknowledge that an event has certainly taken place.

Case B. A group of artists decides to create a song and puts it online so that people can buy it. Then, they create a smart contract in order to: a) transfer the song to the customer, b) receive the payment from the customer, and c) divide those funds among the artists that collaborated in the creation of the song. All these actions would automatically take place without the intervention of any intermediary as the smart contract would produce its effects right after the agreement of the different parties involved.

As we can see, there is a huge variety of uses for smart contracts as they can be complex enough to allow us to perform many different transactions such as transfers of assets, crowdfunding, or receiving/providing insurance services at a

lower cost as there is no intermediary nor third party involved such as lawyers or banks—even though they can be complemented with an oracle— and with a highly-secured protocol thanks to the use of the Blockchain technology.

What is the main role that Ether plays in this platform? As it has been mentioned before, Ether is the fuel that helps this platform work. This cryptocurrency was not created to serve as a medium of exchange but as a way to implement smart contracts using the Blockchain technology behind the Ethereum platform.

Despite the value of its currency, Ethereum is more valuable for "*its increased utility and ability to eventually eliminate third parties' involvement in determining contractual obligations[21]*".

Regarding its weaknesses, Ethereum can hardly support 15 transactions per second, a really low number in comparison with other cryptocurrencies like XRP or Visa. This issue, combined with the increasing number of demanded transactions, is challenging Ethereum and its developers to work on a better version of this technology. Actually, they will implement the Casper in 2018 or 2019 to shift from a proof-of-work to a proof-of-stake protocol in order to improve.

Probably, one of the main problems of Ethereum, as pointed out by Roberto García Mora during a meeting we held back in May 16th 2018, is its price volatility. As in the case of Bitcoin and other cryptocurrencies, Ethereum prices have suffered many variations during the last year. It reached its peak in January 14th 2018 ($1,362 USD) and fell more than 80% in 4 months ($370 USD was its price back in April 6th 2018). Nonetheless, its price is increasing again and has almost double in one month, reaching $694 in May 18th 2018. All this speculation and price variation might affect Ethereum potential as one of the most promising projects in the market at the moment.

Source: CoinDesk

- **Bitcoin Cash**

  Bitcoin itself has split into two cryptocurrencies (Bitcoin & Bitcoin Cash) in order to increase the size of blocks (up to 8MB instead of just 1MB per block) and,

---

[21] D'Alfonso, A., Langer, P. and Vandelis, Z. (October 2017) The Future of Cryptocurrency. An Investor's Comparison of Bitcoin and Ethereum. Ryerson University.

therefore there would also be an increase of the processed transactions. This splitting process is known as hard fork, as those blocks subjected to the previous versions of the software will not be recognized as a valid block by the latest version of the software. Therefore, Bitcoin Cash transactions cannot be replicated in the Bitcoin chain and vice versa.

Another example of hard fork is Bitcoin Gold, which resulted in another cryptocurrency that focused on changing the mining system (from ASIC to GPU). With Bitcoin Gold the process of mining is decentralized with a system that allows anyone with an ordinary laptop or computer to do so -instead of a system based on groups of powerful, industrialized miners that control the mining process of Bitcoin-.

- **Ripple ("XRP")**

  The Ripple project is older than Bitcoin itself, as its creator, Ryan Fugger, started it back in 2004. It is basically a real-time settlement system created by the Ripple company, but its network can operate without the intervention of the enterprise behind it. Ripple has the validation of many major banks and institutions that adopted it as their settlement system -Santander, UBS, or UniCredit- due to the fact that the Ripple system does not only support XRP payments but other tokens such as any domestic currency (USD, EUR,…), cryptocurrency, commodity, or unit of value.

  One of the main advantages of Ripple is how fast payment settlements are done. Within 4 seconds, XRP payments are settled, which is way faster than ETH (more than 2 minutes), BTC (more than 10 minutes), or any other traditional system. Scalability is also one of the main strengths of Ripple, as it handles 1,500 transactions per second and their creators stated that it "*can scale to handle the same throughput as Visa*[22]".

  In general, Ripple offers financial freedom and privacy to their users, as well as low fees and many innovative features regardless borders.

  Regarding its cryptocurrency, unlike Bitcoin, XRP uses "*a common ledger that is managed by a network of independently validating servers that constantly compare transaction records*" that "*doesn't rely on the energy and computing intensive proof-of-work used by Bitcoin. Ripple is based on a shared public database that makes use of a consensus process between those validating servers to ensure integrity*[23]". Instead of being a Blockchain-based cryptocurrency, Ripple uses a Hash Tree to keep record of the transactions and to ensure its payment system.

  The current total number of XRP is around 100 billion units and they are distributed in the following way:

---

[22] <https://ripple.com/xrp/> [23rd March 2018]
[23] <https://bitcoinmagazine.com/guides/what-ripple/> [23rd March 2018]

	Number of XRP	% of Total
Held by Ripple	7.097.884.501	7,10 %
Distributed	39.094.520.623	39,10 %
Placed in Escrow	53.800.000.024	53,80 %

Source: Ripple.com

Ripple's market capitalization is $26.696 billion USD as of May 19th 2018, reaching its maximum on January the 4th 2018 when the price of Ripple was as much as $3,45 USD, around 5 times its current value ($0.68 USD per XRP as of May 19th 2018):
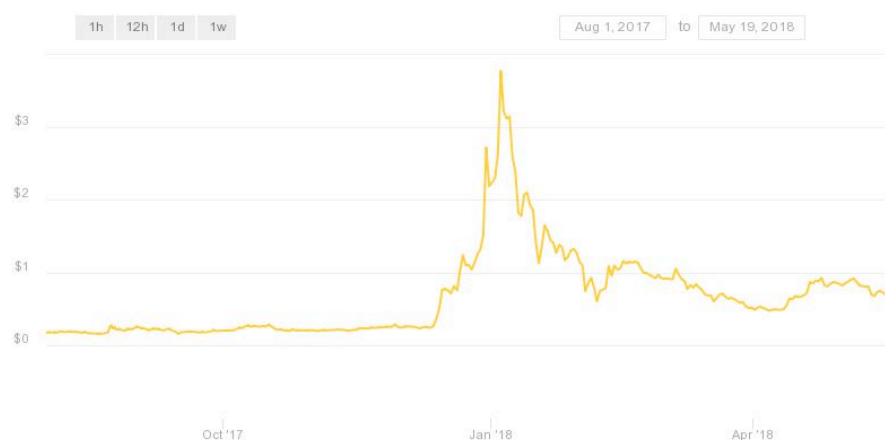
Source: CoinDesk

As the price of Bitcoin astonishingly increased during 2017, the fear of missing out made some cryptocurrencies like Ripple become attractive to investors. But, why did it dramatically dropped from January the 4th onwards? There were rumors about XRP to be included in the CoinBase's Digital Asset Framework, which is a list that highlights the digital cryptocurrencies and tokens that CoinBase thinks will do good in the future. But right after the announcement on January the 4th 2018 that this, nor any other currency, would be included on the list, the price of XRP dropped.

- **Dash**

  In January 2014, Dash -formerly known as Xcoin or DarkCoin- was launched, following the Bitcoin path.

  Dash brags about being a completely decentralized system that provides their users more privacy, not allowing any other user to see other transactions and other users' account balances.

14

- **Litecoin ("LTC" or "Ł")**

  Litecoin was launched in late 2011 by a former Google employee, Charlie Lee, and it is quite similar to its predecessor Bitcoin not just technically, but also when it comes to its purpose.

  Litecoin is also a peer-to-peer cryptocurrency and open source software that uses the Blockchain technology to process transactions even though it is slightly different from Bitcoin because it can process a transaction in 2.5 minutes (four times faster than Bitcoin) and the devices that are capable to carry out the mining process in Litecoin are more expensive and complicated to create.

- **Sovereign cryptocurrencies**

  Some major economies like the US, China, Russia, Japan[24], Sweden, or Uruguay (ALSO UK)are studying or even testing the possibility of issuing their own cryptocurrencies -or at least they are starting to be interested in the topic-, while other players have already started their own crypto-adventure -Venezuela, for instance-.

  In the case of the United States, as stated by the Federal Reserve Bank of New York President, William Dudley, *"it's really very premature,* [...] *the Federal Reserve offering digital currencies, but it is something we are starting to think about*[25]*"*. Those declarations took place amidst the Bitcoin astonishing momentum back in November 2017, therefore it is quite unclear if the Federal Reserve's cryptocurrency project is still in progress or not.

  China's Central Bank seems to have gone one step forward, as it was reported back in June 2017 that it was testing a prototype of cryptocurrency by carrying out transactions with other Chinese retail banks and there is also evidence that they will eventually introduce a digital currency but the implementation of this strategy is uncertain[26].

  The Russian government has been more explicit when it comes to defining it cryptocurrency strategy even though its implementation date is still unknown. It was in October 2017 when Vladimir Putin announced that Russia would launch its own cryptocurrency: the CryptoRuble. Despite the political reasons behind, the CryptoRuble will not be subject to mining and it will be under the control and surveillance of the Russian government[27].

  In the case of Europe, countries are more concerned about implications of current existing cryptocurrencies and how to monitor them rather than issuing domestic cryptocurrencies, even though some countries are interested in launching their

---

[24] <https://www.cnbc.com/2017/09/27/japanese-banks-cryptocurrency-j-coin.html> [23rd March 2018]

[25] <https://www.bloomberg.com/news/articles/2017-11-29/count-new-york-fed-s-dudley-among-the-bitcoin-skeptics> [23rd March 2018]

[26] <https://www.technologyreview.com/s/608088/chinas-central-bank-has-begun-cautiously-testing-a-digital-currency/> [23rd March 2018]

[27] <https://cointelegraph.com/news/breaking-russia-issuing-cryptoruble> [23rd March 2018]

own crypto such as Estonia, which would ally with Ethereum's creator in order to issue the 'Estocoin'[28].

Regardless the position of the above-mentioned countries on cryptocurrencies, other countries have already issued their own domestic cryptocurrency. The most controversial and notorious case is the Petro, the Venezuelan cryptocurrency that was launched in February 2018 and that is backed up by oil and other mineral resources[29]. Not only did Venezuela launched Petro, but also announced they were going to launch the Petro Gold, a gold-backed crypto.

Many uncertainties surround the Venezuelan cryptocurrency. The price of the Petro would be determined by the Venezuelan Government. In fact, the Petro, unlike Bitcoin, is completely centralized by the Venezuelan authorities. The point is that the launching of Petro has been seen as an attempt to obtain financing in a moment in which oil prices and production has been declining, Venezuelan inflation rate is nearly 2,400.00% in 2017 alone and is expected to soar up to 34,000.00% this year[30], and the US has imposed new restrictions on dealings with Venezuelan debt[31].

Despite the case of Petro, governments would still be interested in launching their own cryptocurrencies in order to maintain control and monitor economic activity. As governments would track the existing number of cryptocurrencies that has been issued and every transaction that is being made, the possibility of creating their own cryptocurrency in order to apply its monetary policy and ensure financial stability is quite appealing if eventually general public adopts private cryptocurrencies.

They point is that governments are not keen on issuing a cryptocurrency that is based on a decentralized system as they would like to monitor its activity. That is why in case of launching their own cryptocurrencies, they would base them in a centralized system. Then sovereign cryptocurrencies might become a powerful too in order to avoid tax fraud, fighting against money laundering, or even preventing the financing of illegal activities -terrorism, black market...-. However, in that case some people might oppose it because of privacy issues and extreme government control on transactions.

---

[28] <https://www.cnbc.com/2017/08/23/estonia-cryptocurrency-called-estcoin.html> [23rd March 2018]

[29] <https://www.nytimes.com/2017/12/03/world/americas/venezuela-cryptocurrency-maduro.html> [23rd March 2018]

[30] <https://www.bloomberg.com/news/articles/2018-01-25/imf-sees-venezuela-inflation-soaring-to-13-000-percent-in-2018> [23rd March 2018]

[31] <https://www.gtlaw.com/en/insights/2017/8/us-imposes-additional-sanctions-against-venezuela> [23rd March]

3. CATEGORIES AND FUNCTIONALITIES. DIFFICULTIES REGARDING VALUATION

It is important to bear in mind that not all cryptocurrencies serve or have been created for the same purpose and, as previously detailed several types of cryptocurrencies with different functionalities exist.

Therefore, depending on the intention of the issuer of the cryptocurrency we can distinguish the following broad cryptocurrencies categories:

- **As a medium of exchange** → for example, Bitcoin.

- **As a contractual right to transact on a future or existing protocol** → for example, Ether.

  It is important to mention that this particular category of cryptocurrencies may involve an Initial Coin Offering (ICO). Specifics of a particular ICO can vary but, in general, in this type of operations a new cryptocurrency token is offered to the public (is similar to an IPO in the stock market) and some benefits for their holders are attached to it. However, this token does not usually provide their holders with ownership rights.

  The holders can make some benefits by selling the tokens they have, if their value increases in the market, or the token can confer them the right to use them in the platform or service being developed under the framework of a certain cryptocurrency.

  Another example of a utility token created to use a platform to provide services is Filecoin, which is an opensource cryptocurrency that was designed to facilitate the sharing of computer storage. You pay in Filecoin for the right to store your data on someone else's computer using FIL, the Filecoin token. Filecoin has been able to solve a problem, reliable storage of data, at competitive prices and has created a scalable market for storage. Unlike mass cryptocurrencies like Bitcoin, we can hereby certify that utility tokens have specific uses, which is where all their value comes from.

- **As a security providing cash flow claims** → for example, Blockchain Capital is a Venture Capital fund that raised money this way.

- **As a symbolic gesture or statement** → for example, the FOMO (Fear of Missing Out) Coin.

3.1. CRYPTOCURRENCIES AS A REAL CURRENCY

By its denomination, it could be easy to assume that cryptocurrencies are, in fact, a real currency. However, which are the characteristics or features it has to comply with to fit into this category?

Academics and central banks, including the ECB[32], have usually attributed the following functions to what is considered as money or a real currency:

---

32 <https://www.ecb.europa.eu/explainers/tell-me-more/html/what_is_money.en.html > [4th April 2018]

- **Medium of exchange** – in order to be able to buy things.

  We can find several definitions of what a medium of exchange is, for example, *"an intermediary instrument used to facilitate the sale, purchase or trade of goods between parties. For an instrument to function as a medium of exchange, it must represent a standard of value accepted by all parties. In modern economies, the medium of exchange is currency"[33].*

  In this sense, taking into account the varied features and categories we can identify amongst the different existing cryptocurrencies, many of them do not fit within this category, as they cannot be used by its holder as a medium of exchange for acquiring different products or services.

  On the contrary, Bitcoin, Ether, Litecoin, Dash are examples of cryptocurrencies that can be currently used for acquiring goods or services.

  However, the fact that a certain cryptocurrency cannot be currently used as a medium of exchange does not imply that it would not become one in the future. A currency needs first to have value in order to be able to be spent as a medium of exchange. Therefore, if cryptocurrencies acquire this value (for which they will have to overpass the volatility phase they are currently experiencing) they could be used as a medium of exchange.

