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**BITCOIN AND ETHEREUM EVOLUTION**

**Thesis**

**CENTRIA UNIVERSITY OF APPLIED SCIENCES**

**Business Management**

**November 2017**

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<b>Degree programme</b> Business Management		
<b>Name of thesis</b> BITCOIN AND ETHEREUM EVOLUTION		
<b>Instructor</b> Janne Peltoniemi		<b>Pages</b> 54+10
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<p>This paper's aim is primarily to identify, compare and analyse Bitcoin and Ethereum as current major cryptocurrencies from the macroeconomic perspective. A secondary aim is to determine the reasons behind Bitcoin and Ethereum rise in terms of price and adoption. The overall target is to identify and show cryptocurrencies' possible development and issues based on the cases of Bitcoin and Ethereum.</p> <p>The theoretical part provides an overview of cryptocurrencies concept as well as the specifics of blockchain technology. Ethereum and Bitcoin virtual currencies are presented, analysed and compared. Cryptocurrencies, and particularly Bitcoin and Ethereum, have become one of the key topics of interest from both organizational and consumers' perspectives, therefore an insight into the decentralized cryptocurrencies is presented. As far as Bitcoin and Ethereum "boom" is growing, analysis of whether cryptocurrencies are offering a sustainable alternative to traditional money is shown.</p> <p>The analysis of cryptocurrencies is an integral part of my research, which also includes the following main objectives:</p> <ul style="list-style-type: none"> <li>• to find and show the main issues of cryptocurrencies</li> <li>• to conduct a survey and interviews about the effects of the digital currencies on the economic development</li> <li>• to find the main problems connected with the digital currencies that are threatening its sustainable growth and assess the concept in regard to the economic theories</li> </ul> <p>In order to reach the primary aim of the thesis, survey and interviews have been made. All respondents are showing their own experience of dealing with Bitcoin/Ethereum. The target of the research was to help support the theoretical outcomes or provide additional first-hand knowledge as well as show the macroeconomic perspective of the virtual currencies. The research brings value and understanding into the complex operations of digital currencies and blockchain technology.</p>		
<b>Key words</b> Bitcoin, blockchain, cryptocurrency, decentralized currency, Ethereum, macroeconomic analysis.		

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## 1 INTRODUCTION

Bitcoin and concept of the digital currencies overall became one of the most anticipated topics of the recent years. If a couple of years ago, we were discussing whether it is a "bubble" or not, nowadays, we are primarily focusing on how it should be regulated, combined with the traditional monetary systems and how to adapt to this phenomenon. Scepticism towards Bitcoin is not falling down over time either, at the same time, a number of cryptocurrency supporters are growing as well. Such level of uncertainty and skyrocketing value growth made digital currencies a new megatrend.

The innovative concept brings its own benefits like decentralized protocols, non-limit transactions, lower fees and transaction time, however, the uniqueness of the system is carrying its own issues. Specifically, thefts, security breaches, comparably low adoption, scalability problems and protocol changes - these problems became the key concerns in regard to digital money.

Bitcoin has been introduced in 2009 as the first cryptocurrency. It is using peer-to-peer transactions and is based on the open-source "fundamental" software, Bitcoin Core. The Bitcoin's open source code stimulated cryptocurrencies network growth, therefore, there are so many alternatives to Bitcoin these days. The best known are Litecoin, Ethereum, Ripple - all of which tried to improve the concept of cryptocurrencies by implementing specific additional features. In this thesis, only Bitcoin and Ethereum are analyzed due to the biggest market capitalization and trading volumes. Moreover, Ethereum has implemented a blockchain-based platform that became a "basis" for a large number of altcoins and decentralized applications, unlike Lite/Dash- coins that are primarily oriented to serve as payment networks.

Cryptocurrencies became the major digital alternative to the existing, traditional fiat money, therefore, it is not only software but a completely digitalised approach towards the concept of money. Over the past years, this approach has been supported by the enthusiastic community and even ideology, which is developing rapidly. The analysis is showing the reasons behind the network's development as well as its effects on the end customer.

## **The aim of the thesis**

The primary aim of this paper is to identify and analyse impact, essence and development of cryptocurrencies from the macroeconomic perspective. A secondary aim is to determine the reasons behind Bitcoin and Ethereum economic rise, use and possible threats related to the two major digital currencies. The overall target is to identify and show cryptocurrencies' possible development and issues based on the cases of Bitcoin and Ethereum.

## **Methodology used**

The theoretical part is presented and analysed in order to reach the aims of the thesis, giving an insight on the Bitcoin and Ethereum as the concepts, its unique features and the core technology of blockchain. Specifics of each digital currency are presented. Blockchain technology is analysed and explained, showing the advantages and issues of the cryptocurrencies as well as its possible development and possible use across the various industries.

Macroeconomic analysis is shown through the overview of the value changes of the currencies, their price and market capitalisation history, and applied regulations towards the virtual currencies. New trade theory's view to the concept of digital currencies is shown and explained. In addition, digital currencies are overviewed in relation to the Austrian Business Cycle theory.

In order to reach the primary aim of the thesis, survey and interviews have been made. All respondents are showing their own experience of dealing with Bitcoin/Ethereum along with their view on the future development of virtual currencies. The target of the research was to support the theoretical outcomes and provide additional first-hand knowledge. Moreover, survey and interviews are providing the study with a broader economic perspective behind the use of virtual currencies (tied with the microeconomic issues). The research brings value and understanding to the complex operations of digital currencies and blockchain technology.

Research section follows the theoretic part of the paper. It consists of two parts: qualitative and quantitative research. The qualitative part consists of several in-depth interviews conducted among cryptocurrency miners and investors. Quantitative research is conducted among 1500 persons showing their view on use and future of the cryptocurrencies. Results of the research are oriented to back up the

theoretical part, to enhance the analysis and to provide additional information on the use of aforementioned cryptocurrencies.

## 2 CRYPTOCURRENCIES

Cryptocurrencies became a phenomenon of the present century. Several jumps in the value of Bitcoin starting from 2008 have surprised and intrigued the public while currency's instability made people more sceptical about it. Bitcoin boom caused cryptocurrencies' network growth: new "coins" - altcoins - has started to emerge bringing new features meanwhile having the same blockchain basis. Due to the aforementioned facts, it is important to provide readers with the background, main features and specifics of the major digital currencies in order to proceed with its analysis. The following chapter provides all the necessary information regarding the concept of cryptocurrencies as well as unique features of Bitcoin and Ethereum.

### 2.1 Definition

Bitcoin and Ethereum belong to convertible virtual currencies (CVC). This is a subset of virtual currencies but established with universal intent. Online exchanges can be seen as agents or brokers and are used to convert virtual currencies to the fiat ones (Bal & Lee 2015). CVC relates to the virtual currency schemes with a bidirectional flow. In other words, you can buy or sell CVC according to the exchange rates; the value of the virtual currency is dependent upon the digital activities done by the users. (European Central Bank 2012.)

Apart from being CVCs, Bitcoin and Ethereum are falling within a group of cryptocurrencies. Cryptocurrencies are the type of virtual currencies that are using cryptography (Bal & Lee 2015). It provides currency with encoding mechanism that is securing the transactions done by users (Narayanan, Bonneau, Felten, Miller & Goldfeder 2016).

In this paper, we will be talking about specific cryptographic CVCs - Bitcoin and Ethereum as far as it is most used cryptocurrencies. Bitcoin is the first cryptocurrency that was introduced in 2008 while Ethereum is the "closest" alternative to Bitcoin in terms of value, market capitalization and use, however, having different features and specifics than Bitcoin. The approach regarding the regulation of the Bitcoin and Ethereum is the same due to its common classification. Therefore, understanding the regulations established in regard to Bitcoin and Ethereum will show the common tendency of dealing with CVCs in terms of taxation, personal use, and common practices.



## 2.2 Bitcoin

Bitcoin is a communication, peer-to-peer protocol that enables a payment system and use of virtual currency (Böhme, Edelman, Christin & Moore 2015). Bitcoin was introduced in 2008 by a group of anonymous developers or single developer named Satoshi Nakamoto (Nakamoto 2008). Although the concept of cryptocurrencies was described and suggested firstly in 1998, Bitcoin became the first "practical" proof of the theory (Kelly 2014). Since 2009, when Bitcoin price was less than 1 cent, cryptocurrency has grown enormously now achieving the price point of 15000 dollars per Bitcoin (FIGURE 2).

Bitcoin is blockchain-based decentralised digital currency, meaning that all the transactions are recorded and shown in the public distributed digital ledger. It offers peer-to-peer fast money transfers worldwide provided with relatively low transaction costs (prices are defined by miners and usually may vary depending upon the network's load). As its being said, it is a decentralized currency, in other words, there is no central authority that is registering new users and recording their transactions, as far as it is done by the blockchain technology (Franco 2014). Bitcoins are getting into circulation through the process of mining, in other words, mining is providing the supply of Bitcoins in the network (Nakamoto 2008). Mining and blockchain are explained and analysed further in the following chapter.

Jumps in the value of this cryptocurrency brought a lot of scepticism towards it. Is it a bubble or not? This is one of the most debatable topics that was first brought up in 2013 when the currency value grew from 14 dollars to 935 dollars/BTC. Debates are still going on, however, Bitcoin is already a part of the financial system, as the USA, the EU and China are bringing regulations towards the cryptocurrencies. More about regulations and whether CVCs are seen as an asset or a currency will be shown in chapter 3.

Cryptocurrencies and, especially, Bitcoin can be seen as a response to the crises of 2008 and central banks' failure to manage it (Narayanan, Bonneau, Felten, Miller & Goldfeder 2016). Due to the fact that Bitcoin is anonymous and decentralized, threats to its development have started to occur, such as speculation, money laundering, thefts, etc. Therefore, to regulate the crypto-network, governments worldwide have introduced set of regulations. Regulations do vary in regard to the region: while some states have completely prohibited the use of the cryptocurrencies, others decided to treat it as the money-like mean of exchange. (Bal & Lee 2015.)

Even though the Bitcoin's protocol is applying advanced and sophisticated technological concepts, there are still multiple technical issues, preventing and affecting cryptocurrency's large adoption. Therefore, miners and community are trying to improve it through the various blockchain updates. Bitcoin is based on a software - Bitcoin Core - that can be improved with "Bitcoin improvement proposals" (BIP) that are suggesting some technical changes to the blockchain or related software. In order for BIP to be implemented, it first should be locked in, in other words, any changes that are introduced by the miners should be supported by the economic majority (Nakamoto 2008). Such concept drove the community to a high level of debates due to the opposing views regarding Bitcoin's future development.

### **2.2.1 Wallet**

The virtual alternative to money brought digitalisation to the related tools, one of which is digital wallet - a software program that is collecting and storing acquired cryptocurrency. Instead of money, digital programs are storing private keys for Bitcoin addresses as far as electronic coins are seen as a chain of digital signatures. (Bal & Lee 2015.)

There are four main types of digital wallets: web, desktop, hardware and mobile. Web type is operating through the browsers, can be used both mobile and desktop. The desktop is a downloadable software program that is creating Bitcoin addresses for transactions as well as storing private keys for the Bitcoin addresses, such programs are giving you full control over the operations as well as advanced privacy level. Hardware is the most limited type of a wallet providing with a high-secured private keys storage, in order to simplify, such hardware can be seen as a memory stick running a special software. Mobile wallets are very much alike desktop ones, these are applications installed on your phone providing you with a high level of control over your money but having a basic privacy level. (Bal & Lee 2015.)

There are several digital wallet providers for every type of the wallet. Providers vary in terms of the privacy, control over the wallet (what data is stored), transaction fees (whether fees are static/dynamic), security of the environment, etc.

Even though the wide variety of the digital wallets is presented, it is also common to store Bitcoins in so-called "paper wallets". In other words, the private keys and Bitcoin addresses are printed out and saved physically. Due to the variety of possible threats, such as cyber-thefts, transactions frauds, malware, or scepticism towards the digital wallets, this way of storing Bitcoins is considered one of the

safest. However, due to the common practice of trading cryptocurrencies, some may use the crypto-exchange account to store their assets, although this is not considered as a safe method of storing digital currencies. (Bal & Lee 2015.)

### **2.2.2 Price & Market summary**

Bitcoin started with the price of approximately 1 cent per unit back in 2009, currently, its price is over 11000 USD (29/01/2018). One of the first remarkable Bitcoin "jumps" happened in November 2013 - from a price of 205 USD, it rose to 1009 USD/BTC. At the beginning of that year, its price was 12 dollars per unit that shows a high volatility of the cryptocurrency. Back then, such jump led to the questioning whether it is a bubble or not. A number of total transactions were a bit over 100000 with total USD value of bitcoin supply in circulation 10 billion dollars. It was cryptocurrencies' peak price and the record price for the next 3 years. In early 2014, the biggest bitcoin exchange that was handling 70% of all transactions was calling for bankruptcy, stating that 850000 BTC (out of which 750000 were clients' and 100000 its own) were missing. This affected the price drop from 1151 to less than 500 USD/BTC in the following months (Bal & Lee 2015). Based on the calculations, Bitcoin's bubble feature in 2013 and 2014. However, there were periods, during which the bubble price thrives, yet "there is no clear evidence for the persistent bubbles for both Bitcoin and Ethereum" (Corbet, Lucey & Yarovya 2017).

Massive frauds and thefts have questioned the concept of cryptocurrencies being a currency as far as it is not fulfilling money functions. The uniqueness of Bitcoin framework has caused variations in terms of regulations towards cryptocurrencies. Lack of control and decentralization made certain countries to ban it. At the same time, Japan, USA and the EU have recognized Bitcoins as a legal method of payments, however, it is treated as an asset rather than a currency (Bal & Lee 2015). Legal recognition of Bitcoins, BIP91 are supposed to be one of the key factors of a recent price increase that happened in April-June, 2017.

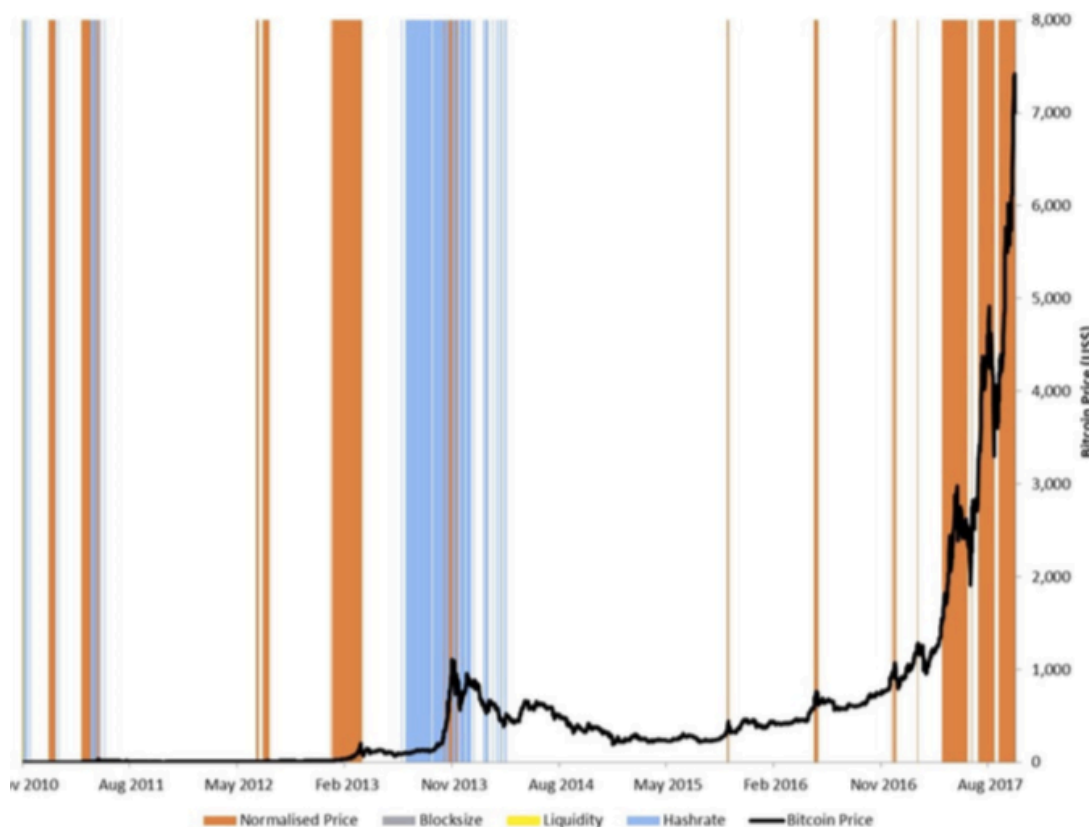


FIGURE 1. Datestamping Bitcoin Bubbles (adapted from Corbet, Lucey & Yarovyia 2017, 16)

Currently, Bitcoin price is floating in the range between 11000 - 14000 USD/BTC with a market capitalization of over 191 billion USD. In December 2017, Bitcoin price reached 20000 USD/BTC demonstrating a sharp rise that was followed by the correction, bringing the price to 9000 USD/BTC at its lowest in January 2018. Since such volatile price jump, it has returned to a relatively stable position, securing the price of over 11000 USD/BTC.

