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BITCOIN: A TECHNICAL AND ECONOMICAL ANALYSIS

BITCOIN: UN'ANALISI TECNICA ED ECONOMICA

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Introduction

The official site bitcoin.org describes Bitcoin[1] as «*the first decentralized digital currency*». The introductory video[2] continues saying that «*bitcoins are digital coins you can send through the internet*».

The main difference between bitcoin and the standard money is immediately evident: bitcoins are not coined by a State mint and there is no Central Bank to control their value.

This currency, with the aim of making online transactions faster and safer, is controlled by all Bitcoin users around the world through a peer-to-peer network. Users can participate in this network by installing on a computer, equipped with high computing power, the homonymous *open source[3]* software.

Transactions between users are done using an app for smartphones and tablets or a computer program, which guarantee anonymity thanks to the encryption of the system. Then, these transactions are validated and recorded in a widespread way by the network nodes, which carry out several checks to verify the validity of the operation. This activity is called "*mining*", a term that metaphorically refers to the activity of gold mining, and the nodes that carry it out are the "miners", who are rewarded with newly issued bitcoins.

The following paper has the purpose of analysing this new payment system. The first chapter will be dedicated to the presentation of the Bitcoin system, deepening its characteristics. The second chapter will explore the advantages and disadvantages of the system. The third chapter will deal with the issue of the tax treatment of cryptocurrencies in Italy. In the fourth chapter there will be some considerations about the potential applications of the blockchain technology.

Lastly, I will summarize the most important aspects of the cryptocurrency and then I will give my opinion about its future and what we should expect from this incredible innovation.

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[1] **Bitcoin** is the payment system; **bitcoin** is the currency exchanged through this system.
[2] https://www.youtube.com/watch?v=Gc2en3nHxA4
[3] An open source software is software with source code that anyone can inspect, modify, and enhance.

Abstract in italiano

Il sito ufficiale bitcoin.org descrive Bitcoin come «la prima valuta digitale decentralizzata». Il video introduttivo afferma inoltre che «i bitcoin sono monete digitali che puoi inviare tramite Internet».

La principale differenza tra bitcoin e moneta standard è subito evidente: i bitcoin non sono coniati da una zecca di Stato e non esiste una Banca Centrale che ne controlli il valore.

Questa valuta, avente l'obiettivo di rendere le transazioni online più veloci e sicure, è controllata da tutti gli utenti Bitcoin in tutto il mondo attraverso una rete peer-to-peer. Gli utenti possono partecipare a questa rete installando su un computer, dotato di elevata potenza di calcolo, l'omonimo software open-source.

Le transazioni tra gli utenti avvengono utilizzando un'app per smartphone e tablet o un programma per computer, che garantiscono l'anonimato grazie alla crittografia del sistema. Queste transazioni vengono quindi validate e registrate dai nodi della rete, che effettuano diversi controlli per verificare la validità dell'operazione. Questa attività si chiama "mining", termine che metaforicamente si riferisce all'attività di estrazione dell'oro, e i nodi che la svolgono, noti come "miners", vengono premiati con bitcoin di nuova emissione.

Il seguente lavoro ha lo scopo di analizzare questo nuovo sistema di pagamento. Il primo capitolo sarà dedicato alla presentazione del sistema Bitcoin, approfondendone le caratteristiche. Il secondo capitolo ne esplorerà i vantaggi e gli svantaggi. Il terzo capitolo tratterà il tema del trattamento fiscale delle criptovalute in Italia. Nel quarto capitolo ci saranno alcune considerazioni sulle potenziali applicazioni della tecnologia blockchain.

Infine, riassumerò gli aspetti più importanti dell'analisi della criptovaluta e darò la mia opinione sul suo futuro e su cosa dobbiamo aspettarci da questa incredibile innovazione.

Chapter 1: what is Bitcoin?

1.1 History

In August 2008, the domain name bitcoin.org was registered online. Two months later, a paper entitled "Bitcoin: A Peer-to-Peer Electronic Cash System" was passed around a cryptography mailing list. This paper marks the first appearance of the mysterious Satoshi Nakamoto, the creator of Bitcoin.

In January 2009, the first block of the blockchain, the so-called "genesis block", was born and 50 BTC were generated. Later, in October 2009, Bitcoin has started listing on New Liberty Standard stock exchange at the exchange rate of 1.309.03 BTC per USD.

Transaction were initially limited to non-economic exchanges between those working on bitcoin's source code. Then, in October 2009, an over-the-counter currency exchange was made at a rate of $0.0010 per bitcoin. Six months later, the first dedicated bitcoin exchange was operational. The price climbed to $0.08 in July 2010 and then to $0.50 in November 2010. By the end of 2013, with the price of bitcoin exceeding $700.00, a few major online retailers including Overstock.com were announcing plans to accept bitcoin.

Today, with the price of bitcoin exceeding $8000.00, an entire industry exists to help users acquire, store, exchange, and transfer bitcoin.
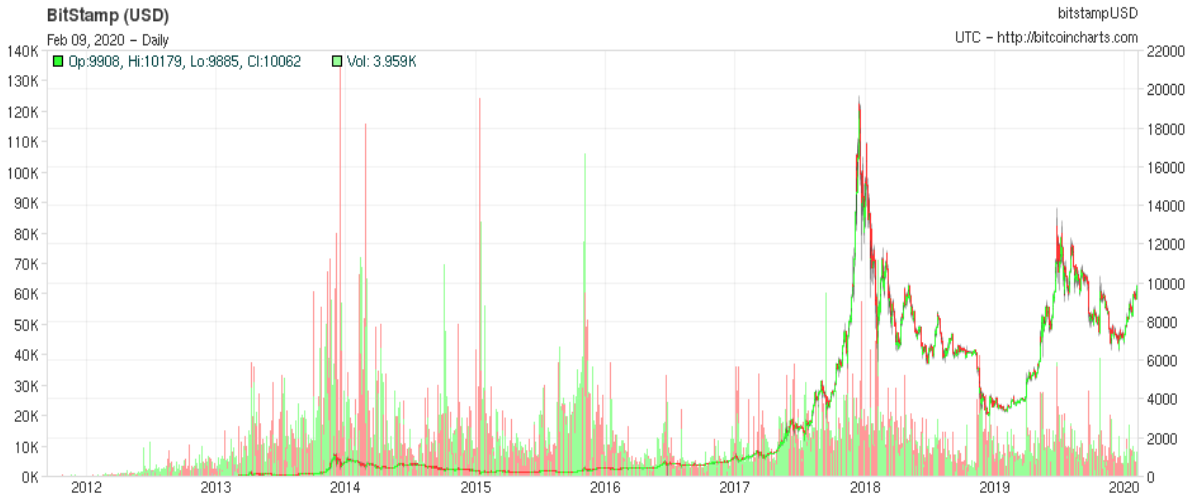

Chart 1 – Exchange values and exchange volumes of bitcoin/USD. Source: Bitcoincharts

1.2 Is bitcoin money?

In one of his articles[4], Yermack argues that bitcoin is not money because it performs poorly as a medium of exchange, unit of account, and store of value.

First of all, Yermack notes that, since bitcoin has no intrinsic value, its value ultimately hinges upon its usefulness as a currency in the consumer economy. However, most of transactions involve transfers between speculative investors, and only a minority are used for purchases of goods and services. Yermack also states that an obstacle to bitcoin becoming a widely used medium of exchange is represented by the difficulty of procuring new bitcoins, unless a consumer is successful as a miner.

Then, Yermack says that another problem in becoming a useful unit of account arises from the extreme volatility of the cryptocurrency: in fact, the value of a bitcoin changes greatly on a day-to-day basis, so retailers who accept the currency have to recalculate prices very frequently, a practice that is costly to the merchant and confusing to the consumer. However, the most serious obstacle occurs due to the relatively high cost of one bitcoin compared to most ordinary products and services.