- **Store of value** – for saving.

  Store of value can be defined as *"any form of wealth that maintains its value without depreciating"[34]*. In particular, for financial assets *"it usually means retaining similar levels of purchasing power"[35]*.

  This feature is particularly important to make people confident with the idea of holding cryptocurrencies. If people have them in storage, they need to have some level of certainty about the idea that they are not going to become worthless or stolen.

  High price volatility is a common characteristic that existing cryptocurrencies have been lately experiencing. For instance, the changes in the price of Bitcoin were particularly relevant during the year 2017.

  The following chart shows a comparative analysis between daily (%) price volatility (in USD) of several a) major cryptocurrencies (Bitcoin, Ether and Litecoin), b) commodities (silver and gold) and c) fiat currencies, from 2013 to December 2017:

---

33 <https://www.investopedia.com/terms/m/mediumofexchange.asp> [4th April 2018]
34 <https://www.investopedia.com/terms/s/storeofvalue.asp> [6th April 2018]
35 <https://cryptofundamental.com/cryptoasset-fundamentals-considering-store-of-value-arguments-da5f6a3e877b> [9th April 2018]
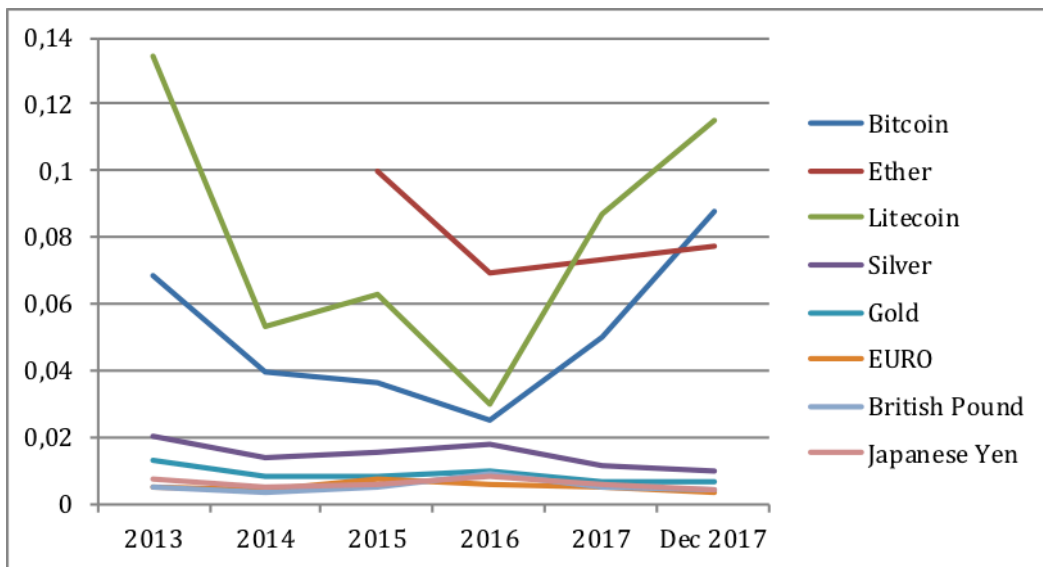
Source: Virdi, D., Seoyoung , K. and Sarin, A. (January 2018) Crypto-Assets Unencrypted. Santa Clara University.

Analyzing the chart we can observe the following:

- Within the analyzed assets, cryptocurrencies are far more volatile than commodities and fiat currencies.
- Variance in volatility for cryptocurrencies is quite extreme and, in particular, in comparison with commodities and cryptocurrencies in which it is quite stable within a narrow range.
- Bitcoin and Litecoin volatility has increased recently; therefore this phenomenon is not being reduced.

Reinforcing this analysis, the following chart shows daily volatility (%) for the end of the year 2017/beginning of the year 2018 for Bitcoin and other assets such as WTI (West Texas Intermediate – *"underlying commodity of the New York Mercantile Exchange's oil future contracts"*[36]), Silver, Gold, S&P 500, EUR/USD and Treasury Bills:
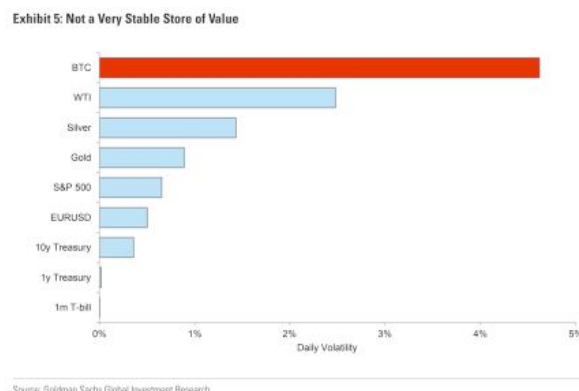
Source: Goldman Sachs Investment Research

Again Bitcoin daily volatility largely exceeds the one experienced by the rest of the assets.

---

36 <https://www.investopedia.com/terms/w/wti.asp> [9th April 2018].

There are various reasons for this price volatility. The following issues are some of which contribute to increase cryptocurrencies volatility:

- **Lack of intrinsic value** – most cryptocurrencies do not generate a return per se so it is difficult to value them. Therefore, holders do not have certainty whether they are overpaying or underpaying for them and, at the end, they depend on market sentiment.

- **Short term investment** – cryptocurrencies investors are usually early adopters, used to technological devices, which are constantly monitoring their investments, are more willing to take risks and do not think about it as a long term investment.

- **Lack of participation from institutional investors** – in connection with the abovementioned reasons, the lack of intrinsic value keeps away institutional investors from this type in product (apart from some specific hedge funds or venture capitalists) and cryptocurrencies should trust in individual investors, which are characterized by a shorter investment horizon.

  However, institutional investors are starting to invest in cryptocurrencies and, as mentioned in following paragraphs, in two of the world's largest future exchanges (the Chicago Board Options Exchange (CBOE) and Chicago Mercantile Exchange (CME), Bitcoin futures are traded; so institutional investors are able to hedge their investments.

- **Lack of regulation** – this situation creates uncertainty amongst holders, for example regarding security, market manipulation, taxation …

- **Lack of knowledge / understanding** – many investors do not really understand the technology or features of the product they are investing on and are quite sensitive to expectations or even news about the behavior of cryptocurrencies. This can also lead to herd behavior with an excess of euphoria or catastrophe sentiment which can be reserved in a short period time.

The analyzed high level of volatility is probably the most important obstacle cryptocurrencies are facing while analyzing its capacity as a medium for store of value. However, cryptocurrencies are also facing additional risks and, in particular, security issues can also diminish this capacity if cryptocurrencies holders have any kind of doubt regarding their safe storage.

- **Unit of account** – for pricing and being able to valuate the cost of goods.

  A unit of account can be defined as *"the unit in which goods and services are priced in a certain country"*[37].

  The relevance of this feature arises from its capability to enable economic agents to make decisions based on this measure.

---

37 < https://www.telegraph.co.uk/investing/news/can-bitcoin-cryptocurrency-actually-work-money/> [4th April 2018].

In the opinion of Garrick Hileman, who holds positions at the London School of Economics and University of Cambridge and is a specialist in monetary systems, this is where cryptocurrencies *"really fall down"*. He also states: *"The unit of account sets how we think about money – most people don't like to think in more than one currency"*.[38]

In addition, this feature is closely related to the volatility and, as previously discussed, cryptocurrencies volatility is an issue, and thus it also affects their consideration as a unit of account.

As a conclusion, we could determine that most of the existing cryptocurrencies cannot be nor would be considered as a real currency. Some of them may become a viable decentralized alternative to existing currencies, but they will have to overpass many problems, some of them intrinsic to them, such as the high volatility or the technical ability to process a large number of transactions in a short period of time, but other related to the external factors, for example, legal issues or investors trust.

Provided they overpass these difficulties, in developed countries the shift from fiat currencies to cryptocurrencies would not be easy, due to the characteristics that these currencies offer: transaction costs are becoming very low, exchange rates and inflation are quite stable and there are not many government restrictions for holding foreign currencies.

However, Jeff Currie, Goldman Sach's Head of Global Commodities Research states that cryptocurrencies could effectively solve the problem of store wealth outside of the banking system in non-developed markets or dark markets. While, in his view, in regulated markets, gold remains superior as a store of value mechanism.

3.2. CRYPTOCURRENCIES AS SECURITIES, COMMODITTIES OR A NEW ASSET CLASS.

Taking into account the abovementioned considerations, if cryptocurrencies are not a currency, how can we define them?

There are varying opinions on this matter. For example, in the U.S., public institutions do not have a common consensus. The Internal Revenue Service (IRS) by its IRS Notice 2014-21, is treating cryptocurrencies, since the year 2014, as property and not as a currency (taxable events are selling cryptocurrencies, trading for another cryptocurrency or purchasing something with them).

The U.S. Securities and Exchange Commission (SEC) is increasing its scrutiny over cryptocurrencies as securities and, recently, they have included in it companies involved with trading. The SEC recently stated *"If a platform offers trading of digital assets that are securities and operates as an 'exchange,' as defined by the federal securities laws, then the platform must register with the SEC as a national securities exchange or be exempt from registration"*[39].

---

38 <https://www.telegraph.co.uk/investing/news/can-bitcoin-cryptocurrency-actually-work-money/> [6th April de 2018].
39 <https://www.sec.gov/news/public-statement/enforcement-tm-statement-potentially-unlawful-online-platforms-trading> [9th April 2018].

On the other hand, the U.S. Commodity Futures Trading Commission (CFTC) provides a broad definition for the term *"commodity"*, including *"all services, rights, and interests in which contracts for future delivery are presently or in the future dealt in"*[40] and it has claimed since 2015 that cryptocurrencies were commodities.

In Europe, there is not a common or unified criterion on this issue. However, the Court of Justice of the European Union issued a ruling in the year 2015, where, regarding taxation, it stated that exchange of traditional currencies for units of Bitcoin is exempt for VAT, under the provision concerning transactions relating to *"currency, bank notes and coins used as legal tender."*[41] Thus, it considers Bitcoin as a currency and the ruling refers to it as a virtual currency.

Cryptocurrencies as securities

A research made by Goldman Sachs states that financial assets or securities have *"a claim or liability attached to it, as it is "secured" to an underlying real asset"*[42]. For example, equities are secured by future earnings of a real company or a dollar bill is secured by the US Government. However, this does not happen with all existing cryptocurrencies, thus they argue that some of them cannot be considered as securities but as the first digital commodity.

In this sense, as previously mentioned, there are cryptocurrencies that arise from an ICO. In a particular case, the SEC investigated in the year 2016 an ICO by the organization The Dao. In this operation, The DAO offered and sold approximately 1.15 billion DAO Tokens in exchange for a total of approximately 12 million Ether and, as the time the offering closed, the total Ether raised was value in, approximately, $150 million.[43]

The investigation has concluded that DAO Tokens are securities under the Securities Act of 1933 and the Securities Exchange Act of 1934. According to their investigation, these tokens fulfill the following features, which make them being considered as securities:

- **Investors invested money** – according to the SEC, *"money"* does not need necessarily to be invested in the form of cash. Investors gave Ether in exchange for DAO Tokens and that investment *"is the type of contribution of value that can create an investment contract"*.

- **Investors had a reasonable expectation of profits** – The DAO was a for-profit entity with the objective of funding projects in exchange for a return and this return constitute a profit.

- **The profits derived from the managerial efforts of others** – according to the marketing that was directed to potential investors, they had an expectation that some companies/entities were going to manage the company to obtain those

---

40 Clark Francis, J., W. Toy, W., and Gregg Whittaker, J. (2000) *The Handbook of Equity Derivatives – Revised Edition*. John Wiley & Sons, Inc.
41 <https://curia.europa.eu/jcms/upload/docs/application/pdf/2015-10/cp150128en.pdf> [9th April 2018]
42 Strongin, S. and Morehead, D. (February 5, 2018) *Is Bitcoin a (bursting) Bubble?* Goldman Sachs.
43 <https://www.sec.gov/litigation/investreport/34-81207.pdf> [15th May 2018]

profits. In addition, voting rights for DAO token holders were limited, so they have to rely on the effort made by the managers of the company.

Therefore, under particular circumstances and referring to specific categories of cryptocurrencies, some of them could be considered as securities. Notwithstanding the above, this circumstance has a very strong regulatory component and, of course, features to consider an asset as a security can vary greatly from one region to another.

It is also relevant to mention that the SEC has been recently issuing subpoenas to many firms that might have violated securities laws in the framework of ICOs. And, more worrying is the fact that the SEC is even suggesting some of the are a fraud and they are raising money for business that do not even exist[44].

Cryptocurrencies as commodities

As previously stated, cryptocurrencies could be considered the first digital commodity.

Recently, on March 6th 2018, a Federal Judge in the U.S. ruled that cryptocurrencies, such as Bitcoin, are commodities and, therefore, can be regulated by the CFTC, who, as previously stated has been supporting this idea since 2015.

In this sense, a commodity can be defined as *"a basic good used in commerce that is interchangeable with other commodities of the same type; commodities are most often used as inputs in the production of other goods or services."*[45] It seems obvious that many of existing cryptocurrencies do not fit within this definition.

However, Bitcoin has several elements in common with gold, such as scarcity and finite supply. Thus, Bitcoin can be considered at some point as a commodity and there has been an official launch of Bitcoin future exchanges by two of the world's largest future exchanges, the Chicago Board Options Exchange (CBOE) and Chicago Mercantile Exchange (CME).

Supporting this consideration, it is important to mention that South Korea's Central Bank defined last year cryptocurrencies as commodities stating that *"Regulation (of virtual currencies) is appropriate because it is regarded as a commodity. It [cannot be] regulated at the level of a currency[46]."*

Cryptocurrencies as a new asset class

Notwithstanding the above, there are still some cryptocurrencies that cannot be considered as a currency, a security or a commodity, thus we could understand that they can be considered as a new asset class. However, this idea is not commonly accepted amongst experts.

NYU Professor Aswath Damodoran argues that *"An asset generates or is expected to generate cash flows in the future. A business that you own is definitely an asset, as is a claim on the cash flows on that business. Those claims can be either contractually set (bonds or debt), residual (equity or stock) or even contingent (options). What assets*

---

44 <http://fortune.com/2018/03/01/sec-ico-cryptocurrency-subpoenas/> [15th May 2018]
45 <https://www.investopedia.com/terms/c/commodity.asp> [10th April 2018]
46 <https://www.ccn.com/south-koreas-central-bank-chief-bitcoin-commodity-not-currency/> [10th April 2018]

share in common is that these cash flows can be valued, and assets with high cash flows and less risk should be valued more than assets with lower cash flows and more risk." [47] In this sense, he maintains that cryptocurrencies can be priced but they cannot be valued.

Cryptocurrencies deriving from IPO's can comply with the abovementioned statement, as they will be expected to generate cash flows in the future. However, many others, such as Bitcoin or Litecoin, do not generate cash flows and investors can only get returns by selling them at a higher price than the acquisition one.

Moreover, difficulties when valuating cryptocurrencies are notorious and, for the majority of institutional investors, the absence of an appropriate valuation framework makes them unsuitable as an asset class. On the other hand, many new cryptocurrencies holders perceive them as a virtual form of hold, as such as a new asset class.