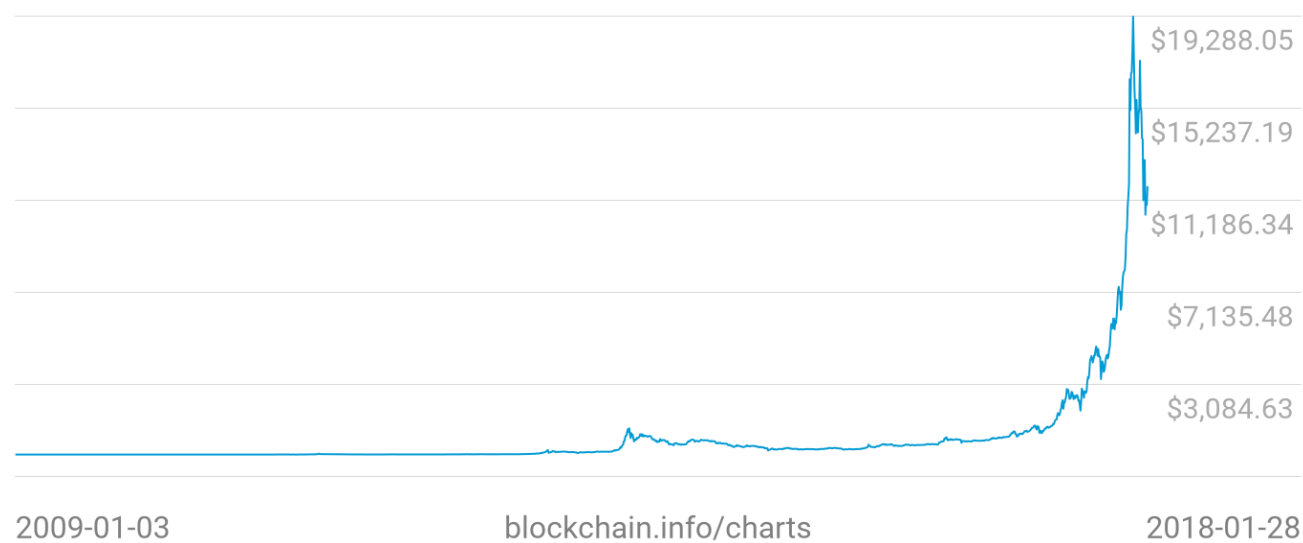


FIGURE 2. Market Price of Bitcoin/Time (adapted from Blockchain Info 2018a)

### 2.2.3 Bitcoin Exchanges

Bitcoins and other cryptocurrencies can be bought through several digital currency exchanges. Today, there is a huge variety of exchanges that are specializing in CVCs, traded currency, region, etc. In order to start buying Bitcoins, you need to register on the exchange website, usually followed by the authentication process - the process of sending your ID copy and address details, after which you can deposit the fiat currency. After the money is transferred to your crypto-exchange balance, person may start to sell/buy available digital currencies. Such process is obligatory for the most of the exchanges, however, verification process vary depending on exchange reliability, etc.

First currency exchanges emerged in 2010 (one year after Bitcoin was brought to use). From 2010 to 2012, the leading position was held by the Japanese exchange, Mt. Gox. It was holding more than 80% of market share. The exchange started to lose its positions in 2013 to the new exchanges, BTC-e and Bitstamp (Brandvold, Molnar, Vagstad & Valstad 2015). At this time, most of the operations have been done in USD. Later, in the Q1 2014, Mt. Gox called for bankruptcy with a statement of 850000 missing bitcoins. It influenced the market extremely, but in terms of leading positions of exchanges as well as bitcoin price. That year, BTC -e, Bitstamp, and Bitcurex had the leading exchange position (Brandvold, Molnar, Vagstad & Valstad 2015).

Earlier this year, the US authorities accused the exchange, BTC-e, and Alexander Vinnik of money laundering. The domain was seized and the cryptocurrency exchange has stopped all the operations. It alleged that Vinnik received funds from the hack of Mt. Gox. According to the court case, "BTC-e became one of the primary ways by which cybercriminals around the world transferred, laundered and stored the criminal proceeds of their illegal activities" (the USA v. BTC-e and Alexander Vinnik 2017). FinCEN assessed a penalty of \$122 million (\$110 million from BTC-e and \$12 million from Vinnik).

Unlike the Mt. Gox, BTC-e has re-launched appearing with a different name, WEX. The website is having the same users' database as well as same interface, allowing users to withdraw their money partially. "WEX received the digital assets of BTC-E, but not the fiat balances" (WEX 2017). Therefore, the exchange has introduced tradeable tokens as a compensation for the lost fiat balances. All the users' balances have been divided into crypto/fiat and tokens with a ratio of 61% to 39% accordingly (WEX 2017). The exchange is keeping its operations and allowing users to withdraw/ trade their money. Such practice of introducing the tokens that will be redeemed in future has been firstly used by Bitfinex

cryptocurrency exchange, that faced the problem of the security breaches that caused loss of over 70 million USD in cryptocurrency equivalent. This case is described in chapter 4.1.

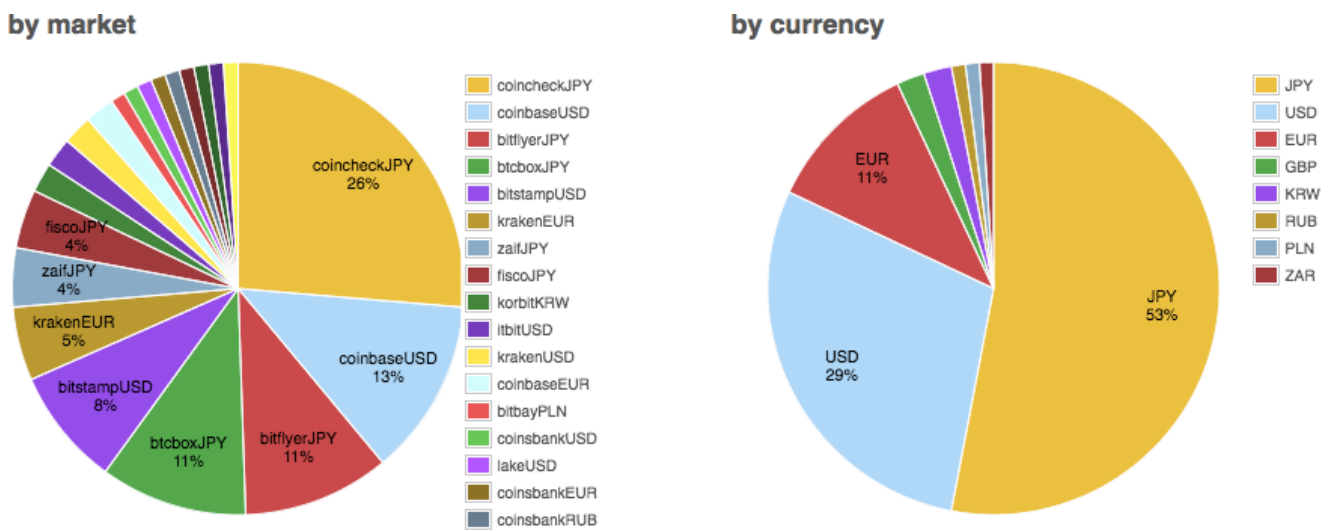


FIGURE 3. Distribution of the Bitcoin trading by market and currency (adapted from Bitcoincharts 2018)

Figure 3 displays the current market situation in terms of exchanges. As we can see, the major trading currency is not USD anymore but JPY, holding 53% of the operations. It is followed by USD and EUR with 29% and 11% respectively. The situation in terms of leading exchanges is appearing differently as well. The current market exchange leader is Coincheck holding most (34%) of the JPY operations, followed by Biflyer with 14% of JPY operations. Coinbase and Bitstamp are the leading USD exchanges.

Differently, to the situation with the fiat money, cryptocurrency exchange rates vary and fluctuate among the different exchanges. It can be explained with a higher "sensitivity" of the cryptocurrencies. Price can be affected by such specific data as market size, exchange volume, the price of entry and currency of trade (Brandvold, Molnar, Vagstad & Valstad 2015) as well as affected by economic, technical and media factors (Ovsyanikova 2016). Therefore, certain exchanges are getting to the leading positions specializing in the transactions of the specific currencies or regions.

Considering everything, Bitcoin exchanges have started to specialize in currencies, location, etc. It is bringing a bigger variety of exchanges with different software features. Unlike the situation that was described by Brandvold, Molnar, Vagstad & Valstad (2015), market is getting more diverse and developed as well as exchanges are improving privacy features by introducing authentication processes.

#### **2.2.4 P2P payments**

Bitcoin payment system is based on the peer to peer system. In this manner, the system can be decentralized, meaning that payments are done directly among two parties without a third party (unlike the centralized system, where transactions are carried out by the third party). Peer-to-peer transactions are carried out by the blockchain-based software. Due to the complete transaction automatization, costs for the transactions are lower rather than in centralized payment systems (Nakamoto 2008). Moreover, payments will be completely anonymous and private - it is done between parties with randomly generated Bitcoin addresses, that cannot be tracked but only confirmed through the blockchain ledger (Nakamoto 2008).

Advantages of the system and its uniqueness bring complexity for the governments to regulate the use of the crypto assets - currently, information on users can be only collected through the use of exchanges, where your ID should be confirmed. In addition, due to the fact that transactions are enabled by coin mining, payments can take more time than bank providers. During the periods of high loads, such as have been mentioned in December 2017, the transaction could have taken up to 3 weeks to be completed. In addition, such parameters as software/protocol updates are affecting the time needed for the transactions. According to the Bitcoin and Ethereum development plans, Lightning and Raiden network implementation will decrease fees for the transactions as well as boost time of the transactions confirmations (Bal & Lee 2015). Such solution is called "2 layer" establishing a fastened payment system upon the existing "layer" of the network. In this way, blockchain will not be overloaded with all the transactions but will concentrate on the large transactions (Buterin 2018).

### **2.3 Ethereum**

Ethereum is a decentralized platform for running and enabling smart contracts based on the blockchain technology (using proof of work blockchain algorithm) "with a built-in Turing-complete programming language" (Buterin 2013). Ethereum platform has been introduced to the public in 2013 by Vitalik Buterin. Later, in 2014 Ethereum project has been funded via crowd sale, just one year after that, in 2015, the system went live. Ethereum platform is aiming to improve the concepts brought by Satoshi Nakamoto. Ethereum platform is using currency inside its network -Ether. Ether coins are used to "pay for computations used for EVM" - Ethereum Virtual Machine (Buterin 2013). The base unit of Ether is

wei,  $10^{-18}$  Ether. Starting from 2014, Ethereum price grew from 0.1 USD to 1100 USD per Ether (Figure 4.)



FIGURE 4. Price of Ethereum 2015-2018 (adapted from Coinmarketcap 2018a)

Same as Bitcoin, Ethereum is a blockchain-based protocol. However, Ethereum has advanced blockchain technology making it programmable, in other words, it is not pre-defined and allows users to create operations of different complexity. Serving as a platform and aiming to become a generalized technology for applications, communities, etc., Ethereum allows its users to create various applications excluding limitations to the cryptocurrencies. Ethereum team states as well, that ether is not used as a primary token for the Ethereum network, but mainly created as a payment for computations. (Buterin 2016a.)

Ethereum Virtual Machine is another key technology of the Ethereum, similarly to the Bitcoin Core, EVM is aimed to execute code of algorithmic complexity (Wood 2017a). For the developers, EVM allows to create applications that are written in a programming language compatible with the EVM itself. EVM is also seen as one of the key innovations for the cryptocurrencies' world - such software that is compatible to several programming languages and that is enabling developers to run the application on the single platform instead of creating several separate blockchains. In this way applications development meets the key advantages of the blockchain technology, such as transparency, security and zero downtime.



The potential of the Ethereum platform brought high interest from the various industries: banking, governmental sector, voting, transporting, media - all these industries are able to enable rapid automation of its sector by applying blockchain solutions. In addition, Ethereum platform brings broader applicability for the cryptocurrencies as well: if the key issue for the Bitcoin is its use in the industry and that there is nothing behind it but speculation - Ethereum growth is ensured by the development of the app, based on the EthOS - operating system enabled by the EVM. (Buterin 2013.)

Through the implemented technology upgrades and set of hard forks - blockchain ledger updates - Ethereum became a more advanced cryptocurrency with higher and faster hash rates and its growth (speed of operations' computing), as well as more flexible in terms of updates and application of the hard forks in comparison to the Bitcoin. The fact of the long-term vision of the company for the Ethereum use, its strategy till 2030 and close cooperation of Ethereum with US-based and Swiss banks bring stronger positions to the cryptocurrency, overtaking Bitcoin, as well as stability in terms of price, decreasing the number of speculations for the Ethereum network. Moreover, Ethereum solution to the problem of scalability, rapidness and price of transactions - Raiden - is supposed to be the first "2 layer" solution for the Ethereum network and for the cryptocurrencies' scalability issue overall and can advance the market and all the dependent altcoins standing as a key substitute to Bitcoin's lightning network. (Buterin 2016a.)

### **2.3.1 Wallet**

Similarly, to Bitcoin, in order to start using/storing Ether, the digital wallet is required. Same as with Bitcoins, it can be stored in hardware, software or paper wallets. As for the trading purposes, Ether can be stored and used directly through the cryptocurrency exchanges, such as Bitfinex, Poloniex, Wex, Binance, Kraken, etc. With the account creation on the exchanges, digital wallets for the traded currencies are generated allowing you to buy, store and transfer the chosen cryptocurrency (Bal & Lee 2015.)

Usually, the key difference between the Ethereum wallet and Bitcoin is the possibility of holding other cryptocurrencies rather than just Ethereum. Such feature is possible due to the fact that it is a platform, so cryptocurrencies based on the Ethereum blockchain can be held by the wallet and recognised. Moreover, wallet provides users with templates for basic applications structuring. The last but not the

least, templates for smart contracts are provided by the wallet, in this way "smart contract" can be easily coded by the amateur programmers.

### **2.3.2 Smart contracts**

The term of smart contracts has been firstly introduced in 1997 by N. Szabo. As he describes, smart contracts are aimed to provide secure, software/hardware-based solutions, formalizing the relationship between the contracting parties (Szabo 1997). In this way, transaction costs are decreased and partially cut due to the direct operations of parties without involving the third side to enable the contract. The basic example that has been presented by Szabo is a vending machine: as a person, interacting with the machine put the precise amount of money, goods will be handed to the person - process as automated and based on if-then principle. Such contracts cannot be reversed and they are secured by the process automation and hardware (in this specific example). (Szabo 1997.)

Back in 1997, the concept of smart contract has been limited by the hardware and software development. Even though the coverage of the smart contracts went broader than just vending machines, its applicability has been narrowed - technology couldn't provide a secure, automated, transparent and global solution. In the context of Ethereum, aforementioned concept meets the technology, introduced in 2008 - blockchain. Blockchain itself is seen as an automated ledger, recording actions of the users, in combination with the concept, the if-then principle can be assured and smart contract self-enforcement can be enabled on a global scale (Buterin 2013). The parameter of "trust" among the parties can be carried by the software in this way, without any interferences from the third parties. Understanding of the potential of this concept today will allow us to image its applicability in the variety of different sectors: transportation, banking, energy, infrastructure, etc. (Norton Rose Fulbright 2016.)

However, even though the concept has highly developed since 1997, it still has several potential threats in its realization and met strong criticism from the public. The current key issue of the concept is understanding the difference between technical and legal contexts of the contract. Due to the fact that contract in this concept becomes just a code and due to its irrevocability, problem of coding arises – contract should be perfect and unbiased (Mik 2017). Unlike average programs, which code contains certain bugs, the code cannot be changed and achieving perfection of the contract may be a challenge in terms of contract agility. Another issue is "translation" of the contracts - even though some legal contracts contain if-then clauses, its translation to the coding language may affect the primary intentions

of the parties. And the last but not the least is the parties' understanding of the code - both parties should be able to read the code in order to ensure understanding of the contract.

Even though technology is still having a need to be further developed, interest towards it is growing across the several segments. In cooperation with Ethereum team, governments, financial institutions and private organisations are maintaining establishment and development of the concept of smart contracts. This may further affect the labour market and result in certain market shifts due to the high technological disruption and industries partial automation. (Norton Rose Fulbright LLP 2016.)

As the technology and applications of the concept are still at the early stage, regulations towards smart contracting can be expected. Specific consumer protective measures are more likely to be followed (Norton Rose Fulbright LLP 2016). Several governments and institutions worldwide have expressed their intentions for the exploration of the blockchain technology as well as for the process of regulating the crypto market in future (Deloitte 2016). More detailed explanation of regulations of cryptocurrencies will be shown in chapter 3.4 and cooperation of developers and governments will be overviewed in chapter 5.