Lastly, Yermack argues that treating currency as a store of value essentially mean protecting it against theft by physically hiding it or by putting it into a bank. Instead, bitcoin must be held in accounts known as "digital wallets", whose security is an important problem for the bitcoin industry. Even if a consumer finds a secure way to hold his bitcoins, he faces the problem of managing the risk arising from their volatility. For example, in 2013 bitcoin's exchange rate volatility was 142%, when most widely traded stocks have volatilities in the range of 20% and 30%, and even very risky stocks rarely exhibits volatility as high as 100%.

Contrary to Yermack's claim, economists like Mishkin do not define money as an item that functions as a medium of exchange, unit of account, and store of value. Rather, they define money as a commonly accepted medium of exchange. According to them, in addiction to confusing the definition of money with the common functions of money, Yermack also confuses those functions with the characteristics of a good money. The distinction between definition, common functions, and characteristics of a good money matters for assessing

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[4] *Handbook of Digital Currency*, Lee D., 2015, pp. 31-43 – "*Is bitcoin a real currency? An economic appraisal*", Yermack D., 2015

whether an item should be classified as money. If an item does not meet the definition, then it is not money, even if it is capable of serving the other functions.

1.3 Technology

1.3.1 Cryptography

Cryptography is the mathematical and computational practice of encoding and decoding data. Cryptography technology is used for multiple purposes: for securing the various transactions occurring on the network, for controlling the generation of new currency units, and for verification of the transfer of digital assets and tokens. Bitcoin uses three different cryptographic methods.

The first one is Symmetric Encryption Cryptography, which uses the same secret key to encrypt the raw message at source, transmit the encrypted message to the recipient, and then decrypt the message at the destination.

The second method is Asymmetric Encryption Cryptography. It uses two different keys – public and private – to encrypt and decrypt data, so a person can encrypt a message using the receiver's public key, but it can be decrypted only by the receiver's private key.

The third method is Hashing, which is used to verify the integrity of data of transactions on the network. It maintains the structure of blockchain data, encodes people's account addresses, is an integral part of the process of encrypting transactions that occur between accounts, and makes block mining possible. So, Hashing is essential when dealing with huge amounts of data.

Additionally, Digital Signatures complement these various cryptography processes, by allowing participants to prove their identities to the network.

1.3.2 Peer-to-peer

A peer-to-peer (p2p) network is group of computers, each of which acts as a node for sharing files within the group. Instead of having a central server to act as a shared drive, each computer acts as the server for the files stored upon it.

However, file sharing is not the only function of the p2p model. One of its uses is distributed computing, which consists in solving highly complex computational problems by exploiting the computing capacity provided overall by a set of standalone computers interconnected by a network.

For that reason, Bitcoin is a distributed system, a set of standalone computers interconnected by a p2p network, which allows the synchronization and the control of the transaction log thanks to its sharing between nods. This control is decentralized and distributed, and it is achieved through the resolution of complex cryptographic calculations by a network of autonomous calculators, which provide the computational force necessary to this purpose.

1.4 Blockchain

Blockchain is a public electronic ledger built around a peer-to-peer system that can be openly shared among disparate users to create an unchangeable record of transactions. Every time a set of transactions is added, that data becomes another block in the chain. Blockchain can only be updated by consensus between participants in the system, and once new data is entered it can never be erased. One of the advantages of blockchain is that it can't be tampered: every block that is added onto the chain carries a hard, cryptographic reference to the previous block. That reference is part of the mathematical problem that needs to be solved in order to bring the following block into the network and the chain. Part of solving the puzzle involves working out random number called the "nonce". The nonce, combined with the other data, creates a digital fingerprint called hash, which is unique and must meet certain cryptographic conditions. Once this happens a block is completed and added to the chain. Lastly, it is important to emphasize that Bitcoin's blockchain was designed to be a decentralized, meaning it is not controlled by one central authority. Anyway, we will consider blockchain's potentialities later in the paper.

1.5 Mining

Bitcoin mining is the process of adding transaction records to the blockchain. The validators, who use mining software and hardware to earn Bitcoin pay-outs, are called miners.

Once a miner figures out the correct answer to the cryptographic puzzle, which is verified by each node in the network, they earn the block reward and a new block is created. For Bitcoin miners, the block reward for validating one megabyte value of Bitcoin transactions is currently 12.5 tokens[5]. Incentivizing miners with pay-outs of Bitcoin to validate its transactions makes the cryptocurrency safe, secure, and trustworthy to use. Validation methods like mining are called proof-of-work.

Mining also releases bitcoins into circulation, which increases the odds that consumers and merchants will be more willing to adopt, accept, and trade it, boosting the cryptocurrency's value.

But even though mining is economically beneficial to miners, consumers, merchants, and Bitcoin itself, digging for it can actually harm the environment: Bitcoin miners are predicted to consume than the entire country of Argentina by the end of the year[6]. That happens because there is a limited supply of Bitcoin: so, to avoid issuing the supply of Bitcoin too quickly, the cryptocurrency makes the cryptographic puzzles that validate each block increasingly more difficult to solve. As a result, the more challenging these puzzles get, the more electricity miners must use.

Another method for mining bitcoins is the so-called cloud mining, that enables people to earn bitcoins without managing hardware, software, electricity, bandwidth or other issues: all bitcoin mining is done remotely in the cloud. Despite this method allows people to not deal with any of the hassles usually encountered when mining bitcoins, such as heat or hosting issues, there are some disadvantages like lower profits due to the fact that cloud mining is provided as a service that implies some cost, and unverifiable bitcoin cloud mining operations.

1.6 Bitcoin wallets

As bitcoins don't exist in any physical form they can't be stored anywhere, so they are accessible through Bitcoin addresses, which require a set of digital keys for entry. Every address has two keys: a public key and a private key. Bitcoin addresses are derived from public keys, and these addresses are shared. A private key represents the ability to access bitcoins belonging to a specific Bitcoin address, so this is the key that needs to be secured in a safe place. In other

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[5] https://www.cryptocompare.com/coins/btc/overview/USDT
[6] https://fortune.com/2018/01/10/bitcoin-miners-electricity-argentina/

words, a bitcoin wallet is the combination between the public key and the private key. There are a wide variety of bitcoin wallet types with varying levels of security.

The first type is paper wallet, which is essentially a document that contains a public address for receiving bitcoins and a private key that allows to spend or transfer bitcoins stored in that address. Paper wallets are often printed in the form of QR-codes so it is possible to scan them and add the keys to a software wallet to make a transaction. The main advantage of this type of wallet is that the keys are stored offline, which makes it completely immune to hacker attacks, but it is important to take certain measures to protect that piece of paper.

Then, there are mobile and online wallets. A mobile wallet runs as an app on smartphone, storing the private key and allowing to pay for things directly from the phone. Moreover, some apps enable users to use their smartphones' NFC[7] feature. Despite being a convenient solution for bitcoin storage, mobile wallets are prone to hacker attacks. Web wallets store the private key on a server that is constantly online and controlled by a third party. Much like mobile wallets, e-wallets enable their users to access their funds on-the-go from any device connected to the internet. Obviously, these wallets must be properly protected. One of the most popular e-wallet is Coinbase.

A desktop wallet is a software that is downloaded and installed onto user's computer, storing his private keys on his hard drive. This makes software wallets more secure than online and mobile wallets, as they don't rely on third parties for their data and are harder to steal.

