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Impact and development of cryptographic currencies on stability and functioning of the financial system - selected aspects

Introduction

With the advancement of the computerization of society, as can be seen in the last decades, more and more aspects of everyday life are being transferred to the realm of virtual reality. This results in the emergence of numerous, unknown phenomena, including those related to the economy. Cryptocurrencies belong to the newest human thought products of recent years, that function solely in the virtual realm. They are intended to be instruments, that are not subject to any administrative regulation, are independent of central banks, and are valued only by the market mechanism [Dopierała, Borodo, 2014 s. 1].

Taking into consideration that one of the main function of the cryptocurrencies is the payment function, national and international supervisors face the challenge of answering the question, whether cryptocurrencies can be treated as money at all. The answer to this question, however, is not easy one, given the functions of money in the economy. We can enumerate:

a) medium of exchange – money effectively eliminates the double coincidence of wants problem by serving as a medium of exchange that is accepted in all transactions, by all parties, regardless of whether they desire each others' goods and services,
b) unit of account – money is a common standard for measuring relative worth of goods and services,
c) store of value – money's value can be retained over the time, so it is convenient way to store wealth [Podstawska, *Pieniądz,* 2013, s.44].

In November 2008, a conspectus (sometimes called a manifest) was posted by a person or group of people working under the name of Satoshi Nakamot, who expressed the need to create a new currency, based entirely on Peer to Peer system ("P2P"). P2P is a communication model in a computer network, that provides all participating devices with the same data sharing as the client-server architecture. This currency would allow

online payments to be made directly between users, bypassing institutions or financial intermediaries. What is more, payment system, connected with virtual currency, would be based on cryptography rather than on trust to third parties[www.bitcoin.org/bitcoin.pdf]. In this way, bitcoin ("BTC"), now considered the first and most common cryptocurrency, was created. He also raised a heated discussion about contemporary forms of money.

Methodology of the research process

Today, there exists a large-scale discussion about the legitimacy of the cryptocurrencies (particular Bitcoin) as a means of payment or investment instrument. The payment function reflects in the best way the idea, that formed the foundation for the cryptocurrencies. However, literature studies and statistical data analysis clearly indicate, that the investment function is main premise for the acquisition of cryptocurrencies. The purpose of this article is to present the relationship between cryptocurrencies and other currencies and to show the impact of cryptocurrencies on public finances, the banking sector and individual users. This will also discuss the dark side of cryptocurrencies and their similarity to the financial pyramids. Authors tried also outline their prospects for development in the context of their payment functions. The article starts with theoretical aspects of cryptocurrencies, including the technical and legal conditions of their functioning. Rate of return, coefficient of variation, range and Pearson correlation coefficient have been used in analysis of Bitcoin quotes in relation to selected national currencies, commodities and stock indexes.

Cryptographic currencies and forms of modern money

The name “Money” comes from Latin (Pecunia) and means horn cattle, which in Roman times was used as a means of exchange. This suggests, everything can be established as money, relying solely on the principles of social contract. Regardless of its external form and economic system, money is defined today as a legally defined, commonly accepted means of payment that can express, store and accept values, and whose value is closely linked to real Gross Domestic Product (GDP) [Schaal, 1996, s. 26].

Money can be classified according to different criteria. The development of the forms of money included primitive, metallic, banking and electronic money [Piaszczyński, 2004, s.19]. Contemporary, money exists in two main forms:

a) cash - money in the form of banknotes and coins,

b) deposit money - does not have a physical form, it is only the subject of accounting records of banks.

New types of payment instruments are emerging in the course of time, which can easily replace current forms of money. From this perspective, cryptocurrencies can be seen as an alternative to both cash and deposit money. However, the good that pretends to play the role of money must fulfill a set of criteria, e.g.:

a) durability – it needs to last,
b) portable – easy to carry around, convenient, easy to use,
c) divisible – it can be broken down into smaller denominations,
d) hard to counterfeit – it can not easily be faked or copied,
e) must be generally accepted by a population,
f) valuable – generally holds value over the time [Bala, Kopyściański, Srokosz, 2016, s 57].

By analyzing the technological aspects of the cryptocurrencies' creation and operation, it can be concluded that they fulfill all of the above-mentioned characteristics satisfactorily, and some features are even higher fulfilled than in examples of cash or deposit money form. Thus, cryptocurrencies could be accepted as modern forms of cash.