As an overall, there is a lack of consensus both from a private and public perspective about the consideration of cryptocurrencies and this consideration can vary depending on the purpose for which the cryptocurrency was created. Therefore, when categorizing a particular cryptocurrency, the analysis of its specific features will be needed.

3.3. DIFFICULTIES REGARDING VALUATION OF CRYPTOCURRENCIES.

As it has been previously pointed out, valuation of cryptocurrencies is a key issue and a very challenging one.

Traditional valuation methods, such as discounted cash flows, cannot be applied to cryptocurrencies, as many of them do not generate nor are expected to generate future proper cash flows.

Considering a cryptocurrency that function as tokens to be used in certain platforms, if the demand for this type of tokens increases, as their number is limited (we could assimilate them to a company's shares), their value will increase and their holders will have a return if they sell them.

Some of the drivers for the tokens demand will be the popularity or predicted value of the underlying asset or service, the liquidity of the token (easiness with which a holder can trade with it), its durability (period of term during which they can be used) or its fungibility (alternative uses for the token outside from the platform for which they were created).

In general, considering all different types of existing cryptocurrencies, the following factors can affect their valuation:

- **Utility**

  Cryptocurrencies should have a function or be used to acquire something, to incentivize people to hold them. If they do not have any utility, they will be simply speculative without any fundamental value.

---

47 <https://aswathdamodaran.blogspot.com.es/2017/10/the-bitcoin-boom-asset-currency.html> [10th April 2018]

Cryptocurrencies' utility is directly and strongly correlated with its value. The more uses a cryptocurrency has, the more people would want to hold it, thus the demand would be higher and the price will go up.

Also in this sense, Metcalf's Law could be applicable to cryptocurrencies. This law states that the effect of a telecommunications network is proportional to the square of the number of users of the system. It characterizes many of the network effects of communication technologies and networks, such as the Internet of social networks.

In these cases, the greater number of users of the service, the more valuable the service becomes to the community. We understand that this fact could be also applicable to utility tokens.

- **Scarcity**

Based on economics, it could be stated that if there is a fixed supply of a certain item, its value in the long term would increase, provided there is an increase on its demand. Therefore, the existence of a maximum fixed supply (for example, 21 million for Bitcoins) creates scarcity, which increases its value. However, it is true that this limit could be breached if there is a hard fork or a majority agrees to change the rules.

Another phenomenon related to this issue that has actually happened is the burning of cryptocurrencies. By destroying an amount of them, the value of the remaining increases.

Some Altcoins functions this way, for example Binance Coin (BNB), in which coins are burned every quarter with the aim of reaching 100 million coins. The first burn occurred in October 2017 and, at that time, the coin was traded at, approximately, $1.5, but after the burn it reached $10 in December. The second burn took place in January 2018 and its price hit $24 within a few weeks.

A curious case about this burning mechanism is how The Iconomi platform has used it to reward holders of their own cryptocurrency (ICN). By owning ICN you become a shareholder of the platform and you would expect to receive a share of its profits. Iconomi perfoms this in a creative way as, based on the profits of the company, it will be buying back ICN from the market and burning them. By performing this action, the value of existing ICN in the hands of shareholders will increase and they will be rewarded.

- **Perceived Value**

An important part of the value of cryptocurrencies can come from market sentiment. In this sense, positive indicators of good progress of the project sustained by the cryptocurrency or good performance of the cryptocurrency will increase their value.

These indicators could be, for example, achieving forecasted milestones, collaborations with other prestigious companies or projects or launching a beta version of their protocol or software.

4. RISKS: REGULATION, FISCAL IMPLICATIONS AND CYBERSECURITY

4.1. REGULATION

The cryptocurrency spectrum is constantly changing and becoming more mainstream. Many governments, tax authorities and regulatory agencies are concerned with the lack of control, supervision and regulation that the crypto markets are enjoying. Their current objective is to better grasp the concept of cryptocurrencies and understand if and where they would fit in the existing regulatory framework. The decentralized nature and the "anonymity" of cryptocurrencies concern these entities as these properties are attractive for criminals wishing to either sell illegal goods, launder money or evade taxes. There are so many grey areas and loopholes that governments must clarify the legal treatment of cryptocurrencies.

Moreover, regulation has been lax when it comes to ICOs and exchanges as well. However, this is changing as many countries are cracking down on cryptocurrency exchanges and ICOs. This is especially the case in countries where participation in cryptocurrencies is significant such as United States, China, South Korea, Japan and the European Union.

The case in the United States

Most US based cryptocurrency exchanges have determined that they should be regulated as money-transmission service providers. The reason for this is that payment services are not subject to regulation and supervision by the SEC or the CFTC. Nonetheless, not everyone seems to agree. The following are the SEC and CFTC opinions on the matter.

SEC→ The march 2018 SEC testimony reads the following: _"History, both in the United States and abroad, has proven time and again that these opportunities flourish best when pursued in harmony with our federal securities laws. These laws reflect our tripartite mission to protect investors, maintain fair, orderly and efficient markets and facilitate capital formation. Being faithful to each part of our mission not in isolation, but collectively, has served us well. Said simply, we should embrace the pursuit of technological advancement, as well as new and innovative techniques for capital raising, but not at the expense of the principles undermining our well-founded and proven approach to protecting investors and markets."_ [48]

The SEC stated that online trading platforms that sell digital assets through Initial Coin Offerings operates as an exchange as defined by federal securities laws. The digital assets being sold in ICOs meet the definition of security under federal securities laws. The SEC stated that with the goal of protecting investors against fraudulent practices, exchanges should register with the SEC or be exempt from it. SEC has subpoenaed many companies demanding for information about the structure of sales and pre-sales of the ICOs. Although the SEC has focused its attention mainly on ICO's,

---

48 <https://www.sec.gov/news/testimony/testimony-virtual-currencies-oversight-role-us-securities-and-exchange-commission>
[4th May 2018]

cryptocurrencies in general are also being scrutinized by regulators. The fears of enhanced regulation over cryptocurrencies have impacted their prices negatively.

With regards to exchanges, many wonder why they don't just register with the SEC instead. The reason exchanges do not register with the SEC and avoid future regulatory risk is that doing so would kill their revenue stream as registered exchanges only allow selling of securities to brokers and accredited investors. [49] The definition of accredited investor leaves out many people. To be an accredited investor you must either have income of $200,000 or more for three consecutive years or you must have a net worth of $1,000,000 (excluding the value of a residence). [50]

There are some ways for exchanges to be exempt from registering with the SEC. For example, if an online trading platform is member of a self-regulating authority and is registered as an alternative trading system ATS (multilateral trading facility in Europe), it has a different regulatory frame work and would allow them to operate without having to confirm if investors are accredited. ATS is described as *"a trading system that meets the definition of exchange under federal securities laws but is not required to register as a national securities exchange if the ATS operates under the exemption provided under Exchange Act Rule 3a1-1(a)"*. ATS' are usually registered as broker-dealers whose purpose is to match buyers and sellers or find counterparties for transactions.

Moreover, the SEC has not approved the listing of any ETF's that hold cryptocurrencies nor has registered any ICO to this date.

Commodities Futures Trading Commission (CFTC)→ Bitcoin was classified as a commodity by the CFTC which entails that the CFTC has supervisory and regulatory authority over it.

Virtual Commodity Association→ The Winklevoss Twins have submitted a proposal to create the Virtual Commodity Association, an industry non-profit focused on self-regulation amongst exchanges. Japan has already gone in this direction by allowing self-regulation by exchanges. This is not a new concept, not even in the US as the SEC and the CFTC rely on self-regulatory organizations to help supervise trading.

The case of the European Union

Compared to other countries, the EU has been lagging when it comes to regulation. There have been statements made about the EU's readiness to regulate cryptocurrencies and commitment to follow them closely. It is expected that the EU decides on how to approach regulation of cryptocurrencies late this year or early 2019. However, policymakers from the EU are concerned that if they regulate cryptocurrencies to heavily, jobs, growth and capital will be lost to other countries that have a laxer regulatory approach.

---

49 <https://www.sec.gov/fast-answers/answers-accredhtm.html> [9th May 2018]
50 <https://www.investor.gov/additional-resources/news-alerts/alerts-bulletins/investor-bulletin-accredited-investors> [10th May 2018]

In March of this year, the UK announces that they will launch a cryptocurrency task force with the purpose of assessing risks and benefits of cryptocurrencies.

The case of China

Back in September 2017 China banned all cryptocurrency exchanges due to widespread fraud in ICOs. However, Chinese citizens have been trading cryptocurrencies in through overseas exchanges. China has gone as far as targeting online platforms that allow Chinese investors to trade cryptocurrencies overseas.

China's battle against cryptocurrency exchanges and ICOs has resulted in a significant reduction of its role and importance in the cryptocurrency business. The country is not against cryptocurrencies; the government is actually very invested in Blockchain technology and is looking into the development of a sovereign cryptocurrency. China supports global regulation of cryptocurrencies which means that the country is open to legalizing the trading of cryptocurrencies once a uniform regulatory framework is established.

The following are some of the reasons why some governments are increasingly interested in regulating cryptocurrencies and ICOs:

- Governments must ensure that investors are protected and well informed about the risks.

- In the United States, cryptocurrencies are more widely seen as an asset rather than a currency hence the SEC scrutiny.

- The market capitalization of cryptocurrencies was considered negligible. During early cryptocurrency staged, the entire market capitalization was less than 50 billion USD. Now it is more than 400 billion USD. [51]

- The lack of understanding of the functioning of cryptocurrencies and the underlying technology therefore, regulators did not even try to approach them. Now, there is increasing interest and more effort placed in the endeavor of grasping the concept. With better understanding of it comes the need for regulation.

- Ethereum was the first ever ICO. It raised 18.4 million USD and everyone following it was mind blown. As of April 2018, there had been 6.3 billion raised through ICO funding, which passed the total funds raised through ICOs in 2017. [52]Many of these ICOs came even after the SEC ruled that ICOs had to be registered as they were security offerings. Jay Clayton, the SEC's chairman, stated in a senate hearing that *"every ICO I've seen is a security."*[53] This makes every ICO a sale of unregulated securities, something that regulators will not let pass.

---

51 <https://cryptolization.com/> [12th May 2018]
52 <https://www.coindesk.com/6-3-billion-2018-ico-funding-already-outpaced-2017/> [10th May 2018]
53 Levi, A. (May 2018) The Future of Blockchain Tech- CB Insights

- Not only does the classification call for regulation but also the fact that many ICOs have been scams. Many ICOs have not been paying their fair share of taxes.

Even though some countries are already aimed at regulating cryptocurrencies, ICOs and, exchanges, there must be global uniformity in the regulatory laws and especially with regards to the classification of Cryptocurrencies and ICOS. Uniformity is required because, since cryptocurrencies are all traded virtually, a significant number of transactions occur outside the United States. Countries must be able to protect investors while not staying behind in the technological innovation era. Uniform regulatory frameworks will keep investors from operating in different countries with lax regulation has been enjoyed. Moreover, stricter regulatory measures have been emerging in countries where major cryptocurrency exchanges are located, such as South Korea and China.

The following map demonstrates the scope of regulation (ranges from light to tight) in various countries. [54]
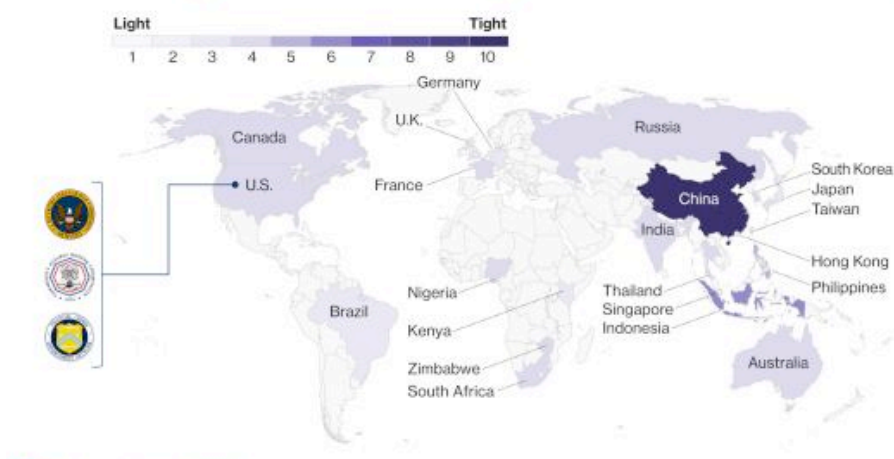
Source: CB Insights

One of the main challenges faced by regulatory entities when it comes to supervising and regulating cryptocurrency markets is the lack of manpower. For example, the SEC is responsible for overlooking all securities and exchanges as well as all companies who wish to go public. So far, this has been manageable but now with all the new participants in the cryptocurrency spectrum, it seems less so. The growing number of ICOs and exchanges that are emerging calls for more resources and manpower from the SEC in order to effectively attempt regulation.

---

[54] Levi, A. (May 2018) The Future of Blockchain Tech- CB Insights.

4.2. FISCAL IMPLICATIONS FOR CRYPTOCURRENCIES

Due to the lack of consensus of what cryptocurrencies can be classified as, fiscal policy that applies to them seems unclear. Different countries have varying opinions of whether cryptocurrencies are actually currencies, commodities or an asset class on their own. As mentioned previously in the regulation section, some countries have banned them entirely. The fact that fiscal implications are unclear and might experience changes in the future poses a risk for investors. Some investors bought virtual currencies aiming to take advantage of tax loopholes which could later be closed and impose tax burdens on them.

For the purpose of our paper, we will discuss taxation for cryptocurrencies in two countries: USA and UK.

The IRS and Cryptocurrencies: USA Case

The IRS is stepping up with the tax enforcement on cryptocurrencies. For a while, investors were taking advantage of a loophole and were knowingly evading taxes on the capital gains derived from trading cryptocurrencies. According to a Forbes article, in November of last year, the IRS won a case against Coinbase (cryptocurrency exchange) and gained access over the information on more than 14,000 accounts that traded amounts over $20,000 worth of cryptocurrencies between 2013 and 2015. According to the IRS *"only 800 to 900 taxpayers reported gains related to Bitcoin in each of the relevant years and that more than 14,000 Coinbase users have either bought, sold, sent or received at least $20,000 worth of Bitcoin in a given year."*[55] These investors were not paying their fair share of capital gains tax and the court found that the IRS had a legitimate interest in investigating these accounts.

In the US, there is a relatively unknown tax loophole called the 'like-kind exchange' (Section 1031), which was intended for real estate transactions. However, cryptocurrency investors took advantage of this to exchange one virtual token for another without paying anything to the IRS. Eventually, the IRS realized this was happening and closed this loophole in December 2017. The Tax Cuts and Jobs Act specifies this like-kind exchange is limited to real estate transactions. This is only an example of the IRS' aim to crack down tax evading cryptocurrency investors.