Lastly, there are hardware wallets, which are a rather unique type of bitcoin wallet that stores the user's private keys in a secure hardware device. It is the most secure way of storing any amount of bitcoin; in fact, there have been no verifiable incidents of money being stolen from a hardware wallet. Unlike paper wallets, which must be imported to software at some point, hardware wallets can be used securely and interactively. Moreover, they are immune to computer viruses, the funds stored cannot be transferred out of the device in plaintext, and in most instances, their software is open source. Some of them even have screens, which add another layer of security, as they can be used to verify and display important wallet details.

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[7] NFC is a feature that allows to make transactions simply by bringing the smartphone closer to the terminal without having to provide any information.

1.7 How to buy bitcoins?

After a user has set up his wallet with a payment method, he will need a place to actually buy bitcoins. Usually, users can buy bitcoin and other cryptocurrencies from online marketplaces called "exchanges", which act as the intermediaries between a buyer and a seller like a traditional stock exchange. To transact in bitcoin on an exchange, a user has to register with the exchange and go through a series of verification processes to authenticate his identity; once the authentication is successful, an account is opened for the user who then has to transfer funds intro this account before he can buy bitcoins. Different exchanges have different payment methods that can be used for depositing funds, including bank wires, direct bank transfers, credit or debit cards, bank drafts, money orders and even gift cards. To withdraw money from the account there are several ways, such as bank transfer, PayPal transfer, check mailing, cash delivery, bank wire, or credit card transfer. However, an exchange is not the only method.

An alternative way of buying bitcoins is represented by the Bitcoin ATMs, where people can insert cash and use it to purchase bitcoins, which are then transferred to a secure digital wallet. Before completing transactions some ATMs may require customers to pass some security check such as a two-factor authentication.

Another method is P2P exchange that consists of an exchange service that provides a more direct connection between users. After creating an account, users can post requests to buy or sell bitcoins, including information about payment methods and price. Services like Local Bitcoins facilitates some of the aspects of the trade allowing users the opportunity to shop around for the best deal and providing ratings systems that consent to evaluate potential trade partners before transacting.

1.8 Analysis of demand for bitcoin

Hazlett and Luther, in a recent article[8], compare the demand for bitcoin with the demand for government-issued base monies. While the market capitalization of bitcoin is readily available on CoinMarketCap, the demand for these monies can be estimated by calculating the market capitalization of their supplies. The market capitalization of a given base money can be calculated by multiplying the total quantity of the base money outstanding by its

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[8] *The Quarterly Review of Economics and Finance – "Is bitcoin money? And what that means"*, Hazlett P. K. & Luther W. J., 2019

market price. It is possible to retrieve data on monetary base supplies and exchange rates from the International Monetary Fund.

To facilitate comparisons, Hazlett and Luther initially focus on the market capitalization of bitcoin in 2018, that ranges from a low of 56.40 to a high 294.22 billion USD; the mean market capitalization is 129.27 billion USD, the median is 117.51 billion USD, and the standard deviation is 40.54 billion USD. With the following table it is possible to present the market capitalizations of 106 government-issued monies of the same period:

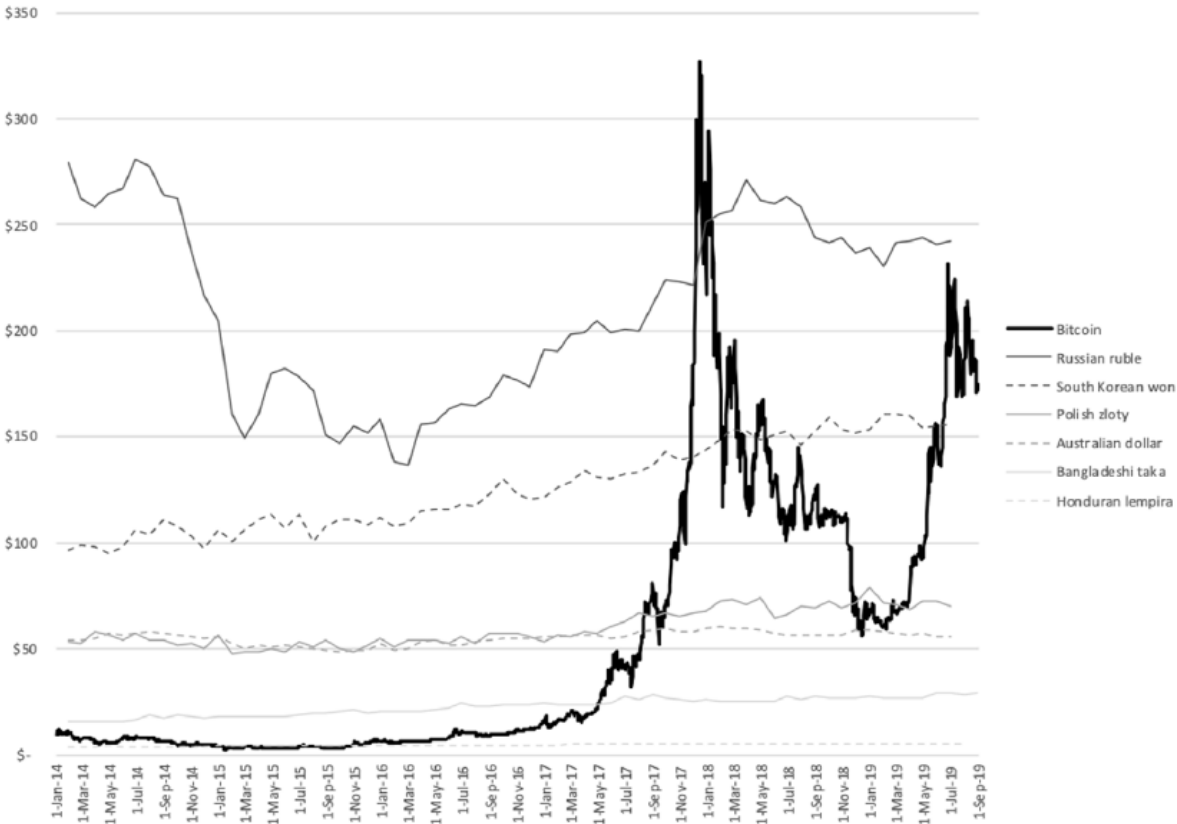| Money	Market cap	Money	Market cap
United States dollar	3411.50	Honduran lempira	5.42
Russian ruble	256.33	Kenyan shilling	5.15
Hong Kong dollar	217.71	Paraguayan guaran	4.98
Brazilian real	195.91	Afghan afghani	4.62
South Korean won	156.61	Belarusian ruble	4.23
Czech koruna	134.40	Trinidad &Tobago dollar	3.94
bitcoin	129.27	Albanian lek	3.92
United Arab Emirates dirham	103.38	Uruguayan peso	3.76
Turkish lira	101.75	Salvadorian centavos	3.38
Mexican peso	87.00	Zimbabwean dollar	3.26
Polish złoty	82.61	Georgian lari	3.10
Indonesian rupiah	82.01	Tanzanian shilling	3.09
Egyptian pound	76.45	Mauritian rupee	2.97
Canadian dollar	69.80	East Caribbean dollar	2.97
Philippine piso	63.39	Haitian gourde	2.92
Australian dollar	60.82	Moldovan leu	2.59
Thai baht	59.67	Armenian dram	2.54
Algerian dinar	57.10	Mozambican metical	2.11
Iraqi dinars	56.78	Mongolian tögrög	2.10
Pakistani rupee	46.12	Brunei dollar	2.07
Libyan dinar	44.98	Ugandan shilling	2.06
Malaysian ringgit	38.56	Macedonian denar	2.05
Colombian peso	33.18	Nicaraguan córdoba	1.95
West African CFA franc	31.55	Panamanian balboa	1.82
Moroccan dirham	30.11	Tajikistani somoni	1.70
Hungarian forint	28.28	Papua New Guinean kina	1.60
Bangladeshi taka	27.93	Kyrgyzstani som	1.59
Romanian leu	25.46	Malagasy ariary	1.55
Kuwaiti dinar	25.16	Congolese franc	1.54
Qatari riyal	22.77	Botswana pula	1.44
South African rand	20.55	Israeli shekel	1.41
Bulgarian lev	20.31	Icelandic krna	1.34
Kazakhstani tenge	19.29	Bahamian dollar	1.33
Swedish krona	19.18	Zambian kwacha	1.30
Peruvian sol	18.67	Guyanese dollar	0.86
Chilean peso	17.61	Maldivian rufiyaa	0.75
Croatian kuna	16.65	South Sudanese pound	0.71
Danish krone	16.26	Surinamese dollar	0.67
Ukrainian hryvnia	16.02	Namibia dollar	0.62
Bolivian boliviano	11.79	Cape Verdean escudo	0.62
Guatemalan quetzal	11.56	Belize dollar	0.40
Costa Rican colón	11.46	Solomon Islands dollar	0.39
Norwegian krone	10.45	Djiboutian franc	0.38
New Zealand dollar	10.13	Burundian franc	0.32
Dominican peso	7.82	Sierra Leonean leone	0.31
Serbian dinar	7.77	Seychellois rupee	0.27
Tunisian dinar	7.43	Gambian dalasi	0.25
Central African CFA franc	7.00	Comorian franc	0.18
Angolan kwanza	6.76	East Timor centavo	0.18
Bosnia &Herzegovina convertible mark	6.28	Lesotho loti	0.15
Azerbaijani manat	6.26	Tongan pa'anga	0.15
Nepalese rupee	5.78	Samoan tālā	0.14
Macanese pataca	5.55	São Tomé &Príncipe dobra	0.07
Ecuadorian centavo	5.53		