Technical conditions for the functioning of cryptographic currencies on the Bitcoin example

The Bitcoin payment network is built on the basis of a cryptographic P2P protocol that gives all users equal rights. In other words, users around the world, andmore precisely their computers, create and control the network they belong to. This means that there is no central server responsible for Bitcoin. From the point of view of a regular user, bitcoin is just a program installed on a computer or mobile phone, that allows access to a virtual wallet, sending and receiving bitcoins [www.bitcoin.org/bitcoin.pdf].

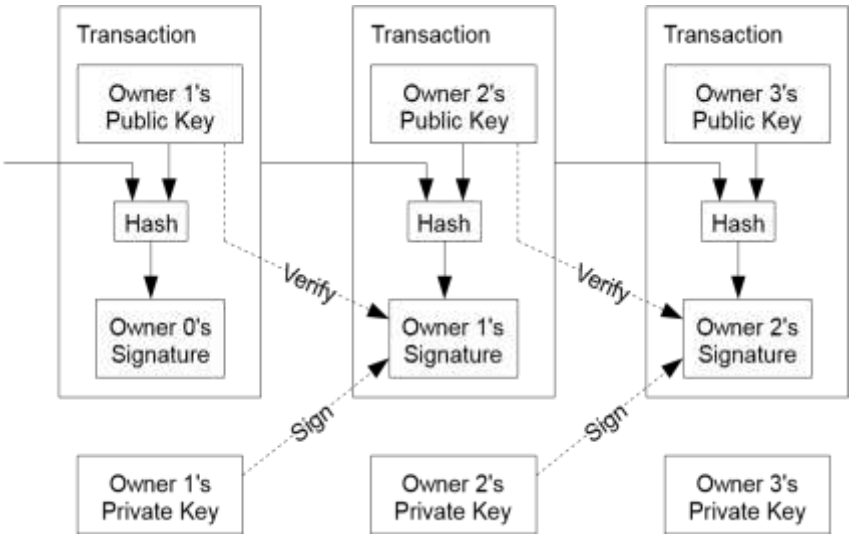
The BTC wallet consists of three numbers:

a) private key - it is used to "sign" (authorize) a transaction,
b) public key - is generated from a private key and serves as an address,
c) address - consists of 27 to 34 alphanumeric characters and can be compared to an email address. If a wallet user wants to pay or transfer bitcoins, he or

she must provide the wallet address, where the corresponding balance is stored.

The Bitcoin network is based on a widely available, scattered database. This is a chronological list of The Bitcoin network is based on a widely available, scattered database. This is a chronological list of all transactions, otherwise called block chains. The Bitcoin network transaction diagram is shown in Figure 1.

Figure1.The Bitcoin network transaction diagram



Source: S. Nakamoto, *A Peer-to-Peer Electronic Cash System*, http://bitcoin.org/

The transaction is a message of some value between the addresses. They are executed and authorised using a private key by each user. All current transactions, before approval, are collected and saved in the block in every 10 minutes. In order to prevent double release of bitcoins or forgery, coherence and chronological chain of blocks are based on the *Proof of Work* (PoW), which are evidences of the taken actions. They involve calculating with a certain probability of the hash (a shortcut - which is a string of letters and numbers) containing information about current transactions and the hash of the previous block. This task is performed by the so-called “miners”. Thus every transaction made between users is confirmed by the P2P network in the *expanding process*. This is a kind of competition, because new bitcoins are randomly allocated to users who provide computing power. The greater the computational power, that is given by a user, the greater probability of receiving new bitcoins. Coin allocation follows the condition of "*block break*", which means solving a cryptographic puzzle[Dopierała, Borodo, 2014 s.3].

Legal aspects of cryptocurrencies on Bitcoin example

Along with increasing interest of cryptocurrencies in societies of different countries, legal aspects of the virtual currency have become one of the most important issues. The authorities' attitude of different countries to cryptographic currencies is still unclear. Officially, cryptocurrencies, including Bitcoin, do not have legal or financial definitions, and probably it will still take long time till the issue will has been resolved. Despite this, some authorities issued statements defining their status in the light of existing legislation.

In Poland, the Ministry of Finance has defined Bitcoin in the light of the following legal acts:

a) Act of July 27, 2002 *Prawo Dewizowe* (Dz. U. 2002r. nr 141 poz. 1178),
b) Act of 12 September 2002 o *elektronicznych instrumentach płatniczych* (Dz. U. 2002 r. nr 169 poz. 1385),
c) Act of 19 July 2011 o *usługach płatniczych* (Dz. U. 2011 r. nr 199 poz. 1175, as amended)
d) Act of 29 July 2005 o *obrocie instrumentami finansowymi* (Dz. U. z 2010 r. nr 211 poz. 1384 , as amended).