The IRS classified cryptocurrencies as property like shares or physical assets. Therefore, profits and losses for investments in cryptocurrencies are to be taxed at the individual's capital gains rate. This rate should be applied to every taxable event which includes every time an investor purchases, sells, or uses the cryptocurrency to purchase goods and services. However, like any other asset, if you held a cryptocurrency for over a year, it would be considered a long-term investment and taxed at a lower rate than a short-term investment.

According to an article in Fortune, if an investor took a loss on cryptocurrency transactions, he can use the losses to offset capital gains or up to $3,000 of ordinary income. Investors can carry their losses forward to the next year.

---

[55] <https://www.forbes.com/sites/kellyphillipserb/2017/11/29/irs-nabs-big-win-over-coinbase-in-bid-for-bitcoin-customer-data/#74d6c2aa259a >[13th May 2018]

The challenge is recording the capital gains and losses. Coinbase and some other exchanges provide investors with a transaction record which includes amounts, dates, sales and purchases, etc. With this information, investors can calculate how much they owe to the IRS. However, the responsibility of record keeping relies solely on the investor. Most tax experts suggest that investors use the First In First Out (FIFO) accounting method to calculate gains/losses.[56] It is recommendable to seek help with tax consults with knowledge in cryptocurrency.

Three ways the IRS currently taxes cryptocurrency investors are: capital gains tax from investing, capital gains from purchasing of goods and services, and income tax applied to cryptocurrency mining income.

1. Capital gains/ losses from investing

Like mentioned above, if an investor buys a cryptocurrency, it increases in value and the investor sells it, he shall pay either short-term or long-term capital gains tax rate. Short-term capital gains are taxed at the federal ordinary income tax rate which varies from 10% to 37%. Long-term capital gains are taxed at either 0%, 15% or 20%. This applies even if you exchange one virtual currency for another as the like-kind exchange no longer applies. [57]

2. Capital gains/losses from purchasing goods and services

If someone pays for a good or service using cryptocurrencies, this is considered a divestment. Divestments are taxable events. If what you bought is worth more than what you paid for the virtual currency, there is a capital gain. This could hinder the adoption of cryptocurrencies as the holder has to pay taxes on every transaction, regardless of its size.

3. Cryptocurrency mining income

Miners based on the US are also taxed. As miners solve complex mathematical problems and validate transactions, they receive what is known as a block reward which is paid in the form of tokens of the virtual currency. The IRS considered this block reward to be income. The miners have the option of declaring it as self-employment income or as other income. Moreover, cryptocurrency miners are required to report capital gains when they dispose of the tokens received through the block reward.

When cryptocurrency miners introduce a fork and create a new virtual currency, this is a tax nightmare for investors. Take the example of Bitcoin Cash. Investors that owned Bitcoin before Bitcoin Cash was created, received one unit of Bitcoin Cash for every Bitcoin they owned. It is still not clear whether investors should consider this similar to a dividend (which is taxable) or if they should only pay taxes once the Bitcoin Cash tokens are sold.

---

56 <http://fortune.com/2018/01/29/bitcoin-taxes-cryptocurrency-irs/> [13th May 2018]
57 <https://www.fool.com/taxes/2018/05/03/3-ways-the-irs-is-taxing-cryptocurrencies.aspx> [14th May 2018]

There are still grey areas in the fiscal implications of investing in cryptocurrencies in the US, however, the IRS is focused on clearing investors doubts. It is in their best interest (IRS) to do so as more and more people are investing in cryptocurrencies.

The HMRC and Cryptocurrencies: UK Case

In March 2014, the HMRC released guidelines on cryptocurrencies and how they are taxed, Brief 9 (2014): Bitcoin and other cryptocurrencies. The brief provides the HMRC position on the tax implications for income derived from investing in cryptocurrencies. It covers VAT, corporation tax, income tax and capital gains tax. No updated guidelines have surfaced.[58]

Tax experts branded the UK tax treatment of cryptocurrencies 'outdated'. The HMRC brief starts by saying that the tax treatment of income received from, charges made in or activities involving cryptocurrencies will depend on the parties involved and, on the purpose/activity. HMRC states that tax treatment will be applied on a case-by-case basis.

For example, a transaction may be considered extremely speculative and considered not taxable. For example, HMRC does not usually tax profits derived from gambling or betting because it is considered speculative and not considered trading income. Cryptocurrency investors in the UK have been taking advantage of this loophole for a while by making millions in profits but declaring the returns as gambling winnings. Moreover, it is unclear who should be characterized as a gambler and who be characterized as an investor.

1. **Value Added Tax (VAT)**

HMRC'S provisional VAT treatment will depend on further regulatory developments. Income received from mining activities will be outside the scope of VAT if there is no link between the services provided and the income received. Moreover, income received by miners for validating transactions and solving the complex mathematical problems (block rewards) will be exempt from VAT under Article 135(1)(d) of the EU VAT Directive.

The HMRC brief also states that no VAT will be due on the value of the cryptocurrencies themselves when they are exchanged for fiat currencies.

Charges made above the value of the cryptocurrency for executing any transactions in the cryptocurrency will be exempt from VAT under Article 135(1)(d).

However, VAT will always be due from sellers of goods or services sold who accept cryptocurrencies as payment. The value of the supply of goods or services on which VAT is due will be the fiat value of the cryptocurrency at the point the transaction takes place.

---

[58] < https://www.gov.uk/government/publications/revenue-and-customs-brief-9-2014-bitcoin-and-other-cryptocurrencies> [14th May 2018]

2. Corporate Tax

When businesses accept payment for goods and services provided in cryptocurrency, there is no different tax treatment to when revenues are recognized or in the calculation of the profit/losses.

The gains of losses derived from exchange movements from one currency to another are always taxable, including when exchanging from or into cryptocurrencies. There, HMRC states that *"the general rules on foreign exchange and loan relationships apply."*[59] HMRC stated that they did not see the need to make special rules apply for cryptocurrencies.

Moreover, the profits and losses of a company that performs transactions with cryptocurrency would be reflected in the company's accounts and taxable under normal corporate tax rules.

3. Income tax

According to HMRC brief, *"the profits and losses of a non-incorporated business on Bitcoin transactions must be reflected in their accounts and will be taxable on normal IT rules."*[60]

4. Capital Gains tax

"Gains and losses incurred on cryptocurrencies are chargeable or allowable for Capital Gains Tax if they accrue to an individual or, for Corporate Tax on chargeable gains if they accrue to a company."[61]

Cryptocurrency users who trade coins for investment purposes are required to pay capital gains tax which is 18% tax on any amount over £11,300 if they pay basic-rate tax and 28% if they are a high- rate taxpayer.[62]

4.3. CYBERSECURITY

As the cryptocurrency hype rages on, they are more likely to become the target for cyberattacks. Rising prices of cryptocurrencies have made cyber heists even more profitable and attractive. Lee Chen, the founder of A10 Networks stated in a CNBC interview, *"I think the digital transformation is the underlying motivation for hackers … So expect the frequency, the size, the volume of hacks to continue to increase in 2018."*[63] During the last couple of years there has been a boom of ICO's, and a plethora of events involving cryptocurrencies. The growing popularity for cryptocurrencies has not only lured investors and miners but also cybercriminals. Although much progress has been achieved in the cryptocurrency universe, it has witnessed ICO fraud, ponzi schemes, bankruptcy of exchanges, and a rise in cyberattacks.

---

59 <https://www.gov.uk/government/publications/revenue-and-customs-brief-9-2014-bitcoin-and-other-cryptocurrencies> [14th May 2018]

60 <https://www.gov.uk/government/publications/revenue-and-customs-brief-9-2014-bitcoin-and-other-cryptocurrencies> [14th May 2018]

61 <https://www.gov.uk/government/publications/revenue-and-customs-brief-9-2014-bitcoin-and-other-cryptocurrencies> [14th May 2018]

62 <https://blockonomi.com/cryptocurrency-taxes/ > [12th May 2018]

63 <https://www.cnbc.com/2017/12/12/bitcoin-hack-expect-larger-cyber-attacks-in-2018-a10-networks-says.html> [12th May 2018]

According to Ruslan Yusufov, a director at Group-IB, a provider of cybersecurity solutions, *"The number of attacks on each ICO in the end of 2017 increased tenfold in comparison to the beginning of the year. In most cases, ICO projects face phishing, website defacement, compromise of administrator accounts - Slack, Telegram, as well as vulnerabilities in their own smart contracts."*[64] Traditional hacking methods are being adapted and perfected for cryptocurrencies. Apart from the hacking methods previously mentioned, hackers redirect investors to fake websites, or use updated banking Trojans.

A research done by Ernst and Young, stated that $400 million of the $3.7 billion raised via ICOs has been stolen or lost. New ICOs are said to be the main targets for cyberattacks, but exchanges, wallet providers, payments systems, traders and crypto owners are also at risk of becoming victims of hackers and should constantly be on the lookout.

An article written by David Balaban, a computer security researcher with experience in malware analysis and antivirus software evaluation lists examples of incidents that made headlines in 2017 involving cyberattacks on cryptocurrencies[65]. The following are some of these incidents:

- February- Bithum, a large cryptocurrency exchange from South Korea, was hacked. More than 30,000 customer records were stolen by compromising an employees' computer. Hackers stole about $1 million worth of Bitcoin.
- July- The attack occurred during the ICO of CoinDash, a new trading platform and the attackers made $7 million worth of Ether by convincing investors who had the intention of participating in the ICO to submit Ether to a rogue address.
- July- Another ICO was targeted and tokens worth $8.4 million were stolen. This ICO was for Veritaseum. 37,000 tokens called VERI were stolen and were then exchanged for ether.
- August- The ICO for another Ethereum backed trading platform, called Enigma, was attacked. Investors were convinced of sending $500,000 worth of cryptocurrency to take advantage of a "pre-sale" of tokens. Phishing emails were sent using Enigma's domain.
- December- The Bitcoin mining platform called NiceHash was compromised. Investors 4,700 Bitcoin, which was then worth about $64 million.
- At some point during the year, a flow in the code of Ethereum's Parity Wallet caused a breach and led to the theft of 150,000 ether which were worth approximately $30,000,000 at the time.

Moreover, the US Department of Homeland Security reported that between 2009 and 2015, over 15% of Bitcoin exchanges were attacked by hackers. In most

64 <https://www.rbth.com/science-and-tech/327380-rise-in-cyber-attacks-cryptocurrency> [10th May 2018]
65 <https://www.tripwire.com/state-of-security/security-data-protection/cyber-security/cryptocurrency-hacks-heists/> [10th May 2018]

countries, including the United States, cryptocurrencies are not recognized as legal tender thus investors have no recourse in case their coins are stolen.

Therefore, it is of vital importance that hacking countermeasures be adopted by all participants. With regards to individual investors, they should attempt to protect their digital assets and prevent theft by taking the following measures:

- Installing an antivirus with anti-phishing support
- Using a VPN to protect your internet connection
- 2FA (2-factor authentication) added for more access protection
- Using a hardware wallet to protect your private key
- Setting up firewall protection [66]

However, it is important to take note that traditional intermediaries and financial institutions are not immune to cyberattacks. Banks and other financial institutions invest millions in cybersecurity systems, yet attacks happen nonetheless. The countless times SWIFT system has been hacked is a clear example. As technology gets increasingly complex, so do hackers.

---

[66] <http://bitcoinist.com/meteoric-rise-cryptocurrencies-triggering-cyber-attacks/> [10th May 2018]

5. FUTURE PROSPECTS AND CHALLENGES

After the broad use of Blockchain for cryptocurrencies transactions, many computer applications based on this technology have been developed in the last few years for a large variety of uses. Due to its characteristics, the Blockchain technology can be disruptive in several fields if properly implemented, shifting from the current Internet of Communication to the known as Internet of Value.

What is the main difference between them? The first type is represented by models such as Google, Facebook, or Uber. In those models, an intermediary in necessary in order to maintain trust among different parties and make the information immutable and impossible to be copied. On the contrary, the Internet of Value is based on the non-existence of a third party to maintain the trust in every interaction between complete strangers. Thanks to the Blockchain technology, immutability, disintermediation and trust can be ensured in a peer-to-peer system that may lead to the disappearance of monopolistic situations in many fields and businesses. In reality, even though many transactions would benefit from decentralization, other would still need intermediary support due to their complex nature, the need to provide guarantees, or the incidence of regulators among other factors. That is why we are still far from the idea of the demise of monopolistic forms of power even though there is a growing number of situations in which the created value is not kept by major central institutions but by the customer instead.

In this chapter, we are going to analyze which are the future prospects for Bitcoin as the main cryptocurrency in the world nowadays, and the current and potential applications of the Blockchain technology to different sectors in the economy.

5.1. FUTURE PROSPECTS OF BITCOIN

The future of Bitcoin is still uncertain. There are many directions it can go that depends, not only on its current applications or if people will adopt it or not, but on its evolution. Bitcoin needs to speed up its velocity so that it can manage more transactions per second and starts escalating. Moreover, there are also security issues. Despite being one of the safest ways to make transactions, it is uncertain if in the future vulnerabilities in the technology behind Bitcoin are discovered, leaving an open door for cybercriminals to spoil its whole system.

We can distinguish three different paths that Bitcoin might follow in the future:

- Widespread usage of Bitcoin as a currency. As we have analyzed in this paper, there are still many obstacles to surpass for Bitcoin to become the leading currency in the world. The main functions Bitcoin has not achieved yet is becoming a unit of account and a store of value, as its price is quite unstable and volatile.

- Usage of Bitcoin as another currency and/or payment method. The possibility of Bitcoin co-existing with other existing currencies and other Altcoins is not as far and unlikely as the previous option.

- Demising. People may lose interest on it, other cryptocurrencies may surpass it as the leading crypto, or even an extraordinary event might happen.

Regarding potential Bitcoin's economic surplus, investor and entrepreneur John Pfeffer points out that because of its open-source protocol, it cannot benefit from monopoly effects and that all the profits it can generate will mostly benefit its users, but would offer a long-term investors unattractive "*returns relative to the inherent risks*" as the case of utility protocols is a highly "*fragmented space with very high failure rates*" and "*most of the long-term winning protocols probably haven't even been launched yet[67]*".

5.2. FUTURE PROSPECTS OF THE BLOCKCHAIN TECHNOLOGY

Some of the most promising opportunities rely, not on the fact that Bitcoin or another Altcoin might become a widespread currency, but on the potential uses of the technology behind all of them. Many institutions and organizations are currently testing or even adopting Blockchain technology internally and/or with other counterparties.

In the case of the **banking industry**, for example, JP Morgan -alongside the National Bank of Canada and other major firms- was reported to be testing "*a new Blockchain platform for issuing financial instruments […] seeking to streamline origination, settlement, interest rate payments and other processes[68]*". Banco Santander has also released "Santander One Pay FX" for cross-border payments and it states that this is one of the many functionalities that they have developed using the Blockchain technology and this is the beginning of the future Blockchain-based offer to their clients[69]. During our meeting with Roberto García Mora, Head of Blockchain and Emerging Technologies at Banco Santander Group, he revealed that they will be launching a brand new Blockchain-based service called "we.trade" for those agents involved in a trade transaction such as the buyer, the seller, their banks or the transporter.