### **2.3.3 Blockchain-based apps platform**

As Bitcoin brought the idea of blockchain and its applicability, Ethereum has proven and advanced that idea. Serving as a platform for the application is not only developing the overall market progression but also promoting its use among the people who are not interested in cryptocurrencies. Assuming the fact that "bubble" characteristics are usually tied up with the cryptocurrencies due to the low adoption, such characteristics are advancing approach towards cryptocurrencies in a great manner, moreover, high public interest towards such applications engage the private sector to adopt the technology. (Deloitte 2016.)

Applications vary in terms of its industrial applicability, right now most popular applications are related to the ICT, energy and healthcare fields. Potential that has been realised in the early stages of the blockchain technology, is growing with applications coded by single developers or developing groups. Moreover, support from the leading market companies such as Microsoft, Visa and MasterCard has occurred, motivating fast application development. Applications are showing the possible innovations

in several governmental and public processes, such as voting, shared economy, ecological footprint identification and reduction, migration, etc. (Deloitte 2016.)

In order to advance decentralised applications development (also known as DApps), some blockchain updates - hard fork - can take place. One of the examples is EtherZero, a recent hard fork that has been locked on 19th of January, 2018. As a result of the update new Ethereum-based cryptocurrency, EtherZero was released. It is aimed to fasten payments across the EtherZero users by eliminating instant fees and implementing "instant pay" system.

### **2.3.4 Crowdfunding via Ethereum**

A single feature of the cryptocurrency, such as its establishment as a platform can completely advance its applications. As one of such examples is the use of the Ethereum platform for the decentralised crowdfunding. Let's shortly overview the process of crowdfunding to establish better understanding of the same process with application of cryptocurrencies and blockchain technologies: project is establishing an estimate of needed recourses for the project to start operations - donations from the interested public are collected- whether the goal is achieved, donators are usually receiving a prize for the project funding.

With the use of the blockchain platform, such crowdfunding project is seen as a "smart contract" with several if-then conditions. Moreover, the prizes that donators receive can be easily tradable with others if a person realises that they are not interested in the project anymore. Automatically rewards will be distributed among the project funders, ensuring the proper crowdfunding realisation. If the project is not achieving the pre-set needed estimate, donators will receive their contributions automatically. (Ethereum GmbH 2016.)

## 2.4 Comparison between Ethereum and Bitcoin

TABLE 1. Bitcoin and Ethereum comparison

	Bitcoin	Ethereum
Market capitalization	235,5 BLN USD	123,9 BLN USD
Blockchain	PoW	PoW
Release date	2009	2015
Cryptocurrency	Bitcoin	Ether
Usages	Payment network	Smart Contracts, blockchain platform
Block time	10 minutes	10-20 seconds
Transactions per second	3-7	10-15
Token standard	Bitcoin	ERC20 (and Ethereum approved standards)
Software development model	Open-source	Open-source

Based on the previous chapters, that are describing in details features of Ethereum and Bitcoin, table 1 has been made in order to conclude the comparison. As can be seen from table 1, Bitcoin has almost twice as big market capitalization as Ethereum. It can be explained by the fact that Bitcoin has been introduced to the public and used 6 years before the Ethereum system went live. In addition, Bitcoin is seen as the first cryptocurrency taken the prior attention in the first years of its existence. However, Ethereum's progress is admirable, locking it as a second largest mineable cryptocurrency nowadays.

As a time required per block is much longer for the Bitcoin in comparison to the Ethereum, as well as the number of transactions per second, we can conclude that Ethereum right now is more suitable for payments. The last but not the least, Ethereum as a platform is able to support any token based on the ERC20 standard, making it more agile and convenient in terms of use.

## 2.5 Blockchain

One of the core elements for the shown cryptocurrencies is tied up with the blockchain technology. Automated, encoded digital ledger of transactions allows cryptocurrencies to have a decentralized

system (Bal & Lee 2015). Blockchain consists of blocks, each block consists of several transactions that happened over time, the sequence of the blockchain is defined by its algorithm of proof that can be either proof-of-work (PoW) or proof-of-stake (PoS). In other words, intermediation from the third parties can be eliminated completely by establishing blockchain, so all the transactions automatically recorded to the ledger. Difference between PoW and PoS algorithms will be shown in sub-chapter 2.5.3. Due to the fact that the blockchain system can be decentralized (as well as centralized as used for the Ripple cryptocurrency), and transactions are P2P, identity protection is advanced, making digital payments transactions become an equivalent to cash.

Key features of the blockchain define the features of the Ethereum and Bitcoin: P2P, decentralized, transparent, secure system with irreversible transactions - such description can be given to any of aforementioned currencies as well as to the technology of the automated ledger (Bal & Lee 2015). However, the way the blockchain is used is different: its efficiency in terms of blocks creation, validation and therefore a number of possible transactions per second varies, making Ethereum more efficient as a payment system (TABLE 1).

As it has been mentioned earlier in this paper, blockchain is not limited by the cryptocurrencies in terms of its applicability and moreover, has been seen as one of the agilest solutions for several sectors. Instead of monetary transactions, actions can be recorded (as for example in smart contracts). Therefore, strong interest in the energy, ICT, logistics sectors have been mentioned (Deloitte 2016). In addition, in order to differentiate CVC on the market, developers implement unique blockchain-based features related to a certain industry (for example, blockchain-based health record). So, through the ICO, such development teams can also raise money for the product development, using its token in future as an exchangeable in-app currency.

### **2.5.1 Enhanced Security**

Overviewed cryptocurrencies are working as peer-to-peer systems - software that is distributed across the nodes making computational resources available across the nodes (Drescher 2017). In a system as such, nodes are individual computers and all the nodes have the same capabilities as well as responsibilities. Due to the software distribution across the nodes, blockchain system is usually distributed (decentralized), however, centralization can be achieved by establishing central nodes-

Central nodes, in this case, will facilitate interactions between the peers (Berke 2017). So, system, in this manner, will establish a hybrid architecture as shown in figure 5.

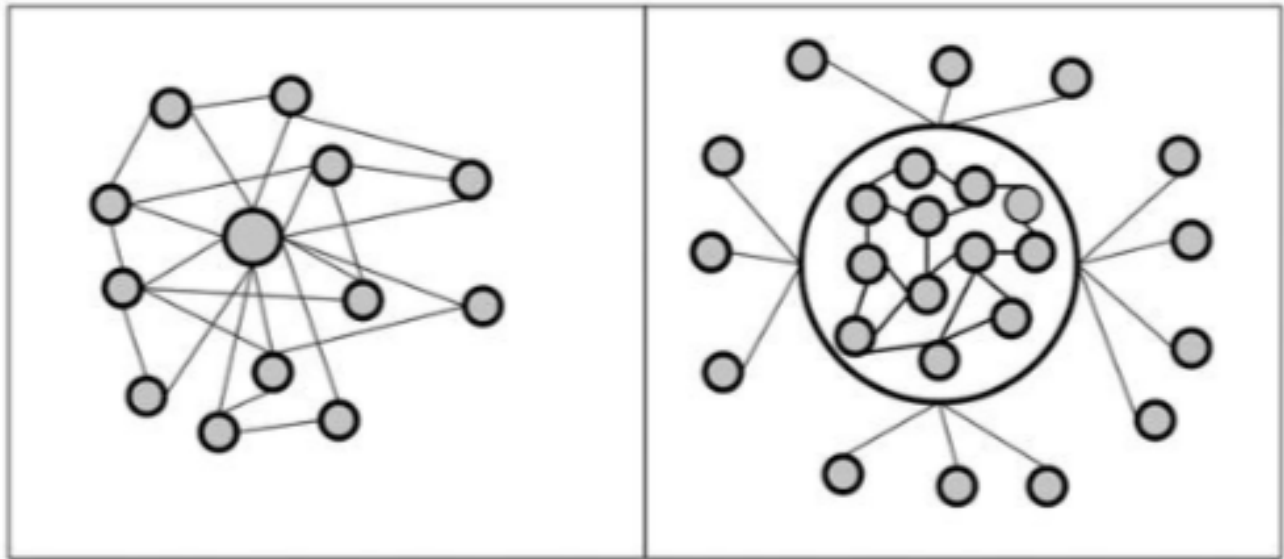


FIGURE 5. Distributed and hybrid peer-to-peer system (adapted from Drescher 2017, 28)

Blockchain technology is able to facilitate and automate distributed systems by implementing tasks of ownership description to transactions verification (Berke 2017). Due to the fact that the system is distributed, it has enhanced security as it cannot be DDoS-ed because data is not stored on any specific server but distributed across the nodes. Systems that are based on the PoS algorithm are able to implement master nodes - node capable of complete anonymization and transaction complete verification (unlike partial in nodes).

The key challenge in terms of security for the blockchain is that the ledger is transparent and available to everyone, yet the data should be protected, ensuring that it cannot be manipulated in any manner. Due to the blockchain data structure, any sort of manipulations with data will be noticeable as far as any change will require complete re-writing of the blockchain, as far as all the referencing will be changed. In other words, all the transactions are irreversible, however, the problem is to recognize the true/false transactions is the key issue for the blockchain. Blocks validation is done by the blockchain-algorithm: it is rewarding nodes that are submitting valid blocks. In order to prevent speculation of the reward, a certain competition is established, usually, it is done by criteria of speed and quality of the validated blocks (Drescher 2017). The process of the blocks validation is dependent upon the algorithm.

The blockchain-users are identified and authorized with the use of the asymmetric cryptography, as well as their transactions are authorized by using the same type of cryptography. Even though the asymmetric cryptography is considered to be one of the most secure methods of cryptographic there are certain issues relating to the private keys - account authorization instrument. If the private keys are not secured the account of an individual cannot be secured. Massive frauds, connected with the cryptocurrencies, are usually based on the insufficient security of the private key - users haven't secured accounts and private keys enough and due to such breach, their digital assets have been stolen. (Drescher 2017.)

As a result, the key factors for the blockchain security are network architecture and transactions verification. Whether the system is centralized or distributed defines the level of the system security and stability: through a partial nodes centralization nodes activity and trustworthiness can be assured. (Drescher 2017.)

### **2.5.2 Mining**

Bitcoins and Ethers are created during the mining processes. Such processes are supported and generated by the network participants based on the cumulative computer power (Scheinert 2016).

Whereas a central bank can be used to classify an individual into a certain threshold, the Bitcoin's and Ethereum's decentralization will limit any regulation on personal holdings, benefiting the wealthier (European Commission 2015). Unlike fiat currencies, mining is a unique feature of the CVCs that are using proof-of-work (PoW) blockchain algorithm. Such algorithm defines which block will be added next to the blockchain and validating it with the proof of a certain kind has been occurred. In case of Bitcoin and Ethereum (and therefore, cryptocurrencies based on the PoW principle) mining is seen as such proof for the blockchain validation. Mining is supposed to be an energy-inefficient way of blocks validation, therefore, PoS is now widely adopted by the new altcoins. Same as with the mining in the past, nodes are receiving a reward for the block validation. Therefore, the approach regarding the taxation and regulation of Bitcoin/Altcoin defines whether mining is taxable or not.



### 2.5.3 Proof-of-Work and Proof-of-Stake algorithms

Currently, there are two key algorithm types that are used among the altcoins: proof-of-work and proof-of-stake. Algorithm defines how the blockchain sequence and blocks validation. As soon as data is fitted to the block after the transaction initiated, it is distributed across the nodes that are related to the blockchain. Nodes are carrying management and administrative power across the blockchain verifying transactions, algorithm of the blockchain defines how the transaction will be verified. (Drescher 2017.)

Proof-of-work is an algorithm that aims to validate the blockchain sequence by providing a solution to a puzzle (work). Such work is usually done by the computers and can be calculated in terms of production. The key problem of the concept in relation to cryptocurrencies is energy issue: due to the Bitcoin/Ethereum network growth, more mining is required, therefore, enormous energy is spent for the blockchain validation. Such growth of the energy required for mining may cause an energy crisis.

As an alternative that is starting to be widely-adapted is proof-of-stake blockchain-algorithm. In such system, blocks are validated by miners who are holding coins. In this way the bigger "stack" (number of coins) you have, more transactions you can validate. As it was described in previous chapters, based on these criteria, the reward for the mining will be higher.

PoS as an alternative way of blocks validation is more energy efficient and faster in terms of transactions verifications, therefore, more emerging altcoins are utilizing such algorithms. Hypothetically, Bitcoin as an open-source platform is able to introduce the algorithm update and switch to the more energy-efficient algorithm, however, such BIP is more likely will not be supported by the majority due to a high number of PoW miners. Ethereum, as Vitalik Buterin (2015) mention, is intending to drive off from the PoW mining dependency, and with following software updates is going to switch to PoS algorithm. (Ethereum GmbH 2016.)

### 2.5.4 Solution as a part of Web 3.0

Overviewed features of the blockchain show the key aspects of the technology such as data integration, data verification automation, network distribution, etc. Such features are making blockchain valuable and are seen as a crucial step towards Web 3.0 enablement. Web 3.0 is based on the milestones of the web 2.0, combined with the data linkage and semantic web establishment (Hendler 2009). With

applications development based on the blockchain, complete data integration can be achieved - for example, Ethereum platform provides templates for the applications and smart contracts development, based on the Ethereum's blockchain, data is automatically collected, distributed and verified across and by the nodes, establishing completely automated connected ledger. Such ledger (as a platform) puts a milestone to the Web 3.0 achievement, providing complete data linkage. As a potential possibility, collected data can be combined with such technologies as AI, cloud database, etc., fully enabling a shift towards the Internet of Things (IoT).

Such drastic change may be followed with the market shift: web 2.0 dominant applications may lose the market share to the emerging application owners unless they will not be able to cope with the technology's disruptive change (Hendler 2009). However, high cross-sectoral interest and early adoption of the blockchain technology has already been mentioned, leaving the key issue to the regulation of the primary application of the blockchain – cryptocurrencies. (Deloitte 2016.)

## **2.6 Cryptocurrencies as a part of the Smart Cities concept**

A large application of the blockchain technology across the various industries has brought attention to the governments and cities. Technology perfectly suits the public needs in terms of transparency and security, so can be used in various interactions between citizens and governing institutions. For instance, a transparent and secure record of the votes of the citizens can improve the credibility of elections as well as governmental transparency. Another example is the implementation of the technology in the financial sector, such as banking: in this way, financial transparency and transactions record can be secured as well as taxation of the private financial institutes. Distributed ledger technologies (DLT), as reported by Deloitte (2017b), can be used in various cases for the cities: establishing of the digital identity, record histories, finances (personal and corporate), cross-border payments (that can be beneficial to attract foreign investments as well apart from the personal use), smart contracts (or in other words, complete automation of the if-then related processes).

To take the first steps in the DL implementation, Singapore has launched project Ubin - "evaluating implications of having SGD (national currency) tokenized on the DL" (Deloitte 2017b). The project Ubin is based on the Ethereum platform blockchain and is implemented by the group of Singaporean banks, MAS (Singaporean Central Bank and financial regulatory authority). All the prototypes, testing and application development are done as a part of the Ethereum network. Moreover, MAS has been developing a system for the currency exchange across the banks to shorten transaction time, fees and

intermediates (Deloitte 2017b). Establishing a distributed ledger-based financial ecosystem and testing it in terms of "technological feasibility and economic viability" is one of the integral objectives of Singapore to achieve high-level Smart City goal - becoming the Smart Financial centre. As a result of the project Ubin implementation, the SGD will become the first digitalised currency.

Another example of implementation of the blockchain technology as a part of the Smart City concept is development and implementation of the emCash concept by Dubai (Government of Dubai 2017). Driven by the same motives as Singapore, Dubai is willing to implement a payment system without intermediates, completely secure and fast. Such payment system will support contactless payment technologies and will be part of the emPay, electronic payment system. The project is carried as a part of the Dubai Economy Accelerators, by Emcredit (a subsidiary of Dubai Economy) in partnership with the British firm, Object Tech Grp Ltd. Such project, similarly to Singapore, is a part of the Smart Economy strategy, that is oriented to completely digitalise economic sector and accelerate the business-related fields in the city. EmCash is seen as an EmPay platform-based part of the economic ecosystem. (Government of Dubai 2017.)

Consulting companies, such as Deloitte, EY, etc., have issued a large variety of the reports regarding future implementation of the DLT in the cities (Deloitte 2017b). The key focus is the "Smart Contracts". Based on this concept DLT, industries that have been far from the process of the digitalisation, can now be involved in it, not only by automating the process but replicating it in a digital manner as well as establishing complete data-collection (Deloitte 2016). Apart from the automated process of the contract implementation, collected data can be used as raw material for the analysis of the industry/company and followed by use in such sophisticated technologies as ML, AI, etc.

### 3 MACROECONOMIC ANALYSIS

Bitcoin as a crypto asset has been developing from 2008. However, adoption and major interest from the public have been tracked in 2013 followed (as well as caused) with the price increase. As it has been said, price per Bitcoin has grown enormously since that moment, jumping from one thousand to 14000 USD. Even though the interest has grown since then, the regulations coming from the high financial institutions, such as IRS, has come only in 2014.