The Ministry of Finance has expressed the opinion that the operating and trading with cryptocurrencies is not illegal. However, given the lack of universal acceptability, they can not be considered as domestic or foreign currency and also as means of payment. Cryptocurrencies may also not be covered by the definition of electronic money or financial instrument, and what is more, cryptocurrency transactions are not payment transactions, because they only cover payment or cash transfer [Kurek, 2015, s.153].

The European Central Bank issued a detailed report on digital currency in 2012 [https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes201210en.pdf], showing the differences between the typical electronic currency and the virtual currency. According to this report, the European Union does not classify any virtual currency as electronic money, because, according to Directive 2000/46 / EC, money is necessarily related to the claim to the issuer to issue the appropriate amount of money, which in the case of cryptocurrencies can not be said, due to lack of issuer. In 2013, the European Banking Authority (EBA) issued a warning announcement about the possible risks of theft and fraud, connected with virtual currency.

There are also examples of states that have a favorable attitude towards cryptographic currencies, although with some degree of distrust. The Belgian National Bank,

along with other financial institutions, withdrew an official warning statement about investments in Bitcoin. In Germany, Bitcoin is not considered as currency, but is defined as "private money" and included in units of account [https://bitcoinmagazine.com/articles/regulation-bitcoins-germany-first-comprehensive-statement-bitcoins-german-federal-financial-supervisory-authority-bafin-1391637959/]. In the United States, each state should regulate itself the matter of cryptocurrencies, however, state bodies point out, that Bitcoin's anonymity may lead to money laundering, terrorist financing or drug trafficking [http://www.ibtimes.com/bitcoin-new-york-state-continues-its-path-regulating-virtual-currency-1721103].

Examples of other cryptographic currencies

Bitcoin was created in 2008 and by 2011 was the only cryptographic currencies in the world. However, in the course of time, bitcoin derivatives have also started to emerge, and often are called altcoins (alternative coins). Most of these coins either have already been forgotten or have very small capitalization, because they did not bring in any technology innovation. However, at least several cryptocurrencies derivatives deserve attention, e.g.:

a) Namecoin (NMC) - the first alternative cryptocurrency, which was launched in April 2011. Most based on the Bitcoin source code. What is relevant and difference these two cryptocurrencies is the fact that Namecoin acts simultaneously as a decentralized DNS (Domain Name System). This is because NMC allows to register in the chain of blocks your own Internet domain with the .bit22 end, so that it is not subject to ICANN supervision (The Internet Corporation for Assigned Names and Numbers supervision). In practice, this allows for domain registrations, that can not be blocked by any authority [www.wiki.namecoin.info].
b) Litecoin (LTC) - this is a work of a google employee - Charles Lee. It was created in October 2011 and now has the second largest capitalization (after BTC). The main difference is the change of the *Proof of Work algorithm* from SHA-256 to Scrypt. This difference raises the security of the network, as well as the special equipment designed for the expand of Bitcoin can not be used to expand Litecoin [www.coinmarketcap.com/].
c) Primecoin (XPM) - it is a very interesting currency because its supply is not precisely defined by the values in the source code. The final amount of

coins is not well known, because of the fact, that it is based on special numbers of primitive numbers strings, that are simultaneously discovered during expanding [www.primecoin.io/bin/primecoin-paper.pdf].

d) Darkcoin (DRK) - it is a relatively new cryptocurrency, created in 2014. Nowadays, in the world of cryptocurrencies, it can be noticed notice the stage, where every new cryptocoin aspires to have the most secure, anonymous system. Darkcoin has a special algorithm, that is supposed to combine multiple transactions into anonymous one, in order to prevent tracing individual transaction history.

Analysis of Bitcoin volatility quotes in relation to selected national currencies, commodities and stock indexes