Table 1 – Market capitalization of government-issue monies and bitcoin, billion USD, 2018. Source: *The Quarterly Review of Economics and Finance – Is bitcoin money? And what that means*, Hazlett P. K. & Luther W. J., 2019.

As we can see, they range from 0.07 to 3411.50 billion USD. The mean market capitalization of government-issued monies is 56.72 billion USD, while the median is just 5.47 billion USD. The standard deviation is 332.07 billion USD. The combined market capitalization

of all government-issued monies for which data is readily available is 6012.63 billion USD, suggesting that the US dollar accounted for around 56.74% of the government-issued base money market in 2018.

Demand for bitcoin in 2018 was comparable to the market capitalization of many government-issued monies. Only six of them had a market capitalization greater than the mean market capitalization of bitcoin, and they are: United States dollar with 3411.50, Russian ruble with 256.33, Hong Kong dollar with 217.71, Brazilian real with 195.91, South Korean won with 156.61, and Czech koruna with 134.40. At its low, the market capitalization of bitcoin exceeded all but 18 for which data is readily available, putting it in the 83rd percentile of monies considered in the table. At its high, the market capitalization of bitcoin exceeded all but United States dollar, putting it in the 98th percentile. Finally, when Hazlett and Luther include the mean market capitalization of bitcoin with the other base monies, they find that bitcoin accounted for approximately 2.10% of the base money market in 2018.

To consider demand for bitcoin over time, the authors present the market capitalization of bitcoin in billion USD from January 2014 to September 2019 in the following graphic:

Chart 2 – Market capitalization of bitcoin and select government-issued monies, billion USD, January 2014 – September 2019. Source: *The Quarterly Review of Economics and Finance – Is bitcoin money? And what that means*, Hazlett P. K. & Luther W. J., 2019

They also decide to include market capitalizations for the Russian ruble, South Korean won, Polish złoty, Australian dollar, Bangladeshi taka, and Honduran lempira because they correspond roughly to the 98th, 95th, 90th, 85th, 75th, and 50th percentile of government issued base monies in 2018.

As we can see, from January 2014 to January 2016 the demand for bitcoin was similar to that of the Honduran lempira. In May 2017, demand for bitcoin surpasses that of the Bangladeshi taka. In August 2017 it rose above Australian dollar and Polish złoty. In September 2017 demand for bitcoin briefly dipped back below them, and then remained above them from October 2017 to November 2018 and after March 2019.

Despite the demand for bitcoin was comparable to that of many government-issued monies in 2018, Hazlett and Luther state that this result is not sufficient for classifying bitcoin as money. In fact, the authors have shown that the demand to hold bitcoin is comparable to that of other items widely regarded as money, but they did not prove that the *transactions demand* for bitcoin is comparable to that of those other items.

In conclusion, Hazlett and Luther affirm that they are unable to determine the extent to which the demand for bitcoin is transactional, rather than speculative, but they argue that bitcoin's routine use as a medium of exchange among some digital actors makes it worthy of the label money, if only over a relatively small domain.

1.8 Bitcoins and deflationary spiral

Deflation is a general decline in the cost of goods and services that occurs when the inflation rate hits the negative; it can also refer to the increased purchasing power of a currency. On the one hand, there is the Friedman rule according to which the limited deflation can alleviate inflation and help in maintaining currency as a store of value. On the other hand, some economists hold the view that deflation is dangerous as it increases the value of debt; when debt grows over time, it places enormous pressure on people owing a debt and can be an accelerant during a recession and worsen a downward deflationary spiral. A deflationary spiral occurs when the value of a currency, relative to the goods in an economy, increases continually incentivizing people to hoard it. Alternatively, it is possible to affirm that a deflationary spiral occurs when the price of a traded article increases at some given rate, which causes people to hoard it, so less and less of it is available thus causing the price to go up even more.

Traditional currencies are inflationary by nature because there is no limit on the amount of currency that can be printed and distributed in the market. In the case of bitcoins, we have the opposite situation: the number of bitcoins that are produced decreases over time and even will stop once supply reaches 21 million. It is important to specify that bitcoin is deflationary not only because it has a fixed supply but also because its issuance – the mining reward – decreases in half every 210.000 blocks every 4 years. This phenomenon is known as "halving".

However, there are also those who affirm that bitcoin is not a deflationary currency at all. For example, in an article published on Medium[9], Conner Brown – a Stanford Law student – asserts that bitcoin is actually guarded against deflationary spiral. Firstly, he claims that deflation is formally a decrease in the supply of money or money substitutes, so it is not a decrease in prices itself but a monetary phenomenon that sometimes causes decreasing prices. So he says that, in this sense, bitcoin is not truly deflationary because its supply will continue to increase until the block reward run out sometime around 2140, when the cap of 21 million coins will be reached. Then, he analyses a chart that examines both the inflation rate and the monetary base:
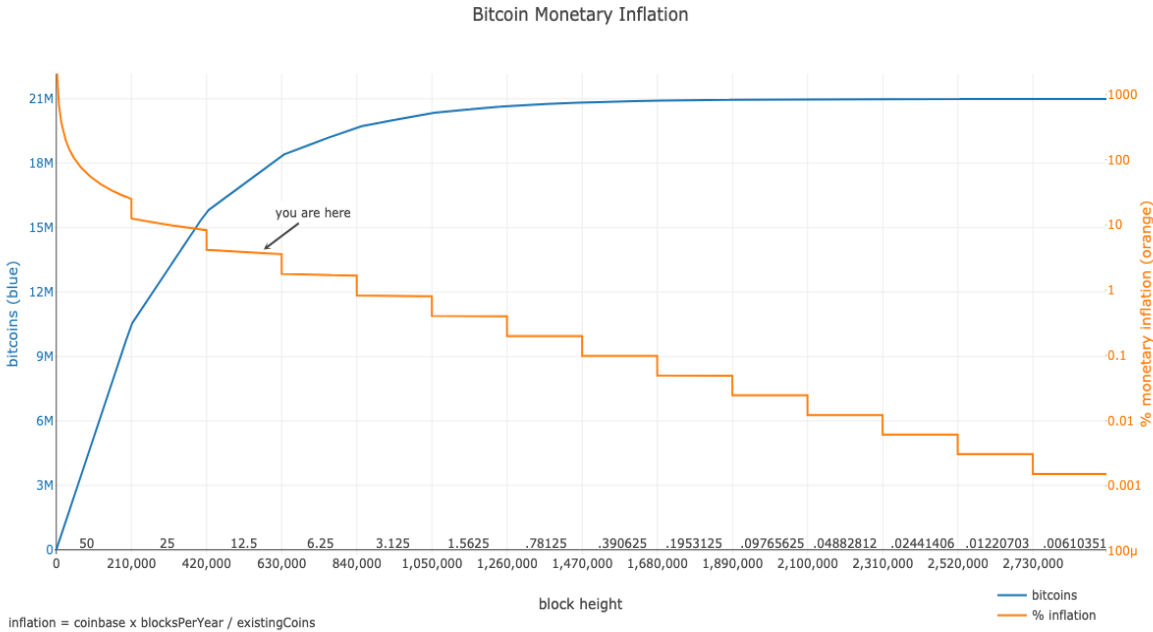
Chart 3 – Bitcoin monetary inflation. Source: Medium. This chart is made using the data provided by Bitcoin Charts.