FIGURE 6. Bitcoin Capitalization (adapted from Coinmarketcap 2018b)

The key price changes, as well as mechanisms affecting Bitcoin and Ethereum during the early stages (2008-2015), have been described in the introductory chapters on these specific currencies. In the following chapter, the key regulation and key macroeconomic affects will be reviewed (mainly starting since 2015 due to the rapid development).

#### 3.1 Cryptocurrencies market overview and statistics

Recent years have shown a drastic increase in cryptocurrencies market overall: market capitalization has grown from 16 billion USD to 653 billion USD, making a change of 97% overall capitalization growth (Figure 6). According to the graph, the biggest "jump" in terms of capitalization has been made in the last quarter of 2017, causing 500% capitalization increase and peaking at 833 billion USD. Such jump was followed by market correction and capitalization drop at 653 billion USD. The recent drops can also be explained with the news and bans of the exchanges in South Korea and China, however, capitalization

and therefore price drop can be explained with the cyclical dynamics being - capitalization drops are similar to previous years.

Unlike the previous year, 2017 became a turning point for the Bitcoin - its capitalization in relation to the overall capitalization has decreased from 87% of the market share to 33%. On the other hand, the market share of Ethereum has grown almost 5 times more just in one year, showing market's growing diversification (FIGURE 7). As can be seen from the graph, in June 2017, Ethereum's capitalization was at its closest in comparison to Bitcoin, holding the 30% of the "crypto" market. Currently, Altcoins are increasing their market dominance as the next logical stage, Bitcoin market cap share should decrease and altcoins' capitalization will take the leading positions.

In 2017, SegWit, soft fork blockchain update, has strongly affected the course of the Bitcoin development, figure 6 shows its effect as a minor drop for the overall market capitalization, however, figure 7 shows cardinal drop of the Bitcoin share, supported with the high rise of the Ethereum as a currency for the "shift" in order to wait over the software upgrade of the Bitcoin system. As a Bitcoin Cash has been created after SegWit update, altcoins have risen at the same time, keeping a high growth rate since then.

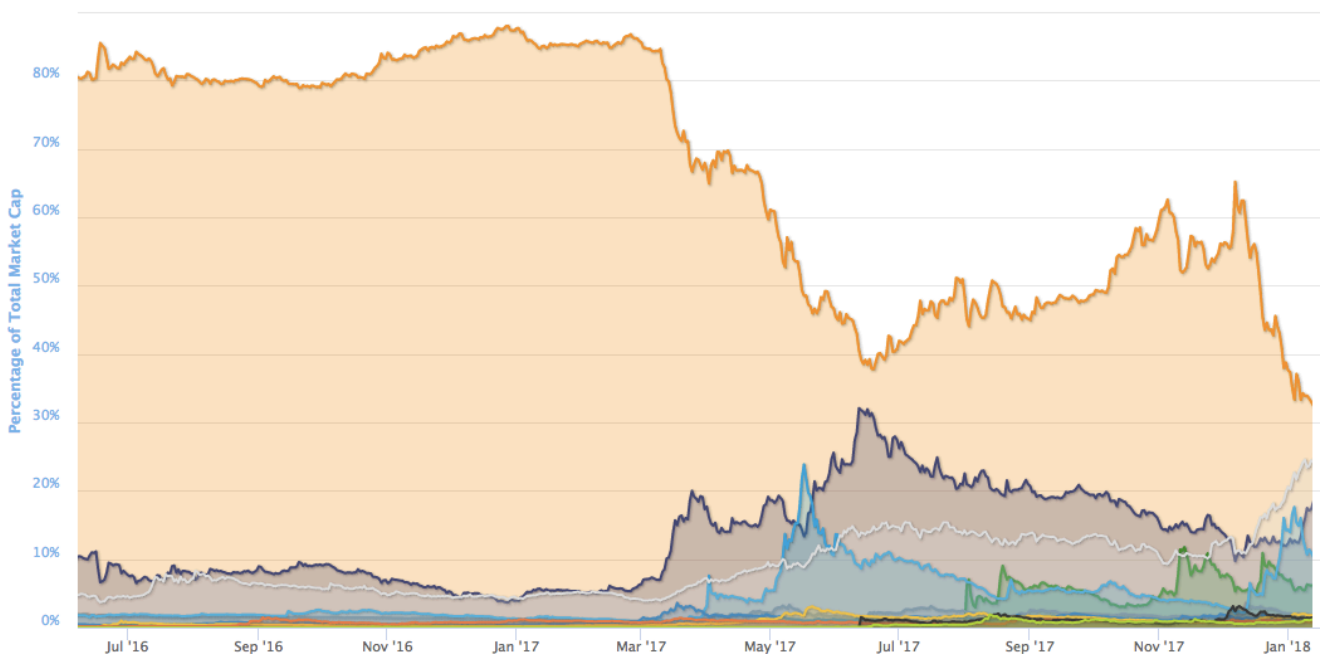


FIGURE 7. Cryptocurrencies Capitalization (adapted from Coinmarketcap 2018c)

From the macroeconomic perspective, the rise of capitalization of cryptocurrencies backed up with the high popularity and strong presence in media can be seen as a crisis of the Bretton Woods system (Grushack 2014). The system has built major dependency upon the US dollar, linking the major world

currencies to the USD, and driving off from the golden standard gave US Treasury full control over the dollar price. Bretton Woods system has ensured the economic stability of the US and therefore financially liable countries after the Second World War while removing aforementioned golden standard made it completely fiat and controllable. The crisis of 2008 has shown the system's weakness as well as lack of stability, the situation like this caused not only economic but social problems, showing the need for economic shift. Bitcoin can be seen as a result of this need - cryptocurrencies overall are reflecting the shift towards the digital economy. In comparison to Bretton Woods system, such economy, as was drawn out by the feature of cryptocurrencies, is decentralized (and peer-to-peer), anonymized and completely digitalized.

In the previous year, first and major regulations towards cryptocurrencies have been established. Need for the precise and correct regulation of the cryptocurrencies is visible, however, it is hard to understand how to regulate it without limiting its technological progress. Moreover, how to adapt the shift towards the digital economy with the minimal social and economic disruptions, making the transfer safe. The early stages of regulations, as well as different approaches towards the digital currencies, are shown further in the chapter.

### **3.2 Price volatility factors**

As Ovsyanikova (2016) presents, there are three main categories affecting Bitcoin's volatility: economic, technical and media. During her research, she mainly focused on the volatility of the Bitcoin only, so the presented factors affecting volatility will be compared.

In terms of the economic factors, the inflation rate is one of the primary factors affecting cryptocurrency's price. In both cases, for Bitcoin there is a total limit of approximately 21 million USD overall, however, Ethereum doesn't have any pre-set overall maximum of tokens in circulation. At the same time, assuming the fact that the system is aiming to upgrade to PoS algorithm, the overall amount of Ether will be reached. Inflation of the Bitcoin, according to Ovsyanikova (2016), will be minimizing with every year and when the maximum amount will be achieved, the inflation rate will be 0 due to the pre-set limit of the minable coins. Inflation has the same effect in the case with Ethereum, assuming its future migration to the PoS algorithm. In the opposite case, its inflation should decrease over time almost achieving zero due to the high network difficulty and more time-consuming mining.

Such parameter as the number of transactions over time is one of the key economic factors affecting volatility (Ovsyanikova 2016). However, this factor is affecting price only in a short-term manner: every transaction rate change indicates the changes in demand and supply. As a logical result, with the growing demand price grows, while with its decrease price will fall. In case with Ethereum, such factor is also affecting the volatility, however, due to the fact that unlike Bitcoin, it is a platform, so more convenient "coins" can be used for the mutual transactions, based on the same blockchain, such factor has less power in terms of volatility, mainly influencing the price of the tradable coin itself.

As has been proposed by Ovsyanikova (2016), the key reason behind Bitcoins' sale is a low adoption across the world, therefore, after its primary function is done (p2p money transaction), Bitcoin is sold. With the recent prices jump and high network difficulty, Bitcoin's transactions have been partially "frozen" due to a large number of transaction overloaded the blockchain. Such transactions are stuck in the process of verification. Assuming the fact that there is a large number of the various payment-oriented fast transactions, it is logical to assume that the factor that was proposed by Ovsyanikova (2016) has partially changed over time: due to the fact that most of the exchanges have adapted their system to exchange fiat for Bitcoin, most of the "buying" transactions are used in order to put money to CVC with the lower fees and exchange rates. The acquired money afterwards is transferred to another CVC, in order to avoid high transaction fees and long verification time - such reason, from the macroeconomic perspective, explains the growth of the altcoins market share and fading Bitcoin's dominance. Factors, proposed by Ovsyanikova (2016), is mainly affecting price in a short-term manner, while the factor of "fiat-bitcoin-altcoin" transactions is affecting on both macro- and microeconomic levels. In comparison to Bitcoin, Ethereum has much larger adoption: there are hundreds of decentralized applications, based on the platform, where the Ether can be used (Buterin 2016a). However, the currency still has low adoption apart from the digital matters - such circumstances lead to the fact that the short-term price volatility can be affected by the currency's "fiat-ether-fiat" procedure, originally stated for Bitcoin.

From the technical perspective, mining power and national regulations applying to CVCs are seen as key factors (Ovsyanikova 2016). Mining power has an effect on both transactions' verifications time and therefore, transaction's speed overall, and blockchain itself. Such factor is influencing both Bitcoin and Ethereum - any sort of the limitations, bans, CVC-related mining regulation as well as regulations regarding energy use is strongly affecting price volatility. Regulations overall, regarding transactions and such matters as taxation, are affecting both cryptocurrencies due to the early stage of the CVC formation. Large adoption and development cannot be achieved if countries will completely ban the use

of CVCs, for example. Oppositely, any regulation/court cases on successful adoption of the cryptocurrency will positively affect its price.

Lastly, media factor plays an important role in the price volatility. News regarding the possible changes of the currencies adoption (such as possible regulations) or technical updates (such as hard forks) are the key reasons regarding short-term price volatility. News as such is also affecting investors' speculation, trying to bargain on a short-game. Market's expectations, regarding the price of the CVC, is the key reason behind the strong effect of media on price volatility. In addition, Bitcoin's Futures start on the stock are proving the factor drawn out by Ovsyanikova (Ovsyanikova 2016). Media factor is affecting both Ethereum, Bitcoin and altcoins due to the currencies' early stage of formation. Digital money is in process of forming market stability, driving from the phase of early adoption to "early majority" phase, based on the theory of diffusion of innovations. Over time, CVCs should become more and more stable, assuming the coherent involvement of it to the current fiat system with regard to large public adoption.

### **3.3 Policies and regulations regarding cryptocurrencies**

In order to understand the effect of the Bitcoin and altcoins on the economies worldwide, the policies and regulations should be overviewed. The differences in terms of approach towards the digital currencies can be tracked based on the taxation policies of the certain regions. This chapter provides the analysis, overview and comparison of the taxation policies regarding the digital money across the three regions: the USA, countries of Europe and countries of Asian region and Australia.

#### **3.3.1 Taxation in the USA**

Bitcoin is a decentralized cryptocurrency the value of which is not controlled by the government. Therefore, it may be difficult for the US tax agency, the IRS, to tax the holders. To find a public benefit in taxes, the IRS decides to treat Bitcoins as having a property value rather than being a currency (Bal & Lee 2015). This property experiences gains or losses depending on the market value of when it is sold, purchased, or mined. When sold, if the purchase price is under the selling price, this realized gain can and should be taxed from the beneficiary who received the gain. Moreover, according to the IRS tax policies, mined Bitcoins become taxable directly after being received, allowing a label to be placed on the Bitcoin of its taxable value at its status (The Internal Revenue Service 2014).



Further, the income tax system of the US is determined by the individual's profit, placing each person in a taxable bracket; but, when the long-term holding originates in Bitcoins, the classification of the income falls into the brackets of a capital gains tax, which are typically 10-15 percentage points lower (The Internal Revenue Service 2014). This method of escaping high progressive income tax rates is Bitcoin's positive aspect. Consequently, the capital asset of a Bitcoin shows more volatility than an asset held in a centralized banking system; a centralized bank can boost its asset's direct use and security establishment. The Bitcoin must eventually be transferred into a direct use asset, ensuring its establishment of value in the hands of the consumer.

Once again, regarding the tax of the CVC, it is important to note that a Bitcoin is not only seen as a property but also as a commodity with similarities to oil or gold, except with no actual tangible value (Gulker 2017). The IRS determines the tax by "the character of gain or loss from the sale or exchange of virtual currency" depending "on whether the virtual currency is a capital asset in the hands of the taxpayer" (The Internal Revenue Service 2014). Therefore, the IRS will use their influence to obtain taxes on the amount realized from the Bitcoin through its constantly changing value, whether in trading or in its first process of mining.

To conclude this section, the IRS can only enforce its legalities and control Bitcoins by demanding strict capital gains calculations and records of transfers. The present value of the Bitcoin must be determined at the time a transaction is made, noted, and explained in detail on tax returns (Bal & Lee 2015). Regardless, whether it is conceivable to use Bitcoins in everyday exchanges or not, it may be completely impractical for daily situations because of the complex IRS requirements. An article in the American Institute for Economic Research asserts if the IRS enforced the rules as stated, "it would render cryptocurrencies inappropriate for everyday use" (Gulker 2017). Ultimately, the IRS sees the Bitcoin as an equally taxable and fair capital asset after going through its rather harsh record specifications.

To test its success of taxing the transfer of Bitcoins, in November 2016, the IRS was permitted by a federal court to issue a John Doe Summons (Wood 2017b). A John Doe Summons always originates from the IRS, but it is different in the nature that the IRS doesn't know the taxpayer they are searching for, who may be liable for paying back taxes (Wood 2017b). In the case of Coinbase, the IRS is interested in its users and the transactions taking place. Consequently, the IRS, being a government-controlled agency, has an advantage on the monitoring of Coinbase as it can usually gain wide access and approval through the courts. With an almost inevitable IRS success, some users of Bitcoin may be exposed, potentially acknowledging common tax frauds or difficulties with following the IRS reporting

guidelines. The biggest problem for the success of virtual currencies and Bitcoin will be to keep records which comply exactly with the IRS demands (Gulker 2017). Furthermore, since an IRS summons is actively taking place, many Bitcoin users will be diligent to remediate past filings and take more time on their current ones, leading to more attentive actions on behalf of the users. As it seems, the IRS tax audit will test the durability of Bitcoin as a viable social currency.

### 3.3.2 Taxation in Europe

As we can assume from figure 8, Individual Bitcoin taxation is divided into Bitcoin trading (consumption tax) – inter-/currency exchanges and mining; and trade done in Bitcoins (Income tax) – product/service exchange made for currency.

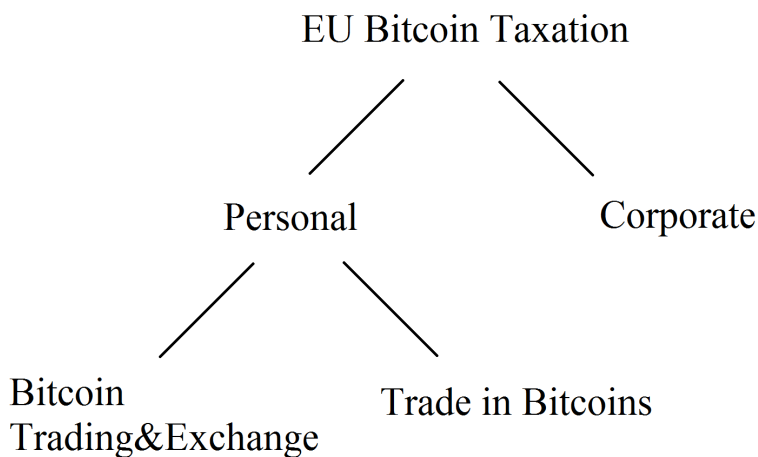


FIGURE 8. Bitcoin Taxation in the EU

In the case of *Skatteverket v David Hedqvist*, where the Swedish Tax Authority appealed against a Swedish citizen regarding towards "the transactions of exchange of traditional currency for the Bitcoin virtual currency and vice versa" (*Skatteverket v David Hedqvist* 2015). According to the final judgement of the Court, such transactions are exempt from the VAT according to the VAT Directive (Article 135, 1(d)), therefore we can conclude that Bitcoin is a mean of payment similar to the legal means of payment (fiat currencies).

However, profits from the mining activities should be registered and are the subjects of VAT Directive, Article 44 (Bal & Lee 2015). Starting registration profit may vary upon the Member states.

The national legislation defines the VAT for the sale of goods and profits gained from the Bitcoin transactions. General approach towards the Bitcoins as a currency on the territory of the EU is treating

it as "a payment means similar to the legal means of payment" (Skatteverket v David Hedqvist 2015). However, national legislations are defining tax levels and whether to tax it as income tax, capital gains, etc.