The high volatility of cryptocurrencies in relation to national currencies raise the question of a possible impact on the stability and functioning of the financial markets. There are many cryptocurrencies on the market, therefore for the purpose of this study has been selected bitcoin (BTC)as the most popular and most recognizable in the world, with largest capitalization and trading volumes from all cryptocurrencies.BTC quotes in relation to national currencies (EUR, USD, PLN, CNY, GBP) and gold have been compared with quotes of other traditional currency pairs (such as EUR/USD, EUR/PLN, etc.), quotes of selected commodities (gold, Brent oil) and stock indexes (SP 500, FTSE 250, DAX).The following statistical method shave been used : rate of return, coefficient of variation, range and Pearson correlation coefficient. Based on the data in table 1, BTC quotes were significantly more volatile than other quotes. For BTC quotes, the daily rates of return were in the range of -36.25% to 52.89%, while for traditional financial instruments quotes a range was from -8.57% to 9.10%.The situation with the coefficient of variation was similar. The average value of this indicator for BTC quotes was 28.27%, whereas for traditional quotations was 4,27% – that is confirmation of a higher investment risk in BTC. The highest daily increase and decline against the opening price occurred on BTC/USD pair – the size for the aforementioned parameters were, respectively 97,96% and -56,57%. The biggest changes to quotes of traditional instruments took place at the price of gold (XAU/EUR). However, compared to the previous situation, in this case the scale of changes was many times lower – the highest and the lowest value shift were, respectively 14,19% and -9,60%. The average intradayrange (in relation to opening price) for BTC quotes was 59,36% and for the rest of financial in-

struments in this study was 8,48% [Bala, Kopyściański i Srokosz 2016, p. 89-91; Kądziołka 2016, p. 12-14, 38-42; https://coinmarketcap.com/#EUR].

Table 1. Intraday statistical analysis of BTC quotes in relation to national currencies and selected commodities and stock market indices in the years 19.07.2010 – 15.08.2017

	Rate of return		Coefficient of variation[a)]	The highest value shift[b)]	The lowest value shift[c)]	Range[d)]
	The highest	The lowest				
BTC/EUR	39,97%	-22,09%	25,41%	44,64%	-38,33%	50,15%
BTC/USD	52,89%	-36,25%	48,14%	97,96%	-56,57%	100,02%
BTC/PLN	39,57%	-22,48%	25,17%	44,22%	-38,29%	49,97%
BTC/CNY	21,50%	-24,10%	16,33%	21,70%	-29,22%	39,49%
BTC/GBP	40,19%	-22,38%	25,55%	44,86%	-38,73%	50,07%
XAU/BTC	23,07%	-28,62%	29,00%	60,49%	-31,00%	66,44%
EUR/USD	3,01%	-2,90%	2,23%	3,86%	-4,50%	4,50%
EUR/PLN	2,70%	-3,03%	2,23%	4,39%	-3,21%	4,73%
EUR/CNY	3,06%	-1,54%	1,95%	3,60%	-3,14%	3,64%
EUR/GBP	6,78%	-2,05%	4,75%	9,22%	-2,28%	9,32%
XAU/EUR	9,02%	-8,57%	7,03%	14,19%	-9,60%	14,19%
CB.F USD	9,10%	-8,30%	5,75%	10,31%	-9,51%	12,11%
SP 500	4,67%	-6,59%	3,81%	5,80%	-6,61%	6,61%
FTSE 250	3,58%	-7,19%	5,98%	4,09%	-12,25%	12,25%
DAX	6,05%	-7,07%	4,65%	6,78%	-8,14%	8,94%

[a)]calculated as quotient of standard deviation and opening price
[b)]calculated as quotient of the highest price and opening price
[c)]calculated as quotient of the lowest price and opening price
[d)]calculated as quotient of the difference between the highest and lowest prices and opening price
Source: own study based on https://stooq.pl information (accessed: 15.08.2017) and Bala, Kopyściański i Srokosz 2016, p. 90.

In order to assess fully impact of the BTC volatility on financial markets, a daily correlation of return rates has been also made (table 2).The correlation between rate of return of BTC and national currencies was positive, while for XAU/BTC quotes, it was a very strong but negative correlation. In turn, interconnectedness between pairs of traditional financial instruments was weak. Analysis of BTC and traditional financial instruments daily rate of return is indicating a lack of correlation between tested variables. This is very positive conclusion as it means that high volatility of BTC and others cryptocurrencies in the situation of market disruption will be not affect rest of the financial market [Bala, Kopyściański i Srokosz 2016, p. 90-91; Kądziołka 2016, p. 42].