According to Business Insider, global firms are entering the Blockchain world because "*the cost savings and operational efficiencies it promises to deliver*" and they mostly do it "*through partnerships with fintechs, membership in global consortia, and via the building of their own in-house solutions[70]*". But not only do banks bet on Blockchain for lowering costs and operational efficiencies, but also for other advantages and strategic reasons. It is widely known that the financial system is facing a transition, which is reflected in irreversible changes in both the supply of and the demand for financial services. Most of these changes are driven by new disruptive technologies and new competitors such as Fintechs. In order to surpass all these obstacles and survive, banks are using huge amounts of money in technology -for example, JPMorgan Chase has spent 16 per cent of its budget on technology in 2016 ($9.5 billion)- so that these new competitors do not dominate the market. The point is that banks are investing millions

---

[67] Pfeffer, J (December 2017) *An (Institutional) Investor's Take on Cryptoassets.* Version 6

[68] < https://www.reuters.com/article/us-jpmorgan-blockchain/jpmorgan-national-bank-of-canada-others-test-debt-issuance-on-blockchain-idUSKBN1HR0CM?utm_source=applenews> [10th May 2018]

[69] <http://www.expansion.com/empresas/banca/2018/04/12/5acf324ee5fdea4a4c8b469f.html> [10th May 2018]

[70] Business Insider (March 2017) *The Blockchain in Banking Report: The future of blockchain solutions and technologies*

of dollars to develop Blockchain platforms to manage many processes and transactions -cross-brother payments, securities settlement…- as probably the most interesting opportunities are those that link not just different parts of an organization, but also different enterprises within the same sectors.

For **internal procedures**, Blockchain is a considerable option for **enterprises and organizations** to keep track of and record all their transactions and information in a trustworthy distributed ledger that safely retains all the immutable data and its history, as it offers them costs and efficiency advantages and eliminates almost every possibility of fraud. As a current example, Ripple allows those banks or institutions that have agreed to be a counterpart in their system to interact and carry out transactions between them. Nonetheless, there are other open-source systems that enable anyone to access and be part of it. In that sense, enterprises and organizations can make use of both types of systems depending on the activities and transactions they want to dedicate that platform to. According to Roberto García Mora, enterprises will be more prone to use private protocols between them, but they will co-exist with other open-source protocols. The Head of Blockchain and Emerging Technologies at Banco Santander Group also pointed out that private networks would be less secure than open-source protocols and they would not be affected by the price of gas that fuels some open-source systems like Ethereum. Nonetheless, despite being less secure, Roberto stated that there is an easy solution for that: not including certain information in the Blockchain. For example, if a contract is signed between two parties, the signature of this contract will be included in the Blockchain but the content of what both parties agreed will be off-chain.

Blockchain could also alter the business models of some of the major agents in the **retail** business like Amazon or eBay. Currently, there are new players that offer identical services without the presence of an intermediary that charges commissions or retrieves data from the counterparties in a transaction -OpenBazaar, for instance, connect users and they perform their transaction directly without any third party involved-. Not only could this be implemented in this type of business but also on cloud-based businesses similar to Dropbox for data storage in order to ensure decentralization and safety.

Regarding **governments**, they could implement the Blockchain technology for their transactions. For example, they can use this technology for issuing their own cryptocurrencies (as seen in chapter three), internal procedures, or external operations like issuing certifications and IDs. For example, Dubai Land Department (DLD) has initiated to conduct all their transaction using a Blockchain-based platform. With the Dubai Blockchain Strategy announced in October 2016, they aim "*to make Dubai the first government in the world to apply all transactions through this network by 2020*[71]".

One of the most promising fields regarding the implementation of the Blockchain technology is **healthcare**, especially for recording and storing data from patients to

---

[71] <https://gulfnews.com/business/sectors/technology/dubai-land-department-becomes-world-s-first-government-entity-to-conduct-all-transactions-through-blockchain-network-1.2102060> [10th May 2018]

contribute to their treatment and medical research. For instance, researchers need organized sets of data to investigate certain diseases and come up with a solution that might differ from one patient to another. The use of Blockchain would be a useful tool in order to provide researchers the broad chain of data -health data from a patient's whole lifetime- they would need in order to carry out their investigations that usually includes studies that have to take into consideration the same variables during a determined period of time (longitudinal studies). The Blockchain technology would be complemented with other tools and gadgets to constantly gather data from individuals -mobile apps, wearables, etc.- in order to support medical research and to offer these individuals a higher-quality customized treatment or service.

In the US, there is a "*lack of common architectures and standards that would allow the safe transfer of sensitive information among stakeholders in the system*", and Blockchain would be a solution to that problem as it "*could enable access to a rich set of standardized, non-patient identifiable information[72]*". Some countries have gone a step forward and had already implemented this technology in their systems. For example, in Estonia, they have introduced a system called e-Health Record that integrates "*data from Estonia's different healthcare providers to create a common record every patient can access online. […] A powerful tool for doctors that allows them to access a patient's records easily from a single electronic file […] including image files such as X-rays even from remote hospitals[73]*". In case of emergency, for example, doctors can access a patient's data and see their blood type, allergies, recent medical history or disease.

All the above-mentioned implementations of the Blockchain technology are just some few examples of what the Blockchain can be used for in the future, but there are many others:

- Smart Contracts (see chapter 2). Smart Contracts can be seen as an alternative to some non-complex transactions that currently requires human resources and considerable legal costs to complete. It is very unlikely that Smart Contracts would replace lawyers in the future, but there would be a decrease in the need for lawyers. Furthermore, it is quite unclear which is the current applicable legal regime in those cases in which the parties involved have decided to use a Smart Contract to do business.

- Social Media. As the number of users on social networks keeps growing, the amount and variety of content is increasing as well. Most of these networks are based on Ads, which is the main revenue stream for those companies (Facebook, Youtube, Twitter…) but users do not always get a real benefit for the content they create. With Blockchain, it would be easier to track how content has been shared and created so that users can be compensated for their activity on social

---

[72] Kraviec, RJ., Housman, D., White, M., Filipova, M., Quarre, F., Barr, D., Nesbitt, A., Fedosova, K., Killmeyer, J., Israel, A., Tsai, L. (2016) *Blockchain: Opportunities for Health Care*
[73] <https://e-estonia.com/solutions/healthcare/e-health-record/> [10th May 2018]

networks. Blockchain could also help avoid censorship in certain countries or even it may end the fake news issue among other advantages[74].

- Other applications development. The Blockchain technology can also be applied to create brand new apps that benefit the users from decentralization and disintermediation. In the case of videogames, users would not have to rely on a third-party server to play with other players thanks to the Blockchain technology behind the application. There are many examples of videogames based on Ethereum like Cryptokitties (players can collect, take care of and sell virtual cats), or World of Ether (in which people purchase eggs, hatch them and use the monsters they breed to battle).

- Internet of Things (IoT), Certifications, Supply Chain Operations (for International Trade Transactions), etc.

---

[74] <https://www.forbes.com/sites/valleyvoices/2018/02/28/how-the-blockchain-can-solve-social-medias-biggest-problems/#1e286427cb3d> [10th May 2018]

6. CASE STUDY: ETHER (ETH) VALUATION.

As previously stated, cryptocurrencies valuation is very complicated due to their particular features, and each of them should be analyzed separately. In addition, there are only preliminary studies on this subject and, as a traditional DCF model cannot be used, different techniques have been proposed.

We have undertaken a valuation analysis on Ether, as we think the development of Ethereum platform will encourage the creation of new applications based on it (including smart contracts) and we believe there is considerable potential for its growth and mainstream use.

However, this case study is a great challenge, as there is no certainty at all whether this growth will happen or, in any case, to what extent. As an example, NYU Professor Aswath Damodoran was asked last January to provide an estimation of the value of Ethereum compared to Bitcoin, but he refused to do it and argued *"I will tell you what is holding me back, I do not see a business model yet from Ethereum. They are talking the talk but they are not walking the walk yet."* And he added *"Until they create a business model I'm going to be holding back, but I think that that's going to be the next phase in the crypto investment market."*[75]

New techniques regarding valuation of cryptocurrencies are currently emerging, but there is no consensus about which one is the best for each cryptocurrency. We have decided to use the equation of exchange, as it has been one of the techniques previously used when valuating other cryptocurrencies and, in particular, it adapts to the features of Ether as a "token" to be used in the Ethereum platform.

We have based our valuation model on a paper written by Chris Burniske[76]. He is one of the cofounders of Placeholder, a New York firm specialized in cryptoassets. Previously, he worked for ARK Investment Manager and led the firm to become the first public fund manager to invest in Bitcoin. He has written many books, articles and reviews on the cryptoassets field and his comments have been featured on the major media channels, such as CNBC, the Wall Street Journal, the New York Times, and Forbes.

In this paper, he explains why the equation of exchange is a good technique in order to value cryptoassets and provides an example regarding the valuation of a fictional bandwidth token (INET). We have adapted this model to the valuation of Ether.

The equation of exchange

Ether serves as a proper currency to the Ethereum platform. We could assimilate the Ether to the fiat currency of a particular country and the Ethereum platform to the real economy of that country. Therefore, as the equation of exchange has traditionally been used to explain the flow of money needed to support an economy, it would be reasonable to apply it to Ether valuation.

---

[75] <https://www.express.co.uk/finance/city/903282/Bitcoin-price-news-Ethereum-cryptocurrency-market-bitconnect-binance-latest> [26th April 2018]
[76] https://medium.com/@cburniske/cryptoasset-valuations-ac83479ffca7 [2nd May 2018]

The equation of exchange is formulated as MxV = PxQ, and when applied to cryptocurrencies it can be interpreted as:

- M = size of the currency base;
- V = velocity of the currency;
- P = price of the digital resource being provisioned;
- Q = quantity of the digital resource being provisioned.

By using this equation, we will able to obtain each year's Ether current utility value (CUV). Then, since markets price assets based on future expectations, we should discount a future utility value back to the present to derive a rational market price for any given year.

Therefore, we will need first to solve M (Monetary Base), which is the size of the monetary base necessary to support a cryptoeconomy of size PxQ at velocity V and dividing this amount by the ETH supply at any moment we will obtain CUV.

An important fact to consider is that P (Price) does not represent the price of the cryptoasset (Ether), but instead the price of the resource being provisioned by the cryptonetwork (in our case, this will be measured in GAS).

Q (Quantity) represents the quantity of the resource provisioned and V (Velocity) represents the number of times a currency changes hands in a given time period.

Inputs for our model

There are four sections which we have completed in the model. Find below a scheme just for illustrative purposes in order to make the explanation easier (each section will be explained in detail) – left column shows inputs and right column shows outputs:

Supply side	
Metric	Assumption
Initial release	72.000.000,00
Allocated to the public	*60.000.000,00*
Allocated to the developer fund	*12.000.000,00*
Total supply April 2018	99.078.000,00
Increase in the supply per year	18.000.000,00
Increase in the supply per month	1.500.000,00
Inflation	0,01
Free-foat percentage	0,8

Section A

ETH supply		
Year from launch	2018	2019
Initial release	72.000.000,00	
Years' supply		9.600.390,00
Total supply	111.078.000,00	120.678.390,00
Free-float supply	88.862.400,00	96.542.712,00

Economy Inputs	
Metric	Assumption
Gas cost (USD)	$ 0,454
Cost decline	14%
Annual number of transactions*gas used	18.980.000.000.000
CAGR for number of transactions	35%
% of global number of transactions	80%
Velocity	14

Section B

ETH Economy and Utility Value Output		
Year	2018	2019
Gas cost (USD)	$ 0,454	$ 0,398
Annual number of transactions*gas used	34.591.050.000.000	46.697.917.500.000
Annual number of transactions (ETH)	27.672.840.000.000	37.358.334.000.000
% Penetration	0,11%	0,24%
Transactions using ETH	30.900.753.462	88.749.839.108
ETH GDP	$ 14.028.942.072	$ 35.344.234.171
Monetary Base	$ 1.002.067.291	$ 2.524.588.155
Current Utility Value of Each ETH	$ 11,27662	$ 26,14996

Adoption Curve Inputs	
Metric	Assumption
Base Year	2015
Saturation Percentage	20
Start of Fast Growth	2022
Take Over Time	6

Section C

Adoption Curve Output		
Year	2014	2015
Output	0,01%	0,01%
Percent Penetration each Year (after adjustment)	0,00%	0,01%
Saturation	20	20

Deriving Current Market Value from Future Utility	
Metric	Value
End Year	2028
Years Between 2018 and End Year	10
Discount Rate	35%
MV in 2018 based on Expectations for Future Utility	$ 229,111

Section D

a) Section A – Supply inputs → This section calculates the amount of Ether that will be in the float.

b) Section B – Economy inputs → This section quantifies the Ether economy using the equation of exchange.

c) Section C – Adoption Curve inputs → This section projects the percentage adoption of Ether within its target market (and this output will also be used as an input for Section B).

   The abovementioned sections altogether provide Ether current utility value (CUV) and, then, it is necessary to discount it back to present value.

d) Section D – Discounting → This section discounts future utility values to the present, obtaining current value of Ether.

We explain below the reasoning we have followed for each of the inputs of the model, but it is important to highlight the fact that information is quite uncertain, and many assumptions are subjective and unpredictable, thus they may change considerably. To mitigate this situation, we have considered a base scenario, but we have also modeled a more optimistic and more pessimistic scenarios.

a) <u>Section A – Supply inputs</u>

   How many Ether will be in circulation in the following ten years? In order to calculate this figure we have undertaken the following reasoning:

   • Initial Ether release – 72,000,000 ETH. 60 million were allocated to the public and the remaining 12 million to the developer fund.

   • Total supply at the end of April 2018 – 99,078,000 ETH[77].

   • Increase in the supply per year – 18,000,000 ETH. This is the fixed amount of ETH that will be released each year; however, as Ethereum platform is going to change to Casper protocol (proof-of-stake), this will not be applicable anymore and we will need to consider inflation.

   • Inflation – Once Casper protocol is implemented, ETH inflation has been estimated to be between 0.5% and 2%[78].

   In the base scenario we have considered an inflation of 1%. The inflation will be 0.5% in the optimistic scenario and 1.5% in the pessimistic one. The lower the inflation, the lower the ETH supply and the higher the CUV of each ETH.

   • Free-float percentage – We understand this percentage should be high because utility of ETH is a key factor. To execute commands and develop applications in the Ethereum Blockchain, ETHs are needed. In this sense, some people compare ETH to "fuel" for the Ethereum ecosystem. Therefore, ETH has a real utility, as you cannot use the Ethereum platform if you do not hold ETH, thus,

---

[77] <https://etherscan.io/stat/supply> [2nd May 2018].
[78] <https://onchainfx.com/asset/ethereum> [13th May 2018].

the majority of people will use ETH and not hold it as a store of value or speculative asset.

In this regard, we have considered a 80% free-float percentage for the base scenario. This percentage will be 70% in the optimistic one and 85% in the pessimistic one. The lower the free-float percentage, the lower the ETH supply and the higher the CUV of each ETH.