Currently, tax authorities of Denmark, Finland, Estonia, Lithuania, Slovenia and Germany published national tax treatments of Bitcoins providing the information on how it will be taxed, treated and on which levels (Bal & Lee 2015). VAT Directive defines taxes on transactions other than discussed in the judgement of ECJ and national legislation, however, lack of the direct certain instructions regarding the Bitcoin taxation makes it confusing for users and debatable at some point for the tax authorities, making most of the Bitcoin-related cases unique.

### **3.3.3 Taxation in the Asian region and Australia**

According to the study, conducted in 2017 by Dr., Garrick Hileman and Michel Rauchs, Asia-Pacific region has the largest number of miners and payment transactions (Hileman & Rauchs 2017). Regulations regarding individual and corporate taxation affecting currencies' volatility may result in market "shocks, during which currency's price may drop by more than 25%. People's Bank of China has not issued final verdicts regarding the regulating matters (Chohan 2017), so the rumours on inside information are affecting market's volatility in a short-term matter. Currently, South Korea and China are hesitating in regard to the Bitcoin regulations. One of the most progressive regulations over the world is made by Japan, where Bitcoin is seen as "a means of payment that is not a legal currency" and officially recognized as a method of payment (Chohan 2017). Cryptocurrency transactions fell into the scope of Japanese Consumption Tax, relatively reaching 55% from the transaction sum (in the transactions involving large sums), however, taxation of the virtual currencies became exempt from the JCT since 1 of July 2017 (Deloitte 2017a). The key reason behind advanced cryptocurrencies practices and comparably progressive adoption of the cryptocurrencies, however, still cautious involvement of the digital money to the system may be reasoned by the case of the crypto-exchange, Mt. Gox, described in chapter 2.2.3 - happening has shown the risks of the cryptocurrency exchanges as well as brought attention to the topic from the early stages.

Back in 2013, Peoples Bank of China has met with the third-party companies, prohibiting them to do business with Bitcoin exchanges in China (Brandvold, Molnar, Vagstad & Valstad 2015). From the business perspective, China has completely prohibited Bitcoin operations for banks and payment

companies, indirectly affecting the business sector in China in terms of cryptocurrencies. ICOs funding has also been banned on the territory of China due to the serious economic disruption. (Central Bank of the Republic of China 2017.)

Most of the south-east Asian countries are referring to Bitcoin as a legal virtual good, however, no serious tax or regulating policies has been made across those countries (Chohan 2017). A similar situation is in countries of Oceania. In Australia, Bitcoin and similar cryptocurrencies became exempt from goods and services tax, removing double taxation of the virtual assets, moreover, virtual currencies' treatment is aligned with money. (Australian Taxation Office 2017.)

### **3.4 New Trade Theory view on cryptocurrencies**

To understand the cryptocurrencies' application in terms of the New Trade Theory (NTT), the application of the cryptocurrencies will be analysed in regard to its concepts and ideas. In order to understand cryptocurrencies in terms of NTT, I will refer to it as an asset, holding the similar position to the regulatory institutions of the EU and the US.

NTT determine economies of scale and product specialization as key features advancing companies' performance on the market. In addition, NTT proposes that early entrants have an advantage in such economic system due to the substantial economies of scale, driving the market to a monopolistic form of competition. In this way, economies of scale are tied with the globalization factor due to the increasing demand for the companies' specific product, moving demand from national to global. Cryptocurrencies in such model are becoming an instrument of driving the demand through its features allowing it to trade to enhance its global presence (Bal & Lee 2015). Moreover, the recent years have shown the rise of the industry-oriented altcoins, narrowing specialization of digital products. Moreover, application of the blockchain technology to the already existing products, such as browsers, video platforms, etc., defines a specialization of products, differentiating them from the solutions provided on the market.

Network effect can be analysed from the perspective of an industry or a company. In case of the cryptocurrencies, the network effect is seen also as a volatility factor, described earlier in this chapter. Currently, currency adoption is one of the backbones and the key challenges for the crypto-market (Bal & Lee 2015.) From the network effect perspective, the introduction of the Bitcoin and its open-source core made a strong effect of the market of the cryptocurrencies – first cryptocurrencies appeared as hard

forks of Bitcoin, later the code has been used to develop more complex “coins”, such as Ethereum. As Vitalik Buterin (2013) mentions in the Ethereum’s whitepaper, Ethereum came to the existence due to the development of the Bitcoin and proposes another view on the cryptocurrencies and its development.

Development of the cryptocurrencies has stimulated rise of the blockchain-related specialists worldwide. In terms of the NTT, it is similar to the product development, however, due to the product being completely digital and open-source, its networking is even stronger. Like described by the Krugman cases of the MNCs developing regional industry, blockchain innovative technologies allow specialists of various levels and backgrounds develop skills and practices. With development and adoption of the local altcoins, such as Neo, for example, network effect takes place as well, however, it is done on a larger scale with direct and close to instant feedback from the users, boosting the process of the overall development of digital money.

As for the SMEs, ICO became more valuable way of raising funds. It now becomes a substitute for the IPO that requires much larger budget and resources of the medium-sized companies. This factor causes the rise of the ICOs worldwide backed up with the existing projects, such situation is visible with the BAT, ENJ, etc.

In terms of globalization, cryptocurrencies are seen as a unique instrument that enables cross-border payments, complete automation of the transaction-related activities and increases "financial mobility". Not only the fact that all the transactions can be done online on your own, without any intermediates (banks, agents, etc.) plays a huge role, but the possibility of ensuring transaction-related actions can be done without parties knowing each other (based on the concept of smart contracts). Automatization of the contracts may be the boosting factor for the SMEs growth on a global scale, so the product's differentiation will play the key role in terms of trade.

According to NTT, governmental regulations may have the key role in the industries promotion and development. If we look at Bitcoin and Ethereum as products, then taxation of the cryptocurrency would be a defensive manner, hedging the national market. The case of China, establishing strict regulations toward the Bitcoin use, however, establishing the national digital currency can be an example of the natural product and concept development of the cryptocurrencies in accordance to NTT.

Use of cryptocurrencies and blockchain adoption by industries is already seen as a disruption to the current technologies and economies. Companies, such as IBM, Microsoft, SAP, etc. are adopting and

developing blockchain-related solutions in order to keep the positions in the market of the monopolistic competition. At the same time, governments worldwide are adopting the cryptocurrencies on a national scale (for example, Singapore and Dubai) in order to gain control and affect the market at the early stage of its development, while other countries are choosing defensive positions, implementing the technologies while assuring market protection with financial regulations like taxation (for example, China).

### **3.5 ABCT and cryptocurrencies**

Austrian Business Cycle Theory (ABCT) proposes that interest rates are regulating the investments and money flow. Therefore, any manipulations with the interest rates will cause the misbalance and will further negatively affect the economy. Manipulations over the long periods will result in "bubbles" - fictive over-invested financial manipulations. Interest rates manipulation not only creates the misbalance in the case as such but will waste private resources and time. As a result, such system will be affected by the recession.

Such theory is explaining the nature of bubbles and crises, especially, the crisis of 2008 - "The Credit Crisis" - that has been caused by the financial manipulations in mortgage markets and manipulation with the related interest rates.

According to this theory, distributed cryptocurrencies will positively affect the current market. Due to the network's decentralization, central banks will not be able to manipulate the interest rates directly. However, with the development of the cryptocurrencies, countries are commonly looking for the hybrid distributed systems, that can be affected by the central institutions.

## 4 PROBLEMS OF THE CONCEPT AND POTENTIAL ISSUES

Even though the concept of digital money is promising, currently it has certain issues that will be overviewed in this chapter. Problems are related to the technological issues of CVC as well as threats that are visible at the moment. Specifics of every problem, examples and possible solutions are presented in regard to every major issue.

### 4.1 Thefts

Over the time, both Bitcoin and Ethereum have been affected by the massive theft cases, followed the Mt. Gox collapse. According to the table 2, the overall amount of the money stolen was equal to almost 520 million dollars (based on the price in 2015, assuming the price rise, the same amount in Bitcoins currently equals to over 6 billion USD) (Bal & Lee 2015). Thefts are seen as a major reason for Bitcoin not being a store of value. Thefts, connected with the major cryptocurrencies, are usually caused by the security breaches of the digital exchanges, digital wallet providers or crypto-related projects (Bal & Lee 2015). Unlike the fiat money, thefts cannot be reversed due to the blockchain based transactions: changes in the system requires a complete change in block recording, requiring complete blockchain re-writing.

TABLE 2. List of known Bitcoin thefts (adapted from Bal & Lee 2015).

No.	Case	Severity in USD
1.	Silk Road seizure	26,867,560
2.	Sheep Marketplace incident	4,070,923
3.	Silk Road 2.0 incident	3,624,866
4.	Bitcoin Savings and Trust	2,983,473
5.	PicoStocks hack	3,009,397
6.	MyBitcoin theft	1,072,570
<i>Subtotal</i>		<i>41,628,789</i>
7.	\$10k-\$100k (19 cases)	5,776,430
8.	Less than \$10k (18 cases)	539,470
9.	2014 Mt. Gox collapse	470,000,000
<i>Grand total</i>		<i>517,944,689</i>

Since 2015, there have also been several theft cases. One of them is Bitstamp case. 19000 Bitcoins (that equalled to approximately 5,000,000 USD at the time) have been reported to be stolen I July 2015

(Whittaker 2015). Unlike many other cases, some of the employees have been targeted for the information phishing.

Another case has been reported in 2016 connected with one of the largest exchanges, Bitfinex, and is supposed to be the second biggest Bitcoin-related theft after the Mt. Gox case (Baldwin 2016). Due to the security breach, 70 million USD have been stolen, affecting even multi-signature accounts. However, since 2016, Bitfinex has completely paid back the customers' losses through the BFX token redemption (tradable exchange token which cost is growing over time in order for users to redeem funds).

Ethereum, similarly to Bitcoin, has also been affected by the massive thefts. Moreover, Ethereum itself became the result of one of the biggest thefts in the history of the cryptocurrencies. After the DAO - decentralized Ethereum blockchain-based organization/fund - has successfully raised the money in 2016, the vulnerability of the code has been found. One month later, some users exploited the code's vulnerability (code has been available to the public as an open-source project) and stole almost third of the funds in Ethereum (Price 2016). However, through the implementation of the hard fork, that happened 1 month later after the incident, Ethereum's blockchain was split in two: Ethereum Classic (the older and original version of the token) and Ethereum (Buterin 2016b). The currencies are co-existed still and the key difference at the time was the lack of DAO's funds in the Ethereum Classic's chain due to the breach and they have been restored in the Ethereum's blockchain.

As we can see from the theft examples, there are issues regarding the thefts and mainly they are done not due to the blockchain breaches but due to the intermediates' breaches. Thefts, however, are still negatively affecting the public image of the cryptocurrencies overall, questioning its secure use.

Massive thefts and similar activities, such as money laundering, are seen as the key need for the regulations towards the cryptocurrencies and may be the key reason behind its ban in the past. Nowadays, governments are trying to regulate CVCs by identifying the cryptocurrencies' users as well as certifying the exchange-providers (Bal & Lee 2015). Even though such means of regulations are understandable, however, questions regarding regulations still cause the debate whether de-anonymization is right as far as such approach "wastes" one of the key features of the cryptocurrencies.



## 4.2 Scalability

One of the key technical issues of the cryptocurrencies is scalability problem. The problem is highly debatable in Bitcoin community with different ways of overcoming this problem being proposed. Scalability issue refers to the case of the mass adoption of the specific cryptocurrency and time/fees processing growth due to the lock size limitations. In Bitcoin network, every block is limited to 1 megabyte per block, so with the growing adoption, transactions queue will grow, therefore, the transaction fees will grow to prioritize certain payments. In December 2017, scalability issue of Bitcoin has faced the users due to the network overload: some of the transaction have been stuck in processing and confirmation for several weeks. According to figure 9, we can see a jump in costs per transaction in comparison to the January 2017.



FIGURE 9. Cost per Transaction for Bitcoin (adapted from Blockchain Info 2018b)

In order to minimize the scalability problem several hard forks (blockchain update after which the chain is divided in 2 - the one that is following new rules and the one that is following old rules, all the blockchain participants will not follow the hard fork). One of the most impactful ones is SegWit2x, the hard aimed to increase the block size to 2 megabytes per block. The segwit2x upgrade should have been implemented in two parts, trying to compromise all the participants of the Bitcoin network. The first half, also known as New York Agreement, has been supported by the majority of miners in August 2017. However, the second half of the update has been cancelled. As a result of the hard fork, new "coin", Bitcoin Cash, has been created, that is based on the blockchain that follows new rules.

Earlier, in 2015, SegWit, soft fork (blockchain update, that makes previous blocks invalid), that has been successfully launched improving blockchain security and block's transactions capacity. Unlike the hard fork, such blockchain update requires not complete miners/nodes support but a majority of the network. In addition, SegWit has "prepared" network for the Lightning Network implementation, that is in process of execution since December 2017. Lightning Network provides "2 layer" solution that is utilized for the most of the transactions off-chain, minimizing transactions load on the blockchain.

Like Bitcoin, Ethereum has scalability issues, however, it is limited not by a memory per block but by the amount of gas (that is constant cost resources needed for the transactions in the network). As Vitalik Buterin (2017) has pointed out, "[Ethereum community] recognized scalability as perhaps the single most important key technical challenge that needs to be solved in order for blockchain applications to reach mass adoption". Buterin (2017) has mentioned, that there are two major types of solutions that can be done to improve the platform, which is sharding and "2 layer" solutions. Both solutions are seen as complementary: sharding is aimed to improve existing base-level protocols, while "2 layer" builds up a technical solution to "lighten" and distribute transactions across the layers. As an alternative to Bitcoin's Lightning Network, Raiden Network is aimed to carry the major amount of transactions from the Ethereum's network. Also, to lighten base layer of blockchain in terms of Smart Contracts, "Plasma" project has been announced. In January 2018, Buterin has announced "scalability R&D subsidy programs" to stimulate community and independent companies for the scalability solutions development with the provided grants.

### **4.3 Low adoption**

Although cryptocurrencies became one of the biggest trends and gained an enormous popularity in the last years, its adoption and use are still the key threats to the cryptocurrencies development, in particular, Bitcoin and Ethereum. Low adoption as a factor can be seen as a sum of other reasons such as:

1. Regulation concerns
2. Market's early stage of development
3. Position of the companies
4. Speculation

The lack of "final" regulations towards the global technology as well as the difference in terms of how it is treated in various regions brings the "imbalance" towards the use of one of the CVCs key features - global approach in terms of payments. Users should not only know their national regulations but regulations of the recipient's state.

Ethereum's and Bitcoin's current development of overcoming scalability issue is one of the key technical requirements for the public adoption of the currencies as payment systems. As we can see from table 1, Ethereum and Bitcoin can handle less than 20 transactions per second, while current payment provider's capacity, such as Visa's, is around 65000 transactions per second. Scalability issues and on-going solutions showing that the technology is at its early stage. Moreover, such issues as sophisticated UI and UX can also be seen as the additional reasons for the system's low adoption.

Even though the market capitalization is relatively high, use of the crypto-capital is pretty limited. For most of the SME's, it might be risky to accept payments in Bitcoins or Ethereum due to the unstable exchange rate. In addition, Bitcoin may cause the problem of double spending during the network's high load, during which fees could have grown up to 160 dollars. Large companies, also, may not be able to use it as a payment system due to the long transaction time during the high-load times.

As a consequence of the previously shown reasons behind the low adoption, the problem of speculation rises. High volatility and market fluctuations cause people to trade the currency. Speculation is not only a consequence of the low adoption but a reason for the market's instability as well.

#### **4.4 Energy crisis**

Major "experienced" cryptocurrencies, such as overviewed Bitcoin and Ethereum are using the PoW blockchain algorithm. Such algorithm requires mining in order to approve and verify transactions. With the growing network's difficulty and a number of users, the larger mining power is required. Assuming the radical jump in prices, high attention from public and cryptocurrencies becoming one of the economic and media trends, the mining is becoming one of the trending practices for the passive income and having large attention from the public. According to Digiconomist's statistics (2018), mining revenues are approximately equal to 10.1 billion USD with the costs of 2.2 billion USD. Just Bitcoin network's mining electricity consumption almost equals to Iraq's with the annual CO2 footprint of 22251 kt.

Such electricity consumption, as well as its rapid growth, are threatening the sustainability of the concept. However, the alternative of the PoW, the PoS algorithm does not require such large electricity consumption rates. In fact, to compare it with the PoW mining, that is usually GPU-based, PoS can be run on an average computer. Such algorithm is bringing the ecologic sustainability to the concept of cryptocurrencies as well as boosting the performance of it - PoS-based networks are verifying and confirming transactions faster.