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[9] https://medium.com/the-bitcoin-times/stop-calling-bitcoin-deflationary-84462cb90345

We can see that at the beginning there was a relatively high inflation rate that is slowly levelling off over time to a hard cap of 21 million coins. Brown notes that the Bitcoin protocol is not inflationary or deflationary in the long run. Instead, it is programmed to be disinflationary, culminating in a constant monetary base without changes to the supply. Brown also disagrees with critics who worry that bitcoin will create a stagnant economy as people hoard appreciating money rather than invest in business. In fact, he is certain that once bitcoin's price discovery[10] phase comes to an end its value will slowly stabilize, so it will function as a constant global value for communicating prices and making investment decisions. Hence, investors would certainly still be motivated to invest bitcoin rather than holding it. In conclusion, Brown asserts that the deflationary spiral will be much less common and severe under a bitcoin standard. According to him, deflation is much worse when a money can be manipulated through central banks printing money out of thin air, altering reserve ratio requirements, and raising and lowering interest rates.

Coindesk, in an article[11], affirms that bitcoins have an advantage: they are currently dividable down to 0.00000001 of one BTC. This unit is called satoshi. If you convert 21 million bitcoins into satoshis you have over two quadrillion of them (2.1×10^{15}), that can be used as a payment method just like bitcoins. In the end, Coindesk declares that price volatility is more of a threat than deflation to bitcoin right now. In fact, as the price of bitcoin rises, that does not necessarily mean people will hoard it: for instance, the savviest and technology-inclined investors could easily trade in pricey bitcoin to buy another cheaper and possibly rising cryptocurrency, like litecoins (LCT).

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[10] The price discovery process is the process of determining the price of an asset in the marketplace through the interactions of buyers and sellers.
[11] https://www.coindesk.com/deflation-and-bitcoins

Chart 3 – LCT/USD appears similar to that of BTC/USD. Source: CoinGecko

However, the debate between those who affirm that bitcoin is a deflationary currency and those who say the opposite is still open.

Chapter 2: advantages and disadvantages of Bitcoin

2.1 Advantages

2.1.1 Transaction fees

Transaction fees are included with a bitcoin transaction in order to have that transaction processed by a miner and confirmed by the Bitcoin network. In every block the space available for transactions in February 2020 is limited to 1.21 MB in the network[12]. This means that to get a transaction processed quickly a user will have to outbid other users. The higher the fee, the more priority it gets within the network and the quicker it gets processed. As we can see in the following graph, on 18th February 2020 the average transaction fee is $0.95723, regardless of the amount sent.

According to the Indipendent, as bitcoin's popularity grew its overloaded network became plagued with slow transaction times and high fees, reaching as high as $60 per transaction at the end of 2017.
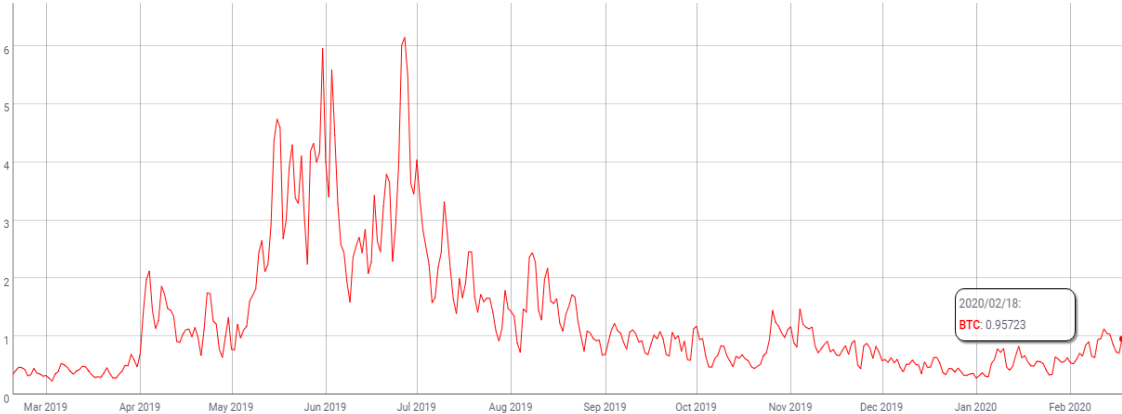

**Chart 4** – Bitcoin average transaction fee, USD. Source: Coin Metrics.

It is possible to find several reasons why transactions fees have dropped from $60 to less than $1. First of all, taking a look at the number of daily confirmed bitcoin transactions, we can see that from over 400.000 in December 2017 they gradually declined. This event is certainly attributable to the collapse in prices that occurred in 2018 after bitcoin's price reached the peak of $20.000 in 2017, creating a bubble effect that later popped leading to the largest bear market[13] on record.