Table 2. Correlation of intraday rates of return in years 19.07.2010 – 15.08.2017

	BTC/ EUR	BTC/ USD	BTC/ PLN	BTC/ CNY	BTC/ GBP	XAU/ BTC	EUR/ USD	EUR/ PLN	EUR/ CNY	EUR/ GBP	XAU/ EUR	CB.F USD	SP 500	FTSE 250	DAX
BTC/ EUR	1,00	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BTC/ USD	0,58	1,00	x	x	x	x	x	x	x	x	x	x	x	x	x
BTC/ PLN	0,97	0,56	1,00	x	x	x	x	x	x	x	x	x	x	x	x
BTC/ CNY	0,65	0,37	0,62	1,00	x	x	x	x	x	x	x	x	x	x	x
BTC/ GBP	0,99	0,57	0,97	0,65	1,00	x	x	x	x	x	x	x	x	x	x
XAU / BTC	-0,94	-0,54	-0,91	-0,63	-0,93	1,00	x	x	x	x	x	x	x	x	x
EUR/ USD	-0,08	0,05	-0,08	-0,02	-0,04	0,05	1,00	x	x	x	x	x	x	x	x
EUR/ PLN	0,02	-0,01	0,08	0,03	0,04	-0,02	-0,18	1,00	x	x	x	x	x	x	x
EUR/	-0,06	-0,01	-0,06	0,02	-0,03	0,04	0,34	0,01	1,00	x	x	x	x	x	x

CNY															
EUR/ GBP	-0,01	0,04	0,01	0,02	0,09	0,01	0,51	0,06	0,19	1,00	x	x	x	x	x
XAU / EUR	0,02	-0,01	0,02	0,02	0,01	0,13	-0,30	0,06	-0,08	-0,17	1,00	x	x	x	x
CB.F / USD	-0,02	0,01	-0,04	-0,03	-0,04	0,04	0,17	-0,20	0,01	-0,03	0,05	1,00	x	x	x
SP 500	-0,01	0,02	-0,03	-0,03	-0,03	0,01	0,25	-0,38	-0,02	0,00	-0,13	0,37	1,00	x	x
FTSE 250	-0,03	0,01	-0,05	-0,05	-0,05	0,02	0,14	-0,36	-0,06	-0,05	-0,10	0,28	0,56	1,00	x
DAX	0,02	0,03	0,01	0,01	0,00	-0,01	0,07	-0,35	-0,08	-0,04	-0,06	0,22	0,56	0,58	1,00

The blue colour stands for results of correlation between quotes of different BTC pairs, orange for correlation between BTC and traditional financial instruments quotes, and green for correlation between various traditional financial instruments pairs.
Source: Own study based on stooq.pl information (accessed: 15.08.2017) and Bala, Kopyściański i Srokosz 2016, p. 90.

BTC quotes against other financial instruments shows a higher volatility. Among other things it is caused by the fact that exchange rate of BTC is determined on market terms, which is not accompanied by any regulations, and which is not controlled by any supervisory authority. These implies lack of any mechanism to prevent currency speculation and limiting foreign-exchange risk and potential loss.The high volatility of BTC quotes is also a result of low market turnover in contradistinction to other instruments. To sum up, all above factors are limiting trust in BTC, as well as all cryptocurrencies, that in fact have been created with intention to perform payment functions. With such a limited trust in reality cryptocurrencies are treated not as a currency but high risk financial asset [Bala, Kopyściański i Srokosz 2016, p. 89, 91; Markiewicz, Nowak 2015, p. 91; Homa 2015, p. 134].

Cryptocurrencies development and their impact on the economy

Increase in use and distribution of cryptographic currencies can have specific effects on functioning of the economy, particularly in areas such as public finances, banking system, financial markets, as well as individual users. Cryptocurrencies can significantly expand growth of the grey economy area. They create opportunity to establish and operate an unregistered business in which deals (e.g. for drugs and crimes) are settled by unidentified entities. Other type of risk and effects in use of cryptographic currencies for public finances are primarily related to money laundering. Anonymity of users, speed of execution of transactions and possibility of their exchange on stock exchanges is a possible source of introduction laundered money to economic turnover, to finance illegal activities or which come from illegal sources. The common denominator of these threats is mainly anonymity of cryptocurrencies users. This contributes to reducing the effectiveness of fiscal control by authorized state agencies, and as a result the level of revenues for the public finance sector may be decreased. It is also a dishonest act against those who legally settle with tax authorities. For the banking sector, crypto-

graphic currencies are perceived as a competition and a threat to credit institutions, and as a result also to giro money, that they create in the process of quantitative multiplication of deposits. Replacing national currencies created by central banks with cryptographic currencies would mean that both central banks (which will lose control of money supply) and commercial banks will be no longer needed. As of today banks have a monopoly on creating money - that may be one of reasons that will stop further development of cryptocurrencies. Supply of cryptographic currencies is limited (e.g. for Bitcoin it is 21 million units). On the one hand, inability to create new units reduces the risk of inflation, what affects on stabilization of the economy. On the other hand, limited supply in the long term can cause deflation. The increasing amount of services and goods in relation to constant quantity of cryptographic currencies units will cause their shortage. Because of that, cryptocurrencies will cease to fulfil a medium of exchange function in favour of the store of value function (this is another example that cryptocurrencies are not able to perform basic money function).The idea of replacing national currencies with cryptographic currencies will undoubtedly contribute to halting economic growth [Bala, Kopyściański i Srokosz 2016, p. 102-105; Kądziołka 2016, p. 35-37; Markiewicz, Nowak 2015, p. 91; Homa 2015, p. 21].