Migration of the "mastodons" of the crypto-world to the PoS blockchain algorithm would be a logical step in terms of its development. Buterin (2015) has mentioned his intentions to drive off the mining dependency of Ethereum in the future with the software updates. However, the question regarding Bitcoin is more complex: due to a large number of miners right now, change of the algorithm will bring up serious debates. Such blockchain update, similarly to SegWit, will require the majority of the nodes/miners to support the decision and it is not clear right now when the community will decide to do so. In an alternative scenario, Bitcoin, due to the fading market dominance will be forced to follow the market change in order to keep the positions.

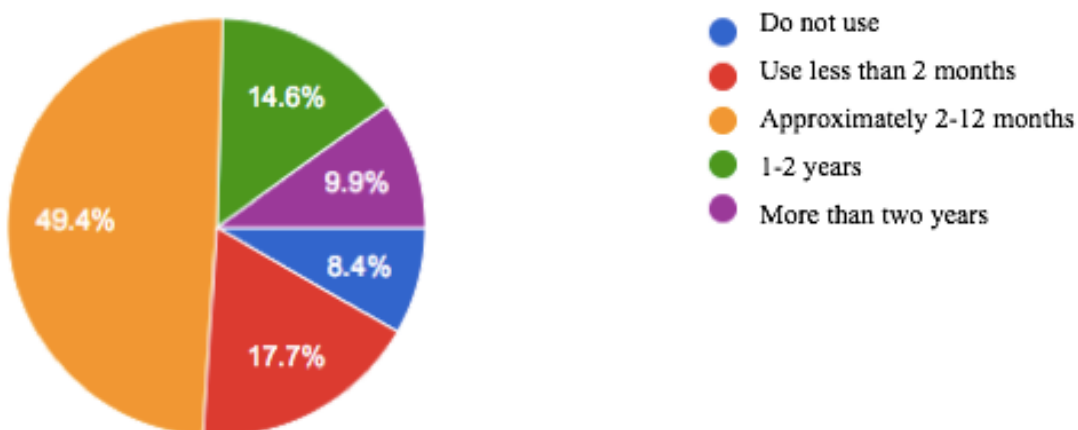
## 5 RESEARCH

This part provides an overview and analysis of the gathered data from the survey respondents. Questions are related to the macroeconomic analysis (including microeconomic issues) of the Bitcoin and Ethereum. The results from the questionnaire are considered and compared to the theoretical part of the study.

### 5.1 Quantitative research

Quantitative research has been done as an online survey that consisted of total 22 questions. Questions are divided into 4 separate sections. Each section is related to a specific "episode" of the cryptocurrency use. Order of the questions depends upon the answers given by the respondent. For example, if the user replies to the question "How long have you been using cryptocurrencies?" with "Have never used", then he/she will be taken directly to section 4, skipping the sections regarding experience-related questions, such as transaction fees, use of smart contracts, etc.

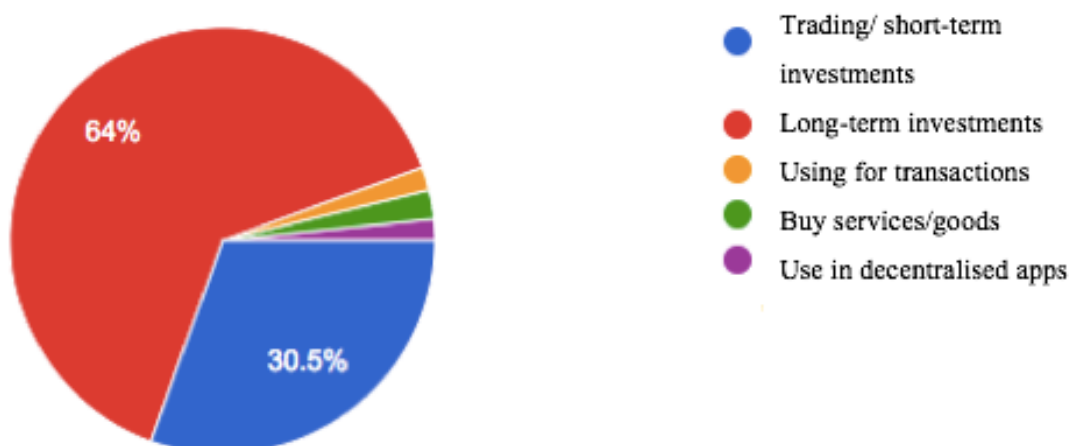
The survey was conducted among 1300 respondents. Majority of the respondents - 52% - belong to the age group of 25-34 years old. It is followed by the age group of 18-24 and 35-44 with the percentage of 19% and 18% respectively. The least number of respondents belong to the age group of 12-17 (approximately 2%) and 45-64 (around 8%). Notably, the greater part of the survey participants fulfilling almost 70%, is likely to recommend the use of the cryptocurrencies, while only 21% of respondents are hesitating in regard to this question. So, only around 10% will not recommend the use of digital currencies. (APPENDIX 1.)



GRAPH 1. How long have you been using cryptocurrencies?

Graph 1 shows the distribution of the survey participants according to their use of cryptocurrencies. As we can see, around 10% do not use cryptocurrencies, while the majority reported to use it for the period of over 2 months but less than a year. Closest group to the minority are the participants using cryptocurrencies for over 2 years. Almost 20% of people participated in the survey are using cryptocurrencies for less than two months. The rest is using it for the time period varying from year to two. Such findings are logical and completely support the theoretical findings. As we can see the price growth of the two dominant cryptocurrencies - it has skyrocketed and multiplied its price mainly by the year 2017. Moreover, the Bitcoin and Ethereum boom was strongly supported and largely overviewed by the media - the interdependency between the price and media overview as well as activity in the social media has been shown in the sentiment analysis proving its dependency at least in a short run (Georgoula, Pournarakis, Bilanakos, Sotiropoulos & Giaglis 2015).

Section 2 consists of four questions. Questions are related to the first steps of use of digital money: buying, trading and intentions behind acquiring it. Graph 2 shows the intentions behind the purchase of cryptocurrencies. It is visible that the majority of the replies, almost 64%, have started to purchase cryptocurrency as a long-term investment, followed by 30% starting to use it for trading/short-term investments. Such data prove the reason behind the volatility factors from the macroeconomic perspective as well as shows the low adoption of the currency to use it as a mean of exchange or for decentralised applications. So, there is a clear pattern of the low adoption of the cryptocurrency in terms of applicability.



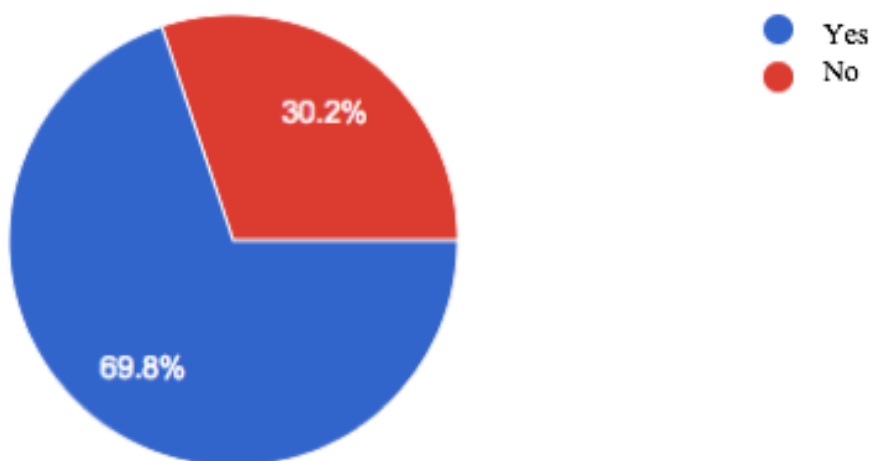
GRAPH 2. What is your reason for buying cryptocurrency?

Other graphs of the section (APPENDIX I) show that most of the people are acquiring cryptocurrencies directly by the bank card transactions or online payment services (like PayPal, AdvCash, etc.). The majority states that they are ready to pay less than 3% to deposit their funds. Such data shows the

financial risks taken by the individuals upon the entering the market. Market's long-term orientation may be also the reason behind the readiness of entering the market with relatively high fees.

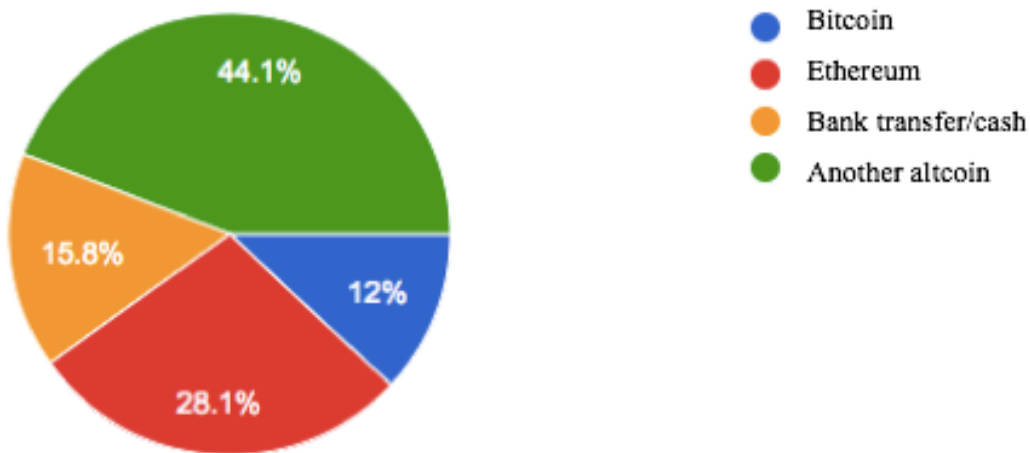
Remarkably, there can be seen a correlation between the results about the deposit of the money to the exchange and the trading fees. Distribution by the percentage between those two figures is relatively common (APPENDIX 1). The reason behind it may be the exchange's benchmark in regard to the fees as well as the common level of the market proficiency among the respondents.

In section 3 respondents answered the questions regarding the use of their digital crypto assets. Its use in terms of wallets transfers, use in decentralised applications, transactions and smart contracts has been emphasised. Graph 3 shows the percentage of the people using decentralised wallets. Remarkably, almost 70% of the answers stated the use of the digital wallet. To my mind, the key reason behind it is the higher reliability of the digital wallets over the crypto-exchanges and purchasing apps. It can be seen from the chapter 4.1, exchanges reported the DDoS and phishing attacks that led to the massive thefts. Another reason behind such distribution of the answers is its interdependency with graph 2, which shows that 30% of replies stated to buy cryptocurrency for trading. Therefore, respondents may avoid exchange-wallet transfers that have transaction fees and time delays and might be inconvenient to store money "outside" of the exchange for these purposes.



GRAPH 3. Do you transfer your crypto assets from a purchasing/exchange app to a personal, decentralised wallet?

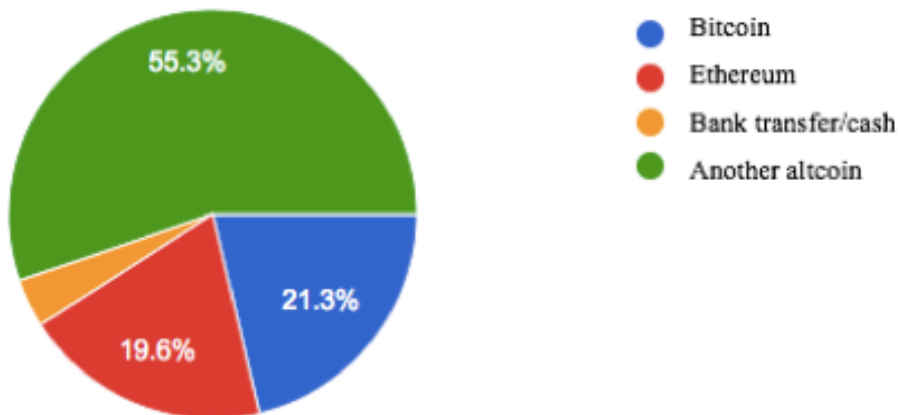
Interestingly, 40% of respondents are using decentralised applications. These results are showing the pattern of the potential altcoins' dominance on the cryptocurrencies market, especially Ethereum being a platform for the decentralised applications. However, use of the smart contracts is twice lower than the use of the decentralised applications. Such results are showing that the adoption and development of this concept are primarily prioritised by companies and the private sector.



GRAPH 4. Which currency will you use for fast payments?

Graph 4 shows that users prefer other cryptocurrencies rather than Bitcoin or Ethereum for the fast transactions. Moreover, Bitcoin, as a payment system, is less popular than bank transfers, having the lowest part of answers - 12%. However, Ethereum is having a much stronger position, locking 28% of the answers. Larger adoption and use of the Ethereum over other cryptocurrencies and, at the same time, faster transactions are more likely the key reason behind the distribution as such. Use of the altcoins in such scenario is logical: currently, there are several altcoins, specializing in fast payments. In this way, implementation of the "2 layer" solutions for Ethereum and Bitcoin might be the crucial point to keep large adoption and use for the transactions.

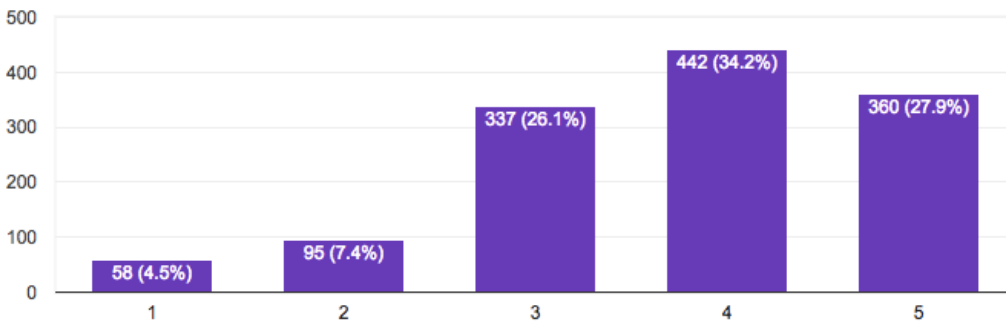
A similar situation can be visible in terms of the use of digital money for the anonymous and secure transactions. The majority will also prefer to use another altcoin, rather than Ethereum. However, fewer people will use the bank transfers or cash, which states about cryptocurrencies' anonymity and decentralisation. Bitcoin and Ethereum have the same rate of choice for the purposes of the anonymous transactions, as can be seen from graph 5. Both graphs show the market's tendency towards the dominance of altcoins as well as the reasoning behind its growth.



GRAPH 5. Which currency will you use for the secure and anonymous transactions?

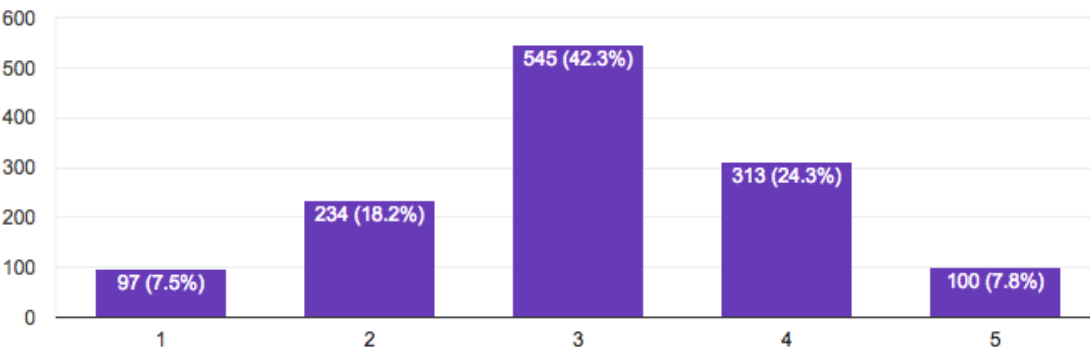


Section 4 is oriented to understand the opinion of the respondents on the future of the cryptocurrencies. Questions related to the themes of regulation, issues and future of the digital money have been asked (APPENDIX 1). As we can see from the first questions of the section, Ethereum has more potential according to the received answers, followed by other altcoins. Again, it proves the potential decrease of the Bitcoin’s dominance on the market mentioned during the analysis of figure 8. At the same time, in the following answer shows that the biggest group of respondents support Bitcoin and Ethereum, from which we can conclude that the respondents see the possible development of the Bitcoin specifically in the future as well as a stable rapid growth of Ethereum.