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[12] https://www.blockchain.com/it/charts
[13] A bear market is a market in which prices are falling, encouraging selling.
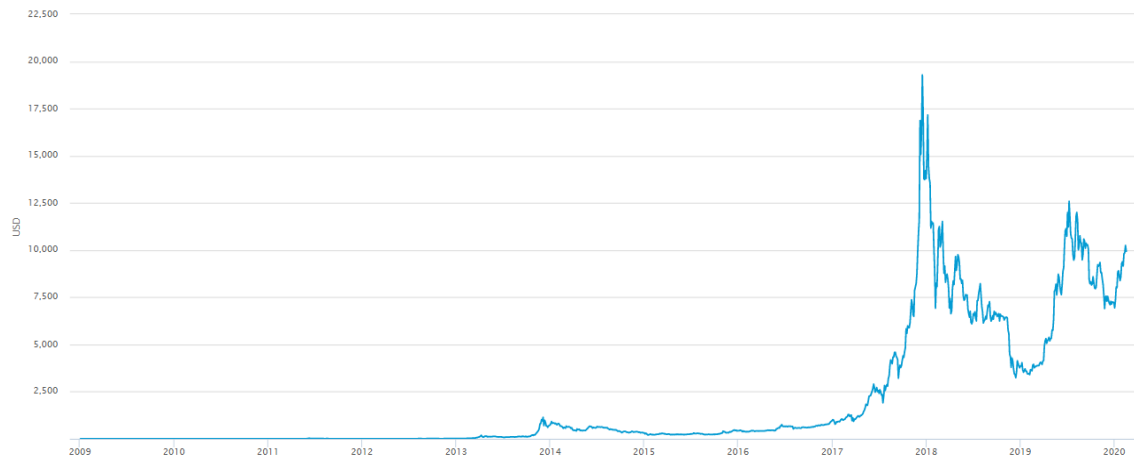
Chart 5 – Bitcoin market price. Source: Blockchain
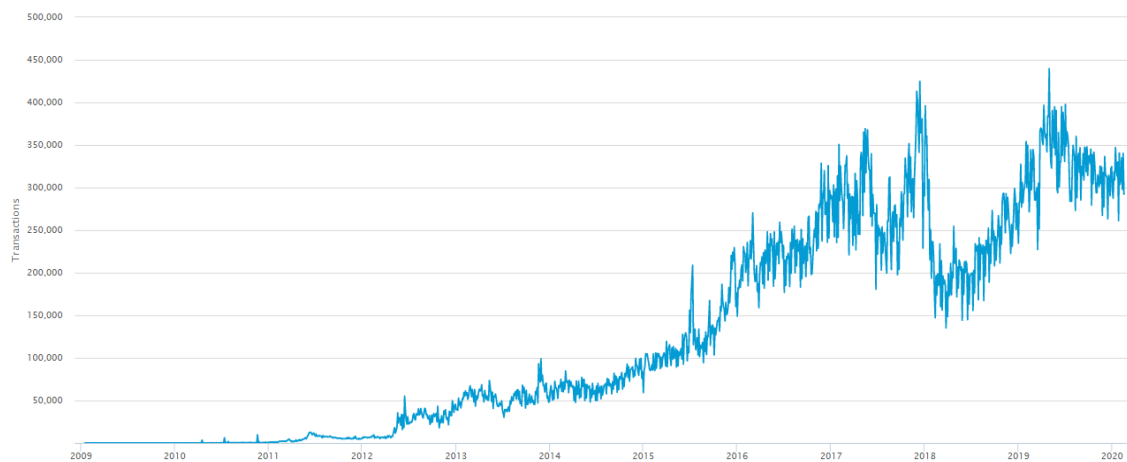
Chart 6 – Confirmed transactions per day. Source: Blockchain

Obviously, with the fall in prices people were no longer interested in investing in bitcoins: as a result, there was less network traffic.

Another reason is the success of bitcoin software update, commonly known as Segregated Witness or SegWit, that is an example of a "soft fork". It consists in changing bitcoin protocol at the beginning of a certain block: this new transaction type rearranges how data is stored in bitcoin blocks, and boosts transaction capacity, making transactions quicker. In other words, SegWit helps alleviating network congestion. An important technological improvement is also "batching", that is combined with the integration of SegWit. Cryptocurrency exchanges usually have to write every individual bitcoin transaction into the blockchain, but this is a time-consuming practice. So, an exchange called ShapeShift announced in 2018 the introduction of batching process, in which multiple transactions are bundled into one Transaction ID to be collectively transferred

on the blockchain. Consequently, there is a significantly reduction in the aggregate number of bitcoin transactions on the network.

So, it is probably that the combination of all these factors are driving bitcoin transaction fees down.

2.1.2 Control and security

According to AVG, there are three reasons why Bitcoin should be considered safe. First of all, because Bitcoin is encrypted with the Blockchain system, as explained earlier.

Then, because Bitcoin is public, which means that all transactions are transparent and available to the public even if the people involved are anonymous, so no one can cheat, scam, or otherwise fraud the system. Bitcoins are also irreversible, so once you get or sell them, no one can demand their money back.

Lastly, because Bitcoin is decentralized: it has servers all over the world, and over ten thousand nodes keeping track of all the transactions happening on the system. That's important because it means if something was to happen to one of the servers, the others can pick up the slack. It also means trying to hack into one of the nodes is pointless: there's nothing there you could steal that the other nodes and servers couldn't prevent, unless you happen to control 51% of the nodes.

2.1.3 Fewer risks for merchants

Thanks to its high level of protection, Bitcoin transactions do not carry with them personal information, so merchants are protected from potential losses that might be caused by fraud. Merchants can easily expand to new markets where either credit cards are not available or fraud rates are unacceptably high. So, the net results are lower fees, larger markets, and fewer administrative costs.

2.1.4 User-friendliness

Anyone can make transactions in bitcoins: in fact, users do not have to worry about crossing borders, rescheduling for bank holidays, or any other limitations that might occur when transferring money. Moreover, people have the total control of their money thanks to the fact that there is no central authority.

2.2 Disadvantages

2.2.1 Volatility

Bitcoin's value has been historically quite volatile because there is a limited amount of coins and the demand for them increases by each passing day. For instance, in a three-month span from October 2017 to January 2018, the volatility of the price of bitcoin reached to nearly 8%. This is more than twice the volatility of bitcoin in the 30-day period ending January 15, 2020.

Chart 7 – Bitcoin's volatility over time. Source: Bitpremier.

We can find several factors behind bitcoin's volatility. Firstly, the news events that scare users include geopolitical events and statements by governments that bitcoin is likely to be regulated. For example, some news stories which shocked investors include the high-profile use of bitcoin in drug transactions via Silk Road[14] that was shut down in

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[14] Silk Road was a digital black market platform that was popular for hosting money laundering activities and illegal drug transactions using bitcoins.

October 2013. Another case is represented by the bankruptcy of Mt. Gox[15]. All these incidents and the public panic drove the value of bitcoins versus fiat currencies[16] down rapidly.

A second reason is represented by the perceived store of value versus the fiat currency. Bitcoin has properties that make it similar to gold, while fiat currency is dynamically managed by governments. So, as economies built with fiat currencies show signs of strength or weakness, investors may allocate more or less of their assets into bitcoin.

Bitcoin volatility is also to an extent driven by holders of large proportions of the total outstanding float of the currency. For bitcoin investors with current holdings above around $10M it is not clear how they would liquidate a position that large into a fiat position without severely moving the market.

Bitcoin can also become volatile when the bitcoin community exposes security vulnerabilities in an effort to produce massive open source responses in the form of security fixes or due to the tax treatment.

Finally, bitcoin's use case as a currency for developing countries that are currently experiencing high inflation is valuable when considering the volatility of bitcoin in these economies versus the volatility of bitcoin in USD. In fact, bitcoin is much more volatile versus USD than the high-inflation Argentine peso versus the USD.

2.2.2 Lack of awareness and understanding

Bitcoin did not immediately find its supporters. In fact, it took several years to build a foundation of the crypto enthusiasts. However, many people are still unaware of Bitcoin and the other digital currencies. Businesses are accepting bitcoins because of their advantages, but the list is relatively small compared to physical currencies, while the workers need to be educated on Bitcoin so that they can help the customers.

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[15] Mt. Gox was a Tokyo-based cryptocurrency exchange that was responsible for more than 70% of bitcoin transactions at its peak. In 2014, it was hacked and declared bankruptcy.
[16] Fiat money is government-issued currency that is not backed by physical commodity, but rather by the government that issued it.

2.2.3 Still developing

The official site bitcoin.org affirms that Bitcoin software is still in beta with many incomplete features in active development to make the digital currency more secure and accessible. This is because Bitcoin is just starting out, and it needs to work out its problems just like how any currency in its beginning stage would need to.

Chapter 3: cryptocurrencies, the tax treatment in Italy

3.1 Introduction

The sudden success of cryptocurrencies, subject to large fluctuations in value, has raised requests for clarification of their tax treatment, with regard both to trading and transactions carried out through a derivative financial contract called Contract for Difference. The risks arising from the fact that virtual currencies are traded on unregulated platforms, subject to manipulation and hacker attacks, should not be underestimated.

With the Legislative Decree 90/2017, the legislator has recognized the use of cryptocurrencies as an alternative payment instrument to those usually used and has defined it as "digital representation of value…transferred, archived, and electronically negotiated".

The Italian Revenue Agency, recalling the interpretation of the Court of Justice of the European Union, provided important clarifications by extending the treatment reserved to traditional currencies to virtual ones.