Cryptocurrencies ensure a higher level of privacy than standard electronic payments. For this reason, they have been repeatedly using to regulate transactions for illicit sale of weapons or drugs, ransom demands, as well as financing of terrorism (e.g. the Silk Road service closed by the FBI in October 2013).Many controversies related to the functioning of cryptocurrencies also concern their numerous similarities to pyramids scheme. The main resemblance between them is so-called "network effect". It is based on the fact that economic benefits for current group of cryptocurrencies holders increase as new users of cryptographic currency join. This applies especially to creators and users who have joined from the very beginning, and who have an vantage over the rest due to the ability to mine cryptocurrencies in the early stages at minimal cost. Within the time, a larger number of individuals influence on increase in use and distribution of cryptocurrencies, which in turn increase their market value and give an opportunity to exchange them for national currencies or other real goods and services with possibility to obtain a great economic benefits. To other similarities can also be included, that new users exchange on cryptographic currency stock exchange official and legally-accepted national currencies for virtual money devoid of intrinsic value. An excellent example of a pyramid scheme may be a trading platform called cryptodouble.com. The whole

mechanism was based on promise of doubling deposits of each users after 100 hours of transaction. At the beginning, payments were made from contributions from new users. However, after some time, stock exchange has been shut down. As a result, its users have lost irretrievably 2233 Bitcoins, i.e. about USD 9 400 930.In summary, it can be stated, that on market has been emerging a new type, with new character and functioning method pyramids scheme based on cryptocurrencies. The very important factor is significant imbalance in the number of BTC holders. According to data in table 3, 0,78% of users own and control 89,20% of the total BTC market value. This can lead to a situation in which a minority of BTC holders gains economic profits thanks to their dominance in the market. Moreover, total market capitalization of BTC is approximately$ 67 trillion – this is a higher value than almost 85% of the listed companies in the S&P 500.The manic sentiment and price activity is very similar to tulips bubble from the 17th century from Netherlands [Bala, Kopyściański i Srokosz 2016, p. 91-95; Szymankiewicz 2014, p. 87-90, 92-95; Kądziołka 2016, p. 37; https://www.cryptocoinsnews.com/bitcoin-ponzi-cryptodouble-disappears-least-2233-bitcoins/; https://www.theguardian.com/technology/2013/oct/08/silk-road-hack-suspicion-fbi-server; https://www.cnbc.com/2017/07/20/bitcoin-bubble-dwarfs-tulip-mania-from-400-years-ago-elliott-wave.html].

Table 3. Distribution of BTC

Balance	Number of addresses	Number of addresses in total [%]	Number of BTC coins	Value in USD
0 - 0,001	11 317 126	59,4%	2 078	8 460 766
0,001 - 0,01	3 302 678	17,4%	12 563	51 143 169
0,01 - 0,1	2 588 875	13,6%	80 872	329 225 318
0,1 - 1	1 211 173	6,4%	396 687	1 614 892 334
1 - 10	472 576	2,5%	1 291 276	5 256 711 999
10 - 100	129 798	0,7%	4 340 986	17 671 912 361
100 - 1 000	16 497	0,1%	3 828 754	15 586 641 907
1 000 - 10 000	1 672	0,0%	3 546 960	14 439 474 299
10 000 - 100 000	118	0,0%	2 898 511	11 799 677 004
100 000 - 1 000 000	1	0,0%	119 080	484 766 441
Aggregated	19 040 514	100%	16 517 767	67 242 905 598

Source: https://bitinfocharts.com/pl/top-100-richest-bitcoin-addresses.html (accessed: 21.08.2017)