Finally, we have estimated that the change to Casper will happen in mid-2019. Therefore, taking into account the number of ETH at the end of 2018, we have added the new ones to be created until mid-2019 and from that date we have adjusted the amount by the corresponding inflation.

The inputs for the base scenario are the following:

Supply side	
Metric	**Assumption**
Initial release	72.000.000,00
Allocated to the public	*60.000.000,00*
Allocated to the developer fund	*12.000.000,00*
Total supply April 2018	99.078.000,00
Increase in the supply per year	18.000.000,00
Increase in the supply per month	1.500.000,00
Inflation	0,015
Free-foat percentage	0,85

And the output, that is, the number of Ether in circulation for each year, is the following:

ETH supply											
Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Initial release	72.000.000,00										
Years' supply		9.600.390,00	1.206.783,90	1.218.851,74	1.231.040,26	1.243.350,66	1.255.784,17	1.268.342,01	1.281.025,43	1.293.835,68	1.306.774,04
Total supply	111.078.000,00	120.678.390,00	121.885.173,90	123.104.025,64	124.335.065,90	125.578.416,55	126.834.200,72	128.102.542,73	129.383.568,15	130.677.403,84	131.984.177,87
Free-float supply	88.862.400,00	96.542.712,00	97.508.139,12	98.483.220,51	99.468.052,72	100.462.733,24	101.467.360,58	102.482.034,18	103.506.854,52	104.541.923,07	105.587.342,30

b) Section B – Economy inputs

- Gas cost – Taking into account current data, we have calculated the average cost in USD for the past three months[79] (from February 11th to May 13th) and this average is 0.454 USD per transaction.

- Cost decline – According to Burniske *"Cost declines are a necessary part of most cryptoasset models given the deflationary nature of the resources they provision[80]"*. He uses a 16% rate of cost decline and we have found another study that estimates a 20% decline with regards to Ether[81].

Taking these rates into consideration, we have assumed a cost decline of 14% in the base scenario, 12% in our optimistic one and 20% in our pessimistic one. The lower the percentage, the higher the Monetary Base and, thus, the CUV of each ETH.

---

79 <https://bitinfocharts.com/comparison/ethereum-transactionfees.html#3m> [13th May 20018]
80 <https://medium.com/@cburniske/cryptoasset-valuations-ac83479ffca7> [2nd May 2018].
81 Pfeffer, J (December 2017) *An (Institutional) Investor's Take on Cryptoassets.* Version 6.

- Annual number of transactions – We have identified the TAM (Total Addressable Market) as the total number of transactions performed within the Blockchain platform per day. In accordance to current data, 1,3 million transactions are performed by day[82].

- Gas used – The gas needed for a simple transaction such as exchanging one ETH amounts to 21,000 units; however, this amount, can be considerably higher in more complex transactions[83].

  Taking this into account, in the base scenario we have assumed an amount of 40,000 gas used per transaction, 60,000 gas in the optimistic one and 30,000 gas in the pessimistic one.

- CAGR (Compound Annual Growth Rate) for the number of transactions – A study based on Coin Desk data has estimated this percentage as 35%[84] per annum.

- % of global number of transactions – This is a particular subjective input.

  From the total addressable market, we understand that a high percentage of it would be potentially willing to use some protocol developed under the Ethereum platform.

  For this reason, we have considered a percentage of 80% in the base scenario, 85% in the optimistic one and 75% in the pessimistic one.

- Velocity – As a framework, velocity of Bitcoin for the year 2016 was 6.5, that is, a Bitcoin changed hands 6.5 times during the year 2016 and USD M1 money stock velocity is around 5.5 times. Burniske uses a velocity of 20 in its example, based on future prospects on Bitcoin.

  In our case, we think that this velocity is too high and, in the base scenario, we have used a velocity of 14. In the optimistic scenario it will be 12 and in the pessimistic one it will be 16. The lower the velocity, the higher the Monetary Base and, thus, the CUV of each ETH.

Therefore, the inputs for the base scenario in this section are the following:

Economy Inputs	
Metric	**Assumption**
Gas cost (USD)	$ 0,454
Cost decline	14%
Annual number of transactions*gas used	18.980.000.000.000
CAGR for number of transactions	35%
% of global number of transactions	80%
Velocity	14

---

82 <https://bitinfocharts.com/comparison/ethereum-transactions.html#1y> [13th May 2018].
83 <https://masterthecrypto.com/ethereum-what-is-gas-gas-limit-gas-price/?lang=es> [13th May 2018].
84 <https://www.coindesk.com/report-blockchain-become-8-billion-global-industry-2024/> [13th May 2018].

c) Section C – Adoption Curve Inputs

- Base year – It determines when the cryptocurrency was or will be launched. In the case of Ether, it was launched in the year 2015.

- Saturation percentage – It represents the maximum share the cryptocurrency will take of its target market.

- Start of fast growth – It determines when the cryptocurrency will hit 10% of its Saturation Percentage

- Take over time – It is the amount of time it takes for the cryptocurrency to go from 10% to 90% of its Saturation Percentage. This will determine the steepness of the Adoption Curve.

The last three inputs are particularly subjective. Taking into account that, we understand that Ether and the Ethereum platform have a huge potential of growth, we have estimated these inputs as 20%, 2022 and 6 years in the base scenario. For the more optimistic scenario we have estimated them as 30%, 2021 and 4 years and as 15%, 2023 and 7 years for the pessimistic scenario.

Therefore, the inputs for the base scenario in this section are the following:

Adoption Curve Inputs	
Metric	Assumption
Base Year	2015
Saturation Percentage	20
Start of Fast Growth	2022
Take Over Time	6

And the outputs the following:

Adoption Curve Output															
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Output	0,01%	0,01%	0,03%	0,06%	0,12%	0,24%	0,50%	1,01%	2,00%	3,75%	6,49%	10,00%	13,51%	16,25%	18,00%
Percent Penetration each Year	0,00%	0,01%	0,02%	0,05%	0,11%	0,24%	0,49%	1,01%	1,99%	3,75%	6,49%	9,99%	13,50%	16,24%	17,99%
Saturation	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

These outputs are combined with the inputs in Section B in order to get the Monetary Base and CUV of each ETH:

ETH Economy and Utility Value Output											
Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Gas cost (USD)	$ 0,454	$ 0,398	$ 0,349	$ 0,306	$ 0,269	$ 0,236	$ 0,207	$ 0,181	$ 0,159	$ 0,140	$ 0,122
Annual number of transactions*gas used	34.591.050.000.000	46.697.917.500.000	63.042.188.625.000	85.106.954.643.750	114.894.388.769.063	155.107.424.838.234	209.395.023.531.616	282.683.281.767.682	381.622.430.386.371	515.190.281.021.601	695.506.879.379.161
Annual number of transactions (ETH)	27.672.840.000.000	37.358.334.000.000	50.433.750.900.000	68.085.563.715.000	91.915.511.015.250	124.085.939.870.588	167.516.018.825.293	226.146.625.414.146	305.297.944.309.097	412.152.224.817.281	556.405.503.503.329
% Penetration	0,11%	0,24%	0,49%	1,01%	1,99%	3,75%	6,49%	9,99%	9,99%	9,99%	9,99%
Transactions using ETH	30.900.753.462	88.749.839.108	249.346.041.188	686.180.774.214	1.832.483.932.492	4.651.109.304.693	10.866.749.119.978	22.600.327.688.536	30.510.442.379.524	41.189.097.212.357	55.605.281.236.682
ETH GDP	$ 14.028.942.072	$ 35.344.234.171	$ 87.106.111.649	$ 210.271.224.812	$ 492.579.828.142	$ 1.096.700.754.026	$ 2.247.638.101.118	$ 4.100.498.238.368	$ 4.855.853.177.015	$ 5.750.352.446.465	$ 6.809.627.897.129
Monetary Base	$ 1.002.067.291	$ 2.524.588.155	$ 6.221.865.118	$ 15.019.373.201	$ 35.184.273.439	$ 78.335.768.145	$ 160.545.578.651	$ 292.892.731.312	$ 346.846.655.501	$ 410.739.460.462	$ 486.401.992.652
Current Utility Value of Each ETH	$ 11,27662	$ 26,14996	$ 63,80867	$ 152,50693	$ 353,72436	$ 779,74952	$ 1.582,23864	$ 2.857,99100	$ 3.350,95349	$ 3.928,94495	$ 4.606,63165

The process for reaching these values is the following (each line of the table is explained):

- Gas cost – It is adjusted each year considering the cost decline.

- Annual number of transactions*Gas used – It is adjusted considering the CAGR.

- Annual number of transactions (ETHER) – It is obtained by multiplying the previous line and "% of global number of transactions".

- % Penetration – It is taken from the Adoption Curve outputs.

- Transactions using ETH – It is obtained by multiplying "Annual number of transactions" and "% Penetration".

- ETH GDP – It is obtained by multiplying "Gas cost (USD)" and "Transactions using ETH".

- Monetary Base – It is obtained by dividing "ETH GDP" by "Velocity".

- Current Utility Value of each ETH – It is obtained by dividing "Monetary Base" by "Free-float supply" obtained in Section A.

d) Section D – Discounting

Now that we have obtained the current utility value of Ether, it is necessary to discount this value back to present.

The difficult input in this regard is the discount rate to be used. Burniske proposes a range between 30% and 50% (3–5x the discount rate used for risky equities that have high WACC's). We consider that we could assimilate investment in Ether as an investment carried out by venture capitalists. The project is extremely risky but the potential gains are unlimited.

Thus, we have considered a base discount rate of 35%, typical of the venture capital industry. In the more optimistic scenario we have considered a 30% rate and a 40% rate in the more pessimistic one.

In addition, we have considered 2028 as the final year for our valuation, as we understand a medium-term period of 10 years is reasonable for our valuation purposes. The uncertainty for longer periods of time will be even higher.

The result, that is, current market value of ETH based on expectations for future utility is the following:

Deriving Current Market Value from Future Utility	
Metric	Value
End Year	2028
Years Between 2018 and End Year	10
Discount Rate	35%
MV in 2018 based on Expectations for Future Utility	$ 229,111

Conclusions

According to the valuation we have carried out, ETH market value in 2018 based on future expectations is 229.11 USD in the base scenario.

From this amount, 11.28 USD are assigned to its current utility value in 2018 and the remaining 217.83 USD to the discounted expected utility value:

Metric	Value
Current Utility Value in 2018	$ 11,28
Discounted Expected Utility Value	$ 217,83

Current ETH price is 699.69 USD (May 17th, 2018). Therefore, it could be understand that it is overvalued. Interestingly, ETH price was around 229 USD just one year ago. However, as we had already pointed out, the subjective nature and uncertainty involving many of the inputs make this result very volatile.

Considering the inputs for the optimistic scenario, current ETH market value will be 2,400.33 USD:

Deriving Current Market Value from Future Utility	
Metric	Value
End Year	2028
Years Between 2018 and End Year	10
Discount Rate	30%
MV in 2018 based on Expectations for Future Utility	$ 2.400,332

Metric	Value
Current Utility Value in 2018	$ 26,06
Discounted Expected Utility Value	$ 2.374,27

Finally, considering the inputs for the pessimistic scenario, current ETH market value will be 22.15 USD:

Deriving Current Market Value from Future Utility	
Metric	Value
End Year	2028
Years Between 2018 and End Year	10
Discount Rate	40%
MV in 2018 based on Expectations for Future Utility	$ 22,155

Metric	Value
Current Utility Value in 2018	$ 3,86
Discounted Expected Utility Value	$ 18,29

It is true that these are both extreme scenarios, in which all the subjective variables have taken extreme values in both directions. However, current price (699.69 USD as of May 17th, 2018) is between the value estimated for base and optimistic cases. Thus, the valuation we have obtained would be consistent with moderately optimistic assumptions in the model.

In any case, we understand that the most valuable conclusions we have reached undertaking this valuation is that, it is possible to value cryptocurrencies but the uncertainty regarding the necessary inputs make valuations too unpredictable and we are not sure to what extent the results are trustworthy.

Another conclusion could be that existing models are not useful or do not consider appropriate inputs to try to value cryptocurrencies and new ones should be developed.

7. CONCLUSIONS

Despite the uncertainty surrounding cryptocurrencies, experts foresee more potential in the technology behind them: Blockchain. Some of them even dare to say that it is going to be as disruptive as other technological development such as the Internet and, in practice, there are plenty examples of Blockchain implementation in many diverse fields such as healthcare, enterprises internal procedures systems, or banking transactions among many others.

The impact of Blockchain technology varies from one field to another, having a huge potential in payment systems or communication between different enterprises from our viewpoint. But the implementation of Blockchain is limitless and a lot of companies are currently working on developing many applications based on open-source systems like Ethereum in order to take advantage of the positive aspects that Blockchain offers and that we have discussed in this paper. Nonetheless, even though Ethereum, and consequently Ether, is more promising that other major Blockchain project, its price volatility might hinder a positive evolution of this system.

Regarding Blockchain potential, we would adopt a prudent position when it comes to disruption prestige. We agree Blockchain technology implementation might transform many sectors but there are many challenges and improvements for this technology ahead. Furthermore, regarding new technological developments like Smart Contracts, we strongly believe human intervention will be necessary in the future even though they might substitute humans in non-complex, repeating, and ordinary activities.

When it comes to cryptocurrencies, a key issue is that there is not a solid consensus about the categorization of cryptocurrencies. The main difficulty derives from the various features of the existing cryptocurrencies.

To be considered a real currency, cryptocurrencies should comply with the functions of medium of exchange, store of value and unit of account. However, many of the existing cryptocurrencies cannot be used by their holders as a medium of exchange for acquiring different products or services. In addition, store of value and unit of account are closely related to volatility and, in this regard, high price volatility is a common characteristic of existing cryptocurrencies.

Considering other options, the U.S. Securities and Exchange Commission (SEC) is treating them as securities, (in particular, regarding ICOs). On the other hand, the Internal Revenue Service (IRS), also in the United Stated, is treating them since the year 2014 as property.

Others have considered them as the first digital commodity, idea also supported since the year 2015 by the U.S. Commodity Futures Trading Commission (CFTC). In fact, in the year 2017 there was an official launch of Bitcoin future exchanges by two of the world's largest future exchanges, the Chicago Board Options Exchange (CBOE) and Chicago Mercantile Exchange (CME).

Finally, cryptocurrencies could be considered as a new asset class, but some experts on the subject do not agree with this idea because an asset class generates or is expected

to generate cash flows in the future and it can be valued and many cryptocurrencies do not comply with these facts.

When considering the growth potential of the cryptocurrency market, it is safe to say that the need for supervision and regulation grows as well. Regulation is, in our opinion, necessary for the success of cryptocurrencies. As cryptocurrencies become more mainstream, regulation is needed to ensure the protection of investors. Many governments, tax authorities and regulatory agencies are concerned with the lax regulatory treatment the cryptocurrency market is enjoying and are starting to crack down on them. Their current objective is to better grasp the concept of cryptocurrencies and understand how, if possible, they would fit in the existing regulatory framework.