3.1 VAT - IVA

The Italian Revenue Agency declared that financial services that consist in the exchange of traditional currency vs. bitcoin units and vice versa are transaction exempted from VAT under Article 10 of Presidential Decree 633/1972. The fee for the intermediation services of traditional currencies with bitcoins – carried out directly and professionally – is subject to VAT, even if exempt, and income taxes, after a deduction of the related expenses.

3.2 Personal income tax - IRPEF

Currencies like bitcoin can generate "other incomes" that are taxable according to the principles of the Article 67 of the Income Tax Consolidation Act, known as TUIR in Italy. For tax purposes it is necessary to verify if the conversion of bitcoins with other cryptocurrencies – or from virtual currencies to euros – takes place as a result of a forward sale or if the average stock of the wallets has exceeded the euro equivalent of 51.645,69 for at least seven continuous

working days in the tax period. These cases, even in the absence of speculative purposes, generate the previously mentioned "other incomes" that are subject to a substitute tax of 26%.

3.3 Corporate income tax - IRES

With the Resolution n. 73/E/2016, the Italian Revenue Agency affirmed that bitcoin transactions represent the object of the activities carried out capable of generating revenues and costs of business income. Regarding direct taxation, the Italian Revenue Agency declared that corporate entities must tax income components deriving from the intermediation activity in the purchase and sale of bitcoins, net of the costs related to this activity.

3.4 Wealth tax on investments held abroad - IVAFE

In Italy, cryptocurrencies are not subjected to the wealth tax on investments held abroad – known as IVAFE – because this tax is imposed to deposits and current accounts exclusively of banking nature.

Chapter 4: Bitcoin nowadays

4.1 A concrete example of bitcoin volatility

Between January and February 2020, bitcoin hit $10,489.78, the highest price it has logged since September 2019, seeing a more than 40% increase from the start of the year. According to Cointelegraph, there are at least three reasons why bitcoin got this incredible result.

First of all, the accumulation of bitcoin since December 2019. The increase in the price of bitcoins is most likely attributable to the surfacing of whales, that are those buyers of large number of coins. In fact, there was a transition from the "wait and see" phase to an "accumulation" phase in the last four months of 2019, when the number of whales addresses increased from 2.000 to 2.030. As reported by Medium, that transition has shot up volatility into the bitcoin market. The site reports that whales began amassing coins in September 2018 and entered wait-and-watch mode in early 2019. In the meantime, the annualized volatility bottomed out below 20% by mid-November and rose steeply to 100% by the end of December. Similarly, in 2019 the rise in price volatility was preceded by accumulation by large wallets. According to Singhal – co-founder and CEO of CRUXpay and CoinSwitch - «during the accumulation phase, whales eat into market liquidity. That affects the supply-demand ratio and causes volatility to re-enter the market».

The second reason is the whale manipulation. The well-known whale Joe007 declared that the upsurge was triggered by other wales placing spoof orders[17] across margin trading platforms to inorganically pump the price of bitcoin up. As Bitcoin's price increased, it squeezed short contracts and pushed short sellers to market buy, which then turned into buying demand that further led BTC to spike.

The last reason is represented by the rising on-chain investor activity. To explain the point, the popular cryptocurrency analyst Willy Woo, who has created various indicators that take both fundamental and technical factors of bitcoin into consideration to predict its trends, showed the following chart with the price of bitcoin alongside on-chain investor activity:

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[17] In a margin trading, a spoof order is a fake buy order of a large size created to lead others into buying into the market with the intent of pushing the price up.
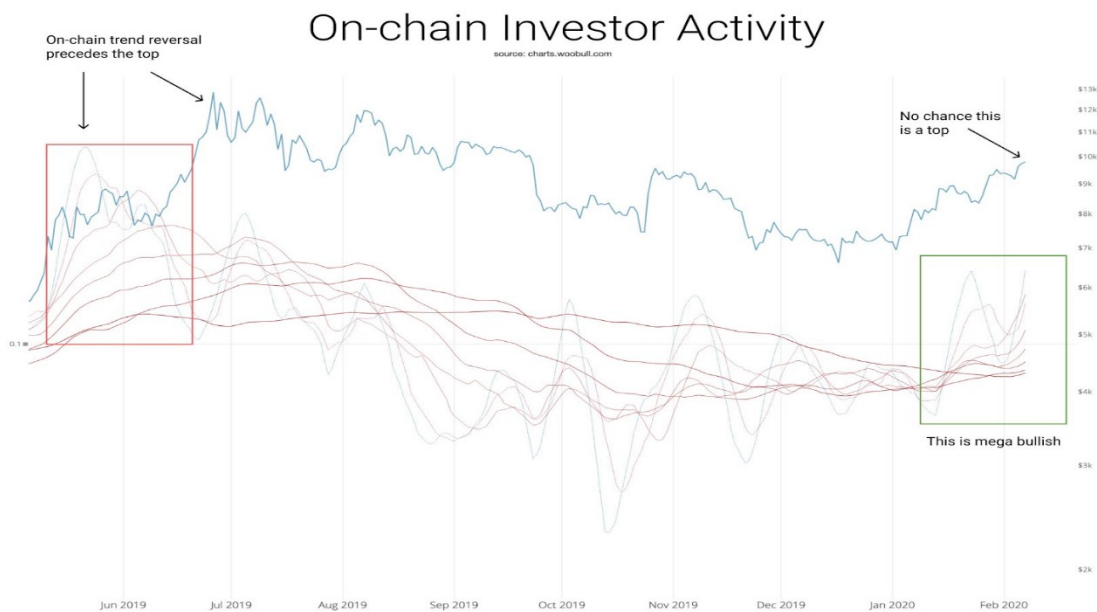
Chart 8 – On-chain investor activity. Source: Twitter.

The Realised Value to Transaction Volume ratio, for instance, is used as a signal to find market bottoms and tops. When Bitcoin's price reached $14,000 last year, the RVT ratio hit nearly 0.04. As of February 10, the RVT ratio is hovering at around 0.018, which shows Bitcoin's price is unlikely to have topped. The ratio peaked at 0.12 when Bitcoin's price hit $20,000 in December 2017.

Suddenly, on 19th February 2020, bitcoin has crashed to $9.200 in just 50 minutes. This sudden crash comes a day after bitcoin was making an impressive increase of $700, ranging from $9.600 to almost $10.300. Then, shortly before 22:00 UTC, bitcoin flash-crashed to a low of $9.264. No specific reason has been found for this abnormal price behaviour: the only explanation is the bitcoin's price volatility.

4.2 Impact of COVID-19 on cryptocurrencies

Cryptocurrency traders are contending with volatile markets due to coronavirus. Fear the virus' spread will lead to a pandemic that could slow the global economy is dragging down stock prices; bitcoin has also taken a hit, with the cryptocurrency trading below $9.000. As reported by Coindesk, some traders are considering to prepare for COVID-19 by not holding volatile cryptocurrency assets unless absolutely needed. According to Paul Ciavardini, head of

trading at [itBit](#), the recent lows in bitcoin's price are probably spilling over from trading decisions made in traditional markets.

Also, since bitcoin has not achieved yet that "familiar status" that people can count upon, it is safe only if it can have the mining support. So, this lack of inaccessibility at this crucial time will have for sure a negative price impact. Once this critical phase passes away, both the traditional markets and the crypto market will rebound to their original state, as people will start buying again money and bitcoins.

Chapter 5: beyond Bitcoin

5.1 The potentialities of the blockchain technology

5.1.1 Cross-border payments

Usually, transferring value is an expensing and slow process especially for payments taking place across international borders. The principal reason for this is that the transfer process, when multiple currencies are involved, requires the participation of multiple banks in different locations before the intended recipient can actually collect the money.