Acceptance of any object or secure verifiable record as money is an economic and legal issue. From economic point of view, money performs following functions : unit of account, medium of exchange, standard of deferred payment and store of value. With regard to the first of mentioned functions, cryptocurrencies perform this function indirectly. Although it is possible to compare value of goods and services expressed in BTC or other cryptographic currencies, it should be borne in mind that due to limited possibilities for exchanging most goods and services for cryptocurrencies, determination of their value occurs only after conversion from national currency. Because, value

of cryptographic currencies is influenced by exchange rate of national currencies (which have a specified purchasing power), and cryptocurrencies are treated as investment assets–for these reasons, direct price determination in particular cryptographic currencies is impossible. The next function (medium of exchange) is related to use of money (as a universal equivalent) to facilitate a buy-sell transactions of services and goods. However, it is important to keep in mind, that intermediary instrument must be accepted by both parties of transaction. This function is not fulfilled by cryptographic currencies, because they are not widely accepted intermediary instruments in routing. Regarding to the third function of money, i.e. standard of deferred payment, which refers to possibility of regulating different types of liabilities (e.g. tax, loans, social contributions, salaries etc.), is also not achieved by cryptocurrencies. First of all, cryptographic currencies are not regulated by law, which is why it is impossible to use them to regulate tax liabilities. Secondly, because it is impossible to control their quantities in economy, they do not have approval of monetary authorities to appear in money circulation. In regards to the last function (store of value), on the one hand, limited supply of cryptocurrencies, in accordance with theory, should increase their appreciation in the long run, which may increase tendency to accumulate them. On the other hand, intangible form of cryptographic currencies (as opposed to e.g. gold), lack of guarantees and state supervision (lack of guarantee funds, as in the case of bank deposits), reduce people confidence of accumulating savings in this way. To sum up, cryptocurrencies do not fully fill the listed functions of money. It could be stated that they are treated more as financial instruments (investment assets) rather than money [Bala, Kopyściański i Srokosz 2016, p. 95-98; Owsiak 2015, p. 128-129; Transakcje i monety internetowe... 2014, p. 80].

Currently, the total number of Bitcoin users is over 19 million. Benefits and threats of use cryptographic currencies by individual users are presented in table 4.

Table 4. Advantages and disadvantages of use cryptographic currencies by individual users

Advantages	Disadvantages
Anonymity - currently, all transactions executed through banks are recorded and subsequently used by enterprises for sales and marketing purposes. Cryptographic currencies, also called "confidential currency", ensure privacy of perform transactions, because it is unknown who hides at the given address.	Transparency lack - cryptocurrencies stock exchanges are entities with unregulated economic activity principles and with obscure ownership and organizational structure. For these reasons and other numerous scandals associated with cryptographic currencies (e.g. Mt. Gox or cryptodouble.com case)possibility of using cryptocurrencies for settlement in the future is very questionable.
Transaction time - bank transfers are dependent on the time of the outgoing and incoming sessions. In case of international transfers the waiting time can be up to 3 working days. Realization of transfers in	High volatility - according to conducted research (table 1), transaction motive is suppressed by speculative motive. This has an impact on a very high price volatility of cryptographic currencies

cryptocurrencies, regardless of geographic reach, lasts up to a dozen minutes.	(high risk of purchasing power loss). For this reason, not all businesses accept payments in cryptocurrencies, what cause that individuals will be not to able to use their virtual currency to settlement payment.
Lower transaction costs - inseparable elements of banking system are transaction fees. In the case of cryptographic currencies, fees are minimal or not at all.	Anonymity and irretrievably of transactions - incorrect address on which means are meant to be transferred, or loss of control over the wallet, causes irretrievable loss of means.
Double spending - it relies on using same units in many different transactions. Cryptocurrencies eliminate this problem because there is no way to recover sent units.	Guarantee lack - in the case of traditional currencies, customers' deposits are guaranteed up to a certain amount by special funds. By contrast to aggregated funds in the banking system, cryptocurrencies do not have any formal money back guarantee.
Generate new units - traditional money is created by banking system. In the case of cryptocurrencies, users create and implement new entities. However, the more units dig up, the harder to get new ones.	Cyber-attacks - both credit institutions and cryptographic currency users are vulnerable to hacker attacks. However, difference between them is that in the first case banks are responsible for security of collected funds, while cryptocurrencies holders do not have any technological support to protect their portfolios. They are responsible for their protection.
Diversification - cryptographic currencies can be next to stocks, bonds or other financial instruments a component of investment portfolio.	Virtual character - in contrast to traditional currency (primarily to banknotes and coins), without access to a computer or smart phone and internet network, use of cryptographic currencies is impossible. Any breakdown of computer, system, power outage or lack of internet access causes that users are not able to use their means.