GRAPH 6. How well are you familiar with the regulations regarding cryptocurrencies in your country of residence? (1– do not know at all, 5 – know well and follow updates)

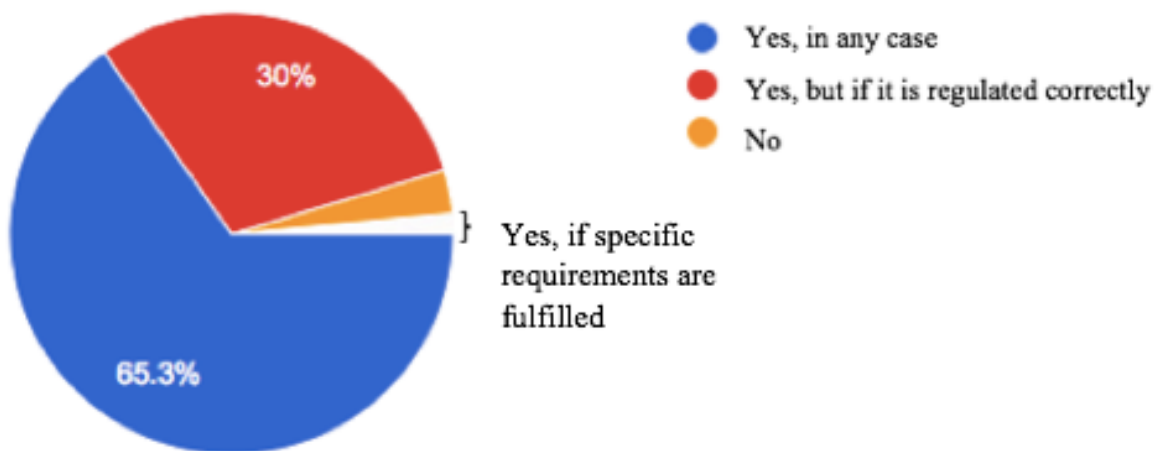
It is important to mention the difference between graph 6 and graph 7 that aimed to find out public's familiarity regarding the issues of regulations of cryptocurrencies in their country of residence and abroad. The majority is familiar with the regulations regarding the domestic regulations and are even proficient in terms of their knowledge that states their high interest in regard to this topic. However, in terms of the regulations abroad, the majority hold basic knowledge. If we see the cryptocurrencies as a global financial tool and mean of exchange, then graph 7 may seem surprising. Yet digital money is in a process of the early development and such pattern can be explained by the interest of the domestic development of the concept and practices, such as mining, etc.



GRAPH 7. How well are you familiar with the regulations regarding cryptocurrencies abroad? (1– do not know at all, 5 – know well and follow updates)

As for the issues, replies have shown that the problem of the growing fees and transaction time can be seen as a priority. Followed by the low adoption and market instability as well as security issues, results prove the theoretical findings regarding the topic. As the market right now is primarily dominated by the "early adopters" group, the issues regarding the interface and UX are not seen as the key ones. Section 4 also draws out dependency with the Graph 2, as 45% of the respondents reported to cash out their crypto assets if they find other investment possibilities. However, the majority - 57% of the survey participants - mentioned that the financial needs would be the key reason to do so, proving their long-term orientation in terms of investments. (APPENDIX 1.)

Whether high interest or support of decentralisation are seen as a driving force behind the use of cryptocurrencies, but surprisingly, 83% have stated to use it in case if it becomes illegal. The key reason behind it might be the will to drive off from the governmental centralisation as well as am the inner potential of digital money becoming disruptive for the current market principles. The opinions divided in the relation of 3 to 1 when people were asked whether it is a bubble or not. Based on the overviewed theoretical data, we can conclude that people understand the "bubble" features of the crypto-assets affected by a high volatility yet seeing it a short-term effect. (APPENDIX 1.)



GRAPH 8. Do you see cryptocurrencies as a money of the future?

The last but not the least, graph 8 shows the distribution of the answers on whether it is the money of future. As we can see, the vast majority of the replies display certainty regarding its use in future, followed by a third of replies stating that it is so if the right regulations are considered. Although graph 1 has shown that around 8% of survey participants haven't used the cryptocurrencies and assuming that quarter of replies stated that it is a bubble, graph 8 shows clearly the dominant opinion, having the overall approval of over 95%, that it will become the money of the future.

## 5.2 Qualitative research

Qualitative research consists of two in-depth interviews. Each interview is aimed to find the reasoning behind cryptocurrencies' nature (APPENDIX 2). Moreover, it compares the technical viewpoint and investing-oriented one. Another aim of the interview was to see a comprehensive insight into the development of the digital money and issues of it.

The first interviewee is an IT specialist, applications developer and a miner, who is involved in the topic of cryptocurrencies for more than two years. His path has started with just a minor mining of altcoin, Zcash, and over time this source of passive income became his major occupational interest. As he personally mentions:

Media and some cryptocurrencies users are amazed with the decentralization of the cryptocurrencies, this makes them imagine future without central authorities. Even though it is an exciting and rather imaginative thought, it is not something that hooked me. The simplicity of the technology - this is what intrigued me at first place. Just think about it, at a core it is just an automated notebook that uses some weird language, but this simple idea is disrupting so many industries.

Even though he started like an average miner, currently he is involved in the development of the decentralized application. This project is oriented to build blockchain-based online strategy game with its own Ethereum-based built-in currency. He mentioned that the concept wants to make "management game as realistic as possible". So far, as he says, there are some issues regarding the design and certain mechanics, however, he believes that such game "will certainly bring the attention to the gaming communities".

As for the cryptocurrencies' potential development, he stated that the following year "will bring a lot of excitement and stabilization". Following this statement, he supposed that in 2018, Ethereum will become the major currency, due to the relatively large applicability, community's loyalty and stability. The interviewee commented:

As a core, Bitcoin is just a payment system and it has shown its huge issues in the recent months, it doesn't support instant payments and loses to its hardfork, Bitcoin Cash. Take any other cryptocurrency from the top 10 [refers to the top major cryptocurrencies by market capitalization], any of those will transfer your money faster and cheaper, it is just a matter of the corporate adoption.

The interviewee mentioned supporting Ethereum as a current market leader in terms of implementation of Smart contracts and decentralised application. The fact that Ethereum has contracts with several banks worldwide as well as a recent agreement with NASA shows its large potential as well as a strong presence on the market. The interviewee mentioned that Ethereum, has very strong and ambitious team behind the project itself - "Vitalik [Buterin] is Elon Musk from the world of cryptocurrencies".

Mentioning the issues of the cryptocurrencies, the interviewee pointed out that community, its building and development are becoming the key question for the following years. The market, as he stated, needs professionals that understand the big picture of the cryptocurrencies, that are not only passionate but skilful. Development of crypto-related tools and applications is another issue:

... [community] is looking how to adapt the technology to the existing financial practices, however, they are missing a possibility of creating a complete ecosystem that at a certain point will attract the user, when, of course, it would be ready to give a high-quality service ... ecosystem as such will be able to compete with existing mastodons of the market, such as Google, and at a certain point will outplay them, keeping the spirit of start-up and competition inside of the ecosystem.

According to his opinion, volatility is harmful to the long-term orientation and currently is caused primarily due to the slow-paced adaption to the financial systems worldwide. High volatility and jump in prices of the last year are driven by a fast development of blockchain-based ideas. Even though the interviewee mentioned that regulations played a strong role, the key factor was the development of the new products, showing the real possible outcome of the cryptocurrencies.

Look, how many new ready-to-use applications came out last year and taken our attention, starting with funny and a bit absurd cryptokitties, concluding with a great browser "Brave" made by the creator of Java-script - first products are driving price strongly.

The second interviewee has been investing in cryptocurrencies for approximately a year and a half. During this time, he has diversified his financial portfolio and managed to "multiply" his crypto-investments. Currently, respondent is financing company that is aiming to launch ICO by the end of November 2018.

Regarding the change in preferences in terms of cryptocurrencies, the interviewee commented that at first he was excited about Bitcoin, Dash and Ethereum primarily, however, Ethereum's DAO case made him sceptical about it at first. He has started from buying Bitcoin, Dash and Litecoin, with the diversification of 60, 20, 20% respectively. The interviewee mentioned that at a certain point he has sold

Litecoin before its rise. As he believes, its affected his market orientation and made him switch to a long-term approach.

Since December, he has moved most of the Bitcoins to Ethereum and the rest diversified among "small" altcoins, such as Stellar, Cardano, Enigma, etc. He stated that he primarily supports anonymity-oriented cryptocurrencies as far as it improves financial privacy. Moreover, he stated that Enigma, for example, has a very advanced team of MIT graduates (that seems similar to Zcash).

As for the key issues, he pointed out "market manipulation" as one of the problems. News and announcements coming from the governments, such as a recent one from South Korea, makes the market "too volatile". In addition, the way government tries to regulate cryptocurrencies seems strange to the interview. As he mentions, cryptocurrencies' popularity rose partially due to the possibility of driving off from the centralisation financial dependency, so government should not try to regulate it as concept of money as "they understand it right now".

Such issues can be solved, according to his opinion, if it is treated as a digitalised cash and if countries will introduce the right approach towards the cryptocurrencies' taxation and use.

This answer has been followed by the question, regarding market volatility. As investor commented, volatility made people excited about the market of cryptocurrencies at first place - it is seen as an alternative to the shares stock exchange. Volatility, in his opinion, is natural and will stabilize as soon as crypto trading will mainly focus on the crypto-related projects rather than "coins". He points out, that there is a big chance that the platform-based currencies, such as Ethereum, will become a "stable basis" while platform-based tokens will be treated as an alternative to company shares.

In the last question, related to the Bitcoin and Ethereum skyrocketing jump the last year, the interviewee has mentioned that there were three key reasons: high attention from media, court cases and regulations regarding cryptocurrencies and SegWit activation.

## 6 CONCLUSION

Cryptocurrencies and their development is a complex and trending topic. Its rapid development, issues and regulations toward the digital money are bringing several social, economic and even ideological questions. Even though there might be a scepticism towards the cryptocurrencies as a concept, the fact that it is becoming one of the key financial trends and will affect the existing financial system is doubtless.

The aim of the research was to identify the impact, essence and development of cryptocurrencies from the macroeconomic perspective. Comparison of the two major cryptocurrencies has been shown by identification of its unique features and development paths. Analysis of the core technology - blockchain - has been presented as well based on the theoretical background.

In terms of the impact, we have identified the growing interest towards the overviewed cryptocurrencies from the public. It can be seen on the rise in terms of price, capitalisation and use of the digital money. Moreover, the analysis of the blockchain technology shows wide applicability of the technology across the various sectors, allowing many industries to automate the core processes, improving their market performance as well as entering the economy of digitalisation. Analysis of the theoretical knowledge related to this field allowed to show objective opinion regarding the applicability and potential of blockchain and cryptocurrencies overall.

The macroeconomic analysis was an integral part of the thesis, establishing the understanding of the regulative environment across the various region in regard to digital money. As an abstract conclusion, we can see that governments are facing various issues, connected with the primary issues of the cryptocurrencies, such as anonymity, making the process of its integration to the existing financial systems tougher. Some regions are providing open-minded regulations, while others are trying to minimize its use and applicability to protect and "prepare" the monetary systems. Cryptocurrencies have been analysed from the perspective of the New Trade Theory that established reasoning behind certain regulations as well as provided with the understanding of the essence of Bitcoin and Ethereum as urban concepts. In terms of this theory, cryptocurrencies are seen as an industry, resulted from the development of globalization and networking. ABCT theory also shows the argumentation and support for the development of the cryptocurrencies as a self-regulatory financial mean of exchange, eliminating forced or "artificial" simulation of interest rates.

The results concluded from the theoretical knowledge, have been backed up with the research. Quantitative research has proven the key reasons behind Bitcoin and Ethereum volatility as well as has shown public's long-term orientation in terms of growth of cryptocurrencies. At the same time, the issues that have been also presented in the theoretical part have been approved by the results of the research - as presented, volatility, low adoption and security issues are seen as the key reasons behind markets instability. However, qualitative research has shown the reasoning behind these issues, pointing out the early development stage of the cryptocurrencies overall as well as presenting opinions regarding CVCs from both technical and economic perspectives.

Even though the cryptocurrencies' threats are recognised, the most of the issues are affecting cryptocurrencies primarily on the short-term scale. Both theoretical analysis and research results have shown the large potential of the cryptocurrencies in terms of personal and corporate use, backed up with a high level of loyalty towards the cryptocurrencies.

Taking everything into account, the aforementioned finding presented the essence and development of the cryptocurrencies from the macroeconomic perspective. Even though large amounts of information have been overviewed and analysed, cryptocurrencies are in a process of rapid development. They carry huge potential; however, several issues should be eliminated for their sustainable growth. Yet with the right regulating policies and elimination of the overviewed threats, blockchain technology and cryptocurrencies might become the major instrument of the economic digital transformation.

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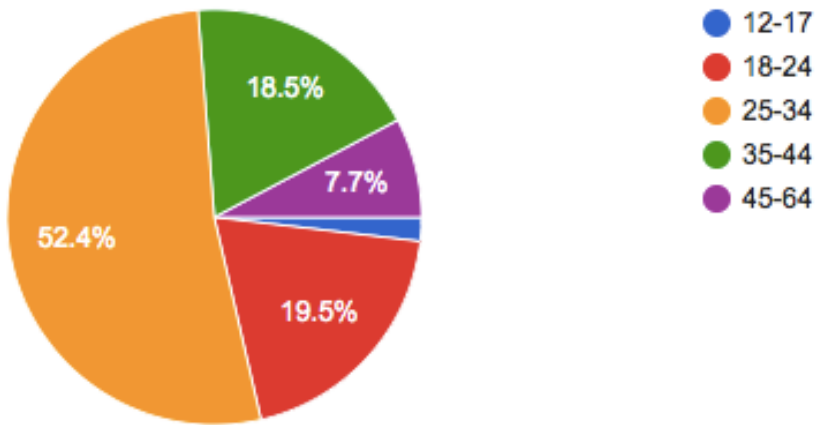
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**APPENDENCIES**

**APPENDIX 1: Survey results**

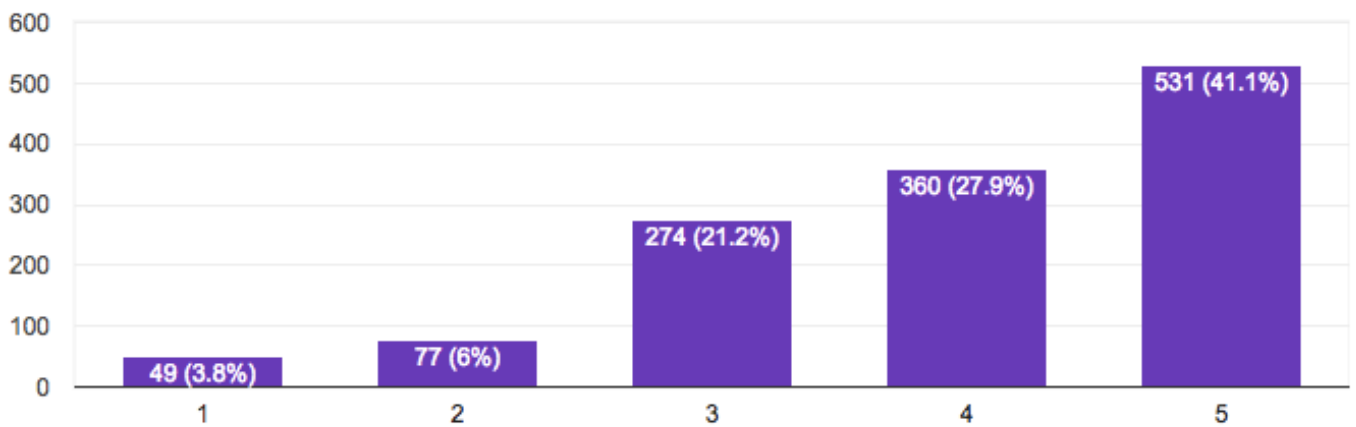
1. How old are you?



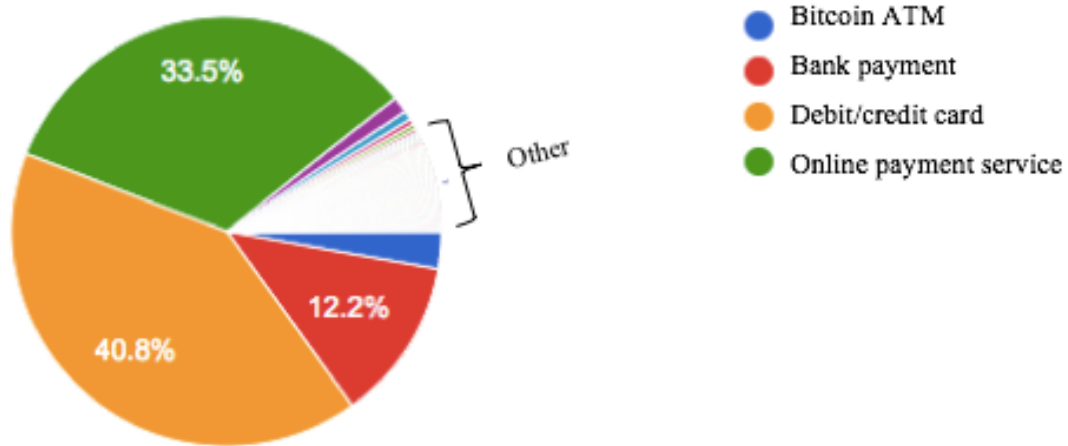
2. How likely will you recommend the use of cryptocurrencies for your relatives/friends?