Blockchain has the potential to provide a much faster and cheaper alternative to these payment methods. While typical money remittance costs might be as high as 20% of the transfer amount, blockchain may allow for costs just a fraction of that, as well as guaranteed and real-time transaction processing speeds. There are some obstacles to be passed, like the regulation of cryptocurrencies in different parts of the world, but it is definitely one of the most promising areas of blockchain technology application.

5.1.2 Identity management

Blockchain has already proved the potential for transforming the way that online identity management takes place. In fact, nowadays, one of the biggest problems is identity security, due to criminals looking to steal and profit off of private information.

Blockchain offers an enormous level of security, thanks to independent processes that take place throughout member computers on a blockchain network. The mechanism of verification used in digital currency cases could be easily applied to other types of procedures, including identity verification. For example, the technology could be used to securely transfer user data across platforms and systems or to maintain and protect records of real estate ownership, titles, and more.

5.1.3 Smart Contracts

A smart contract is a self-executing contract with the terms of the agreement between two people in the form of computer code. They run out on the blockchain, so they are stored on a public database and cannot be changed. Smart contracts were first proposed in 1994 by Nick Szabo, an American computer scientist who invented in 1998 a virtual currency called "Bit Gold" who defined smart contracts as «*computerized transaction protocols that execute terms of a contract*».

Smart contracts are meant to be Turing Complete: in other words, these programs should be capable of computing everything that can be computed, as long as the code has access to unlimited resources and there is no shortage of time. Due to this property, smart contracts can be created simple or infinitely complex, depending on the number of operations they are programmed to execute.

So, they are seen as a highly powerful application of blockchain technology. In fact, their potential applications are essentially limitless and could be extended to almost any field of business in which contract law would normally apply.

5.1.4 Supply chain uses

For many businesses, a key to success is an efficient supply chain. Blockchain has already been used in multiple industries as a means of keeping tabs on supply chains and ensuring their efficiency. This could eliminate human work and the potential from a crucial process.

5.1.5 Example of an alternative use of the blockchain: Augur

Augur is a decentralized prediction market platform built on the Ethereum[18] blockchain and the first decentralized application running on Ethereum to make

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[18] Ethereum is an open-source, blockchain-based, decentralized software used for its own cryptocurrency, known as ether. It enables Smart Contracts and Distributed Applications to be built and run without any downtime, fraud, control, or interference from a third party.

headlines. After a crowdfunding[19] in August 2015, it was launched in July 2018. There are two primary action available on Augur.

The first is Creating Markets, in which you have to spend a small amount of ether to create an Augur market. Market creators set a creator fee, a percentage of the rewards received by winning traders that must be between 0 and 50% of the reward. Usually, they keep the creator fee low enough to incentivize people to bid using your market, but high enough to cover the initial ether cost spent to create the market.

The second is Trading Event Shares, in which you can buy and trade shares that represent the odds that the event in a market will happen. There are two ways to make money as a trader: with fluctuating share prices or predicting an event correctly and holding shares when the market closes. The payout is calculated as: $\frac{Number\ of\ shares * Price}{Number\ of\ ticks[20]}$.
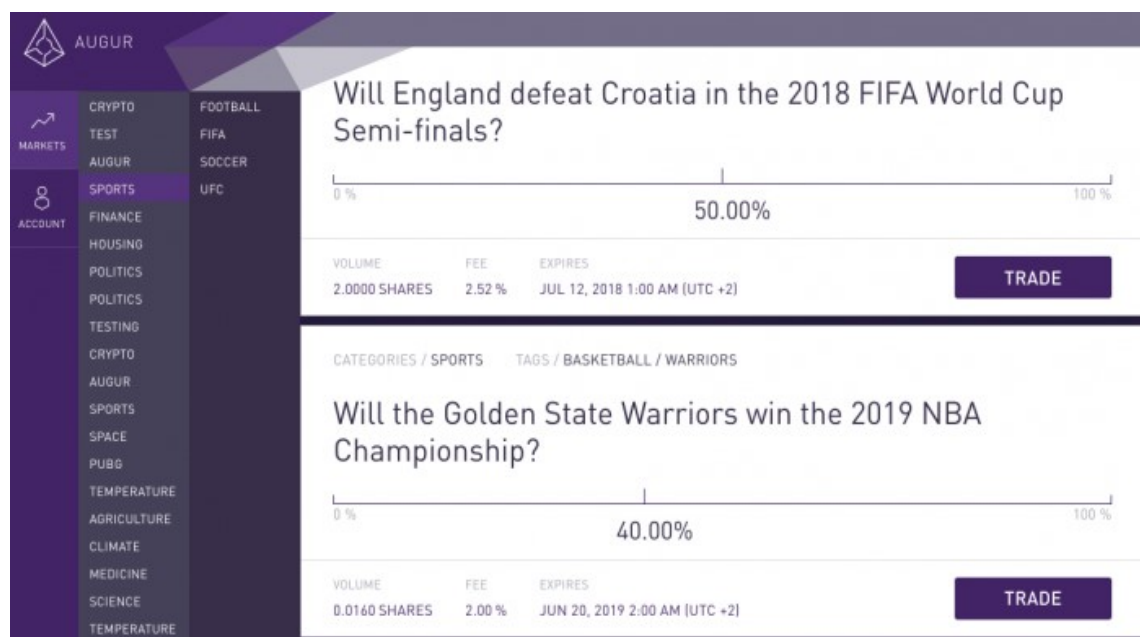
Image 1 – Augur interface. Source: this image has been taken from Cryptonomist.ch because the official site Augur is currently unavailable due to redesign.

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[19] Crowdfunding is the practice of funding a project or venture by raising small amounts of money from a large number of people, usually via the Internet.

[20] The number of ticks is the number of possible price points between the minimum and the maximum prices in a market.

Conclusion: what will be the future of Bitcoin?

In this paper I have analysed the different possible applications of the Bitcoin protocol and the Blockchain technology. It has been demonstrated its reliability, its high safety, and all the advantages descending from being an anonymous and decentralized system. But we also have seen its weaknesses, in particular its volatility.

An important question is what will happen when the last bitcoin is mined. At the moment, we only know that when the capital of the BTC reaches 21 million, the reward will end when mining them, while the transaction must still be stored and verified in blocks of blockchain.

So, miners will only benefit from the commissions of each transaction. According to Medium, there are three possible scenarios: the first of them is that transaction fees will skyrocket, turning bitcoin only as a store of value with a much more centralized network than today due to a smaller number of miners. Another evolution might be represented by a mass adoption by the general public of bitcoin as a payment method or medium of exchange, that will make it possible to have a large volume of transaction, so it will remain interesting for miners to validate blocks of transactions. Lastly, there is the possibility that the Bitcoin Core developer community will be able to find a solution to solve this problem, which will become more important in the coming years due to upcoming halvings.

In my opinion, at the moment the only possible solution is the third one due to the insufficient bitcoin diffusion around the world. People do not immediately trust the innovations, especially when they concern the economic field. This climate of mistrust will slow down bitcoin's spread for sure so, if we want it to survive, we must hope that developers will find a way. However, mine is a short-term analysis of the problem. Since the last bitcoin will be mined in about 100 years, I am sure that by then people will have already accepted the cryptocurrency as a main payment method. Or, thanks to technology evolution, maybe bitcoin will be surpassed by another currency even more secure, reliable and accessible. What is certain is that bitcoin set the foundations for a new way of seeing the economy and in particular the economic relationships between people. As for all important innovations, we will have to wait some time to evaluate cryptocurrency's impact in our lives, although we are seeing how useful is blockchain technology. So, for now, the only remaining question is: will we never be ready to accept digital currencies? I am confident that we will. But it is still too early to talk about it.

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