Source : Bala, Kopyściański i Srokosz 2016, p. 99-102; Kądziołka 2016, p. 34-35; Markiewicz, Nowak 2015, p. 180-184; Szymankiewicz 2014, p. 81-90, Transakcje i monety internetowe... 2014, p. 71-72.

Conclusion

Mining (digging up) new cryptographic currency units require high computing power and it is high time-consuming, resulting in high electricity consumption. Nevertheless, it seems that more serious issues rather than technical aspects of growth in use and distribution of cryptocurrencies are related to economic aspects. Firstly, on the basis of analysis of cryptographic currencies quotations, a very high volatility in relation to traditional national currencies and other financial instruments has been presented, what in result impact on limiting people's trust. It should be also emphasized that original premise of cryptocurrencies was transaction motive, however, due to high quotations volatility, it has been suppressed by speculative motive - for this reason, as investment assets are treated cryptographic currency. Secondly, the way cryptographic currencies are created and distributed, can qualify them as a potential new type of pyramids scheme. On the whole dealings, first of all the most is gained by creators, which at the initial stage of their cryptocurrencies existence, at low cost and quite quickly obtain new units. When cryptographic currencies achieve a high value, units are sold for traditional

currencies, what can additionally lead to a collapse of quotations and tremendous losses of other users means. Thirdly, anonymity of cryptocurrencies users has far-reaching consequences, such as money laundering, financing illegal activities (including terrorism), and act to the detriment of public finances (i.e. evade paying taxes). Finally, in view of the current economic theory, cryptographic currencies can not be considered as money because they do not fully achieve all money functions. Unit of account function is performed indirectly, medium of exchange and standard of deferred payment functions are not fulfilled at all, when store of value function is very debatable (questionable). Even if cryptocurrencies fulfil these functions in a future and be fully legal tender, it will in the long run lead to deflation.

In the longer term, further development and distribution of cryptographic currencies depends primarily on the legal regulations and public oversight of entities that use cryptographic currencies (including the creation of a prevention mechanism in order to counteract the formation of pyramids scheme). If cryptocurrencies have to completely replace current national currencies, a complete change in the functioning of the whole economy would have to take place.

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Abstract

The first cryptographic currency (Bitcoin) was created in 2009. Since that time, cryptocurrencies have been developing very dynamically, and their users number have been systematically growing. This article aims to analyse and estimate impact, development and growth of cryptographic currencies use on stability and functioning of the financial system. The subject of the study is also a question, whether cryptocurrencies fulfils the basic money functions. In the first part of this paper, technical and legal issues of cryptographic currencies have been raised. While in the second part, statistical analysis (Bitcoin quotes have been compared to other traditional financial instruments - for this purpose have been used rate of return, coefficient of variation, range, and Pearson's correlation coefficient) and impact assessment on public finances, banking sector as well as individual users have been performed. The analyses which have been conducted lead to the conclusion that cryptocurrencies can not be treated equally with money (they are treated more as investment assets), their quotations show a very high volatility in relation to traditional financial instruments, and there is a significant similarity of cryptographic currencies to pyramids scheme.

Key words : cryptographic currencies, Bitcoin, stability, financial system.

Streszczenie

Pierwsza kryptowaluta (Bitcoin) powstała w 2009 r. Od tego czasu, kryptowaluty bardzo dynamicznie się rozwijają oraz systematycznie wzrasta liczba ich użytkowników. Cele artykułu to analiza i ocena wpływu, rozwoju i wzrostu wykorzystywania walut kryptograficznych na stabilność i funkcjonowanie systemu finansowego. W artykule zostało również postawione pytanie, czy kryptowaluty spełniają funkcje pieniądza. W pierwszej części opracowania zostają poruszone kwestie techniczne oraz prawne walut kryptograficznych. W drugiej części dokonano analizy statystycznej (notowania Bitcoina zostały porównane do notowań innych tradycyjnych instrumentów finansowych - w tym celu wykorzystano stopę zwrotu, współczynnik zmienności, rozstęp oraz współczynnik korelacji Pearsona) oraz oceny wpływu na finanse publiczne, sektor bankowy czy też indywidualnych użytkowników. Przeprowadzone analizy pozwalają sformułować wnioski, że waluty kryptograficzne nie mogę być traktowane na równi z pieniędzmi (są traktowane raczej jako aktywa inwestycyjne), ich notowania wykazują bardzo

dużą zmienność względem innych tradycyjnych instrumentów oraz występuje bardzo duże podobieństwo walut kryptograficznych do piramid finansowych.
Słowa klucz : waluty kryptograficzne, Bitcoin, stabilność, system finansowy.