1 - will not recommend

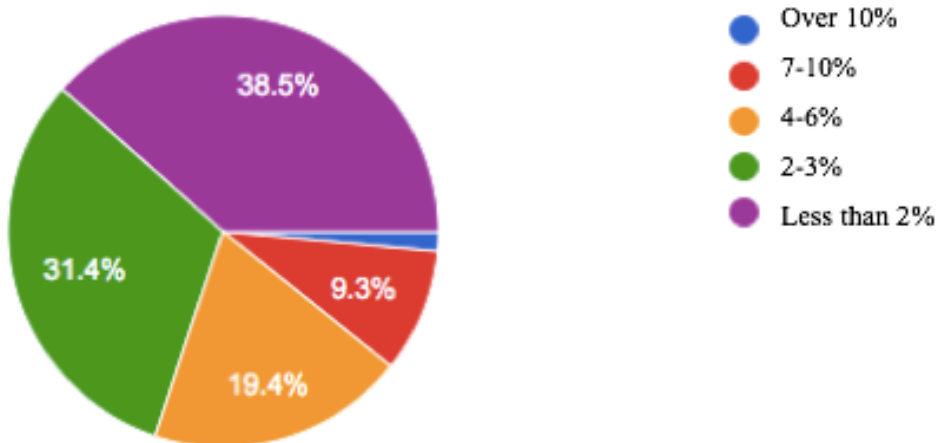
5 – will recommend for sure



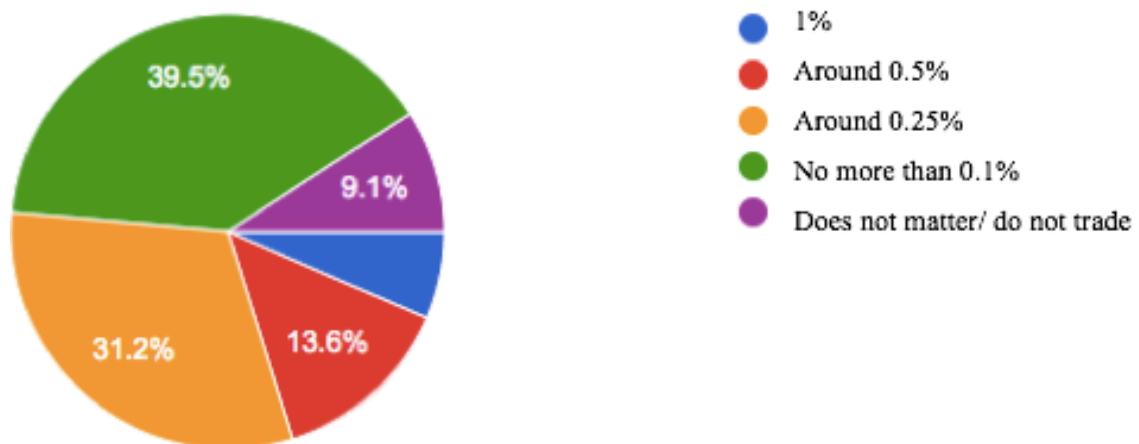
3. Which method do you prefer to use to acquire cryptocurrencies?



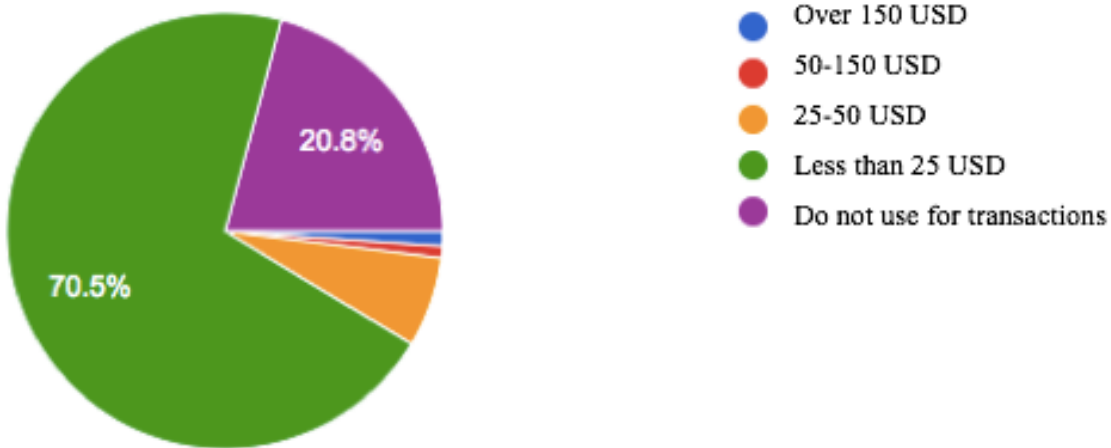
4. What's the maximum fee you'd be ready to pay to deposit money into cryptocurrency exchange/purchasing service?



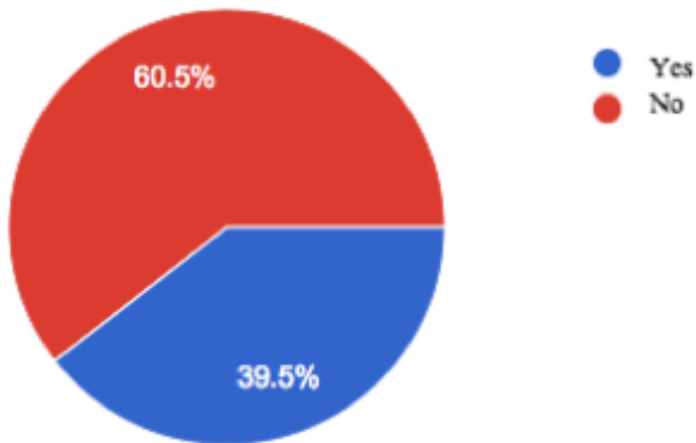
5. What is the maximum trading fee you are ready to pay?



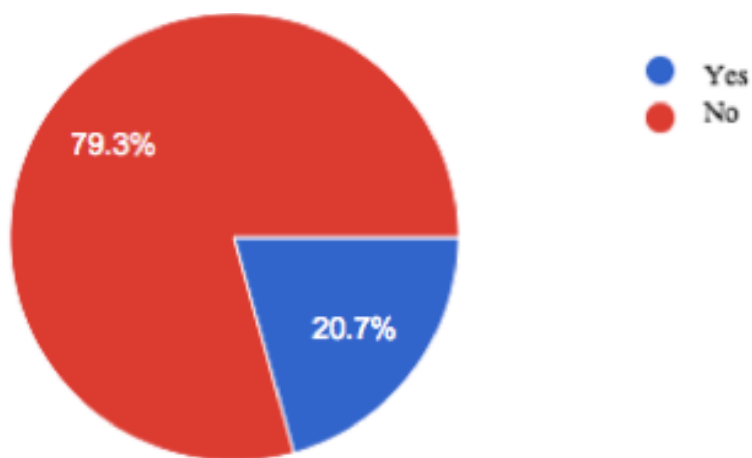
6. What is the fee you are ready to pay for the crypto-transaction? (in USD)



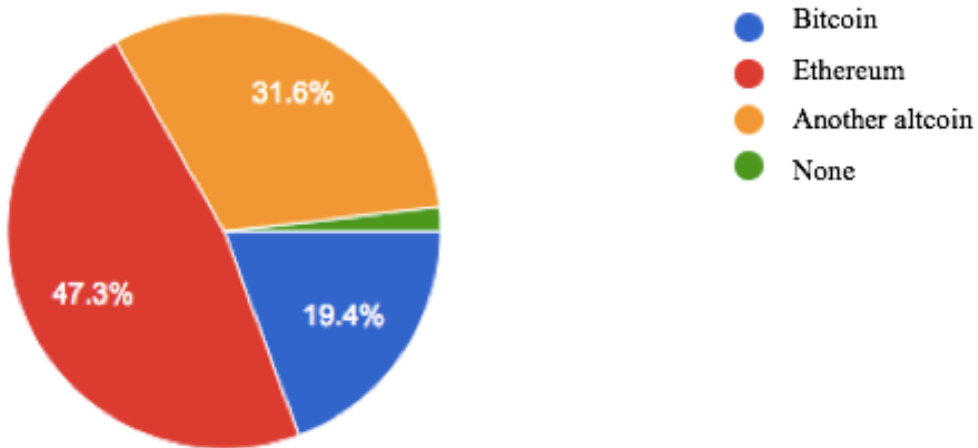
7. Do you use any decentralised applications?



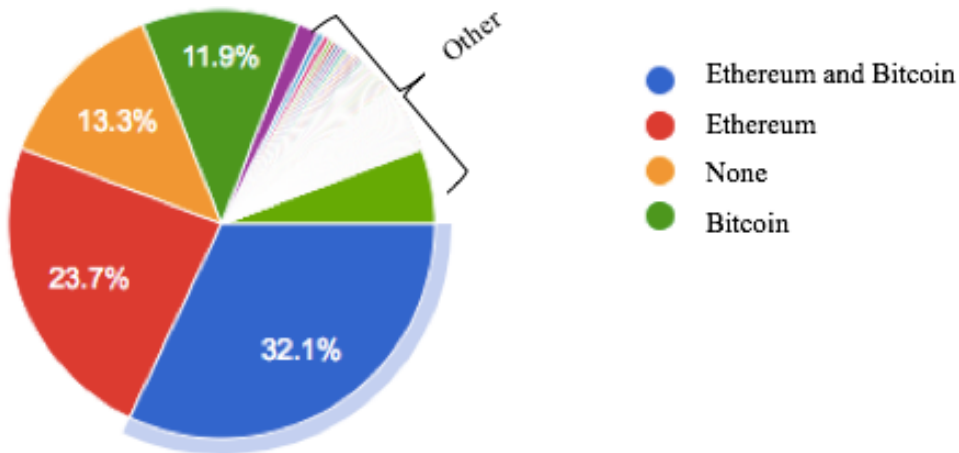
8. Do you use Smart Contracts?



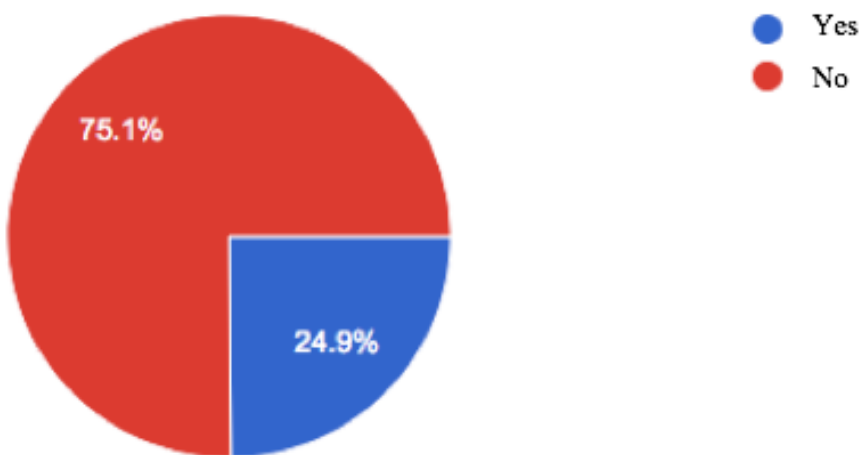
9. Which currency has more actual value (has more potential) for you?



10. Do you support any cryptocurrency specifically?



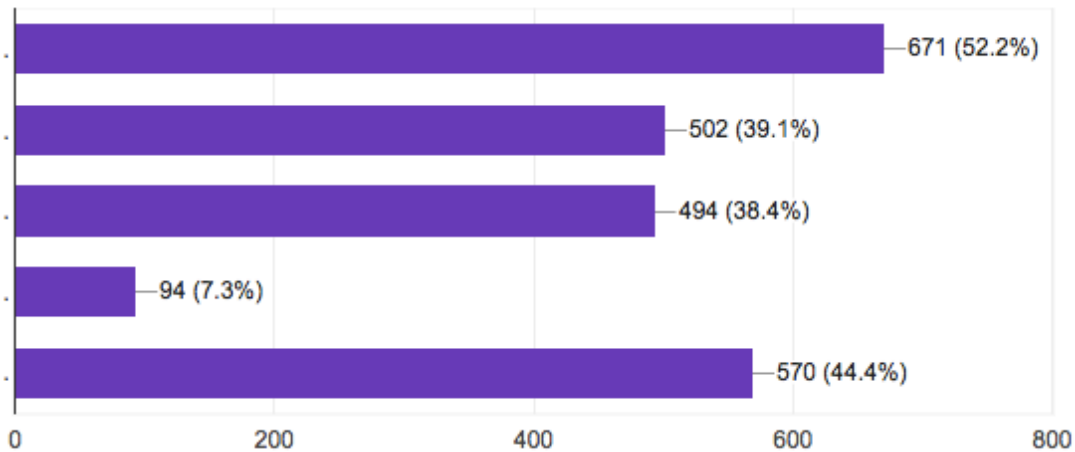
11. Do you see cryptocurrencies as a bubble?



### 12. What makes you nervous/unhappy about cryptocurrencies?

From top to bottom:

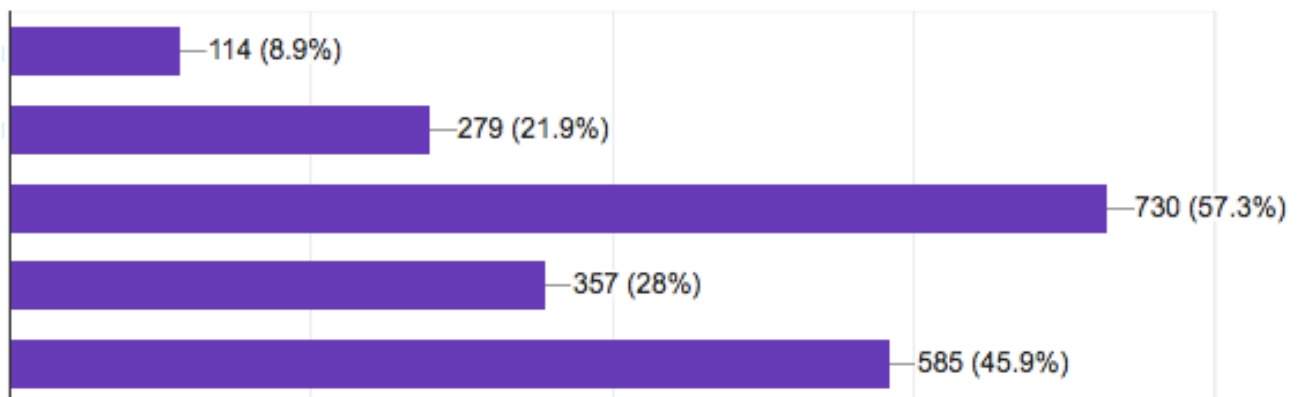
- Growing transaction time and fees
- Market instability
- Security and reliability issues
- Interface and design
- Low adoption



### 13. What may make you suddenly cash out your crypto assets?

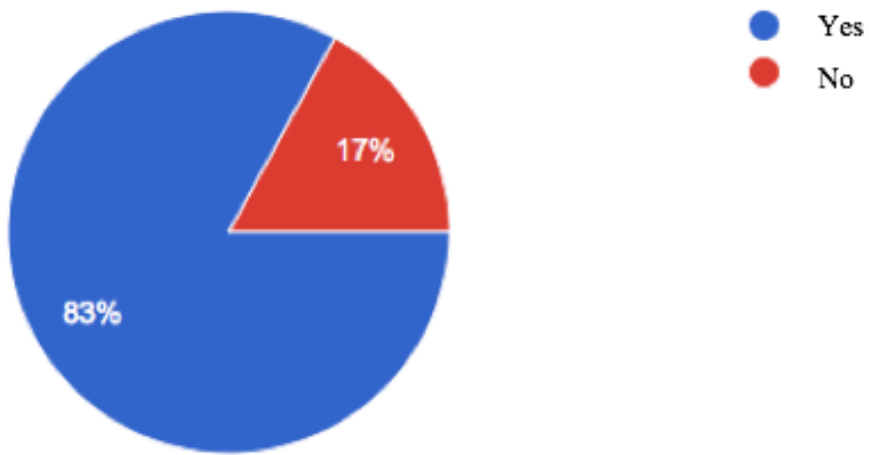
From top to bottom:

- Price fall
- Price growth
- Financial needs
- News regarding the future of digital money (taxation, company agreements, etc.)
- Other investment possibilities





14. Would you use cryptocurrencies if it becomes illegal?



**APPENDIX 2: Interview questions**

1. Can you introduce yourself?
2. How long have you been using cryptocurrencies?
3. What is the main feature that makes you attracted to the concept?
4. Do you participate in any crypto-related projects?
5. How your opinion and preference in regard to cryptocurrencies has changed over time?
6. What are your expectations in regard to Bitcoin and Ethereum for the following year?
7. Do you support and cryptocurrency? Why?
8. Please name the key issue holding the development of digital money?
9. How these issues can be solved?
10. What are your thought on market's volatility?
11. What is the key reason behind the skyrocketing rise in prices of Bitcoin and Ethereum happen in 2017?