We have observed that regulatory agencies have placed their focus mostly on ICOs as there is a near consensus of them being classified as securities offerings which should comply with federal securities laws. Another reason for the regulatory battle against cryptocurrency exchanges and ICOs is that a large percentage of ICO's have been fraudulent.

Moreover, we believe that there must be a worldwide uniformity in the regulatory frameworks. There must be a global consensus when it comes to the classification of cryptocurrencies and ICOs. If regulatory frameworks are uneven country to country, investors will transact in overseas exchanges since cryptocurrencies are traded virtually and this is fairly easy to do. Governments and regulatory agencies aim to protect investors through regulation and do so without lagging behind other countries in technological and financial innovation.

We have experienced several difficulties trying to valuate ETH. We have used a model based on the equation of exchange but existing information about future predictions is quite uncertain, therefore, the inputs to be included into the model are very variable.

We have obtained reasonable results but their accuracy would vary a lot depending on the real future data and the development, growth and effective mainstream use of the Ethereum platform.

We think that, in the near future, new models and ways of valuating cryptocurrencies will arise, as there is a growing concern and a necessity in this regard. They should consider cryptocurrencies particular features, and, we believe that future results will be more exact and reliable.

8. BIBLIOGRAPHY

– Adkisson, J. (2018) *Why Bitcoin is So Volatile* [online] available at <https://www.forbes.com/sites/jayadkisson/2018/02/09/why-bitcoin-is-so-volatile/#725bfead39fb> [6th April 2018]

– Amazon (2018) *Chris Burniske* [online] available at <https://www.amazon.com/Chris-Burniske/e/B06ZYQVJB9> [13th May 2018]

– Aziz (2018) *Cryptocurrencies: A New Asset Class for Institutional Investors* [online] available at <https://masterthecrypto.com/cryptocurrency-new-asset-class-institutional-investors/> [9th April 2018]

– Aziz (2018) *Guía para Ethereum: Qué es el gas, límite de gas y de gas* [online] available at <https://masterthecrypto.com/ethereum-what-is-gas-gas-limit-gas-price/?lang=es> [3rd May 2018]

– Aziz (2018) *Guide to Valuing Cryptocurrency: How to Value a Cryptocurrency* [online] available at <https://masterthecrypto.com/guide-how-to-value-a-cryptocurrency/> [9th April 2018]

– Barker, J. (2018) *Why is Bitcoin's Value so Volatile?* [online] available at <https://www.investopedia.com/articles/investing/052014/why-bitcoins-value-so-volatile.asp> [6th April 2018]

– Bartlett, W. (2018) *A Primer on Filecoin – The Utility Token Everyone Will Need* [online] available at <https://hacked.com/a-primer-on-filecoin-the-utility-token-everyone-will-need/> [15th may 2018]

– Bergman, A. (2018) *Cryptocurrencies Are Commodities, Says Federal Judge* [online] available at <https://www.forbes.com/sites/greatspeculations/2018/03/09/cryptocurrencies-are-commodities-says-federal-judge/#60ceedc5c09d> [10th April 2018]

– Bernstein, B. (2018) *Making Sense Of Crypto Asset Valuation Insanity* [online] available at <https://www.coindesk.com/making-sense-crypto-asset-valuation-insanity/> [26th April 2018]

– Biller, D. (January 2018) *IMF Projects Venezuela Inflation Will Soar to 13,000 Percent in 2018* [online] available at <https://www.bloomberg.com/news/articles/2018-01-25/imf-sees-venezuela-inflation-soaring-to-13-000-percent-in-2018> [23rd March 2018]

– Bitcoin.org (2018) *Frequently Asked Questions: What is Bitcoin* [online] available at <https://bitcoin.org/en/faq#what-is-bitcoin> [17th April 2018]

– BitInfoCharts (2018) *Ethereum Transactions Historical Chart* [online] available at <https://bitinfocharts.com/comparison/ethereum-transactions.html#1y> [13th May 2018]

- BitInfoCharts (2018) *Ethereum, Litecoin, Vertcoin Average Transaction Fee Historical Chart* [online] available at <https://bitinfocharts.com/comparison/transactionfees-eth-ltc-vtc.html> [2nd May 2018]

- Block Fortune (2017) *Characteristics of CryptoCurrencies* [online] available at <http://www.blockfortune.com/2017/07/characteristics-of-cryptocurrencies/> [8th April 2018]

- Bloomberg (2018) *The SEC is Sending Subpoenas in Expanded ICO Crackdown* [online] available at <http://fortune.com/2018/03/01/sec-ico-cryptocurrency-subpoenas/> [15th May 2018]

- Boesler, M. (November 2017) *Count New York Fed's Dudley Among the Bitcoin Skeptics* [online] available at <https://www.bloomberg.com/news/articles/2017-11-29/count-new-york-fed-s-dudley-among-the-bitcoin-skeptics> [23rd March 2018]

- Browne, R. (August 2017) *Estonia wants to launch its own government-backed cryptocurrency called 'estcoin'* [online] available at <https://www.cnbc.com/2017/08/23/estonia-cryptocurrency-called-estcoin.html> [23rd March 2018]

- Buchko, S. (2017) *The End of Mining: Ethereum's Move to Proof-of-Stake* [online] available at <https://coincentral.com/when-will-ethereum-mining-end/> [28th April 2018]

- Buck, J.(October 2017) *Russia Issuing CryptoRuble* [online] available at <https://cointelegraph.com/news/breaking-russia-issuing-cryptoruble> [23rd March 2018]

- Burniske, C. (2017) *Cryptoassets Valuations* [online] available at <https://medium.com/@cburniske/cryptoasset-valuations-ac83479ffca7> [27th April 2018]

- Business Insider (March 2017) *The Blockchain in Banking Report: The future of blockchain solutions and technologies* [online] available at <http://www.businessinsider.com/blockchain-in-banking-2017-3>

- Cardenas, J. (April 2018) *Santander lanza un servicio de transferencias internacionales basado en blockchain* [online] available at <http://www.expansion.com/empresas/banca/2018/04/12/5acf324ee5fdea4a4c8b 469f.html> [10th Mayo 2018]

- Chia, B. *Evolution of Cryptocurrency: Replacing Modern Cash* [online] available at <https://masterthecrypto.com/evolution-cryptocurrency-replacing-modern-cash/> [5th April 2018]

- Chia, B. *Evolution of Cryptocurrency: The problem with Money Today* [online] available at <https://masterthecrypto.com/evolution-cryptocurrency-problem-money-today/> [5th April 2018]

–   Chia, B. *Evolution of Cryptocurrency: What is Cryptocurrency?* [online] available at <https://masterthecrypto.com/what-is-cryptocurrency/> [5th April 2018]

–   Chong, K.Z. (2017) *What factors affect the supply of Ethereum?* [online] available at <https://www.quora.com/What-factors-affect-the-supply-of-Ethereum#> [2nd May 2018]

–   Churchouse, T. (2017) *Is a cryptocurrency like a stock? This is what the SEC says …* [online] available at <https://stansberrychurchouse.com/asia-wealth-investment-daily/cryptocurrency-like-stock-sec-rules/> [9th April 2018]

–   Clark Francis, J., W. Toy, W., and Gregg Whittaker, J. (2000) *The Handbook of Equity Derivatives – Revised Edition*. John Wiley & Sons, Inc.

–   Clayton , J. (2018) *Chairman's Testimony on Virtual Currencies: The Roles of the SEC and CFTC* [online] available at <https://www.sec.gov/news/testimony/testimony-virtual-currencies-oversight-role-us-securities-and-exchange-commission> [4th May 2018]

–   Clearblocks (2014) *Valuing Bitcoin and Ethereum with Metcalfe's Law* [online] available at <https://medium.com/@clearblocks/valuing-bitcoin-and-ethereum-with-metcalfes-law-aaa743f469f6> [15th may 2018]

–   Coin Telegraph (2017) *What is Cryptocurrency. Guide for Beginners* [online] available at <https://cointelegraph.com/bitcoin-for-beginners/what-are-cryptocurrencies#how-to-buy> [17th April 2018]

–   Connington, J. (2018) *Can Bitcoin or any other cryptocurrency actually work as money?* [online] available at <https://www.telegraph.co.uk/investing/news/can-bitcoin-cryptocurrency-actually-work-money/< [4th April 2018].

–   Court of Justice of the European Union (2015) *The Exchange of traditional currencies for units of the "Bitcoin" virtual currency is exempt from VAT* [online] available at <https://curia.europa.eu/jcms/upload/docs/application/pdf/2015-10/cp150128en.pdf> [9th April 2018]

–   Cryptocurrency Chart (2018) [online] available at <https://www.cryptocurrencychart.com> [6th April 2018]

–   CryptoMedication (2018) *What Do the New SEC Regulations Mean for Cryptocurrency?* [online] available at <https://btcmanager.com/new-sec-regulations-mean-cryptocurrency/> [11th May 2018]

–   Cyrptolization (2018) *Total Market Cap* [online] available at <https://cryptolization.com/> [12th May 2018]

–   D'Alfonso, A., Langer, P. and Vandelis, Z. (October 2017) *The Future of Cryptocurrency. An Investor's Comparison of Bitcoin and Ethereum.* Ryerson University.

– Damodaran, A. (2017) *Bitcoin Backlash: Back to the Drawing Board?* [online] available at <https://www.hvst.com/posts/bitcoin-backlash-back-to-the-drawing-board-XeJfJ8qD> [10th April 2018]

– Damodaran, A. (2017) *The Bitcoin Boom: Asset, Currency, Commodity or Collectible?* [online] available at <https://aswathdamodaran.blogspot.com.es/2017/10/the-bitcoin-boom-asset-currency.html> [10th April 2018]

– Das, S. (2017) *South Korea's Central Bank Chief: Bitcoin is a Commodity, Not a Currency* [online] available at <https://www.ccn.com/south-koreas-central-bank-chief-bitcoin-commodity-not-currency/> [10th April 2018]

– Dhillon, S. (February 2018) *How The Blockchain Can Solve Social Media's Biggest Problems* [online] available at <https://www.forbes.com/sites/valleyvoices/2018/02/28/how-the-blockchain-can-solve-social-medias-biggest-problems/#1e286427cb3d> [10th May 2018]

– Durgun, C. (2017) *Cryptocurrencies, value and mediums of exchange* [online] available at <https://medium.com/@cankut_durgun/cryptocurrencies-value-and-mediums-of-exchange-881043ad9d85> [4th April 2018]

– DW Made of Minds (2018) *Hackers stole $6 million in Russia bank attack via SWIFT system* [online] available at <http://www.dw.com/en/hackers-stole-6-million-in-russia-bank-attack-via-swift-system/a-42616207> [2nd May 2018]

– E-Estonia (2018) *E-Estonia Story* [online] available at <https://e-estonia.com/solutions/healthcare/e-health-record/> [10th May 2018]

– Esteves, R. (2018) *China May Follow Global Cryptocurrency Regulations, Central Bank Report Suggests* [online] available at <https://www.newsbtc.com/2018/03/31/china-may-follow-global-cryptocurrency-regulations-central-bank-report-suggests/> [12th May 2018]

– ETH Gas Station (2018) [online] available at <https://ethgasstation.info/> [2nd May 2018]

– ETHEREUM (2018) *What is Ether?* [online] available at <https://www.ethereum.org/ether> [28th April 2018]

– Etherscan (2018) *Ethereum Transaction Chart* [online] available at <https://etherscan.io/chart/tx> [2nd May 2018]

– Etherscan (2018) *Total Ether Supply and Market Capitalization* [online] available at <https://etherscan.io/stat/supply> [28th April 2018]

– European Central Bank (2015, updated 2017) *What is Money?* [online] available at <https://www.ecb.europa.eu/explainers/tell-me-more/html/what_is_money.en.html> [4th April 2018]

– Evans, A. (2018) *On Value, Velocity and Monetary Theory* [online] available at <https://medium.com/blockchannel/on-value-velocity-and-monetary-theory-a-new-approach-to-cryptoasset-valuations-32c9b22e3b6f> [2nd May 2018]

– Floyd, D. (2018) *$6.3 Billion: 2018 ICO Funding Has Passed 2017's Total* [online] available at <https://www.coindesk.com/6-3-billion-2018-ico-funding-already-outpaced-2017/> [10th May 2018]

– Gaban, L. (2017) *How Cryptocurrency is making us better at money* [online] available at <https://medium.com/cryptocurrency-citizen/how-cryptocurrency-is-making-us-better-at-money-484d455ee8f7> [4th April 2018]

– Glazer, P. (2018) *Global Cryptocurrency Regulation Update* April 2018 [online] available at <https://hackernoon.com/cryptocurrency-regulation-update-april-2018-9778df2b6eac> [12th May 2018]

– Glazer, P. (2018) *Global Cryptocurrency Regulation Update* February 2018 [online] available at <https://hackernoon.com/state-of-cryptocurrency-regulation-february-2018-a316c291320> [12th May 2018]

– Glazer, P. (2018) *Global Cryptocurrency Regulation Update* March 2018 [online] available at <https://hackernoon.com/global-cryptocurrency-regulation-update-march-2018-7a779733a407> [12th May 2018]

– Gordon, S. (2018) *Ripple Guide* [online] available at <https://bitcoinmagazine.com/guides/what-ripple/> [23rd March 2018]

– Gulf News (October 2017) *Dubai Land Department becomes world's first government entity to conduct all transactions through Blockchain network* [online] available at <https://gulfnews.com/business/sectors/technology/dubai-land-department-becomes-world-s-first-government-entity-to-conduct-all-transactions-through-blockchain-network-1.2102060> [10th May 2018]

– Hall, T. (2017) *What's Ether Worth? A Probabilistic Valuation* [online] available at <https://steemit.com/bitcoin/@chainstudy/what-s-ether-worth> [26th April 2018]

– Hans, P. (2017) *Bitcoin: Currency or Asset Class – Boom or Bubble* [online] available at <https://www.forbes.com/sites/peterhans/2017/11/16/bitcoin-currency-or-asset-class-boom-or-bubble/2/#29800b57513e> [10th April 2018]

– Higgins, S. (2017) *Report: Blockchain Could Become an $8 Billion Global Industry by 2024* [online] available at <https://www.coindesk.com/report-blockchain-become-8-billion-global-industry-2024/> [13th May 2018]

– HM Revenue and Customs, (2014) *Revenue and Customs Brief 9 (2014): Bitcoin and other cryptocurrencies* [online] available at <https://www.gov.uk/government/publications/revenue-and-customs-brief-9-2014-bitcoin-and-other-cryptocurrencies> [14th May 2018]

– Iinuma, A. (2018) *Why is the Cryptocurrency Market so Volatile: Expert Take* [online] available at <https://cointelegraph.com/news/why-is-the-cryptocurrency-market-so-volatile-expert-take> [6th April 2018]

- Investopedia (2018) *Blockchain* [online] available at <https://www.investopedia.com/terms/b/Blockchain.asp#ixzz5CWbL3zQ1> [6th April 2018]

- Investopedia (2018) *Commodity* [online] available at <https://www.investopedia.com/terms/c/commodity.asp> [10th April 2018]

- Investopedia (2018) *Cryptocurrency* [online] available at <https://www.investopedia.com/terms/c/cryptocurrency.asp#ixzz5CSiAnCU4 > [6th April 2018]

- Investopedia (2018) *Medium of Exchange* [online] available at <https://www.investopedia.com/terms/m/mediumofexchange.asp> [4th April 2018]

- Investopedia (2018) *Store of Value* [online] available at <https://www.investopedia.com/terms/s/storeofvalue.asp> [6th April 2018]

- Investopedia (2018) *West Texas Intermediate – WTI* [online] available at <https://www.investopedia.com/terms/w/wti.asp> [9th April 2018]

- Irrera, A. (April 2018) *JPMorgan, National Bank of Canada, others test debt issuance on blockchain* [online] available at <https://www.reuters.com/article/us-jpmorgan-blockchain/jpmorgan-national-bank-of-canada-others-test-debt-issuance-on-blockchain-idUSKBN1HR0CM?utm_source=applenews> [10th Mayo 2018]

- Jamali, R., Sherwin, L. and Pantoja, R. (2016) *Cryptocurrency. Digital Asset of the Future: Bitcoin vs Ethereum?* [online] available at <https://www.economist.com/sites/default/files/economist_case_comp_ivey.pdf> [9th April 2018]

- John (2017) *7 Smart Ethereum Price Prediction Methods For Holders* [online] available at <https://spreadstreet.io/blog/7-smart-ethereum-price-prediction-methods-hodlers/> [2nd May 2018]

- Kharpal, A. (September 2017) *Japanese banks are thinking of making their own cryptocurrency called the J-Coin* [online] available at <https://www.cnbc.com/2017/09/27/japanese-banks-cryptocurrency-j-coin.html> [23rd March 2018]

- Kith, N. (2018) *Ethereum (ETH) could hit $10,000 and above in the future* [online] available at <https://cryptorecorder.com/2018/02/09/ethereum-eth-could-hit-10000-and-above-in-the-future/> [2nd May 2018]

- Kith, N. (2018) *The upcoming March BURN will push Binance Coin (BNB) to $50* [online] available at <https://www.cryptorecorder.com/2018/02/18/the-upcoming-march-burn-will-push-binance-coin-bnb-to-50/> [26th April 2018]

- Knight, W. (June 2017) *China's Central Bank Has Begun Cautiously Testing a Digital Currency* [online] available at <https://www.technologyreview.com/s/608088/chinas-central-bank-has-begun-cautiously-testing-a-digital-currency/> [23rd March 2018]

– Kraviec, RJ., Housman, D., White, M., Filipova, M., Quarre, F., Barr, D., Nesbitt, A., Fedosova, K., Killmeyer, J., Israel, A., Tsai, L. (2016) *Blockchain: Opportunities for Health Care* [online] available at <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/public-sector/us-blockchain-opportunities-for-health-care.pdf>

– Krawisz, D. (2015) *Bitcoin as a Store of Value, Unit of Account, and Medium of Exchange* [online] available at <http://nakamotoinstitute.org/mempool/bitcoin-as-a-store-of-value-unit-of-account-and-medium-of-exchange/> [6th April 2018]

– Lam, E. (2017) *What the World's Central Banks Are Saying About Bitcoin* [online] available at <https://www.bloomberg.com/news/articles/2017-12-15/what-the-world-s-central-banks-are-saying-about-cryptocurrencies> [10th April 2018]

– Latour, R, Brenan, C. (August 2017) *U.S. Imposes Additional Sanctions Against Venezuela* [online] available at <https://www.gtlaw.com/en/insights/2017/8/us-imposes-additional-sanctions-against-venezuela> [23rd March]

– Lee, Y. (2017) *Cryptocurrencies could be rocked by major hacks next year, expert warns* [ONLINE] AVAILABLE AT <https://www.cnbc.com/2017/12/12/bitcoin-hack-expect-larger-cyber-attacks-in-2018-a10-networks-says.html> [12th May 2018]

– Levi, A. (May 2018) *The Future of Blockchain Tech*- CB Insights

– Liao, S. (2018) *The SEC is probing cryptocurrency companies with initial coin offerings* [online] available at <https://www.theverge.com/2018/3/1/17066828/sec-cryptocurrency-companies-icos-initial-coin-offerings-regulation> [15th may 2018]

– Makridakis, S., Polemitis, A, Giaglis, G. and Louca, S. (October 2017) *Blockchain: Current Achievements, Future Prospects/Challenges and its Combination with AI.* University of Nicosia.

– Meyer, D. (2018) *Mining a Bitcoin Costs About as Much as Buying One These Days* [online] available at <http://fortune.com/2018/03/16/bitcoin-mining-cost-profitability/> [15th May 2018]

– Morris, C. (2018) *Growing Whispers of Federal Regulation Send Cryptocurrencies Down* [online] available at <http://fortune.com/2018/05/01/cryptocurrency-federal-regulation-ethereum/> [10th May 2018]

– Morrison A. , Sinha S. (2016) *A Primer on Blockchain* [online] available at <http://usblogs.pwc.com/emerging-technology/a-primer-on-blockchain-infographic/> [13th May 2018]

– My Crypto Buddy (2018) *GPU Profitability Comparison* [online] available at <http://www.mycryptobuddy.com/GPUProfitability> [15th May 2018]

– My Crypto Buddy (2018) *SHA256 Profitability Comparison* [online] available at <http://www.mycryptobuddy.com/SHA256Profitability> [15th May 2018]

– New York Times Associated Press (December 2017) *Venezuela Plans a Cryptocurrency, Maduro Say*s [online] available at <https://www.nytimes.com/2017/12/03/world/americas/venezuela-cryptocurrency-maduro.html> [23rd March 2018]

– Nova, A. (2018) *'Wild west' days are over for cryptocurrencies, as IRS steps up enforcement* [online] available at <https://www.cnbc.com/2018/01/17/irs-steps-up-tax-enforcement-for-cryptocurrencies.html> [11th May 2018]

– O'Neill, P.H. (2017) *After losing millions to hackers, SWIFT banks now enforce mandatory security controls* [online] available at <https://www.cyberscoop.com/losing-millions-hackers-swift-banks-now-enforce-mandatory-security-controls/> [26th April 2018]

– OCFX (2018) *Ethereum* [online] available at <https://onchainfx.com/asset/ethereum> [3rd May 2018]

– Orcutt, M. (2017) *What the Hell is an Initial Coin Offering?* [online] available at <https://www.technologyreview.com/s/608799/what-the-hell-is-an-initial-coin-offering/> [26th April 2018]

– Oxford Dictionaries (2018) Definition of Cryptocurrency [online] available at <https://en.oxforddictionaries.com/definition/cryptocurrency> [5th April 2018]

– Peaster, W. (2018) *Bitcoin, Cryptocurrency and Taxes: What You Need to Know* [online] available at <https://blockonomi.com/cryptocurrency-taxes/> [12th May 2018]

– Pfeffer, J (December 2017) *An (Institutional) Investor's Take on Cryptoassets.* Version 6.

– Phillips, K. (2017) *IRS Nabs Big Win Over Coinbase In Bid For Bitcoin Customer Data* [online] available at <https://www.forbes.com/sites/kellyphillipserb/2017/11/29/irs-nabs-big-win-over-coinbase-in-bid-for-bitcoin-customer-data/#74d6c2aa259a > [13th May 2018]

– Pinnell, Z. (2018) *How Does The IRS Treat Cryptocurrencies?* [online] available at <https://www.forbes.com/sites/quora/2018/02/21/how-does-the-irs-treat-cryptocurrencies/#4c0b3c441753> [9th April 2018]

– Rabbani, H. (2017) *What is Hashing & Digital Signature in The Blockchain?* [online] available at <https://blockgeeks.com/what-is-hashing-digital-signature-in-the-blockchain/> [17th April 2018]

– Raitelli, W. (2017) *Cuentas, Transacciones, Gas y Límites de Gas en los Bloques de Ethereum* [online] available at <https://medium.com/@wanraitelli/cuentas-transacciones-gas-y-l%C3%ADmites-de-gas-en-los-bloques-de-ethereum-d2150de36559> [2nd May 2018]

– Reuters (2017) *Factbox: CBOE launches Bitcoin futures contracts, CME to follow* [online] available at <https://www.reuters.com/article/us-bitcoin-futures-contracts-

factbox/factbox-cboe-launches-bitcoin-futures-contracts-cme-to-follow-idUSKBN1E10J8> [10th April 2018]

– Reuters (2018) *Virtual currencies are commodities, US judge rule* [online] available at <https://www.cnbc.com/2018/03/07/cryptocurrencies-like-bitcoin-are-commodities-us-judge-rules.html> [10th April 2018]

– Ripple.com (2018) *Frequently Asked Questions* [online] available at <https://ripple.com/xrp/> [23rd March 2018]

– Roberts, J.J. (2018) *Bitcoin and Taxes: What You Need to Know About Cryptocurrency and the IRS* [online] available at <http://fortune.com/2018/01/29/bitcoin-taxes-cryptocurrency-irs/> [13th May 2018]

– Rosic, A. (2017) *Proof of Work vs Proof of Stake: Basic Mining Guide* [online] available at < https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/> [17th April 2018]

– Rosic, A. (2017) *What is Ethereum Casper Protocol?* [online] available at <https://blockgeeks.com/guides/ethereum-casper/> [28th April 2018]

– Ryan, D. (2017) *Calculating Costs in Ethereum Contracts* [online] available at <https://hackernoon.com/ether-purchase-power-df40a38c5a2f> [2nd May 2018]

– Schleifer, T. (2017) *Silicon Valley is obsessed with ICOs - here's why* [online] available at https://www.recode.net/2017/9/19/16243110/initial-coin-offering-ico-explained-what-is-money-bitcoin-digital-currency [26th April 2018]

– Schwarz, M. (2018) *Transaction Speeds: Which Crypto is the fastest?* [online} available at <https://www.abitgreedy.com/transaction-speed/> [14th May 2018]

– Scotto Di Santolo, A. (2018) *Bitcoin competitor Ethereum built on SAND: "I don't see a business plan!"* Expert's WARNING [online] available at <https://www.express.co.uk/finance/city/903282/Bitcoin-price-news-Ethereum-cryptocurrency-market-bitconnect-binance-latest> [26th April 2018]

– Selkis, R. (2018) *Bitcoin IRS Tax Guide for Individual Filers* [online] available at <https://www.investopedia.com/university/definitive-bitcoin-tax-guide-dont-let-irs-snow-you/> [9th April 2018]

– Seth, S. (2018) *GPU Usage in Cryptocurrency Mining* [online] available at < https://www.investopedia.com/tech/gpu-cryptocurrency-mining/#ixzz5FQ4Gsm53> [17th April 2018]

– Shawdagor, J. (2018) *Is The Meteoric Raise In Cryptocurrencies Triggering More Cyber Attacks?* [online] available at <http://bitcoinist.com/meteoric-rise-cryptocurrencies-triggering-cyber-attacks/> [10th May 2018]

– Strongin, S. and Morehead, D. (February 5, 2018) *Is Bitcoin a (bursting) Bubble?.* Goldman Sachs.

– Terzo, G. (2018) *British Cryptocurrency Exchanges Call on MPs to Enforce Regulation* [online[available at <https://www.ccn.com/british-cryptocurrency-trade-group-seeks-fca-oversight/> [12th May 2018]

– Tomaino, N. (2017) *The Investment Case for ETH* [online] available at <https://thecontrol.co/the-investment-case-for-eth-b9082cabdbab> [2nd May 2018]

– Trading, D. (2017) *Bitcoin: Commodity or Currency* [online] available at <https://www.danielstrading.com/2017/12/12/bitcoin-commodity-currency> [10th April 2018]

– Treece, A. (2017) *Cryptoasset Fundamentals: Considering Store of Value Arguments* [online] available at <https://cryptofundamental.com/cryptoasset-fundamentals-considering-store-of-value-arguments-da5f6a3e877b> [9th April 2018]

– Tripwire (2018) *Cryptocurrency Hacks and Heists in 2017* [online] available at <https://www.tripwire.com/state-of-security/security-data-protection/cyber-security/cryptocurrency-hacks-heists/> [10th May 2018]

– US Securities and Exchange Commission (2017) *Accredited Investors* [online] available at <https://www.sec.gov/fast-answers/answers-accredhtm.html> [9th May 2018]

– US Securities and Exchange Commission (2017) *Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO* [online] available at <https://www.sec.gov/litigation/investreport/34-81207.pdf> [15th May 2018]

– US Securities and Exchange Commission (2018) *Investor Bulletin: Accredited Investors* [online] available at <https://www.investor.gov/additional-resources/news-alerts/alerts-bulletins/investor-bulletin-accredited-investors> [10th May 2018]

– US Securities and Exchange Commission (2018) *Statement on Potentially Unlawful Online Platforms for Trading Digital Assets* [online] available at <https://www.sec.gov/news/public-statement/enforcement-tm-statement-potentially-unlawful-online-platforms-trading> [9th April 2018]

– US Securities Exchange Commission (2018) *Statement on Potentially Unlawful Online Platforms for Trading Digital Assets* [online] available at <https://www.sec.gov/news/public-statement/enforcement-tm-statement-potentially-unlawful-online-platforms-trading> [11th May 2018]

– Van Zwanenburg, J. (2017) *What is Iconomi (ICN)?* [online] available at <https://www.investinblockchain.com/what-is-iconomi-icn/> [10th April 2018]

– Van Zwanenburg, J. (2017) *Why Burn Cryptocurrencies* [online] available at <https://www.investinblockchain.com/why-burn-cryptocurrencies/> [10th April 2018]

– Virdi, D., Seoyoung , K. and Sarin, A. (January 2018) *Crypto-Assets Unencrypted*. Santa Clara University.

– Wikipedia (2018) *Metcalfe's Law* [online] available at <https://en.wikipedia.org/wiki/Metcalfe%27s_law> [15th may 2018]

– Williams, S. (2018) *3 Ways the IRS Is Taxing Cryptocurrencies* [online] available at <https://www.fool.com/taxes/2018/05/03/3-ways-the-irs-is-taxing-cryptocurrencies.aspx> [14th May 2018]

– Wolfe, J. (April 2018) *Bitcoin, the Biggest Bubble in History, Is Popping* [online] available at <https://www.bloomberg.com/news/articles/2018-04-09/bitcoin-seen-popping-like-the-greatest-bubbles-by-bofa> [17th April 2018]

– Wong, J.I. (2018) *The woman who led crypto policing in the US guesses what's next for regulation* [online] available at <https://qz.com/1236501/the-woman-who-once-policed-the-crypto-world-for-the-us-government-says-a-crackdown-is-coming/> [10th May 2018]

– Yermack, D. (2014) *Bitcoin Lacks the Properties of a Real Currency* [online] available at <https://www.technologyreview.com/s/524666/bitcoin-lacks-the-properties-of-a-real-currency/> [4th April 2018]

– Zavyalova, V. (2018) *The drastic rise in cyber-attacks on cryptocurrencies worries blockchain community* [online] available at <https://www.rbth.com/science-and-tech/327380-rise-in-cyber-attacks-cryptocurrency> [10th May 2018]